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SITE INSPECTION REPORT FOR OUTLYING LANDING FIELD BARIN NAS WHITING FIELD FL

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E C JORDAN

SITE INSPECTION REPORT
OUTLYING LANDING FIELD (OLF) BARIN
FOLEY, ALABAMA

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Prepared by:

E.C. Jordan Co.
2571 Executive Center Circle East, Suite 100
Tallahassee, Florida 32301-5001

Authors

Michael A. Keirn
Eric A. Blomberg
R. Michael Nugent
Janet Burris

Prepared for:

Southern Division
Naval Facilities Engineering Command
P.O. Box 10068
Charleston, South Carolina 29411-0068

Kim Queen, Code 18219, Engineer-in-Charge

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's Environmental Restoration Program as created by the Superfund Amendments and Reauthorization Act of 1986.

The IR Program consists of three phases. Phase one consists of the Preliminary Assessment and Site Inspection to identify the location (site) and presence of pollutants and assess their potential or actual threat to public health and the environment. Phases two and three are initiated based on the degree of threat and the need for remediation of the contamination. Phase two consists of a Remedial Investigation and Feasibility Study to analyze the site contamination and determine the optimum remediation solution. Phase three is the implementation of the solution.

Preliminary Assessment results for Outlying Landing Field (OLF) Barin indicated past potential releases to the environment have taken place at five sites. A Site Inspection, presented herein, has been performed to verify the nature of contamination at each site. OLF Barin is a subinstallation of Naval Air Station (NAS) Whiting Field. Southern Division, Naval Facilities Engineering Command (NAVFACENGCOM) has assisted NAS Whiting Field in implementing this program.

Questions regarding this report should be addressed to the Commanding Officer, NAS Whiting Field, or to Southern Division, NAVFACENGCOM, Code 11515, at AUTOVON 563-0571 or (803) 743-0571.

EXECUTIVE SUMMARY

This Site Inspection (SI) Report describes the SI field program conducted at the Outlying Landing Field (OLF) Barin, Foley, Alabama. The requirement for this SI report is a result of the potential for contamination identified during the Preliminary Assessment (PA) as reported in the PA report, February 1989. The SI was conducted at OLF Barin in accordance with the Navy's Installation Restoration Program. The following previously identified sites at OLF Barin are included in this SI report:

- Site 19B, Former Hangar Maintenance Area,
- Site 20B, Abandoned Underground Storage Tanks (UST) and Fuel Pit Area,
- Site 21B, Rubble Landfill,
- Site 22B, Old Firefighting Demonstration Area, and
- Site 23B, Drainage Ditch Leading to Sandy Creek.

The purpose of the SI at OLF Barin was to:

- characterize each identified site of potential contamination to evaluate
  - presence, nature, and quantity of any wastes or releases,
  - contaminated environmental matrices,
  - contaminant migration potential and migration pathways, and
  - chemicals of concern;

- present significant findings, site characterization, and conclusions;

- eliminate from further consideration those releases that pose no threat or potential threat to public health or the environment;

- provide recommended follow-on actions for sites at which significant contamination and/or threat of contaminant migration exists; and

- compile and present the demographic, land use, climatological, geohydrological, and environmental data necessary to support Hazard Ranking System (HRS) scoring in accordance with the revised U.S. Environmental Protection Agency HRS (HRS II) Final Rule, December 1990.

The SI was initiated in spring 1990 and the SI field investigations were conducted from the end of April through the beginning of June 1990 and included:

- soil sampling at Sites 21B, 22B, and 23B;

- surface water and sediment sampling at Site 23B;

- subsurface soil boring with subsequent monitoring well installation at Sites 19B and 20B;

- sampling of the installation water supply well and all groundwater monitoring wells; and

- hydraulic conductivity testing in all newly installed monitoring wells.

Background information on OLF Barin and adjacent southern Baldwin County, Alabama, required for the HRS II scoring was compiled from October 1990 to January 1991.

While conducting the SI field program and during the October 1990 HRS II site visit, three additional sites with potential for significant contamination and contaminant migration were identified. These are:

- Machine Gun Butt,
- Uncontrolled Dumpsite, and
- Abandoned Wastewater Treatment Plant.

Based on the results of the SI field program, none of the five previously identified sites can be recommended for "no further action" or "monitoring only" due either to existing data gaps or the presence of contaminants in soil, sediment, surface water, or groundwater. Because of the nature of detected and potential contamination, onsite locations, similarity of contaminant migration pathways, and receptor populations, it is recommended that HRS II scoring be done on a set of three site groups individually rather than the installation as a whole. The significant findings, site characteristics, and significant contaminants (chemicals of concern) detected are summarized in Table E-1.

Additional sampling and analysis are required for contamination confirmation and verification. A Phase I Remedial Investigation is therefore recommended to more completely describe the nature and extent of contamination at the five identified sites and to verify the contamination status of the three additional areas of potential contamination identified during the SI. The recommended program includes installation-wide and site-specific sampling and analysis.

A Remedial Action Plan and design has been completed for removal of the abandoned UST at OLF Barin. This plan is awaiting funding to be implemented during 1991. This removal action is recommended to be coordinated with further sampling and analysis at OLF Barin.

For two of the sites identified during the SI program, the recommended sampling and analysis program also provides sufficient data to support design of interim remedial actions. These sites are the Machine Gun Butt and the Uncontrolled Dumpsite. At the Machine Gun Butt, lead in surface soils and lead and copper bullet fragments potentially represent an ecological threat and may be causing on-going spread of contamination. At the Uncontrolled Dumpsite, immediate action is recommended to restrict entry by the public through a breach in the boundary fence and prevent further dumping, to remove any waste posing an imminent threat to public health or the environment, and to contain waste that may spread contamination if not controlled.

Table E-1
Summary of Wastes and Hazardous Substances By Site

Site Inspection Report
OLF Barin, Foley, Alabama

Site Name and Number	Contaminated Media		Wastes Potentially Present	Hazardous Substances Detected
	Observed	Potential		
Former Hangar Maintenance Area Site 19B (see Section 5.1)	None	Groundwater Surface soils Subsurface soils Stormwater runoff	Solvents Waste oils Fuels Battery residues and electrolytes	Mercury
Abandoned Underground Storage Tanks and Fuel Pits Area Site 20B (see Section 5.2)	None	Groundwater Surface soils Subsurface soils Stormwater runoff	Aviation fuels Lead	Lead
OLF Barin Supply Wells (see Section 5.3)	Groundwater	Not applicable	Solvents	trans-1,2-Dichloroethylene Trichloroethylene Tetrachloroethylene
Rubble Landfill, Site 21B (see Section 5.4)	Surface soils	Subsurface soils Surface Water Sediments Groundwater	Unknown	Methylene chloride
Old Firefighting Demonstration Area, Site 22B (see Section 5.5)	Surface soils	Subsurface soils Air Groundwater Stormwater	Lead PAH	Lead
Machine Gun Butt (see Section 5.5)	Surface soils	Subsurface soils Air Groundwater Stormwater	Lead Copper	Not sampled
Drainage ditch leading to Sandy Creek, Site 23B (see Section 5.6)				

Table E-1 (Continued)
Summary of Wastes and Hazardous Substances By Site

Site Inspection Report
OLF Barin, Foley, Alabama

Site Name and Number	Contaminated Media		Wastes Potentially Present	Hazardous Substances Detected
	Observed	Potential		
Upper ditch	None	Subsurface soils Groundwater	Solvents Fuel residues Waste oils Battery residues and electrolytes	None
Sandy Creek	Surface water Sediments	--	Unknown, (however, see Site 21B and below)	Cyanide (surface water) Toluene (sediments) Ethyl benzene (sediments) Xylene (sediments) Methylene chloride (sediments) 4,4-DDT (sediments) 4,4-DDD (sediments) 4,4-DDE (sediments) Dieldrin (sediments)
Abandoned Wastewater Treatment Plant (see Section 5.6)	None	Surface soils Subsurface soils Groundwater Surface water Sediments	Dried sewage sludge (unknown)	Not sampled
Uncontrolled Dumpsite (see Section 5.6)	None	Surface water Sediments Surface soils Subsurface soils Groundwater	Household trash Waste oils/solvents Paints Unknown	Not sampled

Note: -PAH = polynuclear aromatic hydrocarbons

The scope of the recommended Remedial Investigation program includes the installation, sampling, and analysis of 2 deep monitoring wells and 14 water-table monitoring wells; 3 soil borings; 43 test pit excavations; 82 surface soil samples; 9 surface water and sediment samples; a pumping test and sampling and analysis of the OLF Barin water supply well; a soil gas survey; and a remote sensing geophysical survey.

ACKNOWLEDGEMENTS

In preparing this manual, the Remedial Investigation/Feasibility Study personnel at E.C. Jordan Co. commend the support, assistance, and cooperation provided by the personnel at NAS Whiting Field and SOUTHNAVFACENGCOM Engineering Command. In particular, we acknowledge the outstanding effort, dedication, and professionalism provided by the following people in the preparation of this report.

Name	Title	Position	Location
Ted R. Campbell	Environmental Engineer	Engineer-in-Charge	SOUTHNAVFAC-ENGCOM
Jim Holland	Environmental Engineer	Environmental Coordinator	NAS Whiting Field
Danny Locklear	Engineering Technician	Environmental Coordinator	NAS Whiting Field

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GLOSSARY

AA	Atomic absorption spectroscopy
ARARs	Applicable or Relevant and Appropriate Requirements
AWQC	Ambient water quality criteria
AVGAS	aviation gasoline
BLS	below land surface
CAG	Cancer Assessment Group
cal.	caliber
CAS	Chemical Abstract Service
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CIP	USEPA CLP-Caucus Inorganics Protocol
CLP	USEPA Contract Laboratory Program
cm/sec	centimeters per second
COP	USEPA CLP-Caucus Organics Protocol
°F	degrees fahrenheit
°C	degrees centigrade
DEM	Department of Environmental Management (Alabama)
DERA	Defense Environmental Restoration Account
DERP	Defense Environmental Restoration Program
DON	Department of the Navy
DQO	data quality objectives
4,4'-DDD	dichlorophenyl dichloroethane
4,4'-DDE	dichlorophenyl dichloroethylene
4,4'-DDT	dichlorophenyl trichloroethane
EC_{50}	effective concentration (50) Concentration at which 50 percent of organisms show a given effect
FID	flame ionization detector
ft/day	feet per day
ft/ft	feet per foot
$ft^3/s/mi^2$	cubic feet per second per square mile
FR	*Federal Register*
GAC	granular activated carbon
GC	gas chromatography
GC/MS	gas chromatography/mass spectroscopy
gpm	gallons per minute
gpm/ft	gallons per minute per foot
HPLC	high performance liquid chromatography
HRS.	Hazard Ranking System
HRS II	USEPA Hazard Ranking System, Final Rule, December 1990
ICP	inductively coupled argon plasma
IR	Installation Restoration
Jordan	The E.C. Jordan Company
JP-5	Naval jet fuel
K_{ow}	octanol-water partition coefficient
LOEL	lowest observable effects level
LC_{50}	lethal concentration (50) Concentration at which 50 percent of organisms die

LD_{50}	Lethal dose (50) Dose ingested that causes 50 percent of organisms to die
mph	miles per hour
MCL	maximum contaminant limit
MCLG	maximum contaminant limit goal
MEK	methyl ethyl ketone
MS/MSD	matrix spike/matrix spike duplicates
MTBE	methyl tert-butyl ether
$\mu g/\ell$	micrograms per liter
$\mu g/kg$	micrograms per kilogram
$\mu mho/cm$	micrograms per centimeter
mg/ℓ	milligrams per liter
MSL	mean sea level
NAAS	Naval Auxiliary Air Station
NAS	Naval Air Station
NCP	National Oil and Hazardous Substances Contingency Plan
NEESA	Naval Energy and Environmental Support Activity
NGVD	National Geodetic Vertical Datum of 1929
NOAA	National Oceanic and Atmospheric Administration
NPI	non-destructive inspection
NPL	National Priorities List
OPNAVINST	Naval Operations Instruction
OLF	Outlying Landing Field
OVA	organic vapor analyzer
OSWER	Office of Solid Waste and Emergency Response
PA	Preliminary Assessment
PAH	polynuclear aromatic hydrocarbons
PCB	polychlorinated biphenyls
POL	petroleum, oils, and lubricants
PVC	polyvinyl chloride
QC	quality control
RfD	verified reference dose
RI/FS	Remedial Investigation/Feasibility Study
SARA	Superfund Amendments and Reauthorization Act
SDN	Site Discovery and Notification
SI	Site Inspection
SOUTHNAV-FACENGCOM	Southern Division, Naval Facilities Engineering Command
SVOC	semivolatile organic chemicals
TAL	target analyte list
TCL	target compound list
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
UST	underground storage tanks
VOC	volatile organic chemicals
WWII	World War II
WWTP	Wastewater treatment plant

1.0 INTRODUCTION

1.1 PURPOSE. E.C. Jordan Co. (Jordan), under contract to Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM), prepared this Site Investigation (SI) report for Outlying Landing Field (OLF) Barin located near Foley, Alabama. The SI was completed under Amendment 2 of Contract No. N62467-88-C-0382 between SOUTHNAVFACENGCOM and Jordan.

In accordance with the Department of the Navy's (DON) Installation Restoration (IR) program, OLF Barin was investigated to verify the source(s) and extent of soil and groundwater contamination. This IR program is implemented in several phases. Each phase uses information from the previous phase. The first phase was the Site Discovery and Notification (SDN), which consisted of recognizing the potential existence of a problem. Subsequent ~~to the~~ SDN, the Preliminary Assessment (PA) was conducted. This phase consisted of a records search and personnel interviews to collect information to support the findings of the SDN. The PA was conducted by the Naval Energy and Environment Support Activity (NEESA) in December 1988. Five potential contaminant sources (sites) were identified and recommended for additional study (NEESA, 1989).

This SI constitutes the next step prescribed by the Navy's IR program. A Final Work Plan for OLF Barin was developed by Jordan in March 1990 to describe the operations and procedures to be followed and quality assurance objectives to be met while completing this phase.

The overall purpose of the SI was to characterize five previously identified sites with potential for contamination and/or contaminant migration (Sites 19B through 23B) and either eliminate sites from further consideration within the Navy IR program (i.e., no further action) or present the necessary information (i.e., nature and distribution of contaminants) to plan future response actions including a Remedial Investigation/Feasibility Study (RI/FS). In addition, required information was gathered for ranking of OLF Barin according to the final rule of the revised U.S. Environmental Protection Agency (USEPA) Hazard Ranking System (HRS II) for prioritizing uncontrolled hazardous substance releases (55 *Federal Register* (FR) No. 241:51532-51667, December 14, 1990).

This SI report presents findings, results, and recommendations based on information and data collected during the SI field operations.

1.2 SCOPE. The Navy IR Program was designed to identify and abate or control contaminant migration resulting from past operations at Naval installations. The IR Program is the Navy response authority under Section 120 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986 and Executive Order 12580. CERCLA requires that Federal facilities comply with the act, both procedurally and substantively. SOUTHNAVFACENGCOM is the agency responsible for the Navy IR Program in the Southeastern United States. Therefore, SOUTHNAVFACENGCOM has the responsibility to process OLF Barin through PA, SI, priority listing, and remedial response selection in compliance with the

guidelines of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) [40 Code of Federal Regulations (CFR) 300].

Section 105(a)(8)(A) of SARA required USEPA to develop criteria in order to set priorities for remedial action based on relative risk to public health and the environment. To meet this requirement, USEPA has established the HRS as Appendix A to the NCP. The HRS is a scoring system designed to assess relative threat due to documented or potential releases at a site. First promulgated in 1982, the HRS was amended in December 1990, effective March 14, 1991 (55 FR No. 241:51532-51667), to comply with requirements of Section 105(c)(1) of SARA to increase the accuracy of the assessment of relative risk. The newly promulgated HRS II has been substantially revised and is designed to prioritize sites after the SI phase of the CERCLA process. The SI or extended SI is used to present the required data to expeditiously perform an HRS II ranking.

The scope of the OLF Barin SI was to develop data to perform the HRS II as follows:

- to compile required demographic, land use, water use, climatological, hydrological, geological, and ecological data from the installation and appropriate surrounding areas to appropriately score air, surface water, groundwater, and soil exposure pathways and to evaluate and score human and environmental receptors of actual or potential contaminant migration;

- to perform site-specific environmental measurements in support of characterizing the
  - site environmental setting,
  - presence or nature of any wastes or releases at sites,
  - types of contaminated environmental materials,
  - migration potential,
  - chemicals of concern (significantly above background),
  - site-specific contaminant mobility and persistence factors,
  - estimates of waste or contaminant quantities,
  - actual or potential releases; and

- to identify and compile summaries of the chemical, toxicological, and physical attributes of the chemicals of concern to assess mobility, persistence, and receptor-specific toxicity relative to identified "benchmark" concentrations.

Second, the scope of the SI was to characterize and support development of "no further action" findings for sites where contamination is not verified, address data gaps, and recommend specific additional activities for planning future response actions.

Five sites identified during the PA were investigated during the SI. Three additional potential sites were identified during the SI field program. These are shown in Figure 1-1 and identified as follows:

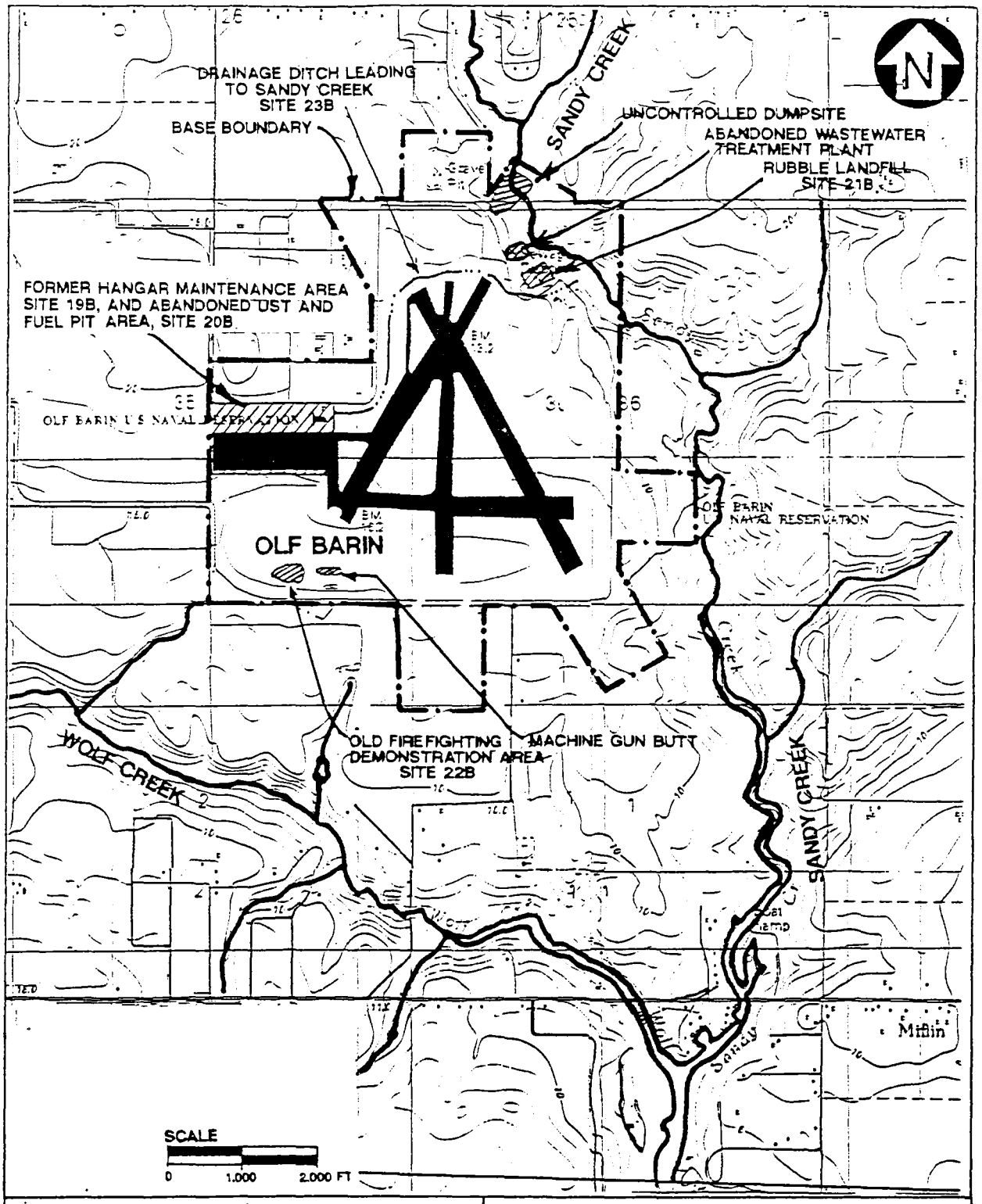


FIGURE 1-1
LOCATION OF SITE INSPECTION STUDY AREAS AT OLF BARIN

SOURCE: MODIFIED FROM USGS 7.5' QUADRANGLE MAP, FOLEY AL (1980 B)

SITE INSPECTION REPORT

OLF BARIN
FOLEY, ALABAMA

Previously Identified Sites

Site 19B, Former Hangar Maintenance Area
Site 20B, Abandoned Underground Storage Tanks (UST) and Fuel Pit Area
Site 21B, Rubble Landfill
Site 22B, Old Firefighting Demonstration Area
Site 23B, Drainage Ditch Leading to Sandy Creek

Sites Identified during the SI

Machine Gun Butt
Uncontrolled Dumpsite
Abandoned Wastewater Treatment Plant

The Former Hangar Maintenance Area, Site 19B, was the location of four large hangars where maintenance and storage activities were conducted during the period of active operations at OLF Barin. All above ground structures associated with this site were demolished in 1959. Adjacent to the Former Hangar Maintenance Area is Site 20B, Abandoned UST and Fuel Pit Area, which provided fueling and fuel storage for aircraft. Site 21B, the Rubble Landfill, is located in the northeastern quadrant of the installation. Reportedly this site received demolition debris when the field was inactived in 1959. During WWII, reports indicated that a Firefighting Demonstration Area existed to the south of the runway at OLF Barin. This site has been designated Site 22B (Old Firefighting Demonstration Area). The remaining previously identified site (Site 23B) is a Stormwater Drainage Ditch leading from the former hangars and fuels storage area to Sandy Creek. Reportedly, in 1954 a 2,000-gallon aviation fuel spill migrated into this ditch.

During the SI field program, the three additional sites listed above were identified as having potential for environmental contamination. The first of these is the Machine Gun Butt. This is the site of apparent, former small arms training and former test firing of 0.50 caliber machine guns. At this location, the soil surface is littered with corroding spent bullets.

Because of the contamination status of Sandy Creek, reconnaissance in the northeastern corner of OLF Barin identified the last two sites. The Abandoned Wastewater Treatment Plant (WWTP) and the Uncontrolled Dumpsite. The abandoned WWTP was decommissioned in 1959. The status of sludge drying beds or underground, or aboveground structures is unknown. North of the abandoned WWTP, an uncontrolled dumpsite exists adjacent to Sandy Creek. This site consists of household trash, used oil cans, paint cans, and other debris that has been dumped by unknown persons. Public access exists due to a breach in the OLF Barin boundary fence. Specific locations and site histories are presented in Sections 2.0 and 5.0 for each of the above sites.

The specific scope of explorations and environmental measurements conducted during the SI is described in Section 4.0. In summary, this program consisted of the collection and chemical analysis of 2 surface water samples, 2 sediment samples, and 60 surface soil samples; installation of 8 soil borings; collection, lithological classification, and field screening of 78 subsurface soil samples;

installation of 8 monitoring wells; measurement of groundwater elevation; and collection and analysis of 9 groundwater samples. Aquifer tests (in-situ slug tests) were conducted in the monitoring wells to evaluate hydraulic conductivity and groundwater flow.

1.3 OVERVIEW OF SITE INSPECTION (SI) REPORT. This SI report contains the following six sections.

- Section 1.0 is the Introduction.
- Section 2.0, Activity Description, presents background information associated with OLF Barin including site location, ownership, history, and remedial actions to date.
- Section 3.0, Environmental Setting, presents information on the environmental setting of OLF Barin including topography, hydrology, geology, groundwater, climate, meteorology, population characteristics, land use, water supply, and sensitive environments.
- Section 4.0, Summary of Field Investigation Program, summarizes the investigations to date at OLF Barin and describes the SI field program.
- Section 5.0, Site-Specific Investigations, provides the site specific history of operations, results of each of the site-specific investigations, site characterization and evaluation, and significant findings and conclusions. This section also provides a rationale and basis for recommended further actions.
- Section 6.0, Recommended Further Action, provides specific recommendations for further investigations at OLF Barin.

The report organization supports two end uses of the compiled data and assessments. First, within the context of site ranking using HRS II, essential data are contained in Sections 3.0 and 5.0. Data required for scoring receptors or targets are contained in Section 3.0 along with the general information required to score migration pathways. Waste characterization and significant constituent concentrations are contained in Section 5.0, as are the summarized chemical and toxicological properties of each contaminant of concern interpreted as present at greater than background concentrations. These data are required to evaluate waste characterizations, toxicity, likelihood of release, and potential migration pathways.

Second, rationale for the specific recommended follow-on actions presented in Section 6.0 are developed in detail in section 5.0. This process is initiated by data analysis and an assessment of the contamination status of each site and any data gaps present. Conclusions and significant findings presented on a site-specific basis are supported by this assessment. Recommended further actions were placed in a separate, succinct section for clarity and consistency.

Laboratory results, boring logs, monitoring well installation reports, and toxicological and chemical characteristic profiles for each chemical or element of concern can be found in the Appendices.

2.0 ACTIVITY DESCRIPTION

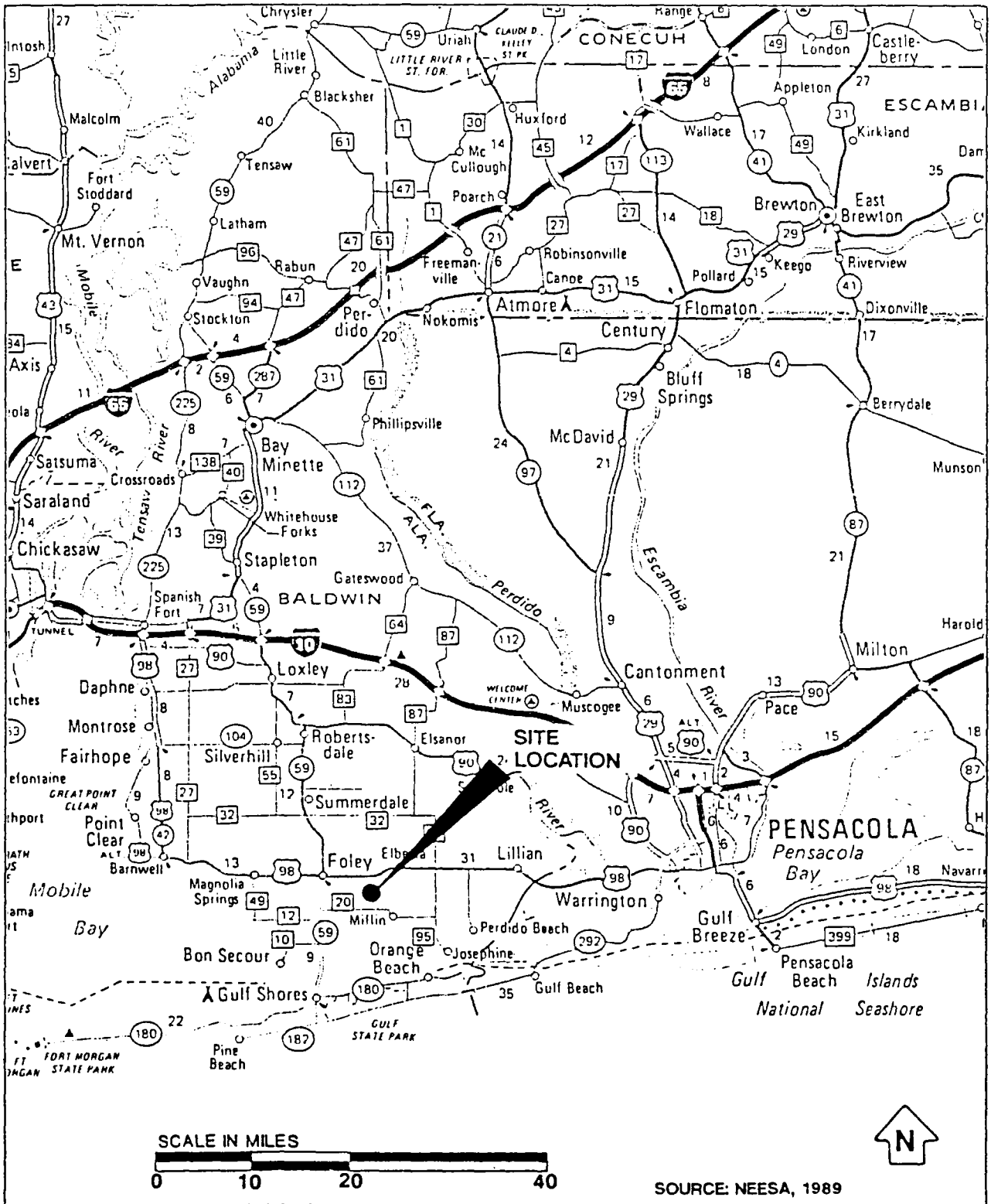
2.1 LOCATION OF INSTALLATION. OLF Barin is located in Baldwin County, Alabama, 40 miles southeast of Mobile, Alabama. It is approximately 10 miles north-northeast of Gulf Shores, Alabama, and 35 miles west of Pensacola, Florida, near the Gulf of Mexico coast (Figure 2-1). Presently, OLF Barin consists of approximately 490 acres, considerably less than the nearly 1,000 acres that comprised the station during World War II (WWII) and the Korean Conflict. A major part of the land within the activity boundaries is used for three active airstrips.

2.2 INSTALLATION LAYOUT. The Foley, Alabama, municipal airport was leased from the city of Foley and commissioned by the U.S. Navy as the Naval Auxiliary Air Station (NAAS) Barin on December 5, 1942. The airport consisted of three airstrips covering 310 acres which became the OLF Barin West Field. The Navy acquired another 655 acres east of the original airport to build another three airstrips (East Field) and an administration and housing area. Figure 2-2, taken from the PA (NEESA, 1989) depicts the layout of NAAS Barin during WWII.

2.3 INSTALLATION OWNERSHIP AND MISSION. After commissioning, NAAS Barin was used for basic and advanced flight training and as an indoctrination center for enlisted personnel. During WWII, NAAS Barin grew to include 4 large aircraft hangars, an underground refueling system with 8-25,000 gallon tanks connected to 2.15 miles of fuel lines and 60 fuel pits, as well as approximately 65 structures used to support station personnel and 6 active airstrips.

NAAS Barin was deactivated on January 5, 1947, and remained closed until the Korean Conflict. Reopened in 1952, the airfield again functioned as a training facility until 1959. Upon closing in 1959, the original airstrip area west of the facility was transferred back to the City of Foley. The majority of the installation buildings were either sold or dismantled at this time. The east field remained unoccupied until 1985. At that time, pilots from Naval Air Station (NAS) Whiting Field, Milton, Florida, began using the field for "touch-and-go" practice. NAS Whiting Field began construction of a crash crew building in 1985 and the field was officially reopened in May 1988 and renamed OLF Barin.

Under the command of NAS Whiting Field, OLF Barin functions as a practice landing strip for pilots training at NAS Whiting Field. A major part of the land within the activity boundaries is used for three active airstrips. A small part of the field is occupied by station personnel as operational building and equipment storage. A small contingent of firefighters (63 personnel) is assigned to the station to be on hand in case of an aircraft accident. This is the only currently ongoing activity at OLF Barin. The remaining acreage consists primarily of mowed and open grasslands and pine plantations. Figure 2-3, adapted from NEESA (1989) shows the current layout of OLF Barin as well as the identified sites of potential contamination.



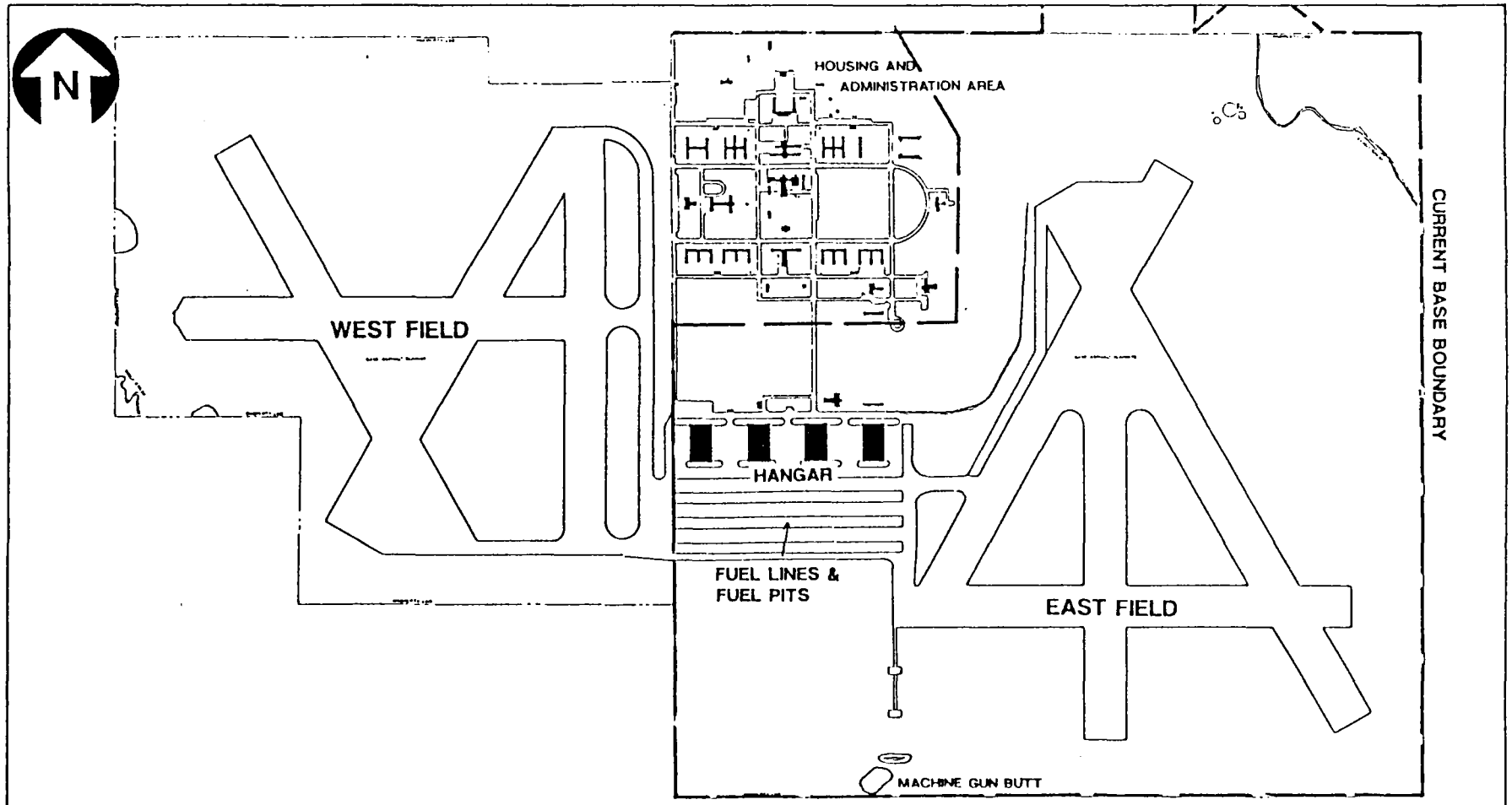
SOURCE: NEESA, 1989

FIGURE 2-1

LOCATION OF OLF BARIN
FOLEY, ALABAMA

SITE INSPECTION REPORT

OLF BARIN
FOLEY, ALABAMA



APPROX. SCALE

0 600 1,200

SOURCE: NEESA 1989

HISTORICAL SITE SKETCH

SITE INSPECTION REPORT
OLF BARIN
FOLEY, ALABAMA

FIGURE

2-2

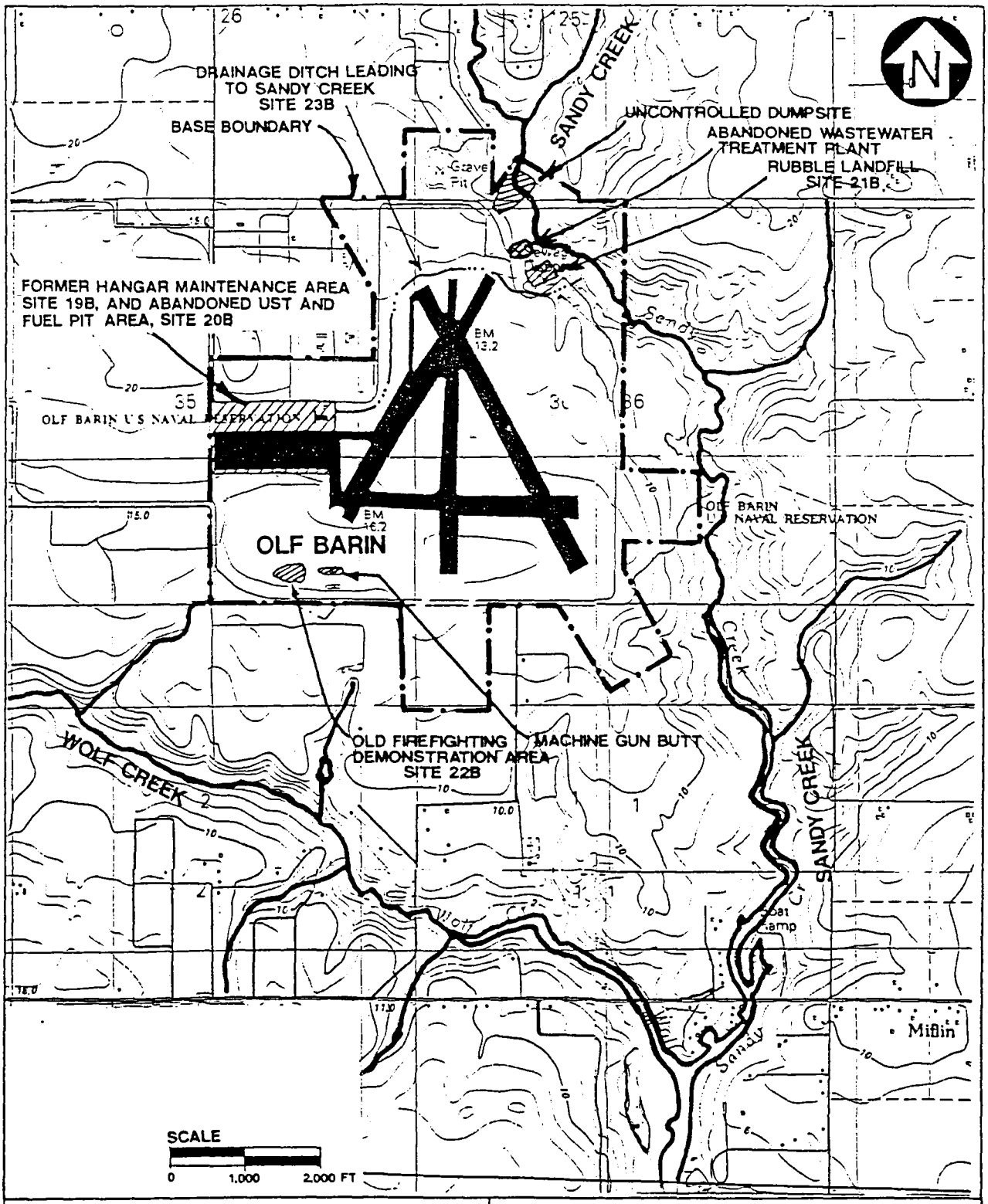


FIGURE 2-3
LOCATION OF SITE INSPECTION STUDY AREAS AT OLF BARIN

SOURCE: MODIFIED FROM USGS 7.5' QUADRANGLE MAP, FOLEY AL, (1980 a)

SITE INSPECTION REPORT

OLF BARIN
FOLEY, ALABAMA

2.4 REGULATORY HISTORY. SARA Section 211 (1986) provides continued authority for the Department of Defense Environmental Restoration Program (DERP) and the Defense Environmental Restoration Account (DERA). The Navy IR Program is authorized by Chief of Naval Operations Instruction (OPNAVINST) 5090.1 of 26 May 1983. SOUTHNAVFACENGCOM manages the Navy program.

SOUTHNAVFACENGCOM tasked NEESA to conduct a PA for each Navy and Marine Corps facility listed on the Federal Agency Hazardous Waste Compliance Docket as required by SARA Section 120.

The PA for OLF Barin began with investigation and review of available records at NEESA and SOUTHNAVFACENGCOM. After the record search the PA team, composed of NEESA personnel, visited OLF Barin in December of 1988 to complete documentation of past and present operations and disposal practices. The PA completed in February 1989 identified and recommended five potential contaminant sources for additional study (NEESA, 1989).

An SI of the five identified potential sources was the next step prescribed by the Navy's IR Program. A Final Work Plan for the OLF Barin SI was developed in March 1990 by Jordan under contract to SOUTHNAVFACENGCOM. The SI field program was completed as described in Section 4.0 during the period April through June 1990.

2.5 REMEDIAL ACTIONS TO DATE. During WWII and again during the Korean Conflict, NAAS Barin was used for training and aircraft maintenance. Numerous types of aircraft fuel, solvents, petroleum, oils, and lubricants (POL) were used by maintenance personnel in these operations.

In August 1988, a drinking water supply well located at OLF Barin was discovered to be contaminated with trans-1,2-dichloroethylene, tetrachloroethylene, and trichloroethylene. Granular activated carbon (GAC) filters were installed to remove the above-mentioned organic contaminants detected in the groundwater from the water supply well. The State of Alabama permitted the use of the well by the personnel after the GAC filtering system and monitoring program were put in place. The installation of the GAC treatment system does not constitute a permanent remedial measure.

As a result of past flight and aircraft maintenance operations, 19 abandoned POL UST exist at OLF Barin. Remedial action plans and specifications have been completed for removal and closure of these tanks by SOUTHNAVFACENGCOM. Removal action has been prioritized for completion in 1991.

The contamination status of the existing and former station supply wells and the UST are described in Section 5.0 of the SI report.

3.0 ENVIRONMENTAL SETTING

This section presents a description of the environmental and demographic setting at OLF Barin and adjacent southern Baldwin County, Alabama. This section represents a synthesis of general background information provided mainly by the U.S. Geological Survey (USGS) and the Alabama Geological Society, as well as the U.S. Soil Conservation Service and Baldwin County Chamber of Commerce. Site-specific hydrogeologic information collected during the SI field program is also presented, as applicable, to characterize the environmental setting at OLF Barin. Where appropriate, data are organized in terms of HRS II ranking criteria.

3.1 TOPOGRAPHY. OLF Barin is located in the Southern Pine Hills/Coastal Lowlands District Region, which is part of the East Gulf Coastal Plain portion of the Coastal Plain Physiographic Province. Elevations at OLF Barin, taken from the Foley and Elberta, Alabama, USGS quadrangle maps (7.5 minute) (USGS, 1980a; 1980b), range from 10 feet (3.1 meters) to 53 feet (16.2 meters) above the National Geodetic Vertical Datum (NGVD) of 1929. The station is characterized by a relatively flat topographic surface, except in the extreme eastern part where topography slopes steeply down to the narrow floodplain of Sandy Creek. Figure 3-1 shows the topography and surface drainage features within a 4-miles radius of OLF Barin. A 4-mile radius was chosen because the HRS II uses distances out to 4 miles as discriminators in target or receptor evaluations. As shown, the land slopes slightly upward to the north with the highest elevations at approximately 100 feet (31 meters) NGVD to the north of the towns of Foley and Elberta, Alabama. In general, the major relief features are the floodplains of Sandy Creek and Wolf Creek. The land surface reaches mean sea level in the salt marshes and coastal swamp forests adjacent to Wolf Bay.

3.2 SURFACE HYDROLOGY. OLF Barin is located in USGS Hydrologic Unit 03140107, an Eastern Coastal Unit adjacent to the Perdido River Drainage Basin (O'Neil and Mettee, 1982). The Perdido River flows south from Alabama and forms the border between Baldwin County, Alabama, and Escambia County, Florida. Figure 3-2 is a map of the southern part of Baldwin County. As shown, the Perdido River System becomes a long southwesterly trending estuarine system that opens to the Gulf of Mexico among a series of barrier islands. As shown in Figure 3-2, the southeastern part of Baldwin County, which makes up the Eastern Coastal Unit, drains to the Perdido Bay estuarine system via a series of creeks and bayous. The western part of Baldwin County drains westerly into Mobile Bay. Wolf Creek and Sandy Creek have drainage areas estimated as 10.91 and 13.54 square miles, respectively, upstream of OLF Barin. No USGS streamflow gauging stations exist on either Wolf Creek or Sandy Creek.

O'Neil and Mettee (1982), in their assessment of coastal hydrology of the Mobile Bay area, estimated unit runoff in the Perdido River Basin and the Fish River at an average annual flow of approximately 2.0 cubic feet per second per square mile ($ft^3/s/mi^2$) based on the following gauging locations:

- Perdido River at Barrineau Park, Florida (1942-1967), 1.96 $ft^3/s/mi^2$
- Styx River at Loxby, Alabama (1952-1962), 1.94 $ft^3/s/mi^2$
- Fish River near Silverhill, Alabama (1954-1962), 2.16 $ft^3/s/mi^2$

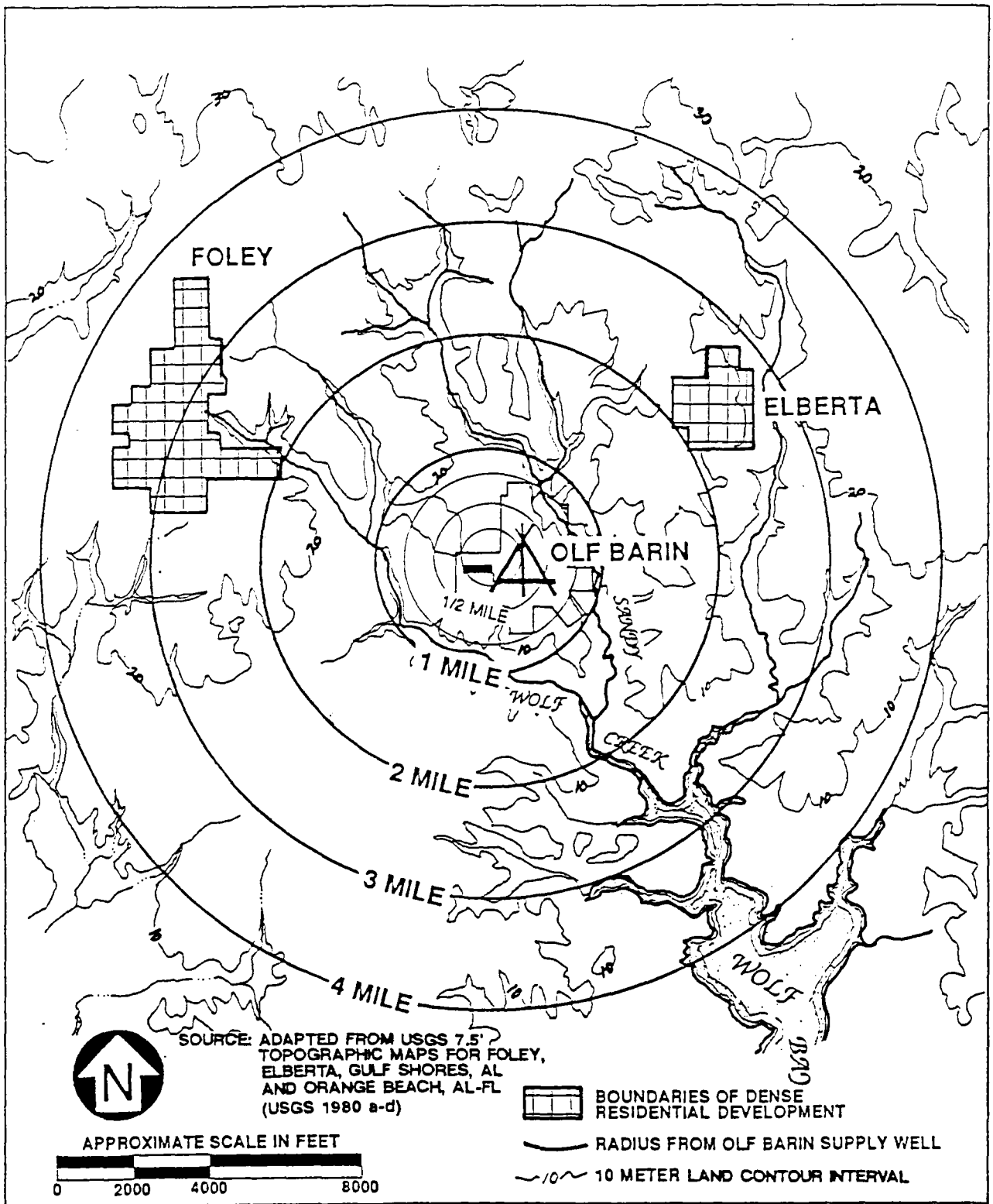


FIGURE 3-1

FOUR-MILE RADIUS MAP
OLF BARIN FIELD

SITE INSPECTION REPORT

OLF BARIN
FOLEY, ALABAMA

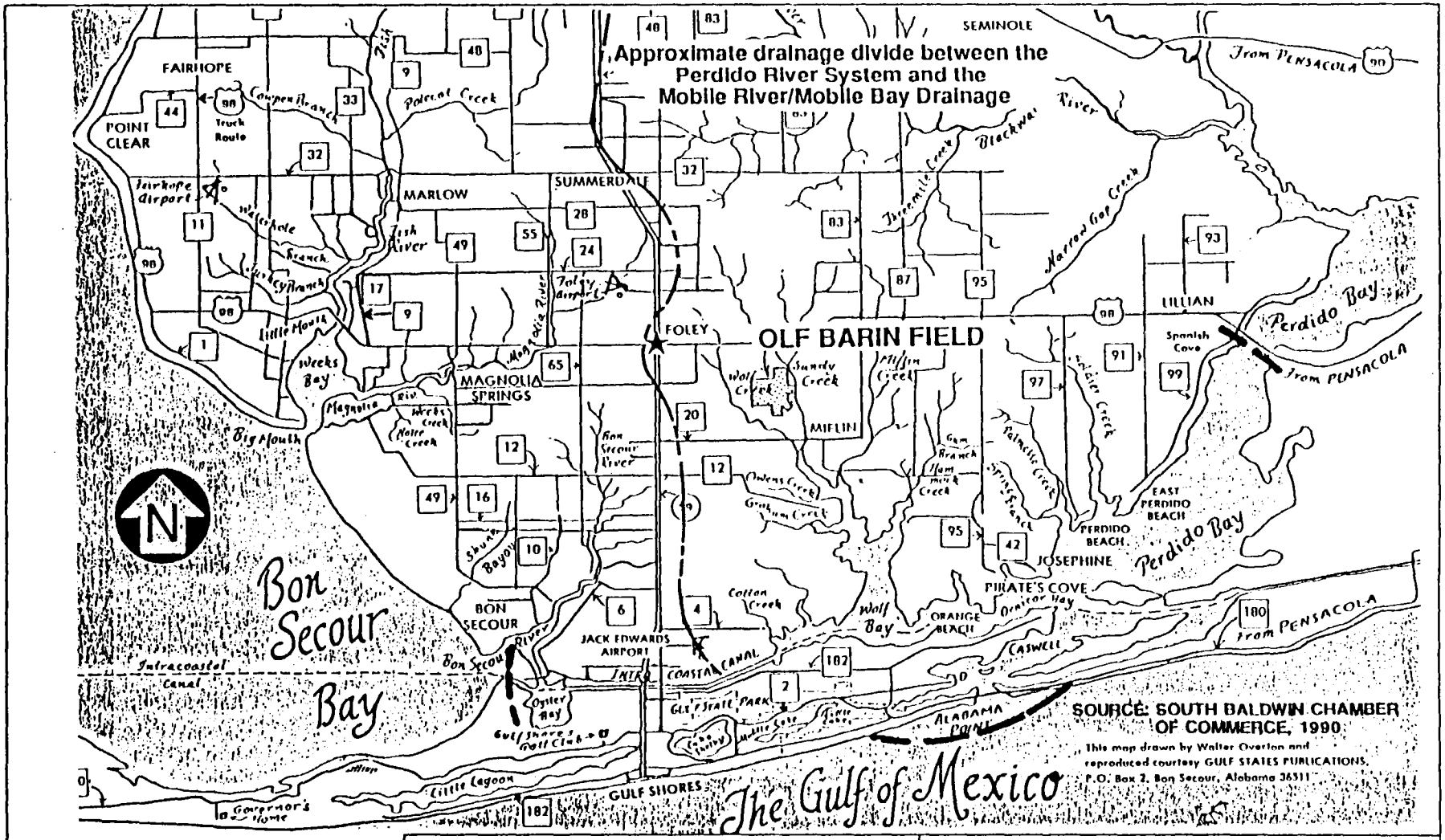


FIGURE 3-2

OVERALL SURFACE HYDROLOGIC FEATURES OF SOUTHERN BALDWIN COUNTY, ALABAMA

SITE INSPECTION REPORT

OLF BARIN
FOLEY, ALABAMA

Overall land use, topography, and, therefore, runoff relationships would be expected to be similar for the non-tidal reaches of Wolf Creek and Sandy Creek.

Using these assumptions, the average annual discharge of Wolf Creek and Sandy Creek can be estimated as 22 cubic feet per second (ft^3/s) and 27 ft^3/s, respectively.

Figure 3-2 also shows the areas 15 river miles downstream from OLF Barin that are identified as target areas for surface water contaminant migration route assessment using the HRS II. Points 15 miles downstream include all of the tidal part of Wolf Bay, the Intracoastal canal to Mobile Bay, and Perdido Bay from the U.S. Highway 98 bridge to the Gulf of Mexico waters immediately offshore of Alabama Point at Perdido Pass.

The installation is drained by Wolf Creek to the west and Sandy Creek to the east (Figure 3-3). Both streams flow to the south-southeast into Wolf Bay. No other naturally occurring bodies of surface water that can receive flow from the station appear to be located within the immediate vicinity of OLF Barin. Several man-made ditches are located throughout the former aircraft maintenance and runway areas that convey drainage to the east into Sandy Creek. Runoff from a portion of the southern half of the runways flows overland into Wolf Creek. Overland flow distances from the former operational areas of OLF Barin to the streams are relatively great. Runoff from the former fuel storage system, the north side of the former hangar areas, and administrative area was collected in drainage ditches that flowed for approximately 5,500 feet before discharging to Sandy Creek. Runoff from the former aircraft parking areas and the southern part of the former hangar areas flows for 4,000 to 4,500 feet overland before discharging into Wolf Creek. Runoff from the area of the Machine Gun Butt and Old Firefighting Demonstration Area travels 4,000 feet overland before discharging to Wolf Creek. The Abandoned WWTP and Rubble Landfill are located within 200 feet of Sandy Creek. An unrestricted dumping area (Uncontrolled Dumpsite) located just north of the WWTP is just above and possibly on the banks of Sandy Creek.

Because of the relatively small drainage basins of Wolf and Sandy Creeks above OLF Barin, and the steep slopes from the installation to the thalweg of the streams, only a small part of the northeastern part of OLF Barin is within the 500-year or 100-year floodplain. The 100- and 500-year floodplains are delineated in Figure 3-3. The Abandoned WWTP and the toe of the Rubble Landfill are near the edge of the 100-year floodplain. An Uncontrolled Dumpsite lies partially within the 100-year floodplain.

According to Alabama Waste Quality Criteria Use Classification Regulations (Alabama Water Improvement Commission Regulations, Policies and Procedures Title II, 1982), the waters of Sandy Creek and the estuarine systems are all classified "S", suitable for human body contact recreation as well as "F&W" and/or "SH." "F&W" and "SH" classes are suitable for propagation of fish and wildlife and suitable for taking of shellfish, respectively.

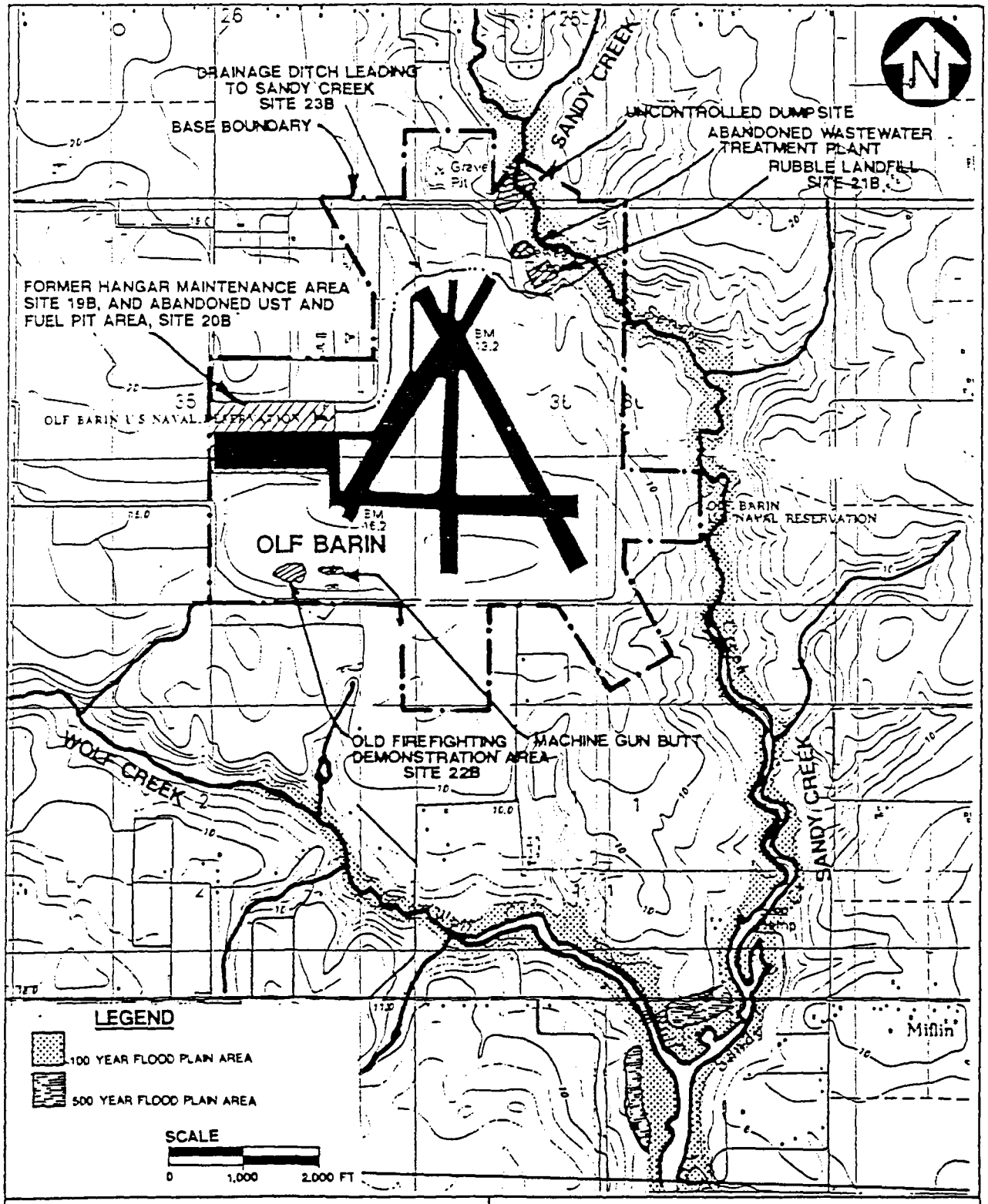


FIGURE 3-3

DELINEATION OF FLOOD PRONE AREAS ADJACENT TO OLF BARIN

SOURCE: MODIFIED FROM USGS 7.5' QUADRANGLE MAP, FOLEY AL. (USGS 1980 B) AND FEMA, 1985

SITE INSPECTION REPORT

OLF BARIN
FOLEY, ALABAMA

Wolf Creek downstream of the Foley, Alabama, sewage treatment discharge and upstream of Wolf Bay is classified "F&W" only.

The Uncontrolled Dumpsite was visited during the HRS II site visit in October 1990. Frequent fishing, as well as wading, swimming, and picnicking was evident on the bank of Sandy Creek.

3.3 GEOLOGY AND SOILS.

3.3.1 Regional Geologic Setting OLF Barin is primarily situated on the surface exposure of the Citronelle Formation of Pliocene age. Holocene and Pleistocene alluvial deposits are found only near the floodplain of Sandy and Wolf Creeks. A general geologic map of shallow sediments in southeastern Baldwin County, Alabama, is presented in Figure 3-4. The deposits are composed mostly of unconsolidated and highly permeable sands and gravels interspersed with silts and clays. They range in unit thickness from 0 to 50 feet, with an average thickness ranging from 15 to 30 feet. Figure 3-5 shows the stratigraphic sequence in southern Baldwin County. The sequence was developed from the log of a boring approximately 10 miles northeast of OLF Barin presented by O'Neil and Mettee (1982) and does not show the Citronelle Formation. OLF Barin is located very near the surficial "pinch-out" of the coastal Pleistocene and Holocene Quaternary sedimentary deposits. The shallow deposits underlying OLF Barin can also be in hydraulic communication with the Pliocene-Miocene aquifer, but because of their relatively thin and discontinuous nature they are not a source of abundant supplies of groundwater.

Pleistocene Quaternary sediments are expressed on OLF Barin only in the northeastern edge adjacent to Sandy Creek. Throughout most of the remainder of southern Baldwin County and underlying the remainder of OLF Barin is the Citronelle Formation of the Pliocene Series (Mooty, 1988). This formation consists of mostly reddish brown, thin-bedded to massive gravely sands, and gray and orange and brown lenses of sandy to silty clays. Sand and gravel beds make up the bulk of the formation, which can be as thick as 200 feet. This formation is the primary source of water for the monitoring wells that were installed at OLF Barin.

In southern Baldwin County, the Citronelle may be 100 to 200 feet thick. As discussed in the previous section, the sediments are generally sands to gravelly sands. Sediments at the base of the formation tend to have a high clay content (Mooty, 1984).

Below the Citronelle Formation lies the Miocene Series Undifferentiated. These deposits generally extend from approximately 50 to over 3,000 feet in thickness and are composed of bedded sands, gravels, and sandy clays. As shown in Figure 3-5, the Tampa Limestone is encountered at approximately 1,500 feet below land surface (BLS) in southern Baldwin County. The sands range from fine to very coarse grained, and the upper part of this formation (just below the Citronelle) is listed as the major producing formation for public water supplies within the area, including OLF Barin (Mooty, 1988).

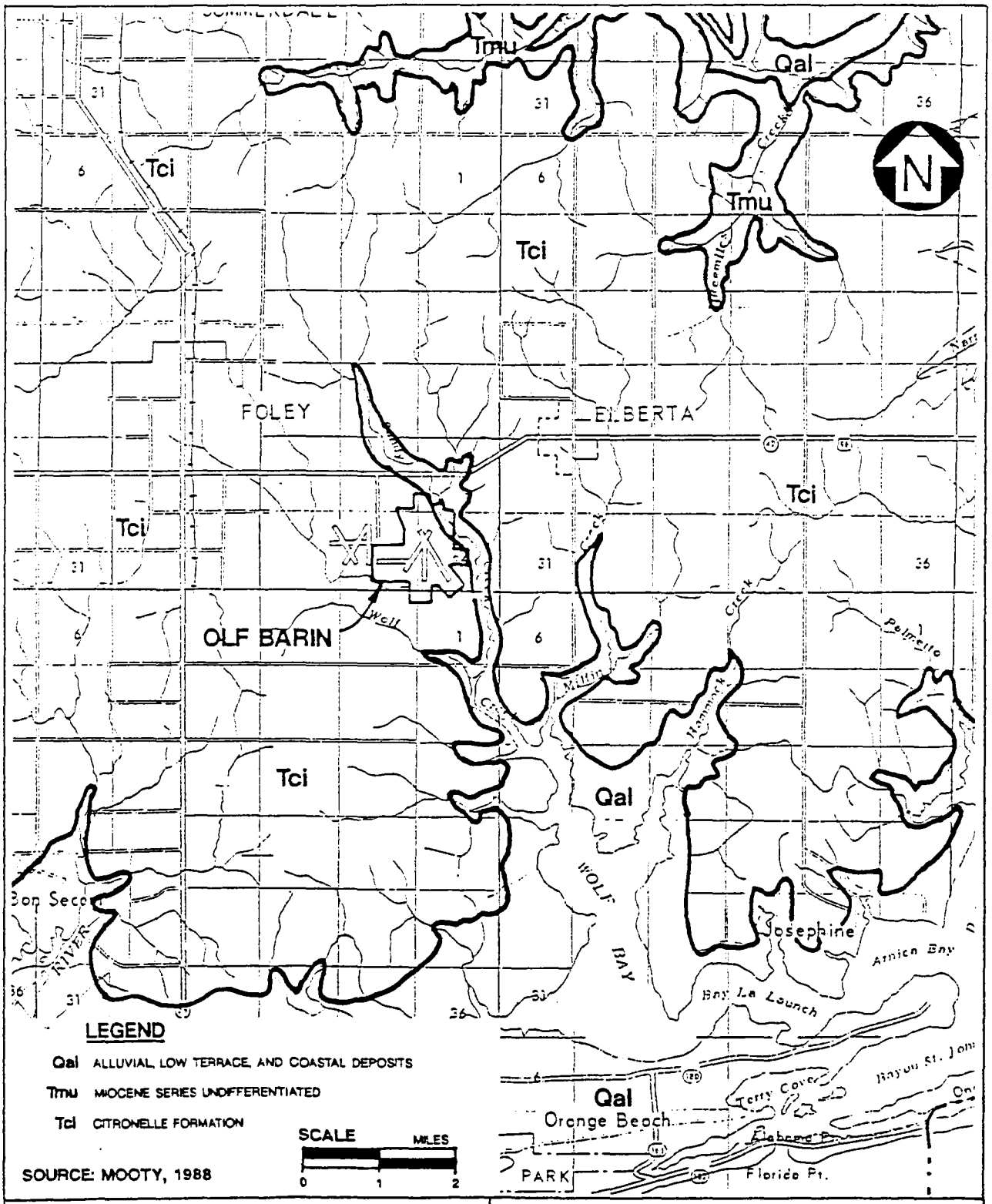


FIGURE 3-4
GENERAL SURFICIAL GEOLOGIC MAP
WITHIN 4 MILES OF OLF BARIN

SITE INSPECTION REPORT

OLF BARIN
FOLEY, ALABAMA

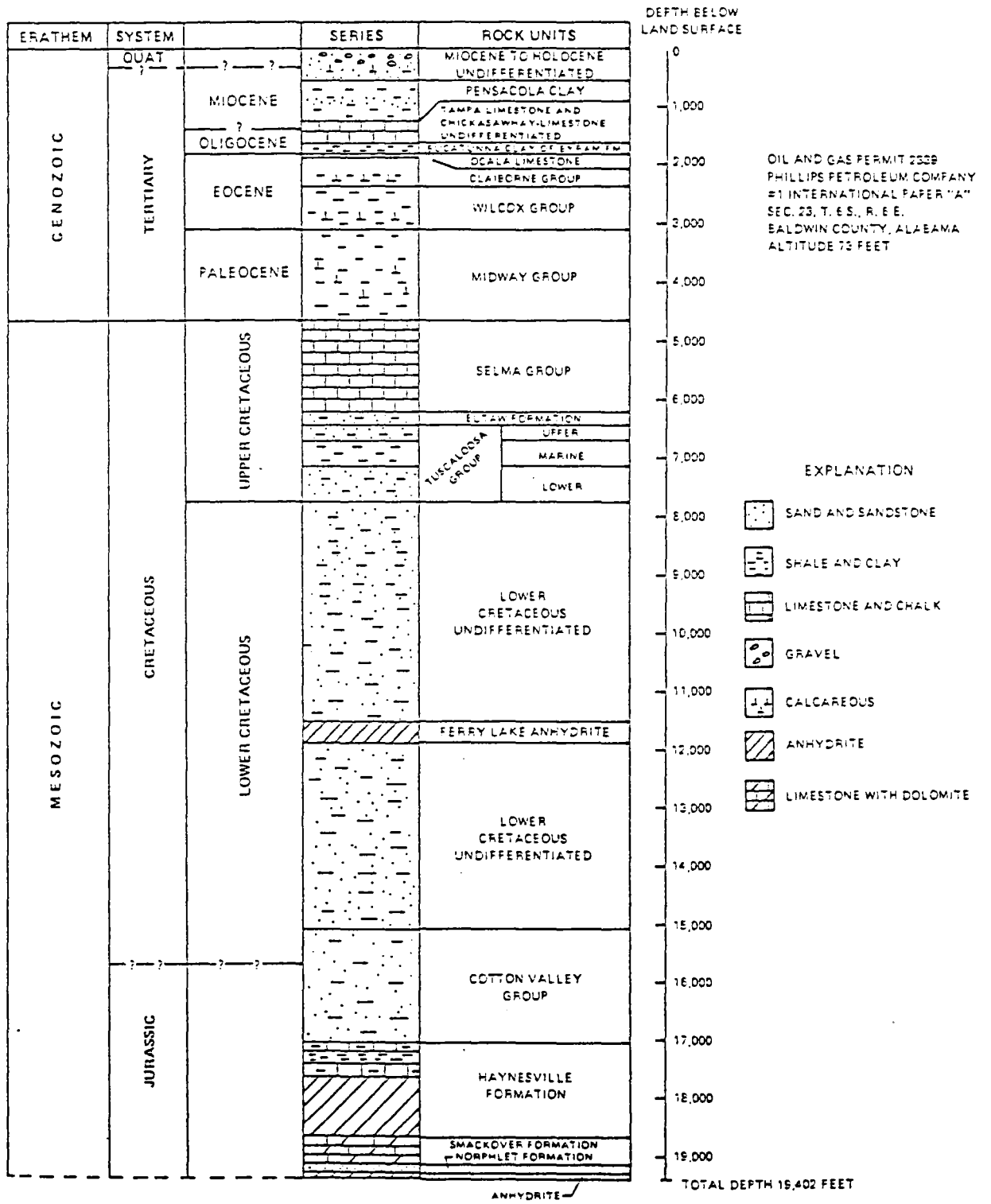


FIGURE 3-5

TYPICAL STRATIGRAPHIC SEQUENCE IN SOUTHERN BALDWIN COUNTY, AL
SOURCE: O'NEILL AND METTEE, 1982

SITE INSPECTION REPORT

OLF BARIN
FOLEY, ALABAMA

3.3.2 Soils and Drainage Figures 3-6 and 3-7 show the general soil associations for southeastern Baldwin County and the specific soil series on and adjacent to OLF Barin, respectively. Table 3-1 summarizes the drainage and slope characteristics of the soils delineated in Figure 3-7. In general, soils belong to the Lakeland-Plummer or Norfolk-Klej-Goldsboro associations. These are deep soils that occur on the nearly level to gently sloping surfaces of uplands. Lakeland-Plummer association soils are characterized as soils occurring on poorly drained, level bottom lands extending, however, to excessively drained uplands and slopes.

The Norfolk-Klej-Goldsboro Association consists of deep, moderately well-drained soils to well-drained soils that occur in uplands. Figure 3-7, which shows the detailed soil classes, indicates a predominance of Lakeland loamy fine sand comprising the soil making up most of OLF Barin. South and southeast of the runways are these areas of Scranton loamy fine sand.

Lakeland soils have a permeability of 6.0 to 20 inches per hour (U.S. Department of Agriculture, Soil Conservation Service, 1962). Clay content increases as a function of depth in typical Lakeland soils from 10 percent or less at the surface to up to 35 percent at depths greater than 4 feet. This lowers permeability below the surface by up to an order of magnitude. As discussed in Section 3.3.3, the surface stratigraphic sequence shows some silt and clay content in the upper 5 feet of the onsite soil borings.

Alluvial, fine-grained, poorly-drained soils are found in the floodplains of both Sandy Creek and Wolf Creek. These are areas with low infiltration rates. The upland soils on and adjacent to OLF Barin are sandy loams to loamy, fine sands and are characterized as medium- or coarse-textured soils with moderate to high infiltration rates. No silty loams, silts, or sandy clays appear to be present.

In order to evaluate the importance of overland flow as a component of contaminant migration in the HRS II scoring, the drainage area upgradient of each source and of the sources themselves must be estimated. The surface drainage patterns at OLF Barin are modified due to the presence of storm drainage ditches, mainly for the runways. The ditches, interpreted flow directions, and drainage basin delineations are shown in Figure 3-8 in relation to the identified sites. The drainage areas estimated for each site are as follows:

- Site 19B, Former Hangar Maintenance Area, 58.9 acres;
- Site 20B, Abandoned UST and Fuel Pit Area, 58.9 acres;
- Site 21B, Rubble Landfill, 2.3 acres;
- Site 22B, Old Firefighting Demonstration Area, 6.9 acres; and
- Site 23B, Drainage Ditch Leading to Sandy Creek, 58.9 acres.

The new sites identified during the SI have the following drainage area:

- Machine Gun Butt, 6.9 acres;
- Uncontrolled Dumpsite, 10.2 acres; and
- Abandoned Wastewater Treatment Plant 2.7 acres.

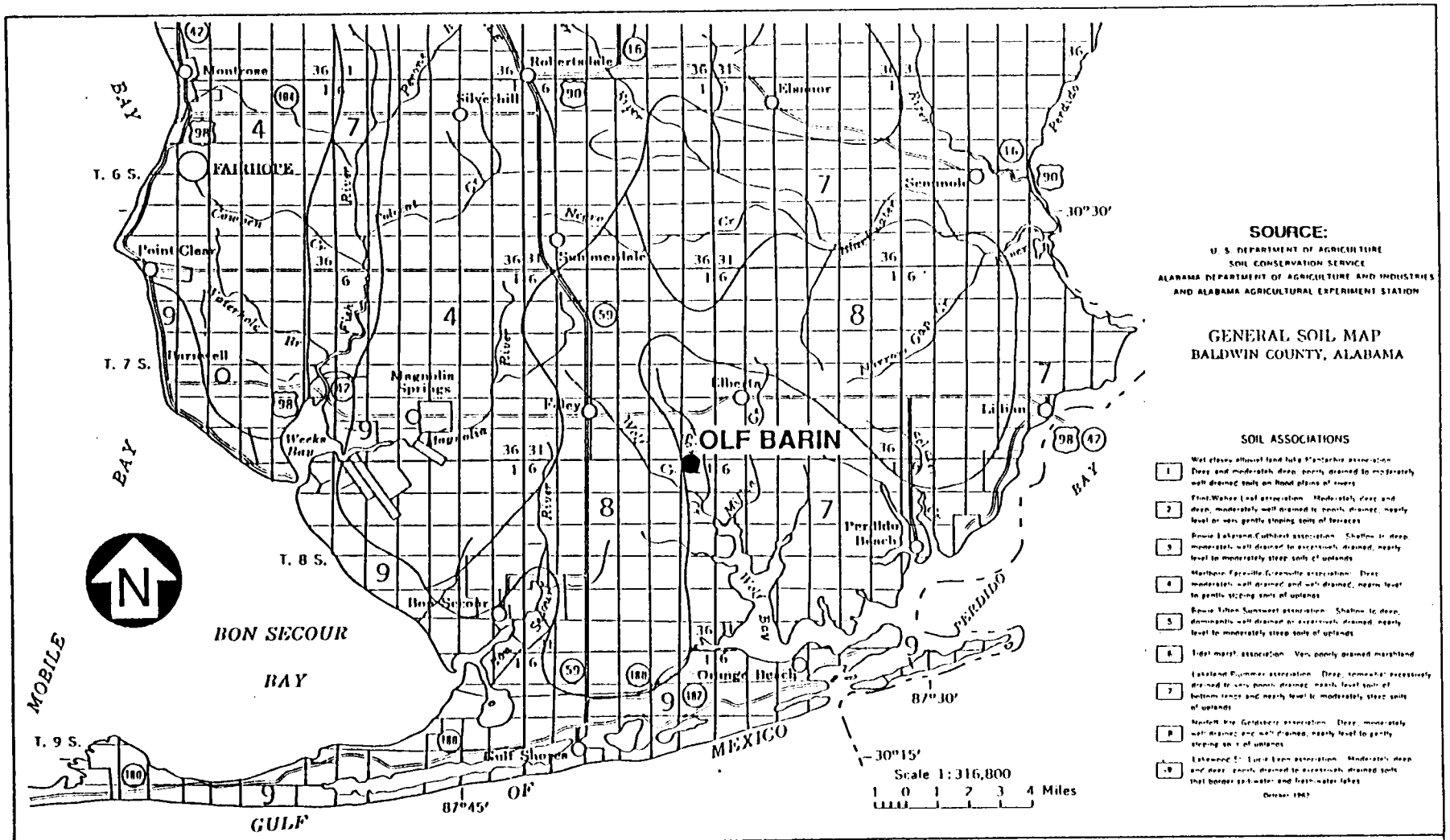
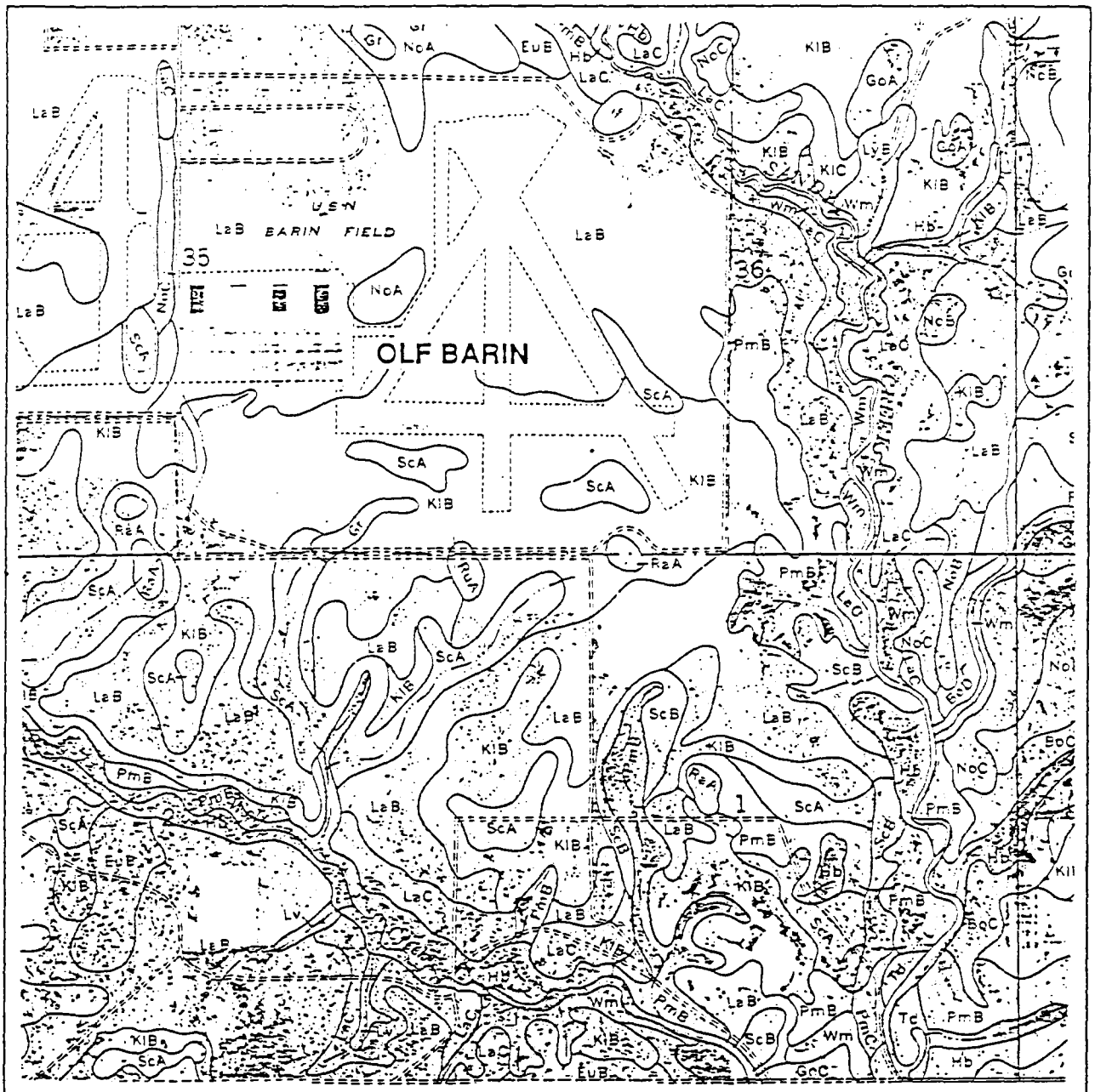


FIGURE 3-6

GENERALIZED SOILS MAP OF
SOUTHERN BALDWIN COUNTY, ALABAMA

SITE INSPECTION REPORT

OLF BARIN
FOLEY, ALABAMA



APPROXIMATE SCALE IN FEET

0 800 1600 3200

SEE TABLE 3-1 FOR SOIL CLASS KEY
SOURCE: U.S. Dept of Agriculture, Soil Conservation Service General Soils Map, Baldwin County, Alabama.1963

FIGURE 3-7

SOIL TYPES ON AND ADJACENT TO OLF BARIN

SITE INSPECTION REPORT

OLF BARIN
FOLEY, ALABAMA

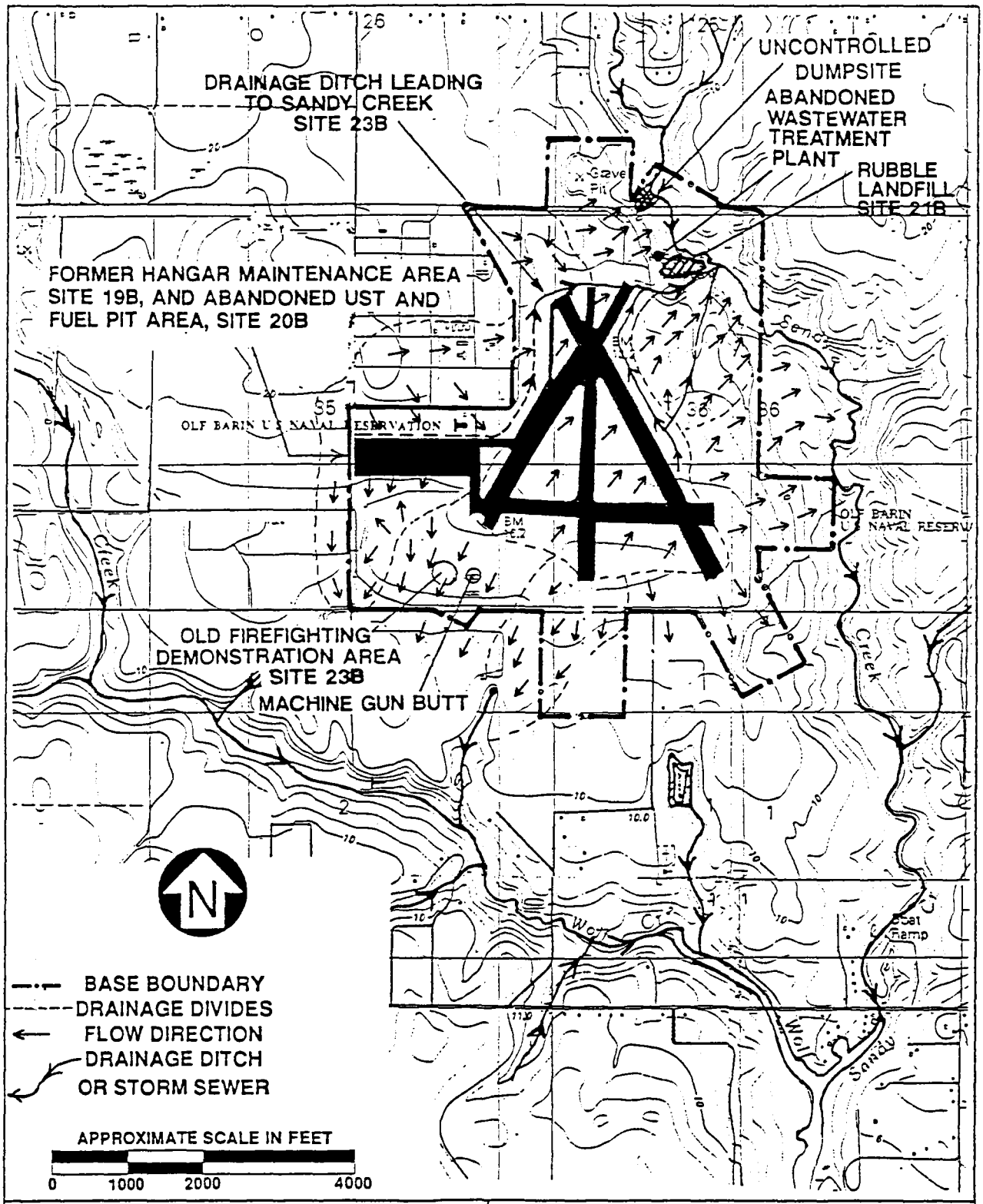


FIGURE 3-8

STORMWATER DRAINAGE AREAS
OLF BARIN

SOURCE: ADAPTED FROM USGS 7.5' QUADRANGLE MAP FOLEY, AL (1980 a)

SITE INSPECTION REPORT

OLF BARIN
FOLEY, ALABAMA

Table 3-1
Soil Classes On and Adjacent to Outlying Landing Field (OLF) Barin

Site Inspection Report
OLF Barin, Foley, Alabama

Symbol	Description
BoC	Bowie fine sandy loam, 5 to 8 percent slopes
EuB	Eustis loamy fine sand, 0 to 5 percent slopes
GoA	Goldsboro fine sandy loam, 0 to 2 percent slopes
Gr	Grady soils
Hb	Hyde and Bayboro soils and muck
KlB	Klej loamy fine sand, 0 to 5 percent slopes
KlC	Klej loamy fine sand, 5 to 8 percent slopes
LaB	Lakeland loamy fine sand, 0 to 5 percent slopes
LaC	Lakeland loamy fine sand, 5 to 8 percent slopes
Lv	Local alluvial land
LyB	Lynchburg fine sandy loam, 2 to 5 percent slopes
NoA	Norfolk fine sandy loam, 0 to 2 percent slopes
NoC	Norfolk fine sandy loam, 5 to 8 percent slopes
PmB	Plummer loamy sand, 0 to 5 percent slopes
RaA	Rains fine sandy loam, 0 to 2 percent slopes
RuA	Ruston fine sandy loam, 0 to 2 percent slopes
ScA	Scranton loamy fine sand, 0 to 2 percent slopes
ScB	Scranton loamy fine sand, 2 to 5 percent slopes
Td	Tidal marsh
Wm	Wet loamy alluvial land

Source: U.S. Department of Agriculture, Soil Conservation Service, General Soils Survey, Baldwin County, Alabama, 1963.

Only the Former Hangar Maintenance Area and Abandoned UST and Fuel Pit Area (19B and 20B) have drainage areas in excess of 50 acres. The 1954 fuel spill (Site 23B) is located in the drainage ditch just downstream of the flightline and maintenance areas.

3.3.3 Site-Specific Geologic Setting Based on regional geological information presented in Section 3.3.1, the upper 100 feet of the geological matrix at OLF Barin is expected to consist of the Pleistocene and Holocene alluvium near the creek systems and the Pliocene age Citronelle Formation on the upland terraces. The stratigraphy to a depth of 100 feet BLS was explored during the SI field program by means of three borings (WHF-19B-1D through WHF-19B-3D). Five other borings (WHF-20B-1 through WHF-20B-5) were installed to depths of 18 to 22 feet BLS. These borings were installed in the western half of OLF Barin at the locations shown in Figure 3-9 to evaluate the stratigraphy, soil, and groundwater contamination status. Monitoring wells were installed in each boring. Contamination status is discussed in Section 5.0. Figure 3-10 shows the interpreted north/south and east/west stratigraphy at OLF Barin for the two cross-sections located as shown in Figure 3-9. Boring logs for the SI soil explorations are contained in Appendix A. These logs show a thin series of deposits generally ranging from silts and silty sand with minor clay components to coarse sand interspersed with a few gravel lenses. Typically, however, the matrix consists of fine to medium sands. The only significant clay was found at boring WHF-19B-2D at the southern boundary of OLF Barin. This consisted of a set of clay layers lying from approximately 30 to 41.4 feet BLS. These layers consist of red, orange, tan, and brown to tan clay mixed with medium to fine sand and small amounts of gravel at approximately 35 feet. At 56 feet, boring WHF-19B-2D encountered a 0.2-foot thick hardpan layer. The stratigraphy shown is typical of undifferentiated deposition sediments of either Pliocene (Citronelle) or more recent age. No explorations have been performed along the creek slopes or eastern half of the installation. Based on the existing site-specific data and regional/area geologic data, the entire installation is likely to be similar to the western half. This setting is a set of thinly bedded sands with minor amounts or stringers of silts, clays, and gravels. No really contiguous confining layers or aquitards, therefore, appear to be present. Wood fragments were observed in a sample from 70.0 to 71.2 feet BLS in boring WHF-19B-3D.

3.4 GROUNDWATER.

3.4.1 Hydrogeology OLF Barin lies within the recharge area of the Pliocene-Miocene aquifer that supplies most, if not all, of the potable groundwater in the general region. This aquifer is within the lower Citronelle Formation and the upper Miocene Series. This unit produces water in Baldwin, Washington, Clarke, and Mobile Counties of Alabama (Hinkle, 1984). The Citronelle and Miocene undifferentiated sediments together comprise an aquifer that is highly transmissive and is capable of producing water in sufficient quantities for large public systems. Most wells completed in the above mentioned aquifer range from 40 to 1,100 feet deep and can yield up to 700 gallons per minute (gpm). Aquifer testing has shown that specific capacities of more than 10 gallons per minute per foot (gpm/ft) in wells drilled in the area are not uncommon (Hinkle, 1984). Water supply wells within the vicinity of OLF Barin are described in Section 3.8. The Pliocene-Miocene aquifer is also connected hydraulically to the Alluvial

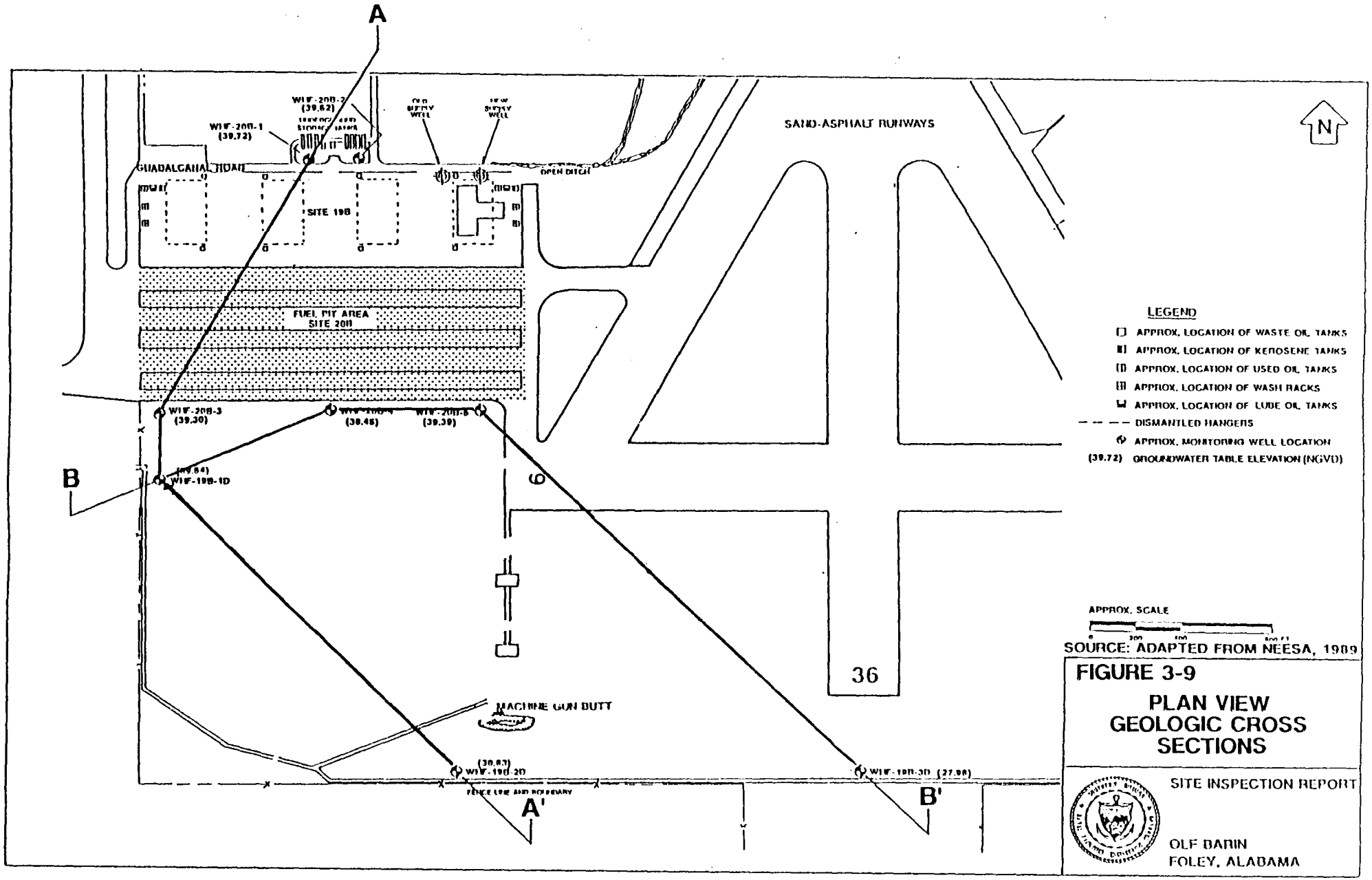


FIGURE 3-9

PLAN VIEW
GEOLOGIC CROSS
SECTIONS

SITE INSPECTION REPORT

OLF BARIN
FOLEY, ALABAMA

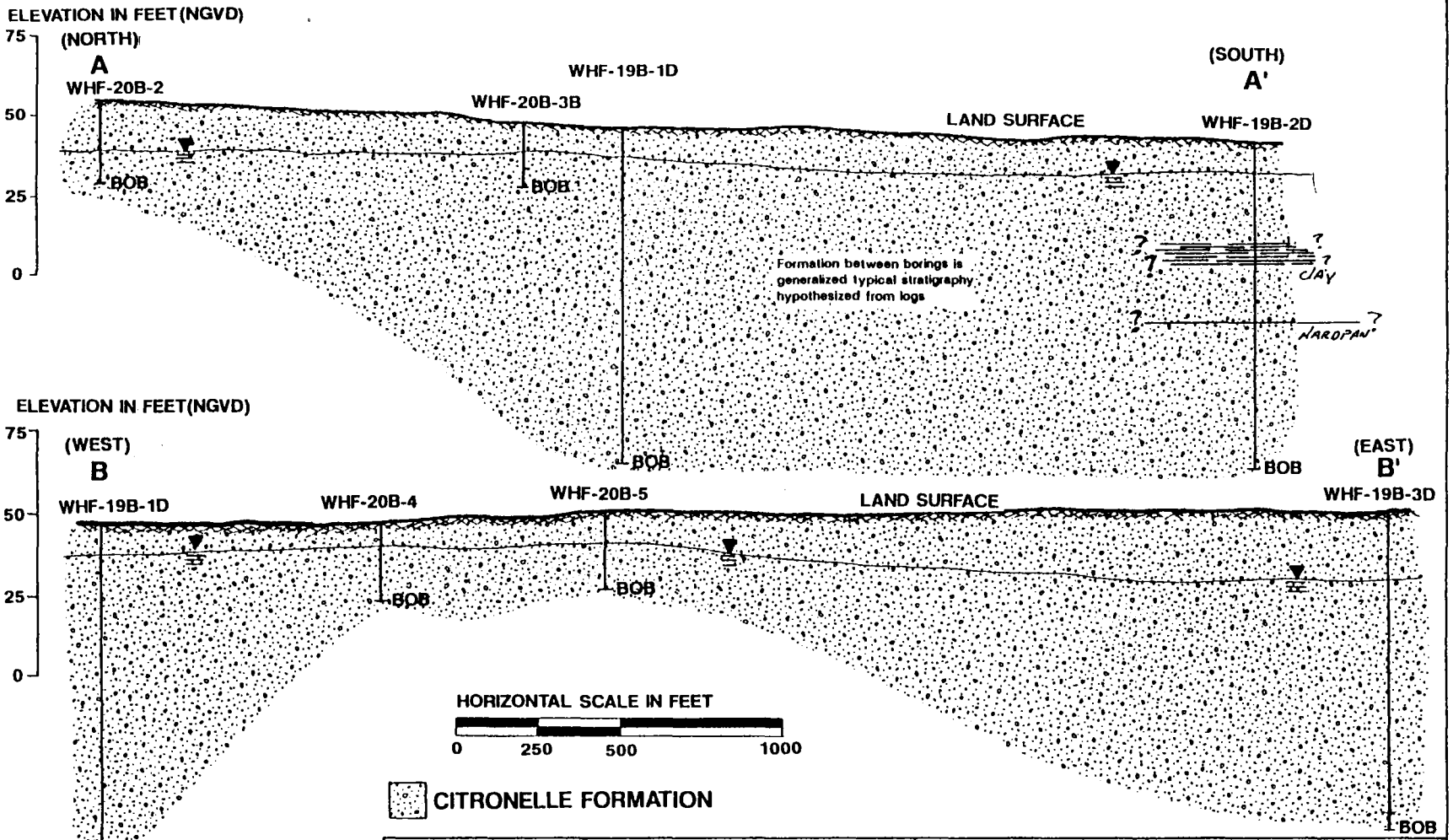


FIGURE 3-10

NORTH-SOUTH AND EAST-WEST CROSS SECTIONS AT OLF BARIN FIELD

SITE INSPECTION REPORT

OLF BARIN
FOLEY, ALABAMA

Coastal Plain aquifer. Although the formations comprising these aquifers differ somewhat in their origin, age, and lithology, both the systems are unconfined andexist under water table piezometric conditions throughout the southern part of Baldwin County. Figure 3-11, adapted from Mooty (1984) and Riccio et al (1973), shows the regional hydrogeological systems and potentiometric surface (i.e., water table) in southern Baldwin County. This shows that OLF Barin lies in the Pliocene-Miocene system with the exception of the eastern and northeastern corners in which the Alluvial-Coastal system is expressed along Sandy Creek.

Within the confines of OLF Barin, groundwater lies approximately 10 to 20 feet BLS. Depth to groundwater and groundwater elevations in the monitoring wells installed and sampled during June 1990 are summarized in Table 3-2. As described in Section 4.0, these wells were installed in the western part of OLF Barin to verify contaminants in groundwater. The groundwater contour map of the groundwater table in the western half of the site is presented in Figure 3-12. Groundwater in the western part of the installation flows south-southeasterly at a very low gradient.

Table 3-2
Groundwater Elevation Summary
June 12, 1990

Site Inspection Report
OLF Barin, Foley, Alabama

Monitoring Well No.	Total Depth (feet bls)	Screen Interval (feet bls)	Riser Elevation (feet above NGVD)	Depth to Water (feet)	Water Table Elevation (feet above NGVD)
WHF-19B-1D	100	90-100	48.65	10.20	38.45
WHF-19B-2D	100	90-100	43.78	13.15	30.63
WHF-19B-3D	100	90-100	50.28	22.30	27.98
WHF-20B-1	22	12-22	57.60	17.88	39.72
WHF-20B-2	22	12-22	56.99	17.37	39.62
WHF-20B-3	18	8-18	49.00	9.70	39.30
WHF-20B-4	18	8-18	49.31	9.77	39.54
WHF-20B-5	18	8-18	51.29	11.90	39.39

Note: bls = below land surface
NGVD = National Geodetic Vertical Datum of 1929.

Under non-pumping conditions, the water table exists under a fairly low gradient in the former fuel storage and hangar maintenance areas. Because of this, it is likely that pumping of the installation supply wells has a significant effect on flow direction in the highly permeable substrate of Sites 19B and 20B (see Figure 3-12 and Section 3.4.2). The gradient across this portion of the site is estimated as 2.26×10^{-4} foot per foot (ft/ft) based on averaged water levels in

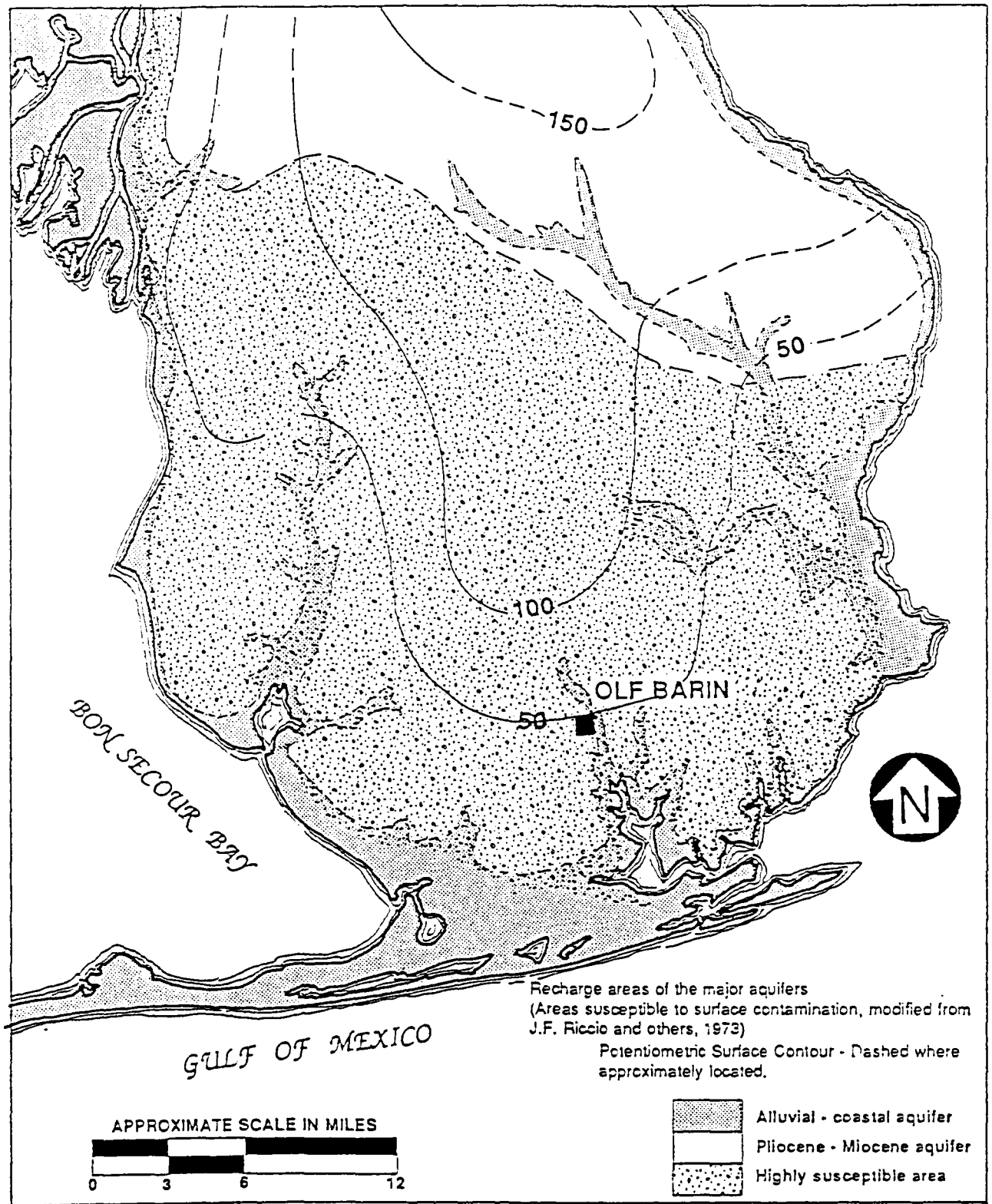


FIGURE 3-11

REGIONAL HYDROGEOLOGY

SITE INSPECTION REPORT

OLF BARIN
FOLEY, ALABAMA

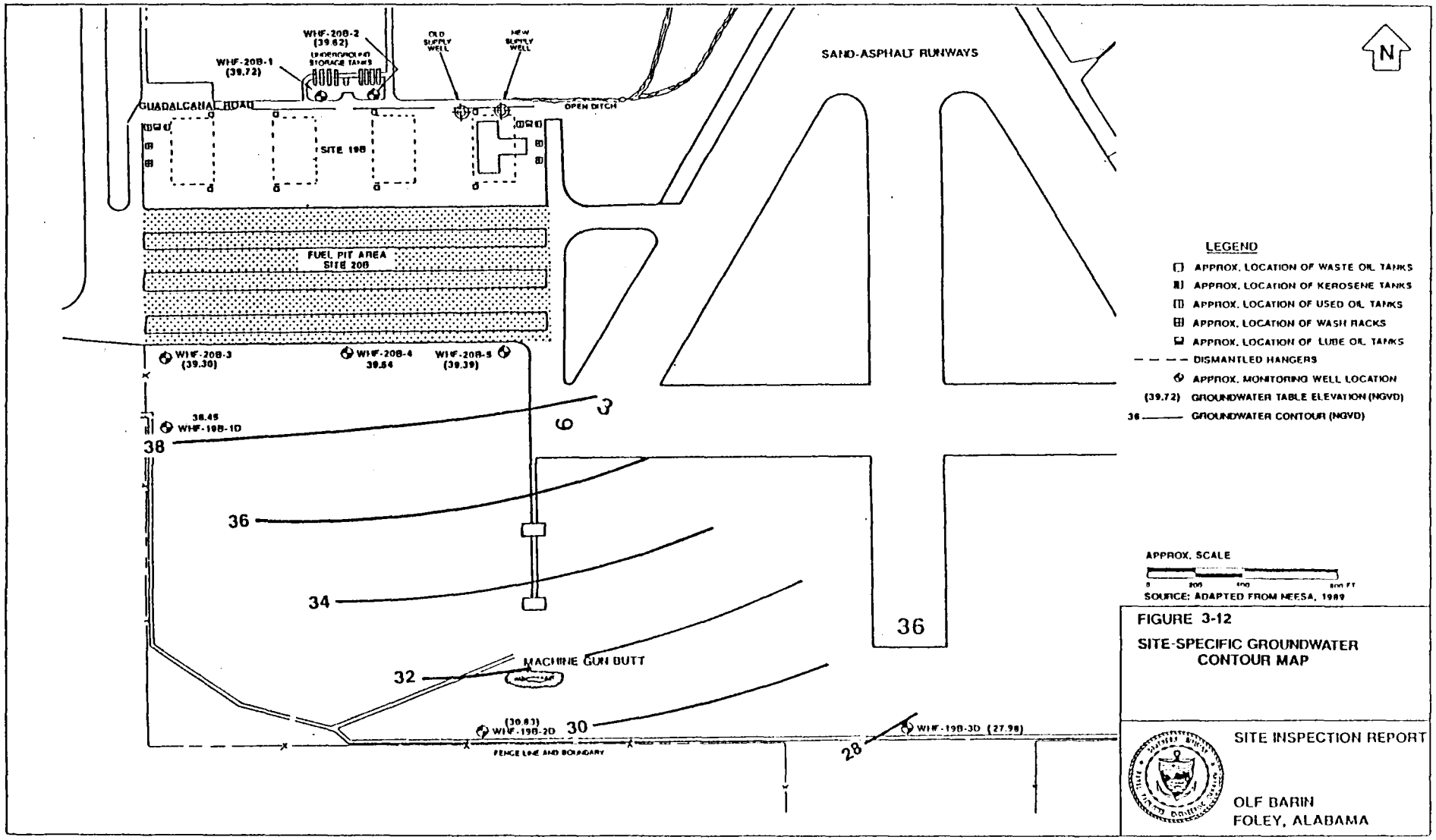


FIGURE 3-12

SITE-SPECIFIC GROUNDWATER CONTOUR MAP

SITE INSPECTION REPORT

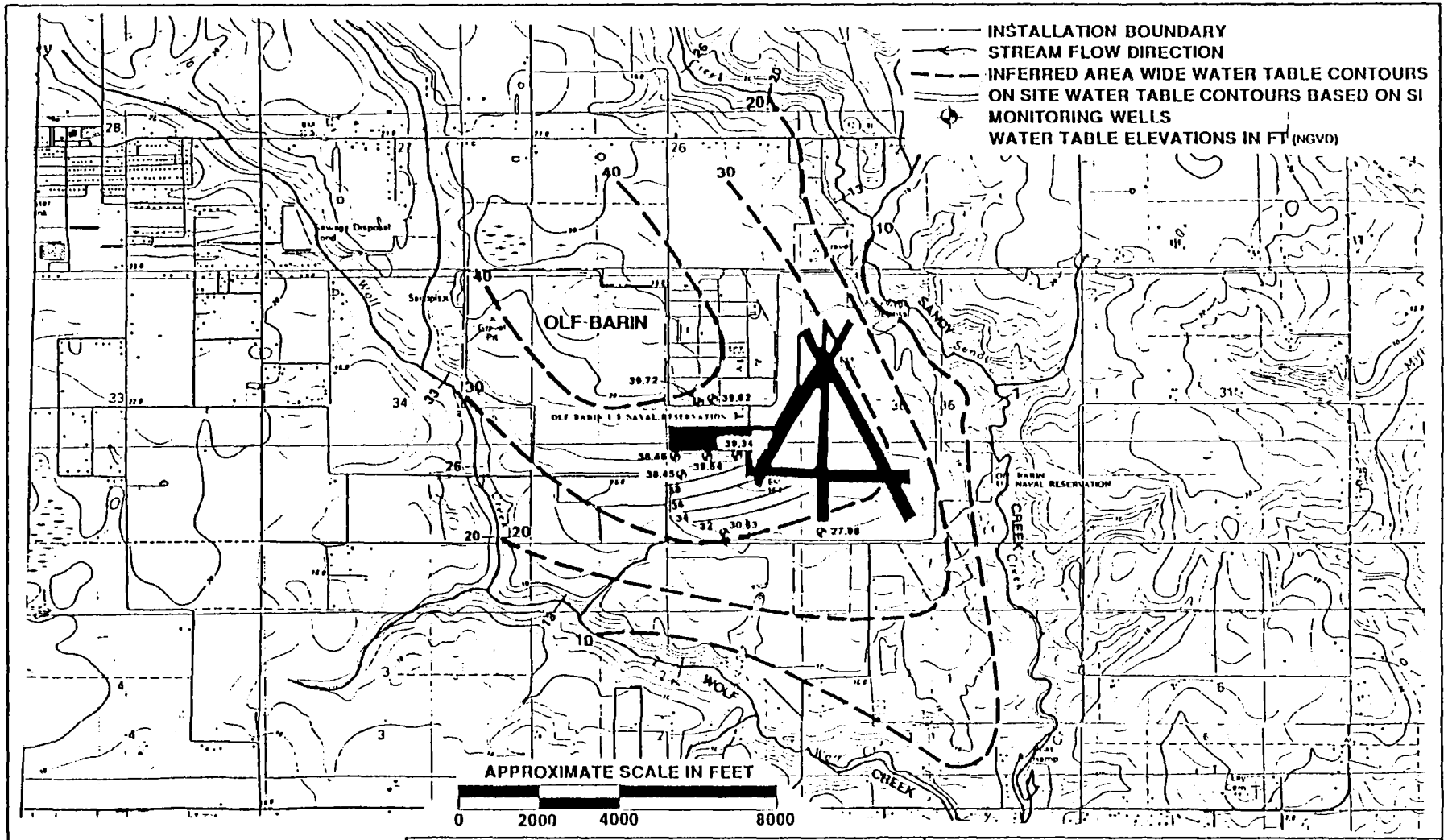
OLF BARIN
FOLEY, ALABAMA

Wells WHF-20B-1 and WHF-20B-2 compared to Wells WHF-20B-3, WHF-20B-4, and WHF-20B-5. Overall across the site (WHF-20B-1 and WHF-20B-2 to WHF-19B-3D) the gradient was 3.20×10^{-3} ft/ft.

In order to more adequately evaluate groundwater migration pathways for HRS II scoring at OLF Barin, an areawide groundwater elevation contour map was interpreted from the site-specific data, topography, stream flow direction, and elevation for the areas adjacent to OLF Barin. Figure 3-13 shows the interpreted contours in 10-foot intervals. The site-specific 2-foot groundwater contour intervals interpreted from the SI data are shown in Figure 3-13 as well as the surveyed groundwater elevations. The water levels off-station were interpreted based on the following assumptions. First, the regional contour groundwater shows a 50-foot NGVD contour parallel to a line between Foley and Elberta (see Figure 3-11). It is assumed, based on the permeable lithology of the upper Citronelle aquifer and the adjoining Alluvial-Coastal aquifer in the Sandy Creek Valley, that the system would be unconfined and follow general topographic contours. It was also assumed that base flow of Wolf Creek and Sandy Creek consists of groundwater and the streams are not perched. The water table would intersect the stream beds and consequently groundwater discharge would occur along both streams. Therefore, the contour lines on the 7.5 minute USGS topographic map represent approximate 2 meter (6.6 feet) elevation intervals for groundwater elevation where the creeks cross a contour line.

Based on these assumptions, it has been interpreted that groundwater flow is southeastward and eastward from immediately northwest of OLF Barin toward the respective creeks and that under the installation the water table is fairly flat, decreasing from approximately 39 feet NGVD north of the former hangar maintenance and fuel areas to 30 feet NGVD at the southern boundary. Groundwater from the western half of OLF Barin discharges to Wolf Creek. Groundwater from the north and east portions of OLF Barin discharges to Sandy Creek.

3.4.2 Aquifer Characteristics The results of hydraulic conductivity analyses of all monitoring wells at OLF Barin as estimated from in-situ rising head "slug" permeability tests (see Section 4.1.4) during the SI are presented in Table 3-3. The geometric mean hydraulic conductivity of all eight monitoring wells was 3.89×10^{-3} centimeters per second (cm/sec). Even though the shallow and deep wells are both part of the same aquifer, considerable variability in the calculated hydraulic conductivities exists as shown. The conductivity of the deeper zone (90 to 100 feet BLS) was approximately 6 times lower than the conductivity at the water table. At the water table wells (WHF-20B-1 through WHF-20B-5), the geometric mean hydraulic conductivity was 7.93×0^{-3} cm/sec. This variability may be a result of the different lithologies present over the screened interval of the monitoring wells. Because the soils encountered below the site are not homogeneous and exhibit a wide range of grain sizes and degrees of sorting, greater deviations from the mean hydraulic conductivity can be expected.



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SOURCE: ADAPTED FROM USGS 7.5' QUADRANGLE MAP, FOLEY, AL (1980 a)

FIGURE 3-13

INTERPRETED AREA-WIDE WATER TABLE CONTOURS AT OLF BARIN

SITE INSPECTION REPORT

OLF BARIN
FOLEY, ALABAMA

Table 3-3
Hydraulic Conductivity Estimates

Site Inspection Report
OLF Barin, Foley, Alabama

Well No.	Hydraulic Conductivity Rising Head (cm/sec)	Geometric Mean Hydraulic Conductivity (cm/sec)
WHF-19B-1D	3.34×10^{-3}	Deep wells
WHF-19B-2D	3.34×10^{-4}	
WHF-19B-3D	1.50×10^{-3}	1.19×10^{-3}
WHF-20B-1	1.84×10^{-3}	Water table wells
WHF-20B-2	7.08×10^{-3}	
WHF-20B-3	1.53×10^{-2}	7.93×10^{-3}
WHF-20B-4	7.90×10^{-3}	
WHF-20B-5	1.99×10^{-2}	

NOTES: Overall geometric mean = 3.89×10^{-3} cm/sec.
cm/sec = centimeters per second.

The average groundwater seepage velocities across the site can be estimated using the following equation:

$$v = \frac{KI}{n}$$

where:

v = seepage velocity (cm/sec),
K = hydraulic conductivity (cm/sec),
I = hydraulic gradient, and
n = effective porosity.

The average hydraulic conductivity (7.93×10^{-3} cm/sec) and the hydraulic gradient (2.26×10^{-4}) for the area under the former hangar maintenance and fuel pit areas were calculated previously from data collected during the SI. The effective porosity is estimated to be 0.25, which is a typical value for fine- to coarse-grained sands.

Seepage velocity calculated between the area of WHF-20B-1 and WHF-20B-2 and the area of WHF-20B-3, WHF-20B-4, and WHF-20B-5 is as follows:

$$v = \frac{(7.93 \times 10^{-3})(2.26 \times 10^{-4})}{0.25} = 7.2 \times 10^{-6}\ cm/sec\ or\ 0.020\ ft/day$$

This seepage velocity is a representative rate at which groundwater is moving horizontally through the pore spaces in the upper part of the aquifer at OLF Barin.

3.5 CLIMATE AND METEOROLOGY. OLF Barin is located in a region of humid, near-subtropical climate with an average annual temperature of 68 degrees Fahrenheit according to Moore (1987). The region can be characterized as having a long spring and fall, extremely hot summers, and short, mild winters. Average yearly precipitation is approximately 64.6 inches (Moore, 1987). The wettest month is July, and the driest month is October. Heavy rains can occur in the mid-summer to early fall months when tropical storms enter the Gulf of Mexico.

The nearest source of long-term National Oceanic and Atmospheric Administration (NOAA) meteorological data to OLF Barin is Mobile, Alabama, located at the head of Mobile Bay. Review of the Alabama-wide data presented by Moore (1987) indicates that southern Baldwin County and OLF Barin share similar conditions of average annual temperature, precipitation, and runoff with the Mobile area.

Table 3-4 summarizes monthly means and extremes for wind velocity, rainfall, and temperatures. Calculated monthly evapotranspiration and monthly net precipitation for Mobile, Alabama, are tabulated in Table 3-5. These data are required for evaluating the importance of the groundwater and air (particulate) contamination migration pathways. Monthly evapotranspiration was calculated using the equation below, presented in Section 3.1.2.2 of the final HRS II rule (USEPA, 1990).

Calculate monthly potential evapotranspiration (E_i) as follows:

$$E_i = 0.6\ F_i\ (10\ T_i/I)^a$$

where:
E_i = monthly potential evapotranspiration (inches) for month i,
F_i = monthly latitude adjusting value for month i,
T_i = mean monthly temperature (°C) for month i (tabulated temperatures in Table 3-4 are in degrees Fahrenheit; these are converted to degrees Centigrade for calculation),
$I = \Sigma\ (T_i/5)^{1.514}$, and
$a = [6.75\times10^{-7}(I^3)] - [7.71\times10^{-5}(I^2)] + [1.79\times10^{-2}(I)] + 0.49239$.

Latitude adjusting values (Fi) for each month were selected as follows.

Mobile, Alabama, and OLF Barin are at latitude 30° 41′ North and 30° 23′ North, respectively. Monthly adjustment F Factors for this latitude zone selected from USEPA (1990) are shown in Table 3-5.

Table 3-4
Temperature Normals, Means, and Extremes for Mobile, Alabama

Site Inspection Report
OLF Barin, Foley, Alabama

	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Year
Temperature °F:													
Normals													
- Daily maximum	60.6	63.9	70.3	78.3	84.9	90.2	91.2	90.7	87.0	79.4	69.3	63.1	77.4
- Daily minimum	40.9	43.2	49.8	57.7	64.8	70.8	73.2	72.9	69.3	57.5	47.9	42.9	57.6
- Monthly	50.8	53.5	60.0	68.0	74.8	80.5	82.2	81.8	78.2	68.5	58.6	53.0	67.5
Extremes													
- Record highest	84	82	90	92	100	102	104	102	99	93	87	81	104
- Record lowest	3	11	21	36	43	49	60	59	42	32	8	8	3
Precipitation (inches):													
Water equivalent													
- Normal	4.59	4.91	6.48	5.35	5.46	5.07	7.74	6.75	6.56	2.62	3.67	5.44	64.64
- Maximum monthly	10.40	11.89	15.58	17.69	15.08	13.07	19.29	15.19	13.61	13.20	13.65	11.38	19.29
- Year	1978	1983	1949	1955	1986	1967	1949	1984	1957	1985	1948	1953	Jul. 1949
- Minimum monthly	0.98	1.31	0.59	0.48	0.45	1.19	1.72	2.35	0.58	T	0.25	1.29	T
- Year	1968	1948	1967	1954	1962	1966	1983	1972	1963	1978	1960	1900	Oct. 1978
- Maximum in 24 hours	8.34	5.37	6.52	13.36	8.00	7.38	5.34	6.62	8.55	5.65	7.02	5.50	13.36
- Year	1965	1981	1951	1955	1981	1967	1975	1969	1979	1985	1965	1968	Apr. 1955
Wind:													
Mean speed (mph)	10.5	10.7	11.0	10.4	8.9	7.7	7.0	6.8	8.0	8.2	9.3	10.1	9.0

Notes: Period of record: 44 years temperature/precipitation
37 years wind speed

°F = degrees Fahrenheit.
T = trace.
mph = miles per hour.

Source: Ruffner and Bair, 1986.

Table 3-5
Calculated Monthly Net Precipitation and Potential Evapotranspiration for Mobile, Alabama

Site Inspection Report
OLF Barin, Foley, Alabama

Month	Average Rainfall (inches) (1)	Latitude Adjusting Factors (2)	Average Evapotranspiration (inches) (3)	Net Precipitation (inches)
January	4.59	0.90	0.59	4.00
February	4.91	0.87	0.77	4.14
March	6.48	1.03	1.64	4.84
April	5.35	1.08	2.95	2.40
May	5.46	1.18	4.71	0.75
June	5.07	1.17	6.10	-1.03
July	7.74	1.20	6.77	0.97
August	6.75	1.14	6.33	0.42
September	6.56	1.03	4.86	1.70
October	2.62	0.98	2.76	-0.14
November	3.67	0.89	1.26	2.41
December	5.54	0.88	0.75	4.79

NOTES: (1) From Table 3-4.
(2) Taken from Table 3-3 of United States Environmental Protection Agency (USEPA), 1990.
(3) Calculated from USEPA, 1990.

Based on these calculations and Table 3-5, the annual net precipitation at OLF Barin is estimated as 26.4 inches per year. This figure represents the summary of monthly net precipitation. For months in which evapotranspiration exceeds rainfall, 0 inches net precipitation is used in the summation to be consistent with the factor as developed in the HRS II. Table 3-5 shows that two-thirds of the annual net precipitation, and therefore the recharge to the aquifer, occurs in winter (December through March).

Rainfall intensity is a factor that strongly influences the potential for surface water migration of contaminants via overland flow or runoff. NOAA publishes rainfall intensity-duration-frequency curves for various locations in the United States (U.S. Department of Commerce, 1955). For Mobile, Alabama, the 24-hour maximum rainfall total expected every 2 years is 5.28 inches (0.22 inches per hour). The 100 year, 24-hour rain event is estimated as 12.0 inches. Table 3-4 shows the maximum 24-hour rainfall total for the 44 years of record for each month.

3.6 LAND USE. Three airstrips with associated flat grassland and pine plantations cover the major part of the 490-acre area of OLF Barin. On-site activity at the facility occurs on approximately 4 acres. This area comprises the firefighting operations and storage buildings, parking lot, and recreational area. The northeastern and eastern edge of the installation, consisting of the slope to and the floodplain of Sandy Creek, are forested. This forested area represents approximately 70 acres. Approximately 6 acres at the southern boundary are also forested.

In general, land use surrounding OLF Barin within a 4-mile radius includes a sparsely populated area of few residential homes, mobile homes and agricultural lands, commercial lands, pasture lands, timberland and fallow land, as well as the suburban residential areas of Foley and Elberta, institutional (churches and schools), and urban commercial uses in the centers of Elberta and Foley.

To evaluate the land uses adjacent to OLF Barin for the purposes of HRS II scoring, 1988 aerial photographs (U.S. Department of Agriculture, Soil Conservation Service) and the Baldwin County Land Atlas and Plat Book (Baldwin County Soil and Water Conservation District, 1988) were reviewed to tabulate land use classification within ¼, ½, 1, 2, 3, and 4 miles from OLF Barin. Table 3-6 is a land use summary for the area surrounding OLF Barin. No heavy industry is located in the area of OLF Barin. Principal local industry has traditionally been forestry, cropland agriculture, and service-oriented commercial activities. According to the South Baldwin Chamber of Commerce (1988), manufacturing in Foley includes assembly of aluminum, steel, silk-screened products, synthetic fiber, marine nets, and filters; seafood processing; precision tool manufacture; lingerie; and three aerospace-related companies. The Town of Foley has purchased 284 acres formerly belonging to the U.S. Navy adjacent to OLF Barin. As of 1988, industrial development had not commenced in the latter area.

3.7 POPULATION DISTRIBUTION. The total population of Baldwin County was 88,673 in 1985, which translates into a population density of 50 people per square mile (South Baldwin Chamber of Commerce, 1988). Foley, Alabama (1985 population 4,490) is approximately 2 miles northwest of OLF Barin. Elberta, located approximately 1.9 miles northeast, had a 1985 population of 558 (South Baldwin Chamber of Commerce, 1988). The population of the beach areas 15 to 20 miles to the south increases 12- to 15-fold during the summer months, to approximately 50,000. The population within a 4-mile radius of OLF Barin has been estimated to be 6,499. Population estimates were developed by review of the 1988 aerial photographs, 1980 USGS quadrangle maps, 1980 census for the Town of Foley, and South Baldwin Chamber of Commerce (1988) for Elberta. No especially sensitive

Table 3-6
Distribution of Land Use Within 4 Miles of Outlying Landing Field (OLF) Barin

Site Inspection Report
OLF Barin, Foley, Alabama

	Percentage of land in:							
			Residential		Agricultural			
Distance (miles)	Institutional Use (schools, churches)	Commercial or Light Industrial	Single Family	Multi-family	Prime	Non-prime	Forest	Wetland
0 to ¼	0	10	2	0	30	8	30	20
¼ to ½	0	5	2	0	13	10	60	10
½ to 1	0	2	10	0	43	10	30	5
1 to 2	0	5	10	2	55	5	15	8
2 to 3	<1	10	25	3	30	2	20	10
3 to 4	1	4	16	1	50	5	15	8

Source: 1988 aerial photograph interpretation (U.S.Department of Agriculture, Soil Conservation Service).

subpopulations (hospitals, schools, day care centers, or nursing homes) lie within 2.0 miles of OLF Barin. Population distribution is shown in Table 3-7.

Table 3-7 shows the population distribution centered in the area of Sites 19B and 20B, the Former Hangar Maintenance Area and Abandoned UST and Fuel Pit Area. The Old Firefighting Demonstration Area (Site 22B), the Uncontrolled Dumpsite, and Rubble Landfill areas are remote from this center. The population living within ¼ and ½ miles for these sites was estimated from the 1988 aerial photography as follows:

Old Firefighting Demonstration Area		Uncontrolled Dumpsite and Rubble Landfill	
0 to ½ mile	0	0 to ¼ mile	83
¼ to ½ mile	33	¼ to ½ mile	10
½ to 1 mile	17	½ to 1 mile	16

Table 3-7
Estimated Human Population Near Outlying Landing Field (OLF) Barin

Site Inspection Report
OLF Barin, Foley, Alabama

Mile Radius from OLF Barin Supply Well	Population Estimate
On-site	63[1]
0 to ¼	30[2]
¼ to ½	88[3]
½ to 1	200[2]
1 to 2	1,370[3]
2 to 3	2,308[4]
3 to 4	2,440[4]
Total	6,499

Notes:
1 Information from OLF Barin personnel (personal communication, station fire chief, 1991).
2 Based on the number of residences counted on 1988 aerial photographs x 2.75 people per household (1988 census for Baldwin County).
3 Total population of Elberta of 600 plus the number of residences counted at 2.75 people per household.
4 Based on percentage of the Town of Foley within the respective mile radius plus isolated residences.

3.8 WATER SUPPLIES. The following paragraphs describe the sources and distribution of potable water in the area of OLF Barin. These data are required in the HRS II ranking model to evaluate the actual or potential human receptors of any contaminants migrating via groundwater or surface water, and to evaluate any commercial agriculture exposure due to use of contaminated water for irrigation or stock watering. No surface water is used as a source of drinking water or an agricultural supply within 4 miles of OLF Barin or within 15 river miles downstream. This section describes the use of groundwater on and near OLF Barin.

3.8.1 Outlying Landing Field Barin (OLF) Water Supply Wells The OLF Barin facility receives its water from a water supply well located north of the station headquarters adjacent to Guadalcanal Road. The water is used for firefighting activities, cleaning, and personal consumption by the station personnel. The water is obtained from the Pliocene-Miocene aquifer from a depth of approximately 100 feet BLS. No drilling or well construction logs are available for this well.

Analyses of the water from this well in July and September of 1988 revealed the presence of trans-1,2-dichloroethylene, tetrachloroethylene, and trichloroethylene. Prior to the use of this well, the station water supply was from an old supply well about 200 feet due west of the new well. Water from the old well analyzed in September of 1988 contained tetrachloroethylene and trichloroethylene. The old supply well subsequently has been abandoned and grouted. Table 3-8 shows the results of analysis of the water from the OLF Barin supply wells. As described in Section 5.0 and shown in Figure 3-12, the OLF Barin supply wells are located adjacent to the Former Hangar Maintenance Area and within 400 feet of the abandoned UST. Presently, water from the installation supply well is treated with activated carbon prior to use to remove volatile organic carbons (VOC). Table 3-8 shows results of analysis on April 30, 1990, for the water supply after carbon treatment.

3.8.2 Public Water Supply Wells and Private Residential Supply Wells Public water supply wells near OLF Barin and Foley draw water from depths of 80 to 157 feet BLS and can yield up to 700 gpm. Foley is listed as having three high capacity wells ranging in depth from 138 to 157 feet. The locations of the Foley wells are indicated on Figure 3-14. Records indicate these wells are drilled to the Miocene, although the screened interval most likely overlaps the Miocene/Citronelle contact. Capacity of these wells was reported by the Town of Foley to be 400, 550, and 550 gpm respectively (Foley, Alabama, Department of Public Works, 1991). The Town of Elberta, Alabama, is served by a single well with a capacity of 45,000 gallons per day (Scott, 1991). The location of this well is also shown on Figure 3-14.

The population using groundwater drawn from wells within a 4-mile radius of OLF Barin was estimated to be 6,499 people, based on the total estimated population being supplied by groundwater. Groundwater is used as a potable water supply, industrial uses, irrigation, and stock-watering. The number of well completion reports completed for private groundwater supply wells within the area is 298, but there are no records of wells installed prior to 1975. The number of isolated residences (assumed to be on well water) were multiplied by the number of people per household in Baldwin County, Alabama, of 2.75 (available from the 1980 U.S. Census) and added to the population of Foley and Elberta to obtain the population drinking groundwater from wells within a 4-mile radius of OLF Barin. The nearest public water supply well is the station water supply well located on OLF Barin within 400 feet of the nearest potential contaminant source and has a documented history of contamination. The nearest residential wells are located between 0.25 and 0.5 mile from OLF Barin to the north and northwest and 0.17 mile to the south. At distances ranging from 2 to 4 miles, the population served by groundwater is served by a combination of the Foley and Elberta municipal supplies and private wells. Based on the number of residential water meters in the two towns, 4,610 are estimated to be served by the public supply and 138 are estimated as having private supplies (based on an average of 2.75 people per

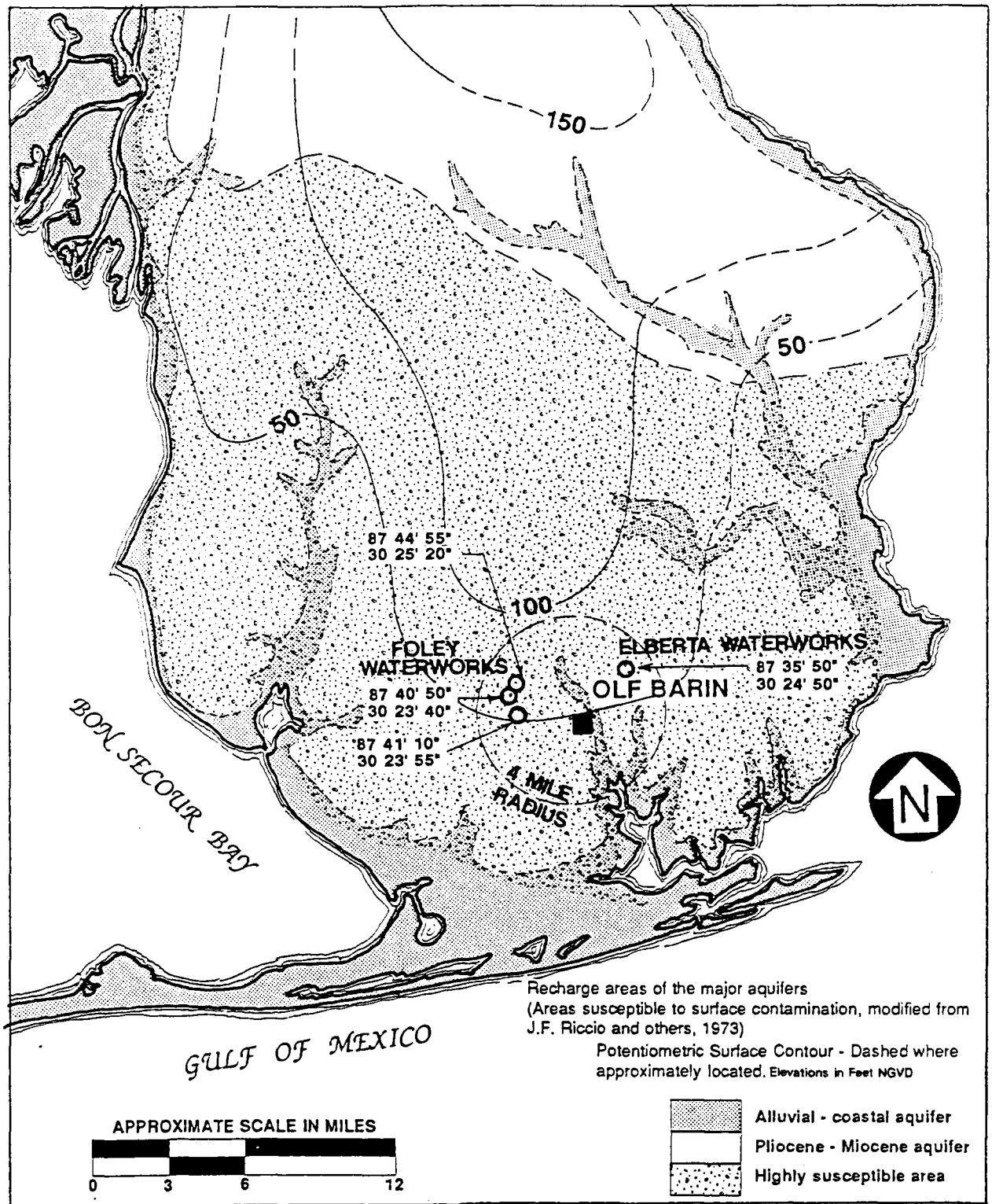


FIGURE 3-14

LOCATION OF PUBLIC WATER SUPPLY WELLS WITHIN 4 MILES OF OLF BARIN
(Mooty, 1988)

SITE INSPECTION REPORT

OLF BARIN
FOLEY, ALABAMA

Table 3-8
Analytical Data for Outlying Landing Field (OLF) Barin Water Supply Wells

Site Inspection Report
OLF Barin, Foley, Alabama

Parameters	Well and Sample Data			
	Raw Water			Treated Water Supply
	New Well 7/29/88	New Well 9/07/88	Old Well 9/07/88	4/30/90
Physical Characteristics				
Specific conductance (μmho/cm)	32.0	48.0	40.0	34.0
pH (standard units)	5.7	5.2	3.3	5.6
Organic Chemicals				
trans-1,2-Dichloroethylene (μg/ℓ)	13.2	< 5.0	< 5.0	< 0.5
Tetrachloroethylene (μg/ℓ)	6.0	6.0	7.0	< 0.5
Trichloroethylene (μg/ℓ)	4.0	8.0	7.0	< 0.5
Inorganic Analytes				
Alkalinity (mg/ℓ as $CaCO_3$)	5.0	Not analyzed	Not analyzed	10.0
Chloride (mg/ℓ)	4.0	Not analyzed	Not analyzed	8.0
Total hardness (mg/ℓ as $CaCO_3$)	3.0	Not analyzed	Not analyzed	5.0
Calcium (mg/ℓ)	< 0.01	Not analyzed	Not analyzed	Not analyzed
Magnesium (mg/ℓ)	0.88	Not analyzed	Not analyzed	Not analyzed
Lead (mg/ℓ)	0.004	Not analyzed	Not analyzed	0.004
Total dissolved solids (mg/ℓ)	5.7	Not analyzed	Not analyzed	3.0

Notes: No extractable organic chemicals, pesticides, or herbicides were detected.

μg/ℓ = micrograms per liter.
mg/ℓ = milligrams per liter.
μmho/cm = micromhos per centimeter.
$CaCO_3$ = calcium carbonate.

Source: Personal Communication, Department of Public Works, NAS Whiting Field, 1990.

household). In the distance ranges from ¼ to 2 miles, the population is entirely served by private wells. The populations in these ranges are shown in Table 3-7.

3.9 SENSITIVE ENVIRONMENTS. The forested ecological communities within the 4-mile radius surrounding OLF Barin include remnants of longleaf pine-turkey oak upland forest, pine plantations, coastal strand, pine flatlands, bottom land hardwoods and swamp hardwoods. The wetland and aquatic ecological communities within the drainage basin of Sandy Creek and up to 15 miles downstream into Perdido Bay include freshwater marsh and swamps, floodplain forest, cypress stands, salt marsh, intertidal mud flats, medium salinity estuary, high salinity estuary, and the coastal offshore Gulf of Mexico waters. Major wetland systems are shown in Figure 3-15. Seagrass flats occur in the Old River estuary adjacent to the barrier strand along Perdido Key near Alabama Point. The Old River estuary is further down-estuary than is shown in Figure 3-15. See Figure 3-2 for the location of Old River.

As shown in the 1988 aerial photography (U.S. Department of Agriculture, Soil Conservation Service), much of the upland area within 4 miles has been greatly changed due to agriculture and silviculture. Table 3-6 presented the approximate distribution of land uses. Cropland agriculture systems are the predominant terrestrial system. Human influenced systems represented by old field and shrub successional stages and successional forest appear to dominate areas not maintained as pasture, cropland, or managed residential yards and gardens.

Wetland and aquatic ecosystems in the area surrounding OLF Barin appear much less affected by man's activity. The flora and fauna of these systems are well described by O'Neil and Mettee (1982). Figure 3-15 presents the location of wetlands within 4 miles of OLF Barin and downstream into Wolf Bay. This figure was developed from the U.S. Fish and Wildlife Service Wetland Inventory. All of the wetlands surrounding OLF Barin are within the Coastal Zone Federal Management Area (U.S. Fish and Wildlife Service, 1982). Dominant wetlands in the reaches of Sandy Creek and Wolf Creek adjacent to and downstream from OLF Barin are palustrine forested swamps or forested/shrub mixed swamps with broad-leafed deciduous, broad-leafed evergreen, and narrow-leafed evergreen dominants and codominants. Downstream within 15 miles of OLF Barin these systems are replaced in the tidal and estuarine reaches by estuarine intertidal emergent vegetation or salt marsh, intertidal swamp forest, subtidal open water estuarine system, intertidal mud flat, and dredged areas.

According to the PA (NEESA, 1989), no State or Federal endangered plant species are known to occur on OLF Barin. A SOUTHNAVFACENGCOM endangered plant species survey is currently ongoing. More recent surveys of threatened or endangered animal species that may reside in the area of OLF Barin have been conducted by SOUTHNAVFACENGCOM.

SOUTHNAVFACENGCOM (Burst, 1990) has compiled a list of rare, threatened, or endangered species that could occur on or near OLF Barin, as part of a survey of the biota of NAS Whiting Field, Florida, and each of its subinstallations. Table 3-9 lists each of the species, its likelihood of occurrence, and its status at OLF Barin.

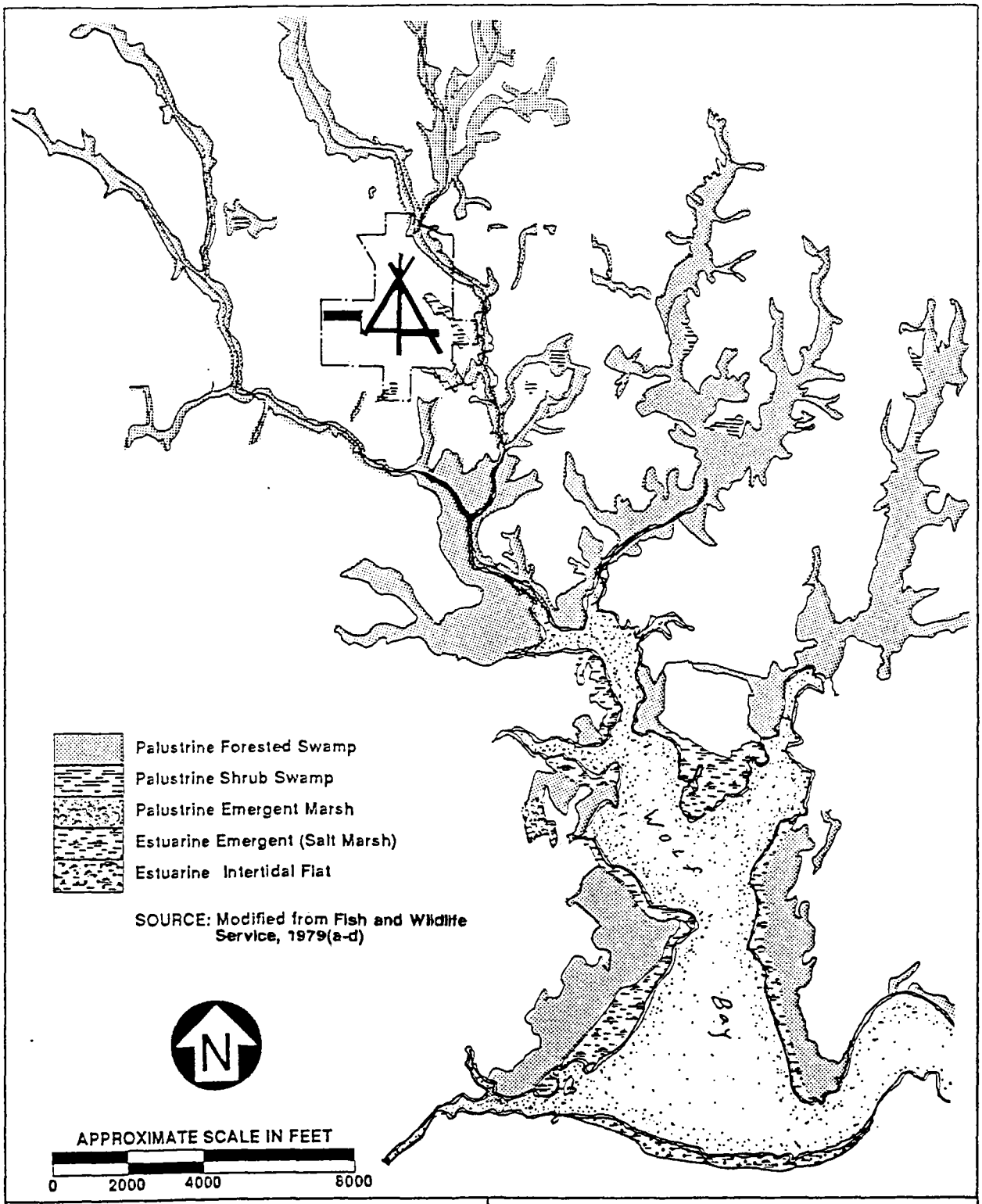


FIGURE 3-15

MAJOR WETLAND TYPES ADJACENT TO AND DOWNSTREAM FROM OLF BARIN

SITE INSPECTION REPORT

OLF BARIN
FOLEY, ALABAMA

Table 3-9
Rare, Threatened, or Endangered Species
Occurrence at Outlying Landing Field (OLF) Barin

Site Inspection Report
OLF Barin, Foley, Alabama

Organism		Status		Occurrence at
Common Name	Scientific Name	Alabama	Federal	OLF Barin
Animals				
Eastern indigo snake	Drymarchon corais couperi	T	T	PR
Dusky gopher frog	Rana areloata	T	C-2	PR
Black pine snake	Pituophis melanoleucus loding	T	C-2	PR
Southern hog-nose snake	Herterodon simus	T	N	LR
Gopher tortoise	Gopherus polyphemus	N	C-2	PR
Flatwoods salamander	Ambystoma cingulatum	SC	C-2	PR
American alligator	Alligator mississippiensis	SC	E	PR
Woodstork	Myceteria americana	E	E	PV
Bald eagle	Haliaeetus leucocephalus	E	E	PV
Mississippi sandhill crane	Grus canidensis pulla	E	E	UR
Red-cockaded woodpecker	Picoides borealis	E	E	PV
Bachman's sparrow	Aimophila aestivalis	N	C-2	
Bachman's warbler	Vermirora bachmanii	E	E	UR
Southeastern myotis	Myotix austroriparus	SC	E-2	PR

Table 3-9 (Continued)
Rare, Threatened, or Endangered Species
Occurrence at Outlying Landing Field (OLF) Barin

Site Inspection Report
OLF Barin, Foley, Alabama

Organism		Status		Occurrence at
Common Name	Scientific Name	Alabama	Federal	OLF Barin
Animals (Continued)				
Rafinesque's big-eared bat	Plecotus rafinesquii	SC	C-2	PR
Alligator snapping turtle	Macroclemys temmincki	SC	C-2	NH
Southeastern american kestrel	Falco sparverius paulus	N	C-2	LR
Migrant loggerhead shrike	Lanius ludovicianus migrans	N	C-2	LWR
Arctic peregrine falcon	Falco perogrinus tundrius	T	T	WV
Plants				
Orange azalea	Rhododendron austrinum	N	C-5	PR
Incised groove bur	Agrimonia incison	N	C-2	PR
Southern three-awn grass	Aristidia simplicifolia	N	C-2	PR
Eliott's croton	Croton elliottii	N	C-2	PR
Serviceberry holly	Ilex amelanchier	N	C-2	PR
Carolina false lily	Lilaeopsis carolinensis	N	C-2	PR
Piedmont water milfoil	Myreophyllium laxum	N	C-2	PR
Naked-stemmed prairie Grass	Panicum nudicarli	N	C-2	PR
Hacry fevertree	Pinckneya pubes	N	C-5	PR
Chapmrans butterwort	Pinguicula planifolia	N	C-2	PR
Chaff seed	Schwalbec americana	N	C-2	PR

Table 3-9 (Continued)
Rare, Threatened, or Endangered Species
Occurrence at Outlying Landing Field (OLF) Barin

Site Inspection Report
OLF Barin, Foley, Alabama

Organism		Status		Occurrence at
Common Name	Scientific Name	Alabama	Federal	OLF Barin
Plants				
Cooley's meadowrue	Thalictrum cooleyi	N	C-1	PR
Drummond's yellow-eyed grass	Xyris drummondii	N	C-2	PR
Harpers yellow-eyed grass	Xyris scabrifolia	N	C-2	PR
Panhandle lilly	Lilium iridollae	N	C-2	PR
Florida jointtail	Coelorachis tuberulosa	No data		
Florida pondweed	Potamiooeton floridana	No data		

Occurrence at OLF Barin

C = confirmed L = likely P = possible R = resident
W = winter V = visitor U = unlikely NH = no habitat

Legal Status

E = Endangered
N = Not protected or not applicable
T = Threatened
SC = Species of special concern

C-1 = Federal Candidate for Listing; substantial evidence for need to list.
C-2 = Federal Candidate for Listing; not enough evidence for listing at this time.
C-5 = Former Federal candidate for listing; more common than previously thought.

Source: Burst, 1990

Suitable habitat exists for a number of species on OLF Barin. The alligator and alligator snapping turtle might be expected to inhabit the palustrine and riverine wetlands in the immediate area of the installation. While likely present in freshwater marshes near OLF Barin, the woodstork is unlikely to occur on the installation or in the wooded swamps of Sandy and Wolf Creek. In addition, the red-cockaded woodpecker also would not be likely to occur on OLF Barin because of its restricted habitat of large mature stands of longleaf pine. The brown pelican, Pelecanus occidentalis, although not listed by Burst (1990), would be expected in the medium salinity and high salinity estuarine and salt marsh systems.

The final HRS II rule lists a set of sensitive environments recognized as specific targets or receptors of contaminants migrating from potential hazardous waste sites. Those found at OLF Barin are listed in Table 3-10, along with their respective distance overland or downstream tabulated.

Table 3-10
Relationship of Sensitive Environments[1] to Outlying Landing Field (OLF) Barin

Site Inspection Report
OLF Barin, Foley, Alabama

Designation	Sensitive Environment
Habitat known to be used by Federally and Alabama designated threatened or endangered species	On OLF Barin to a distance of 4 miles and in the aquatic systems for 15 river miles downstream including the estuarine areas of Wolf Bay, Perdido Bay, and the Gulf of Mexico nearshore waters.
Coastal barrier	Bayou St. John's, Perdido Key, and Alabama Point and Perdido Pass, 10 to 15 miles from OLF Barin.
Spawning areas critical for the maintenance of fish and shellfish species within river, lake, or coastal tidal waters	Sea grass flats in Bayou St. John's, approximately 10 miles from OLF Barin Salt marshes in lower Wolf Bay, 5 river miles from OLF Barin.
State designated areas for protection of maintenance of fish and aquatic life	All waters of Sandy Creek and Wolf Creek are designated F & W (Fish and Wildlife Propagation) Use Classification by Alabama Department of Environmental Management (DEM) With the exception of Wolf Creek, all waters of Sandy Creek and the estuarine system are designated as suitable for Body Contact Recreation (S) by Alabama DEM All tidal/estuarine waters, except Mifflin Creek and Hammock Creek, are also designated SH and F&W designating their classification as suitable for shellfish harvesting (within 5 river miles of OLF-Barin) by Alabama DEM

Notes: [1] As defined in Table 4-23 of the HRS II Rankings (United States Environmental Protection Agency, 1990).

4.0 SUMMARY OF SITE INSPECTION FIELD INVESTIGATION PROGRAM

Five sites were identified during the PA (NEESA Document # 13-193, February 1989) as having potential for environmental contamination and contaminant migration. These were the following:

Site 19B, Former Hangar Maintenance Area;
Site 20B, Abandoned Underground Storage Tanks (UST) and Fuel Pit Area;
Site 21B, Rubble Landfill;
Site 22B, Old Firefighting Demonstration Area; and
Site 23B, Drainage Ditch Leading to Sandy Creek.

These sites were investigated by sampling and analysis during the field phase of the SI. This section provides a summary of SI field investigations for each of the five sites. Locations of these sites are shown in Figure 4-1 as taken from NEESA (1989).

The field component of the SI was performed in accordance with the March 1990 Site Inspection Work Plan for OLF Barin, Foley, Alabama (Jordan, 1990) with deviations due to field conditions as noted in Section 4.1.7. The Work Plan consisted of four sections as follows:

- Work Plan,
- Quality Assurance Field Program Plan,
- Site Specific Quality Assurance Plan Addendum, and
- Health and Safety Plan.

Each of these plans, as well as all field changes, were approved by USEPA Region IV and the Alabama Department of Environmental Management (DEM).

Section 4.1 of the SI report summarizes the geological, hydrogeological, and sampling and analysis activities performed during the field phase of the SI. Specific details of all aspects of the environmental field program are contained in the Work Plan. The SI field work consisted of the installation of 8 soil borings and 8 monitoring wells; lithological characterization and field screening of 78 subsurface soil samples; aquifer testing of each well; sampling and analysis of 9 groundwater samples, 60 surface soil samples, 2 surface water samples, and 2 sediment samples. The SI field work was conducted from April 30, 1990, to June 14, 1990. Additional supporting data to conduct the HRS II was gathered and field checked during October through December 1990.

Section 4.2 discusses attainment of the Data Quality Objectives (DQOs) set forth in the Section 1.4 of the Work Plan (Jordan, 1990). These reflect USEPA Level I data quality for field screening during the soil boring and sampling program and NEESA Level C (functionally equivalent to USEPA Level III DQOs stated in Data Quality Objectives for Remedial Response Activities Development). Identification of any actions that might have compromised field or laboratory data relative to the DQOs are described for the field activities. The impact of these have been addressed in terms of:

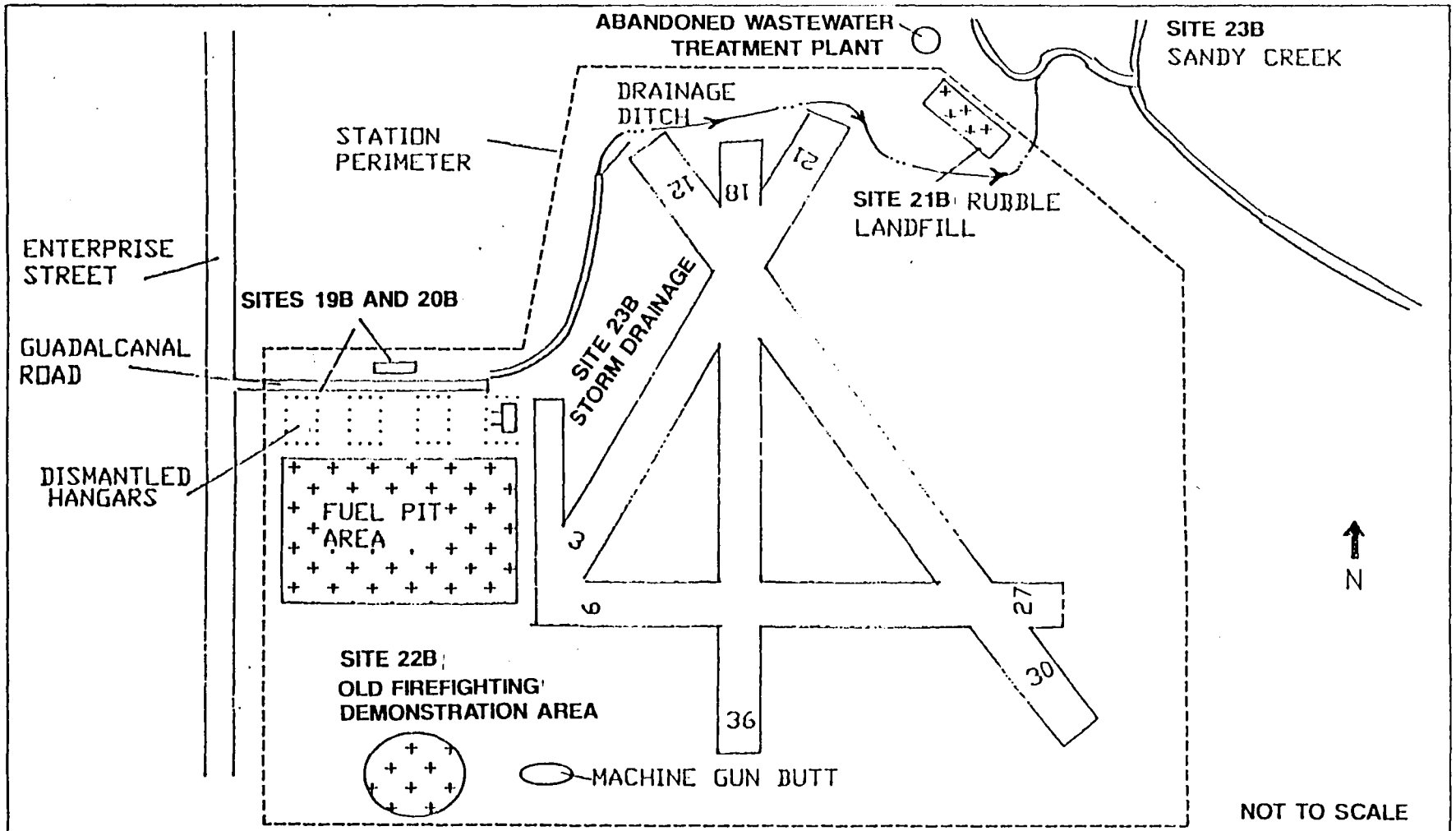


FIGURE 4-1
LOCATION OF SI STUDY SITES
(FROM FIG. 6, SITE LAYOUT IN NEESA, 1984)

SITE INSPECTION REPORT

OLF BARIN
FOLEY, ALABAMA

SOURCE: NEESA 1989

- completeness of program,
- verification of chain-of-custody,
- attainment of Level C quality control criteria, and
- sample handling and laboratory chemical artifacts.

In general, the procedures implemented provide a data base adequate for attaining the stated objectives of the SI.

4.1 SITE INSPECTION (SI) FIELD PROGRAM. The following paragraphs provide a summary of the rationale and scope of the components of the field program conducted at OLF Barin. Table 4-1 shows the overall sampling and analysis schedule by site. Note that the well installation and groundwater sampling program was focused at Sites 19B and 20B together. As described in Section 4.1.3, shallow wells located adjacent to the USTs and the fuel pits were designated "WHF-20B," while the deeper monitoring wells (screened at the same depth interval as the production well) were located farther in the presumed down-gradient direction and were designated "WHF-19B." Site 23B, the storm Drainage Ditch Leading to Sandy Creek, and Sandy Creek were broken into two distinct types of investigation. The potential release of concern for this system was a 2,000-gallon fuel spill at the fuel storage area. Surface soil samples for lead and polynuclear aromatic hydrocarbons (PAH) were collected to verify the presence of residuals from the spill in the section of the ditch near the reported spill. Surface water and sediment samples were collected above and below the confluence of the drainage ditch with Sandy Creek, which is approximately 5,500 feet down ditch from the former spill site.

Prior to the collection of all samples, sampling equipment was thoroughly decontaminated using an Alconox™ water cleaning solution, a laboratory grade isopropanol rinse, and final rinse with deionized water.

4.1.1 Surface Soil Sampling Surface soil samples were collected as part of the investigation of the Rubble Landfill (Site 21B), the Old Firefighting Demonstration Area (Site 22B), and the Drainage Ditch Leading to Sandy Creek (Site 23B). The number of environmental samples collected at each site as well as the analyses conducted on the samples are itemized in Table 4-1. Quality control samples are discussed in Section 4.2. Locations of the samples are indicated on maps in the site-specific contamination assessment in Section 5.0. Rationale for the surface soil sampling and analysis was presented in the Work Plan. In summary, a complete Target Compound List (TCL) and Target Analyte List (TAL) analytical set was performed at the Rubble Landfill (Site 21B) to estimate whether any risk to public health or the environment exists due to surface soil contamination by organic or inorganic chemicals. At the other two sites a more focused program was performed to determined whether contamination residuals remained. The analyses at these sites were limited to specific contaminants. Lead and PAHs were analyzed at the Drainage Ditch Leading to Sandy Creek (Site 23B) to locate residual weathered hydrocarbon products of the fuel (PAH) and/or residual lead from AVGAS. A grid sampling program was carried out to locate the Old Firefighting Demonstration Area (Site 22B) using residual lead (from AVGAS) as the indicator analyte.

Table 4-1
Overall Sampling and Analysis Schedule

Site Inspection Report
OLF Barin, Foley, Alabama

Analyses	Number of samples per site			
	19B and 20B	21B	22B	23B
Groundwater				
Inorganics	9	NS	NS	NS
Pesticides and polychlorinated biphenyls	9	NS	NS	NS
Semivolatile organic chemicals	9	NS	NS	NS
Volatile organic chemicals	9	NS	NS	NS
Subsurface soils				
Organic vapor analyses (field screening)	78	NS	NS	NS
Surface soils				
Lead only	NS	NS	54	3
Polynuclear aromatic hydrocarbons	NS	NS	NS	3
Inorganics	NS	3	NS	NS
Pesticides and polychlorinated biphenyls	NS	3	NS	NS
Semivolatile organic chemicals	NS	3	NS	NS
Volatile organic chemicals		3	NS	NS
Surface water				
Inorganics	NS	NS	NS	2
Pesticides and polychlorinated biphenyls	NS	NS	NS	2
Semivolatile organic chemicals	NS	NS	NS	2
Volatile organic chemicals	NS	NS	NS	2
Sediments				
Inorganics	NS	NS	NS	2
Pesticides and polychlorinated biphenyls	NS	NS	NS	2
Semivolatile organic chemicals	NS	NS	NS	2
Volatile organic chemicals	NS	NS	NS	2

19B Former Hangar Maintenance Area
20B Abandoned Underground Storage Tanks (UST) and Fuel Pit Area
21B Rubble Landfill
22B Old Firefighting Demonstration Area
23B Drainage Ditch Leading to Sandy Creek

See Section 4.1.6 for analytical procedures.

Notes: NS = not sampled:

Soil samples were collected with a stainless steel hand auger at sites 21B, 22B, and 23B. Soil samples collected for VOC analysis at Site 21B were obtained by driving a stainless steel tube into undisturbed soil, capping the ends with a Teflon™ cap, and wrapping in aluminum foil. Soil collected for analyses other than VOCs was thoroughly mixed in a stainless steel bowl with a stainless steel spoon to obtain a homogeneous composite sample. The composite sample was then placed in the appropriate sample jars for delivery to the laboratory.

4.1.2 Surface Water and Sediment Sampling Surface water and sediment samples were collected at two locations in Sandy Creek as part of the investigation of Site 23B. Sample locations are shown in the site-specific contamination assessment presented in Section 5.0. The number of environmental samples collected as well as analyses performed are itemized in Table 4-1. Surface water and sediments were analyzed for the entire suite of TCL and TAL analytes to evaluate the contamination status of Sandy Creek upstream and downstream of the storm drainage outfall.

Surface water samples were collected by submerging the sample bottles to mid-depth in Sandy Creek and allowing a well-mixed, representative sample to fill the bottles. Water samples were collected prior to sediment sampling from the same location.

Sediment samples were collected by using the sample jar as a horizontal scoop. Care was taken not to distribute the fines at the sediment/water interface during sampling. Sediment VOC samples were collected using stainless steel tubes to collect an undisturbed sediment sample. These tubes were capped with Teflon™ caps and wrapped in aluminum foil for transport to the laboratory.

4.1.3 Soil Boring and Monitoring Well Installation Eight monitoring wells were installed to obtain geologic and hydrogeologic data for the characterization of lithology, groundwater flow, and groundwater quality. The specific rationale for the location of each monitoring well is presented in Table 4-2. The presumed groundwater flow direction was based on the regional drainage patterns and research of local and state hydrogeologic records. Well locations, including interpreted groundwater contour lines developed during the SI based on actual elevation data, are shown on Figure 4-2. Boring logs and well construction diagrams are included as Appendix A.

Sections 3.3 and 3.4 presented regional and site-specific characterization of the geology and hydrogeology for OLF Barin and vicinity. Site-specific geological and hydrological attributes for each of the five identified sites and three additional areas of potential contamination are presented in Section 5.0. Figure 4-2 shows the locations of each of the sites and the relationship to the wells and measured and interpreted groundwater contours from Section 3.0.

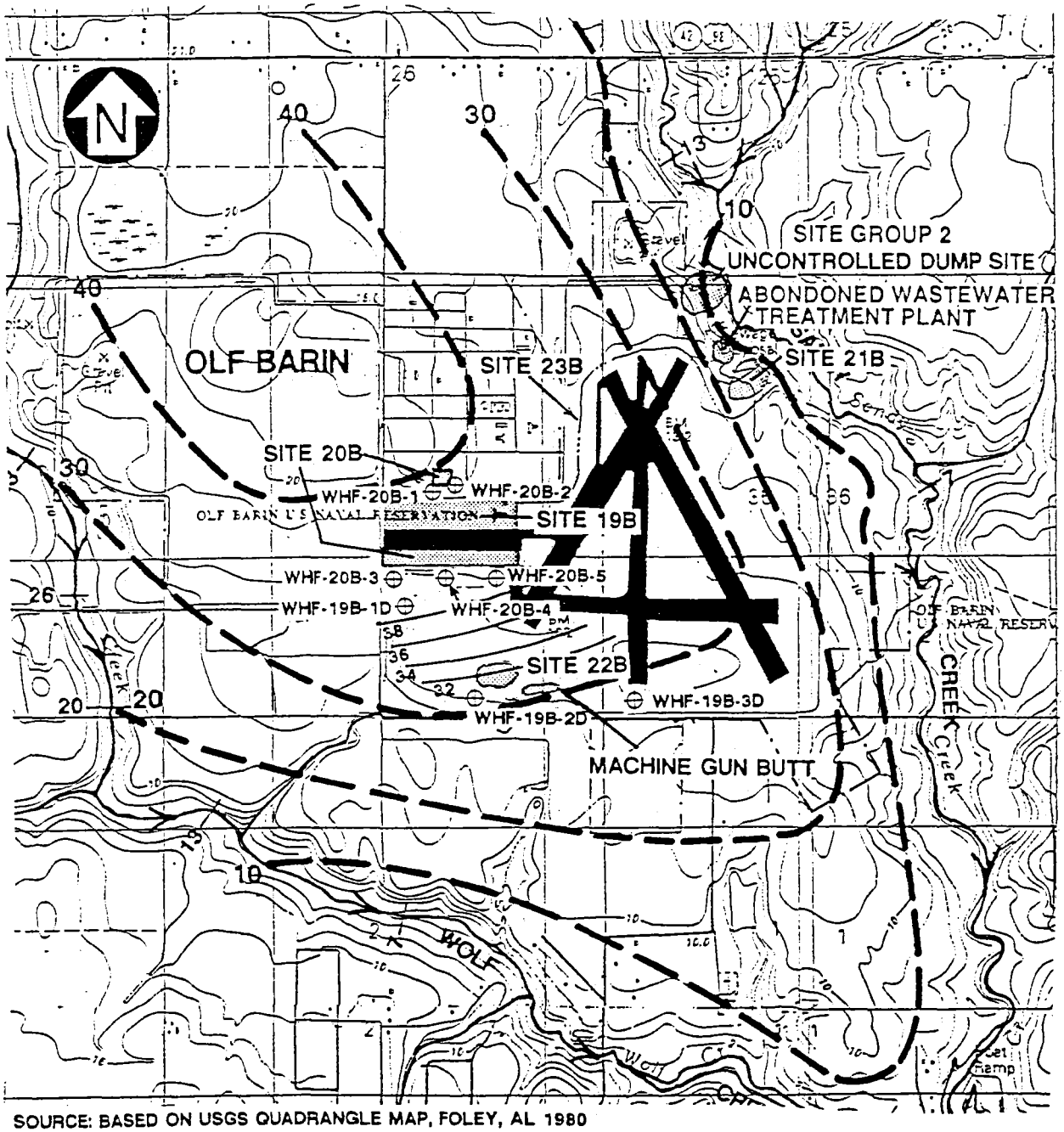
The monitoring wells were installed between May 11 and June 2, 1990, by Layne Environmental Services, Pensacola, Florida, under supervision of the Jordan geologist. The hollow-stem auger and mud rotary wash drilling techniques were used to advance soil borings for monitoring well installation. Hollow stem auger drilling techniques were used to install the water table monitoring wells. Mud rotary drilling was used to achieve the 100 feet BLS depths required for the deep

Table 4-2
Specific Monitoring Well Location Rationale

Site Inspection Report
OLF Barin, Foley, Alabama

Monitoring Well	Rationale
WHF-19B-1D	WHF-19B-1D is a deep monitoring well (100 feet BLS) located along the property line to the south-southwest of Site 19B and, based upon the regional drainage pattern, is downgradient of Sites 19B and 20B. Soil samples were taken during installation of this well and were used to identify site lithology.
WHF-19B-2D	WHF-19B-2D is a deep monitoring well (100 feet BLS) located along the property line to the south of Sites 19B and 20B and, based upon the regional groundwater flow, is downgradient of these sites.
WHF-19B-3D	WHF-19B-3D is a deep monitoring well (100 feet BLS) located along the property line to the southeast of Sites 19B and 20B and, based upon the regional groundwater flow, is downgradient of Sites 19B and 20B.
WHF-20B-1	WHF-20B-1 is a shallow monitoring well located south of the abandoned underground storage tanks (UST). This well is downgradient of the western end of the UST site and upgradient of the maintenance area around the hangars.
WHF-20B-2	WHF-20B-2 is a shallow monitoring well located south of the UST site. This well is downgradient of the eastern end of the UST site and upgradient of the maintenance area around the hangars.
WHF-20B-3	WHF-20B-3 is a shallow monitoring well located at the southwestern edge of the fuel pit area. This well is downgradient of the fuel pit area.
WHF-20B-4	WHF-20B-4 is a shallow monitoring well located at a central position south of the fuel pit area. This well is downgradient of the fuel pit area.
WHF-20B-5	WHF-20B-5 is a shallow monitoring well located at the southeastern edge of the fuel pit area. This well is downgradient of the fuel pit area.

Notes: See Figure 4-2 for well locations.
BLS = below land surface.



SOURCE: BASED ON USGS QUADRANGLE MAP, FOLEY, AL 1980

INSTALLATION BOUNDARY
STREAM FLOW DIRECTION
INFERRED AREA WIDE WATER TABLE CONTOURS
ON SITE WATER TABLE CONTOURS BASED ON SI
MONITORING WELLS
WATER TABLE ELEVATIONS IN FT/NGVD

APPROXIMATE SCALE IN FEET

0 2000 4000 8000

FIGURE 4-2

LOCATION OF MONITORING WELLS RELATIVE TO POTENTIAL CONTAMINATION SITES

SITE INSPECTION REPORT

OLF BARIN FIELD
FOLEY, ALABAMA

monitoring wells. All wells were constructed to the specifications of the SOUTHNAVFACENGCOM (March 1990 Final Work Plan).

A 2-foot long, split-spoon sampler was used to collect soil samples at 5-foot intervals during the advancement of the mud rotary borings. Continuous split-spoon sampling was conducted to the water table in the hollow stem auger borings. Soil samples were screened onsite for VOC contamination using an organic vapor analyzer (OVA). OVA results are presented in Appendix A. Soil samples were also logged by the field geologist. Color, grain size, consistency, and other pertinent data were used to describe soil samples recovered from the borings. Boring logs for each of the wells are presented in Appendix A.

Once the monitoring well installation was completed, each well was developed and the following information was collected.

- Water level measurements were taken from top of the well riser.
- pH, specific conductance, and temperature were measured during purging of five volumes of well water.
- In-situ hydraulic conductivity tests were performed on each well.
- Wells were sampled for the TCL parameter groupings: VOCs, semivolatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), and inorganic analytes of the TAL.

Total depth of the monitoring wells ranged from 18 to 100 feet. Five of the wells, WHF-20B-1 through WHF-20B-5, were shallow wells (18 to 22 feet total depth) and the remaining three wells, WHF-19B-1D through WHF-19B-3D, were deep wells (100 feet total depth).

Water samples were also collected from the existing potable water supply well on the installation and submitted for laboratory analysis to verify that the carbon treatment system was effective in removing VOCs. The specific methods and parameters of analysis are detailed in Section 2.4 of the March 1990 "Final Work Plan, OLF Barin Site Inspection."

4.1.4 Aquifer Testing In-situ rising hydraulic conductivity tests (slug tests) were conducted in each newly installed monitoring well in accordance with USEPA Method 9100. The data was analyzed using a method developed by Bouwer and Rice (1976) for calculating the hydraulic conductivity of an aquifer from partially penetrating wells in an unconfined aquifer. Results of the hydraulic conductivity analyses were presented in Section 3.4.2.

Rising head hydraulic conductivity tests were conducted in all eight wells. Because the shallow wells (WHF-20B-1 through WHF-20B-5) were screened across the water table surface, falling head tests could not be conducted. Both rising and falling head hydraulic conductivity tests were performed on the deep wells screened below the water table in the 90 to 100 feet BLS zone. For comparability of the results from the water table surface, rising head data have been used in Section 3.4.2 in the assessment of aquifer properties. Comparison of the rising

and falling head results for wells WHF-19B-1D, WHF-19B-2, and WHF-19B-2, and WHF-19B-3D are as follows:

	Calculated Hydraulic Conductivity (cm/sec)	
Well No.	Rising Head	Falling Head
WHF-19B-1D	3.34×10^{-3}	1.56×10^{-3}
WHF-19B-2D	3.34×10^{-4}	4.20×10^{-4}
WHF-19B-3D	1.50×10^{-3}	1.54×10^{-3}

A first field trial of the rising head test for well WHF-19B-2 failed to provide an analyzable set of data and was repeated. The results generally agree as well as expected for rising and falling head tests. A Students "t" test of the mean rising head and falling head results indicated that the mean conductivities in the production zone as measured by rising and falling head tests were not significantly different at the 95 percent confidence level (P=0.05). Therefore, use of the rising head data for comparison was justified. Rising head conductivity tests more directly approximate the manner by which an aquifer would respond as a result of water flow into a well from pumping.

4.1.5 Groundwater Sampling Groundwater samples were collected following development and aquifer testing from all eight newly installed monitoring wells with a Teflon™ bailer and the Installation water supply well after GAC filtration. Prior to sampling, five well volumes of groundwater were removed from each well using centrifugal and hand pumps to ensure that a representative groundwater sample was obtained. Groundwater measurements of pH, temperature, and specific conductance were performed during sampling activities.

4.1.6 Laboratory Analytical Program The schedule of analysis of the environmental samples was summarized in Table 4-1. All samples, with the exception of the soil samples collected from Sites 22B and 23B, were analyzed for the full Target Compound List (VOCs, SVOCs, pesticides, and PCBs) and Target Analyte List inorganics. The analytes are presented in Table 4-3. Site 22B soil samples were analyzed only for total lead and Site 23B soil samples were analyzed only for total lead and PAHs.

All samples were prepared and analyzed in accordance with the procedures outlined in the Pioneer Laboratory, Inc. (Pensacola, Florida), NEESA approved Quality Assurance Plan. NEESA Level C Quality Control (QC) was established for the analytical program. All extraction and analysis techniques used by Pioneer are USEPA approved methods. Table 4-4 summarizes the laboratory analytical procedures.

Evaluation of analytical conformance to NEESA Level C criteria are summarized in Section 4.2.2. Complete laboratory results are appended to the SI report as Appendix B. These results are discussed in relation to each site-specific contamination assessment in Section 5.0.

Table 4-3
Target Compound List (TCL)

Site Inspection Report
OLF Barin, Foley, Alabama

Compound	Chemical Abstract Service Number
Volatile Organic Chemicals (VOCs)	
1. Chloromethane	74-87-3
2. Bromomethane	74-83-9
3. Vinyl chloride	75-01-4
4. Chloroethane	75-00-3
5. Methylene chloride	75-09-2
6. Acetone	67-64-1
7. Carbon disulfide	75-15-0
8. 1,1-Dichloroethene	75-35-4
9. 1,1-Dichloroethane	75-34-3
10. 1,2-Dichloroethene (total)	540-59-0
11. Chloroform	67-66-3
12. 1,2-Dichloroethane	107-06-2
13. 2-Butanone	78-93-3
14. 1,1,1-Trichloroethane	71-55-6
15. Carbon tetrachloride	56-23-5
16. Vinyl acetate	108-05-4
17. Bromodichloromethane	75-27-4
18. 1,2-Dichloropropane	78-87-5
19. cis-1,3-Dichloropropene	10061-01-5
20. Trichloroethene	79-01-6
21. Dibromochloromethane	124-48-1
22. 1,1,2-Trichloroethane	79-00-5
23. Benzene	71-43-2
24. trans-1,3-Dichloropropene	10061-02-6
25. Bromoform	75-25-2
26. 4-Methyl-2-pentanone	108-10-1
27. 2-Hexanone	591-78-6
28. Tetrachloroethene	127-18-4
29. Toluene	108-88-3
30. 1,1,2,2-Tetrachloroethane	76-34-5
31. Chlorobenzene	108-90-7
32. Ethyl benzene	100-41-4
33. Styrene	100-42-5
34. Xylenes (total)	1330-20-7

Table 4-3 (Continued)
Target Compound List (TCL)

Site Inspection Report
OLF Barin, Foley, Alabama

Compound	Chemical Abstract Service Number
Semivolatile Organic Chemicals (SVOCs)	
35. Phenol	108-95-2
36. bis (2-Chloroethyl) ether	111-44-4
37. 2-Chlorophenol	95-57-8
38. 1,3-Dichlorobenzene	541-73-1
39. 1,4-Dichlorobenzene	106-46-7
40. Benzyl alcohol	100-51-6
41. 1,2-Dichlorobenzene	95-50-1
42. 2-Methylphenol	95-48-7
43. bis (2-Chloroisopropyl) ether	108-60-1
44. 4-Methylphenol	106-44-5
45. N-Nitroso-di-n-dipropylamine	621-64-7
46. Hexachloroethane	67-72-1
47. Nitrobenzene	98-95-3
48. Isophorone	78-59-1
49. 2-Nitrophenol	88-75-5
50. 2,4-Dimethylphenol	105-67-9
51. Benzoic acid	65-85-0
52. bis (2-Chloroethoxy) methane	111-91-1
53. 1,2,4-Trichlorobenzene	120-82-1
54. Naphthalene	91-20-3
55. 4-Chloraniline	106-47-8
56. Hexachlorobutadiene	87-68-3
57. 4-Chloro-3-methylphenol (para-chloro-meta-cresol)	59-50-7
58. 2-Methylnaphthalene	91-57-6
59. Hexachlorocyclopentadiene	77-47-4
60. 2,4,6-Trichlorophenol	88-06-2
61. 2,4,5-Trichlorophenol	95-95-4
62. 2-Chloronaphthalene	91-58-7
63. 2-Nitroaniline	88-74-4
64. Dimethylphthalate	131-11-3
65. Acenaphthylene	208-96-8
66. 2,6-Dinitrotuluene	606-20-2
67. 3-Nitroaniline	99-09-2
68. Acenaphthene	83-32-9
69. 2,4-Dinitrophenol	51-28-5
70. 4-Nitrophenol	100-02-7
71. Dibenzofuran	132-64-9
72. 2,4-Dinitrotoluene	121-14-2

Table 4-3 (Continued)
Target Compound List (TCL)

Site Inspection Report
OLF Barin, Foley, Alabama

Compound	Chemical Abstract Service Number
Semivolatile Organic Chemicals (Continued)	
73. Diethylphthalate	84-66-2
74. 4-Chlorophenyl-phenyl ether	7005-72-3
75. Fluorene	86-73-7
76. 4-Nitroaniline	100-01-6
77. 4,6-Dinitro-2-methylphenol	534-52-1
78. N-nitrosodiphenylamine	86-30-6
79. 4-Bromophenyl-phenylether	101-55-3
80. Hexachlorobenzene	118-74-1
81. Pentachlorophenol	87-86-5
82. Phenanthrene	85-01-8
83. Anthracene	120-12-7
84. Di-n-butylphthalate	84-74-2
85. Fluoranthene	206-44-0
86. Pyrene	129-00-0
87. Butylbenzylphthalate	85-68-7
88. 3,3'-Dichlorobenzidine	91-94-1
89. Benzo(a)anthracene	56-55-3
90. Chrysene	218-01-9
91. bis (2-Ethylhexyl)phthalate	117-81-7
92. Di-n-octylphthalate	117-84-0
93. Benzo(b)fluoranthene	205-99-2
94. Benzo(k)fluoranthene	207-08-9
95. Benzo(a)pyrene	50-32-8
96. Indeno (1,2,3-cd)pyrene	193-39-5
97. Bebenz(a,h)anthracene	53-70-3
98. Benzo(g,h,i)perylene	191-24-2
Pesticides and Polychlorinated Biphenyls	
99. alpha-BHC	319-84-6
100. beta-BHC	319-85-7
101. delta-BHC	319-86-8
102. gamma-BHC (Lindane)	58-89-9
103. Heptachlor	76-44-8
104. Aldrin	309-00-2
105. Heptachlor epoxide	1024-57-3
106. Endosulfan I	959-98-8
107. Dieldrin	60-57-1

Table 4-3 (Continued)
Target Compound List (TCL)

Site Inspection Report
OLF Barin, Foley, Alabama

Compound	Chemical Abstract Service Number
Pesticides and Polychlorinated Biphenyls (Continued)	
108. 4,4'-DDE	72-55-9
109. Endrin	72-20-8
110. Endosulfan II	33213-65-9
111. 4,4'-DDD	72-54-8
112. Endosulfan sulfate	1031-07-8
113. 4,4'-DDT	50-29-3
114. Methoxychlor	72-43-5
115. Endrin ketone	53494-70-5
116. alpha-Chlordane	5103-71-9
117. gamma-Chlordane	5103-74-2
118. Toxaphene	8001-35-2
119. Aroclor-1016	12674-11-2
120. Aroclor-1221	11104-28-2
121. Aroclor-1232	11141-16-5
122. Aroclor-1242	53469-21-9
123. Aroclor-1248	12672-29-6
124. Aroclor-1254	11097-69-1
125. Aroclor-1260	11096-82-5

Inorganic Target Analyte List (TAL)

Compound	Compound	Compound	Compound
Aluminum	Calcium	Magnesium	Silver
Antimony	Chromium	Manganese	Sodium
Arsenic	Cobalt	Mercury	Thallium
Barium	Copper	Nickel	Vanadium
Beryllium	Iron	Potassium	Zinc
Cadmium	Lead	Selenium	Cyanide

Table 4-4
Laboratory Analytical Procedures

Site Inspection Report
OLF Barin, Foley, Alabama

Media	Analysis	Method	Reference
Soils and Sediment	Total lead	ICP	USEPA Method 6010
	Volatile organic chemicals	GC/MS	CLP-COP
	Semi-Volatile organic chemicals	GC/MS	CLP-COP
	Polynuclear aromatic hydrocarbons	HPLC	SW 846-8310
Surface Water and Groundwater	Volatile organic chemicals	GC/MS	CLP-COP
	Semivolatile organic chemicals	GC/MS	CLP-COP
	Total metals	AA and ICP	CLP-CIP
	pH	Potentiometric	USEPA Method 150.1
	Specific conductance		USEPA Method120.1

NOTES:

ICP = Inductively coupled plasma.
GC/MS = Gas chromatography/mass spectrometry.
USEPA = United States Environmental Protection Agency.
CLP-COP = Contract laboratory program, caucus organic protocols.
CLP-CIP = Contract laboratory program, caucus inorganic protocols.
HPLC = High performance liquid chromatography.
SW = Solid waste.
AA = Atomic absorption.

4.1.7 Deviations from Final Work Plan Three deviations from the final work plan were made in order to expedite the field operations. The three deviations were related to drilling activities and included the following.

- A mud rotary drilling technique instead of hollow stem auger was used to advance the borehole and install monitoring wells WHF-19B-2D and WHF-19B-1D.

- Split-spoon samples were not collected at 5-foot intervals to total depth in the boreholes for monitoring wells WHF-19B-1D and WHF-19B-2D.

- The deep monitoring wells were constructed of schedule 80 polyvinyl chloride (PVC) instead of schedule 40 PVC.

The mud rotary drilling technique was found to be more appropriate when problems associated with flowing sands and augers locking up due to overburden pressures were encountered during hollow-stem augering of the first deep monitoring well borehole.

Split-spoon samples could not be collected from monitoring well boreholes WHF-19B-1D and WHF-19B-2D past depths of 77 feet and 57 feet BLS, respectively. Representative soil samples could not be recovered below these depths due to settling of gravels from the drilling mud in the bottom of the borehole. The mud rotary drilling technique required for well installation does not support soil sample collection at depth due to the failure to return 100 percent of coarse grained material. Loss of lithological data from two wells at depths below 50 to 70 feet resulted. Properly developed, mud rotary installed wells provide adequate groundwater quality and physical data.

Schedule 80 PVC screen and riser pipe were used to construct the deep monitoring wells instead of schedule 40 PVC to prevent warping of the PVC from the heat of hydration produced as the Portland cement grout was curing. Schedule 40 PVC may warp more readily than schedule 80 from heat produced by the grout in large diameter (>10 inches) boreholes because schedule 40 PVC wall thickness is substantially less than the schedule 80 PVC.

4.2 QUALITY ASSURANCE PROGRAM AND DATA QUALITY ASSESSMENT

4.2.1 Sample Handling, Delivery, and Chain-of-Custody Collection of soil, groundwater, sediment, and surface water samples was performed in accordance with the procedures outlined in the Site-Specific Quality Assurance Plan Addendum and Quality Assurance Plan Field Program of March 1990.

All samples were properly preserved, placed in coolers, and packed with bagged ice immediately after their collection and remained in the custody of the field operations leader until delivery to the laboratory. All samples were hand delivered, complete with chain-of-custody forms, to Pioneer Laboratory, Inc. (Pioneer) in Pensacola, Florida, for analysis. Upon arrival at Pioneer, the chain-of-custody and preservation was checked with the contents of each cooler

by Pioneer personnel. After verification, the chain-of-custody form was signed by Pioneer personnel and the samples accepted for analysis.

Review of the field notebooks and chain-of-custody forms did not indicate any nonconformance relative to field instrument calibration or sample handling. Table 4-5 tabulates the field quality control samples collected for analysis. These include field duplicate, equipment rinsate blanks, field blanks, and VOC trip blanks for each VOC water sample shipment. All required field quality control samples were collected in conformance with the requirements of the USEPA, NEESA, and Alabama DEM approved Jordan Quality Assurance Plans and the June 1988 NEESA "Sampling and Chemical Analysis Quality Assurance Requirements for the Navy Installation Restoration Program" (NEESA Document 20.2-047B).

Review of the field duplicate results showed adequate agreement for soils and sediment inorganic chemicals, SVOCs, PAHs, pesticides, and PCBs. Where an analyte was not detected in one replicate it was generally within 3 times the detection limit in the duplicate. Due to natural nonhomogenaity in the distribution of inorganic and organic matter in soils and sediments, such discrepancies are not uncommon. For concentrations of metals in soils, differences by a factor of 2 to 5 times among replicates is characteristic. The surface water and groundwater duplicates replicated adequately.

VOC replication was less consistent largely due to the presence of methylene chloride, toluene, and 2-butanone. The chemical 2-butanone is more commonly known as methylethyl ketone (MEK). In the surface soil replicate (WHF-SS-21B-3/3D-1, see Table 4-5), methylene chloride was observed at high concentration in one replicate and was not detected in the duplicate. Toluene was observed in the duplicate. Toluene, but not methylene chloride, was detected in the method blanks. In the sediment replicates WHF-SD-23D-2/2D-1, ethyl benzene and total xylenes replicated adequately as did toluene. Toluene was found in the method blanks for the sediment data set at 18 $\mu g/\ell$. Based on CLP functional guidelines toluene at less than 180 $\mu g/g$ in sediments is therefore likely an analytical artifact, and not likely present in the environmental samples. Methylene chloride and MEK were present in one of the two sediment replicates. Because of the overall presence of these two VOCs in method blanks in other data sets and the lack of presence or absence in replication suggests that these two analytes detected in sediments were due to an analytical artifact.

4.2.2 Chemical Analysis Data Quality Assessment The analytical results presented in Appendix B were evaluated relative to meeting NEESA Level C quality control criteria. These criteria are outlined in Table 4-6 and described in Section 7.3.2 of NEESA (1988) document 20.2-047B. Data review indicated that the laboratory met all analytical QC criteria for inorganic analyses, pesticides, and PCBs, and SVOCs. Holding times were met for all sample lots.

For VOC analyses, and gas chromatographic/mass spectroscopic (GC/MS) tuning criteria, holding times, internal standard/surrogate recovery, precision, and accuracy criteria were met. However, analytical method blanks contained detectable concentrations of several VOCs. Acetone, methylene chloride, MEK, 4-methyl-2-pentanone (methyl isobutyl ketone), and toluene are common laboratory solvents and are frequently observed artifacts in laboratory method blanks. None

Table 4-5
Field Quality Control Samples and Results

Site Inspection Report
OLF Barin, Foley, Alabama

Sampling Event	Control Sample	Results	
	Field duplicates	Total lead	
A. Soil sample at Site 22B, Old Firefighting Demonstration Area	WHF-SS-22B-J1/J1-D1	<7.1/ < 6.9 mg/kg	
	WHF-SS-22B-I5/I5-D1	<7.0/ < 6.8 mg/kg	
	WHF-SS-22B-G6/G6-D1	<7.1/ < 7.1 mg/kg	
	WHF-SS-22B-E4/E4-D1	<6.9/ < 19 mg/kg	
May 7, 1990 - May 8, 1990	WHF-SS-22B-B7/B7-D1	<7.0/ < 7.0 mg/kg	
	Field blanks	Total lead	
	WHF-EB-22B-1	<0.13 µg/ℓ	
	WHF-EB-22B-1	<0.13 µg/ℓ	
	WHF-EB-22B-2	<0.13 µg/ℓ	
	WHF-EB-22B-3	<0.13 µg/ℓ	
	WHF-EB-22B-4	<0.13 µg/ℓ	
B. Soil sampling at Site 23B, Drainage Ditch Leading to Sandy Creek, and Site 21B, Rubble Landfill	Field duplicates	Inorganics	
May 9, 1990	WHF-SS-1B-3/3D-1	Total phenols	<0.28/<0.27 mg/kg
		Aluminum	2.41/1.32 percent
		Arsenic	2.20/1.65 mg/kg
		Barium	24/18 mg/kg
		Calcium	167/130 mg/kg
		Chromium	24/12 mg/kg
		Copper	11/4.4 mg/kg
		Iron	1.16/0.70 percent
		Potassium	117/60 mg/kg
		Magnesium	167/66 mg/kg
		Vanadium	40/24 mg/kg
		Zinc	6.1/<1.1 mg/kg
		Organics	
		Methylene chloride	448/<33 µg/kg
		Toluene	<180UJ/21J
		No other VOCs, SVOCs, pesticides or PCBs detected	

Table 4-5 (Continued)
Field Quality Control Samples and Results

Site Inspection Report
OLF Barin, Foley, Alabama

Sampling Event	Control Sample	Results	
	WHF-SS-23B-2/2D-1	Total lead	<7.1/<7.1 mg/kg
		No PAH detected	
	Field blanks	Organics	
	WHF-EB-21B-1 WHF-EB-23B-1	Sodium	0.2 mg/ℓ
C. Surface water and Sediment Sampling at Site 23B, Sandy Creek	Field duplicates	Organics	
	WHF-SW-23D-2/2D-1	Calcium	2.0/1.7 mg/kg
		Iron	0.32/0.30 mg/kg
		Potassium	0.8/0.7 mg/kg
		Manganese	1.7/1.7 mg/kg
		Sodium	3.1/3.0 mg/kg
		No organic chemicals detected	
		Inorganics	
	WHF-SD-23D-2/2D-1	Total Phenols	3.8/0.35 mg/kg
		Silver	0.021/0.014 mg/kg
		Aluminum	0.54/0.31 percent
		Arsenic	0.69/0.42 mg/kg
		Barium	9.0/<6.9 mg/kg
		Calcium	130/132 mg/kg
		Chromium	4.9/2.8 mg/kg
		Copper	2.8/2.18 mg/kg
		Iron	2639/1215 mg/kg
		Potassium	64/65 mg/kg
		Magnesium	76/47 mg/kg
		Manganese	0.71/0.71 mg/kg
		Sodium	<14/14 mg/kg
		Vanadium	0.28/0.21 mg/kg
		Zinc	1.4/2.1 mg/kg

Table 4-5 (Continued)
Field Quality Control Samples and Results

Site Inspection Report
OLF Barin, Foley, Alabama

Sampling Event	Control Sample	Results	
		Pesticides	Organics
		4,4' DDD	2/2 µg/kg
		4,4' DDE	5/4 µg/kg
		4,4' DDT	14/10 µg/kg
		Dieldrin	10/8 µg/kg
		VOCs	Organics
		Ethyl benzene	26/42 µg/kg
		Xylenes	126/226 µg/kg
		Toluene	115J/155J µg/kg
		2-Butanone	<38/56 µg/kg
		Methylene chloride	<38/113 µg/kg
		No SVOCs detected	
	Field blanks		
	WHF-TB-23B-1	No VOCs detected	
	WHF-FB-21B-1	No chemicals detected	
	WHF-EB-21B-1	0.2 mg/ℓ	
	WHF-TB-23B-1	No VOCs detected	
D. Groundwater Sampling	Field duplicate	Inorganics	
June 13, 1990 - June 14, 1990			
	WHF-19B-3D/3D/D1	Total phenols	<0.005/<0.0005 mg/ℓ
		Aluminum	0.8/0.8 mg/ℓ
		Calcium	7.1/7.2 mg/ℓ
		Cadmium	<0.0002/0.0002 mg/ℓ
		Iron	0.20/0.19 mg/ℓ
		Potassium	17/18 mg/ℓ
		Magnesium	0.22/0.23 mg/ℓ
		Sodium	<0.1/0.1 mg/ℓ
		No organic chemicals detected	

Table 4-5 (Continued)
Field Quality Control Samples and Results

Site Inspection Report
OLF Barin, Foley, Alabama

Sampling Event	Control Sample	Results	
	Field blanks		
	WHF-MW-FB-1	No chemicals detected	
	WHF-MW-EB-1	Toluene	6 µg/ℓ
	WHF-MW-EB-2	Toluene	6 µg/ℓ
	WHF-MW-TB	No VOCs detected	

Notes:
mg/kg = milligrams per kilogram
g/kg = micrograms per kilogram
VOC = volatile organic carbon
SVOC = semivolatile organic chemicals
PCB = polychlorinated biphenyls
PAH = polynuclear aromatic hydrocarbons
mg/ℓ = milligrams per liter
g/ℓ = micrograms per liter

of these artifacts were present in excess of 10 times the method detection limit, which would call for rejection of the sample data associated with that blank. In reporting results of environmental sample analyses and analyses of field QC samples associated with the contaminated blanks, detection limits for non-detects were adjusted to a level 10 times the detection limit concentration and flagged as "UJ" in the tabular data for interpretation in Section 5.0. For the less common artifacts 2-hexanone (methyl n-butyl ketone), 1,1,2,2-tetrachlorethane, and 1,1,2-trichloroethane, detection limit correction has been done by adjustment by a factor of 5 times. These detection limit corrections and flagging have been implemented in accordance with USEPA functional guidelines for analytical data assessment. Environmental sample VOC results and those for field quality control (QC) samples are interpreted as undetected, estimated "UJ" for all non-detects, or "J" for results below the 10 times or 5 times detection limit criteria as appropriate.

4.2.3 Data Quality Objectives Assessment The quality and completeness of the field sampling data generated during the field program met the established field QC criteria and were traceable to sample location. The data generated, therefore, meets the Level I field screening and Level C DQOs established for the SI and is adequate for use in site characterization and evaluation.

As discussed in Section 4.2.2, no loss of analytical data due to rejection occurred in the SI analytical program. VOC blanks qualification resulted in elevated detection limits for the chemicals discussed earlier. The VOCs 2-hexanone, 1,1,2,2-tetrachloroethane, and 1,1,2-trichloroethane were observed in one method blank and in no environmental samples. The more wide-spread occurrence of acetone, methylene chloride, toluene, and 2-butanone renders the environmental data for these analytes suspect. Based on the maximum method blanks contamination, all observed water quality data for concentrations below

the following list are interpreted in Section 5.0 as possible artifacts even when the specific associated method blanks is substantially free from the analyte.

Acetone	130 μg/ℓ
Methylene chloride	60 μg/ℓ
Toluene	180 μg/ℓ
2-butanone	60 μg/ℓ

For soils data, these concentrations equate to the following levels in environmental soil samples:

Acetone	130 μg/kg
Methylene chloride	60 μg/kg
Toluene	180 μg/kg
2-butanone	60 μg/kg

These concentrations are estimated based on similarity of the analyte being detected and considering a 5 milliliter (mℓ) sample of water purged and a 5 gram soil sample.

Based on the assessment of the analytical data, with the quality qualification of detection limits for VOCs noted above, the data are acceptable for use in the SI site characterization and the HRS II scoring.

Table 4-6
Laboratory Quality Control Criteria

Site Inspection Report
OLF Barin, Foley, Alabama

Analytes	Quality Control Criteria
Organic analytes	1. Surrogate recovery limits for VOC, SVOCs, Pesticides, and PCBs 2. Matrix spike/matrix spike duplicate (MS/MSD) 3. Method blanks and method blank spikes 4. GC/MS tuning results 5. Initial and continuing calibration 6. Internal standard area (VOCs and SVOCs) 7. Second column confirmation results for gas chromatography 8. Holding times
Metals and elements	1. Initial/continuing calibration 2. Blanks 3. Digestion method blanks 4. ICP interference checks 5. MS/MSD recovery/agreement 6. Post digestion spike recovery ICP 7. Post digestion spike recovery graphite furnace atomic absorption 8. Duplicate agreement 9. Method blanks spike recovery 10. Holding times
Cyanide	1. Blanks spike 2. Method blanks 3. MS/MSD 4. Calibration check % RSD for initial and continuing calibration 5. Holding time

Notes:
VOCs = volatile organic chemicals
SVOCs = semivolatile organic chemicals
MS/MSD = matrix spike/matrix spike duplicate
GC/MS = gas chromatography/mass spectroscopy
ICP = inductively coupled argon plasma
RSD = relative standard deviation

5.0 SITE SPECIFIC INVESTIGATIONS

The purpose of section 5.0 is to present the results of the SI field and laboratory program at OLF Barin and to interpret the contamination status of each of the five previously identified sites:

Site 19B, Former Hangar Maintenance Area,
Site 20B, Abandoned Underground Storage Tanks (UST) and Fuel Pit area,
Site 21B, Rubble Landfill,
Site 22B, Old Firefighting Demonstration Area, and
Site 23B, Drainage Ditch Leading to Sandy Creek.

In addition, contamination of the installation water supply well and four additional sites of potential contamination not identified during the PA (NEESA, 1989) are addressed. These are the following:

- Machine Gun Butt,
- Uncontrolled Dumpsite, and
- Abandoned Wastewater Treatment Plant

The Machine Gun Butt is a mound to the south of the runways as shown on Figure 4-1. In the past, 0.50 caliber machine gun testing was apparently carried out at this location based on the spent 0.50 caliber bullets littering the ground. In addition, a limited amount of small arms firing has also occurred. In the immediate vicinity of the mound the ground is littered with copper, brass, lead, and steel from the spent bullets and from cartridge cases.

The Uncontrolled Dumpsite was discovered during the HRS II site reconnaissance in October 1990. The dumpsite is located to the north of the abandoned wastewater treatment plant on the slope of the west bank of Sandy Creek. This site is also shown in Figure 4-1. The Uncontrolled Dumpsite extends from the flat upland terrace to near the creek bank. Although this site appears to be on Navy property, access by the public from off-installation is possible in this area, and appears to account for much of the disposed material.

The Abandoned Wastewater Treatment Plant received sewage flow from OLF Barin during operational years prior to 1959. The portion of the installation served by the sanitary sewer system is unknown; therefore, the potential for contamination at this site due to residual chemicals from past operations is unknown.

For each of the sites, the site disposal history and results of the SI sampling and analysis are presented and interpreted to provide data appropriate for the HRS II scoring relative to waste quantities, pathways, and containment, and to identify waste characteristics (chemicals of concern). Following this descriptive material a contamination assessment has been developed. This integrates the regional and site-specific hydrogeologic factors and chemicals of concern to evaluate which sites pose a significant threat to public health and/or environmental systems. Conclusions are developed for each site related to contamination status and contaminant migration factors. Site-specific hydrogeologic factors are addressed as they relate to migration potential. The

installation-wide and regional environmental setting has been presented in Section 3.0. Contamination assessment conclusions form the basis for recommended follow-on investigations outlined in Section 6.0.

Selection of chemicals of concern has been based on the approach and criteria set forth in the HRS II scoring model (USEPA, 1990) as well as Federal and Alabama water quality standards and criteria. No numerical regulatory standards or criteria exist, except for lead, for soils and sediments. For metals that may be naturally present in soils, chemicals of concern are interpreted as those metals exceeding three times the background concentrations. No site-specific background samples were collected during the OLF Barin SI field program. However, background concentration means and/or ranges for the Gulf Coast of Florida and Alabama, the southeastern coastal plain, and for other soils of appropriate mineralogy and origin are tabulated in Table 5-1, using data taken from Shacklette and Boerngen (1984) and from Kabata-Pendais and Pendais (1984). These regional characteristics have been used for evaluation of the significance of metals concentrations in soils. For groundwater and surface water, inorganic chemicals of concern are those that exceed Alabama standards (summarized in Table 5-2) or Federal Standards or Criteria (summarized in Table 5-3). These represent chemical-specific Applicable or Relevant and Appropriate Requirements (ARARs) for the installation. Alabama and the Federal government do not directly regulate concentrations of chemicals in groundwater. However, because groundwater in a rural setting is frequently used untreated as a potable supply, drinking water standards (MCLs and MCLGs) are relevant and appropriate.

For organic chemicals not naturally present in the environment, the positive detection of the compound in an environmental matrix, uncomplicated by its presence as a probable artifact of sampling and analysis (see Section 4.2), has been the criterion for identification of organic chemicals as chemicals of concern.

In Section 5.7, chemical and toxicological properties required for the HRS II scoring for developing toxicity, mobility, and persistence factors are summarized for each of the chemicals of concern. Also, in Section 5.7 chemical specific "benchmark" concentration factors are developed for discriminating "Level I" and "Level II" levels of concern for the HRS II scoring. "Benchmark" concentrations are defined by USEPA (1990) as concentrations meeting an ARAR or equalling or exceeding an risk-based screening level. This level has been defined by USEPA (1990) as the concentration that results in an estimated 10^{-6} individual excess cancer risk for USEPA class A human carcinogens, or Classes B-1, B-2, and C suspected human carcinogens, or that exceeds the chronic toxicity verified reference dose (RfD) as a result of oral exposure for drinking water, food chain intakes, or soil, and for inhalation exposure for air. This screening constitutes a preliminary or screening risk assessment. Level I concentrations are those exceeding an ARAR or a risk-based screening concentration. The carcinogen classes are the USEPA Carcinogen Assessment Group (CAG) designations for the weight-of-evidence for a chemical probability of causing cancer in humans. Class A chemicals have sufficient evidence from human epidemiologic studies to support a causal relationship between exposure and cancer. Class B chemicals are probable human carcinogens. Class B1 chemicals are classified based on limited evidence of causing cancer in humans and strong evidence for causing cancer in animals. Class B2 classifications are based on evidence for

Table 5-1
Background Concentration Range for Elements in Soils
(Concentration in milligrams per kilogram unless otherwise noted)

Site Inspection Report
OLF Barin, Foley, Alabama

Element	Eastern U.S. (1)		Gulf Coast (2) (FL and AL)	U.S. Clay and Clay Loam (3)		U.S. Alluvial Soils (3)		U.S. Sandy Soils (3)	
	Geometric Mean	Range	Range	Arithmetic Mean	Range	Arithmetic Mean	Range	Arithmetic Mean	Range
Aluminum	3.3%	0.7 - >10%	0.07 - 3%	No data		No data		No data	
Antimony	0.10	<0.08 - 0.31	<1 - 10	--	0.25 - 0.6	No data		No data	
Arsenic	4.8	<0.1 - 73	<0.1 - 100	7.7	1.7 - 27.0	8.2	21 - 22.0	5.1	<0.01 - 300
Barium	31	<20 - 150	10 - 200	535	150 - 1,500	660	200 - 1,500	400	20 - 1,500
Beryllium	0.55	<1 - 7	<1	1.9	<1 - 15	1.6	1 - 3	1.9	<1 - 3
Calcium	0.34%	0.01 - 28%	0.013 - 0.23%	No data		No data		No data	
Cadmium	No data		No data	--	0.4 - 0.57	No data		No data	
Chromium	33	1 - 1,000	1 - 2,000	55	20 - 100	55	15 - 100	40	3 - 200
Cobalt	5.9	<0.3 - 70	<3 - 7	8.0	3 - 30	9.0	3 - 20	3.5	0.4 - 20
Copper	13	<1 - 7,000	<10 - 700	29	7 - 70	27	5 - 50	14	1 - 70
Iron	2.87%	<0.01 - >10	0.01 - 1.5%	No data		No data		No data	
Lead	14	<10 - 300	<10 - 700	22	10 - 70	18	10 - 30	17	<10 - 70
Magnesium	0.21%	0.005 - 5%	0.005 - 0.15%	No data		No data		No data	
Manganese	260	<2 - 7,000	<2 - 7,000	580	50 - 2,000	405	150 - 1,500	345	7 - 2,000
Mercury	0.081	0.01 - 3.4	<0.01 - 5.1	0.13	0.01 - 0.90	0.05	0.02 - 0.15	0.08	<0.01 - 0.54
Nickel	11	<5 - 700	<5 - 15	20.5	5 - 50	19.0	7 - 50	13	<5 - 70
Potassium	1.2%	0.005 - 3.7%	0.22 - 0.88%	No data		No data		No data	

Table 5-1 (Continued)
Background Concentration Range for Elements in Soils
(Concentration in milligrams per kilogram unless otherwise noted)

Site Inspection Report
OLF Barin, Foley, Alabama

Element	Eastern U.S. (1)		Gulf Coast (2) (FL and AL)	U.S. Clay and Clay Loam (3)		U.S. Alluvial Soils (3)		U.S. Sandy Soils (3)	
	Geometric Mean	Range	Range	Arithmetic Mean	Range	Arithmetic Mean	Range	Arithmetic Mean	Range
Selenium	0.30	<0.1 - 3.9	<0.01 - 5	0.5	<0.1 - 1.9	0.5	<0.1 - 2.0	0.5	<0.005 - 3.5
Sodium	0.25%	<0.05 - 5%	<0.05 - 0.2%	No data		No data		No data	
Vanadium	43	<7 - 300	<7 - 50	87	20 - 150	79	30 - 150	47	7 - 150
Zinc	40	<5 - 2,900	28 - 45	67	20 - 220	58.5	20 - 108	40	<5 - 164

Notes:
(1) Shacklette and Boerngen (1984), Table 2 - East of Longitude 96 °West
(2) Taken from Shacklette and Boerngen (1984) data display figures
(3) Kabata-Pendias and Pendias (1984)

Table 5-2
Applicable Alabama Water Quality Standards

Site Inspection Report
OLF Barin, Foley, Alabama

Surface Water Quality [1]

1. All waters free from substances attributable to sewage, industrial wastes, or other wastes in concentrations that are toxic or harmful to humans or aquatic life to the extent commensurate with the designated usage.

2. Specific criteria use classes "S", and "F&W."

   pH - no deviation > 1.0 pH unit or to cause a pH < 6.0 or >8.5.
   Dissolved oxygen - not less than 5.0 mg/ℓ.
   Toxic substances - not to exceed 1/10 of the 96-hour median tolerance limit for fish and aquatic life.
   Bacteria - the fecal coliform contamination shall not exceed a geometric mean value of 200 per 100 milliliters.

Alabama Primary Drinking Water Standards [2]

Maximum Contaminant Levels

Contaminant	mg/ℓ
Arsenic	0.05
Barium	1.0
Cadmium	0.010
Chromium	0.05
Fluoride	4.0
Lead	0.020
Mercury	0.002
Nitrate	10.0
Selenium	0.01
Silver	0.05
Endrin	0.002
Lindane	0.004
Methoxychlor	0.1
Toxaphene	0.005
2,4-Dichlorophenoxy acetic acid	0.1
2,4,5-Trichlorophenoxy acetic acid (Silvex)	0.01
Total trihalomethane	0.10
Benzene	0.005
Carbon tetrachloride	0.005
1,2-Dichloroethane	0.005
Trichloroethylene	0.005
p-Dichlorobenzene	0.075
1,1-Dichloroethylene	0.007
1,1,1-Trichloroethane	0.2
Vinyl chloride	0.002

Table 5-2 (Continued)
Applicable Alabama Water Quality Standards

Site Inspection Report
OLF Barin, Foley, Alabama

Alabama Secondary Drinking Water Standards [2]

Contaminant	mg/ℓ
Chloride	250
Color	15 units
Copper	1
Corrosivity	non corrosive
Foaming agents	0.5
Iron	0.3
Manganese	0.05
Odor	3 threshold odor number
Sulfate	250
Total dissolved solids	500
Zinc	5

NOTES: (1) Wolf Creek is classified as "F&W", suitable for protection of Fish and Wildlife; Sandy Creek is classified "S", "F&W", suitable for swimming and other whole body contact recreation and protection of Fish and Wildlife under Alabama Water Quality Criteria and Use Classification Regulations Title II, Section II, April 1982.

(2) Alabama Administrative Code Chapter 335-7-2, January 4, 1989

(3) Alabama Administrative Code Chapter 335-7-3, January 4, 1989

mg/ℓ = milligram per liter

Table 5-3
Federal Water Quality Standards and Criteria, U.S. Environmental Protection Agency Target Compound List

Site Inspection Report
OLF Barin, Foley, Alabama

	Federal Primary Drinking Water MCL[1] (µg/ℓ)	Federal Primary Drinking Water MCLG[1] (µg/ℓ)	Federal AWQC Aquatic Organisms[2] (µg/ℓ)	Federal AWQC Human Health[3] (µg/ℓ)	Federal Secondary Drinking Water MCL[6] (µg/ℓ)
VOLATILE ORGANIC COMPOUNDS					
Chloromethane				0(0.19)	
Bromomethane				0(0.19)	
Vinyl Chloride	2	0		0(2.0)	
Chloroethane			IND	IND	
Methylene chloride			11,000[a]	0(0.19)	
Acetone					
Carbon disulfide					
1,1-Dichloroethene	7	7	11,600[a]	0(0.003)	
1,1-Dichloroethane					
Cis-1,2-Dichloroethene	70[4]	70	IND	IND	
Trans-1,2-Dichloroethene	100[4]	100			
Chloroform	100[5]		1,240[b]	0(0.19)	
1,2-Dichloroethane	5	0	20,000	0(0.94)	
2-Butanone					
1,1,1-Trichloroethane	200	200	18,000	18,400	
Carbon tetrachloride	5	0	35,200[a]	0(0.4)	
Vinyl acetate					
Bromodichloromethane	100[5]		11,000[a]		
1,2-Dichloropropane	5	0	5,700[b]	IND	
Trans-1,3-Dichloropropene			244[b]	87	
Trichloroethene	5	0	21,900[b]	0(2.78)	
Dibromochloromethane	100		11,000[a]	0(0.19)	
1,1,2-Trichloroethane			9,400[b]	0(0.6)	
Benzene	5	0	5,300[a]	0(0.66)	
Cis-1,3-Dichloropropene			244[b]	87	
2-Chloroethylvinyl ether					
Bromoform	100[5]		11,000[a]		
4-Methyl-2-Pentanone					
2-Hexanone					
Tetrachloroethene	5[5]	0	840[b]	0(0.80)	
1,1,2,2-Tetrachloroethane			9,320[a]	0(0.17)	
Toluene	1,000[4]	1,000	17,500[a]	18,3000	

Table 5-3 (Continued)
Federal Water Quality Standards and Criteria, U.S. Environmental Protection Agency Target Compound List

Site Inspection Report
OLF Barin, Foley, Alabama

	Federal Primary Drinking Water MCL[1] (µg/ℓ)	Federal Primary Drinking Water MCLG[1] (µg/ℓ)	Federal AWQC Aquatic Organisms[2] (µg/ℓ)	Federal AWQC Human Health[3] (µg/ℓ)	Federal Secondary Drinking Water MCL[6] (µg/ℓ)
VOLATILE ORGANIC COMPOUNDS--continued					
Ethyl benzene	700[4]	700	3,200[a]	14,000	
Chlorobenzene	100[4]	100	50[b]	488	
Styrene	100[4]	100			
Xylenes (Total)	10,000[4]	10,000			
INORGANIC COMPOUNDS					
Aluminum			87[e]	146	50 to 200
Antimony			1,600[b]		
Arsenic	50	50	190[e]	0.0022	
Asbestos	7×10^6(f/ℓ)[7]	7×10^6(f/ℓ)[7]			
Barium	1,000[4]	1,000[4]		1,000	
Beryllium			5.3[b]	0(0.0068)	
Cadmium	5[4]	5	1.1[c]	10	
Calcium					
Chromium (total)	100[4]	100			
Chromium VI	50	12	11	50	
Chromium III			210[c]	170,000	
Cobalt					
Copper		1,300	12[c]	1,000[f]	1,000
Cyandie, total					
Fluoride	4,000	4,000			2,000
Iron			1,000	200	3,000
Lead	5[4]	0	3.2[c]		
Magnesium				50	
Manganese				50	50
Mercury	2[4]	2	0.012[e]	0.144	
Nitrate (as N)	10,000				
Nirtrite (as N)	1,000[4]				
Total Nitrate + Nitrite	10,000[4]				
Nickel			160[c]	13.4	
Potassium					
Selenium	50[4]	50	5[e]	10	
Silver	50		0.12[e]	50	100

Table 5-3 (Continued)
Federal Water Quality Standards and Criteria, U.S. Environmental Protection Agency Target Compound List

Site Inspection Report
OLF Barin, Foley, Alabama

	Federal Primary Drinking Water MCL[1] (µg/ℓ)	Federal Primary Drinking Water MCLG[1] (µg/ℓ)	Federal AWQC Aquatic Organisms[2] (µg/ℓ)	Federal AWQC Human Health[3] (µg/ℓ)	Federal Secondary Drinking Water MCL[6] (µg/ℓ)
INORGANIC COMPOUNDS--continued					
Sodium					
Thallium			40[b]	13	
Vanadium					
Zinc			110[c]	5,000[f]	5,000
SEMIVOLATILE ORGANIC COMPOUNDS					
3-Nitroaniline				0.0028	
Acenaphthene			520[b]	70	
2,4-Dinitrophenol					
4-Nitrophenol					
Dibenzofuran					
2,4-Dinitrotoluene				0(0.11)	
Diethylphthalate				434,000	
4-Chlorophenyl-phenylether					
Fluorene				0.0028	
4-Nitroaniline					
4,6-Dinitro-2-methylphenol					
N-Nitrosodiphenylamine				0(4.9)	
4-Bromophenyl-phenylether					
Hexachlorobenzene			50[b]	0.021	
Pentachlorophenol	1	0	13[e]	1010	
Phenanthrene				0.0031	
Anthracene			6.3[d]	0.0031	
Di-n-butylphthalate				34,000	
Fluoranthene			3,980[a]	42	
Pyrene				0.0028	
Butylbenzylphthalate					
3,3'-Dichlorobenzidine				470	
Benzo(a)Anthracene				0.0028	
Chrysene				0.0028	
bis(2-Ethylhexyl)phthalate			3[b]		
Di-n-octylphthalate					
Benzo(b)Fluoranthene				0(0.0028)	

Table 5-3 (Continued)
Federal Water Quality Standards and Criteria, U.S. Environmental Protection Agency Target Compound List

Site Inspection Report
OLF Barin, Foley, Alabama

	Federal Primary Drinking Water MCL[1] (µg/ℓ)	Federal Primary Drinking Water MCLG[1] (µg/ℓ)	Federal AWQC Aquatic Organisms[2] (µg/ℓ)	Federal AWQC Human Health[3] (µg/ℓ)	Federal Secondary Drinking Water MCL[6] (µg/ℓ)
SEMIVOLATILE ORGANIC COMPOUNDS--continued					
Benzo(k)Fluoranthene				0(0.0028)	
Benzo(a)Pyrene				0(0.0028)	
Indeno(1,2,3-cd)pyrene				0(0.0028)	
Dibenz(a,h)anthracene				0(0.0028)	
Benzo(g,h,i)perylene				0(0.0028)	
Phenol			2,560[b]	3,500	
bis(2-Chloroethyl)ether				0(30 ng/ℓ)	
2-Chlorophenol			2,000[b]	0.1[f]	
1,3-Dichlorobenzene	600[4]	650	763[b]	400	
1,2-Dichlorobenzene	600[4]	600	730[b]	400	
1,4-Dichlorobenzene	600[4]	600	763[b]	400	
Benzyl alcohol					
2-Methylphenol					
bis(2-Chloroisopropyl)ether				34.7	
4-Methylphenol					
N-Nitroso-di-n-propylamine					
Hexachloroethane			5,850[b]	0(1.9)	
Nitrobenzene			27,000	19,800	
Isophorone			117,500[a]	5,200	
2-Nitrophenol					
2,4-Dimethylphenol			2,120[a]	400[f]	
Benzoic acid					
bis(2-Chloroethoxy)methane					
2,4-Dichlorobenzene			763[b]	3,090	
Naphthalene			920[b]	IND	
4-Chloroaniline					
Hexacholorobutadiene			9.3[b]	0(0.45)	
4-Chloro-3-Methylphenol			30[a]	3,000	
2-Methylnaphthalene				0.0028	
Hexachlorocyclopentadiene			5.2[b]	206	
2,4,6-Trichlorophenol			970[b]	0(1.8)	
2,4,5-Trichlorophenol				2,600	

Table 5-3 (Continued)
Federal Water Quality Standards and Criteria, U.S. Environmental Protection Agency Target Compound List

Site Inspection Report
OLF Barin, Foley, Alabama

	Federal Primary Drinking Water MCL[1] (µg/ℓ)	Federal Primary Drinking Water MCLG[1] (µg/ℓ)	Federal AWQC Aquatic Organisms[2] (µg/ℓ)	Federal AWQC Human Health[3] (µg/ℓ)	Federal Secondary Drinking Water MCL[6] (µg/ℓ)
SEMIVOLATILE ORGANIC COMPOUNDS--continued					
2-Chloronaphthalene			IND	IND	
2-Nitroaniline					
Dimethylphthalate				350,000	
Acenaphthylene				0.0028	
2,6-Dinitrotoluene					
PESTICIDES/PCB COMPOUNDS					
Alachlor	2[4]	0			
Atrazine	3[4]	3			
Carbonfuran	40[4]	40			
Dibromochloropropane	0.2[4]	0			
2,4-D	70[4]	70			
Ethylene dibromide	0.05[4]	0			
2,4,5-TP	50[4]	50			
alpha-BHC			100[a]	0.073	
beta-BHC				0.0233	
delta-BHC	0.2	0	IND	IND	
gamma-BHC (lindane)	0.2[4]	0.2		0.0174	
Heptachlor	0.4[4]	0	0.0038[e]	0.0011	
Aldrin			3.0[d]		
Heptachlor epoxide	0.2[4]	0			
Endosulfan I		0.056[d]	138		
Dieldrin		0.0019[d]	0(1.1 ng/ℓ)		
4,4'-DDE		1,050[a]			
Endrin	0.2	0.0023[d]	1	1	
Endosulfan II					
4,4'-DDD					
Endrin Aldehyde		0.001[d]			
Endosulfan sulfate					
4,4'-DDT			0.001[d]	0(1.2 ng/ℓ)	
Methoxychlor	40	40			
Endrin ketone					
Chlordane	2[4]	0	0.0043[d]	0(0.022)	

Table 5-3 (Continued)
Federal Water Quality Standards and Criteria, U.S. Environmental Protection Agency Target Compound List

Site Inspection Report
OLF Barin, Foley, Alabama

	Federal Primary Drinking Water MCL[1] (µg/ℓ)	Federal Primary Drinking Water MCLG[1] (µg/ℓ)	Federal AWQC Aquatic Organisms[2] (µg/ℓ)	Federal AWQC Human Health[3] (µg/ℓ)	Federal Secondary Drinking Water MCL[6] (µg/ℓ)
PESTICIDES/PCB COMPOUNDS--continued					
Toxaphene	3[4]	0	0.0002[a]	0(0.026)	
Aroclor-1016				0(>0.0126)	
Aroclor-1221				0(>0.0126)	
Aroclor-1232				0(>0.0126)	
Aroclor-1242				0(>0.0126)	
Aroclor-1248				0(>0.0126)	
Aroclor-1254				0(>0.0126)	
Aroclor-1260				0(>0.0126)	
PCBs (total)	0.5[4]	0	0.014[e]		

Notes--for above table.

[1]From 40 CFR 161, revised by 56 Federal Register 3578, January 30, 1991.
[2]AWQC for the protection of aquatic life - lowest available number is presented (USEPA, May 1986).
[3]AWQC for the protection of human health - from effects through ingestion and contaminated aquatic organisms (USEPA, May 1986).
[4]Effective July 30, 1992.
[5]MCL for total trihalomethanes (sum of concentrations of bromodichloromethane, dibromochloromethane, tribromomethane (bromoform), and trichloromethane) = 100 ug/ℓ.
[6]Secondary MCLs from 40 CFR 143, revised by 56 Federal Register 3595, January 30, 1991. Secondary MCLs are not federally enforceable, they are guidelines to control aesthetic qualities of drinking water.
[7]Units for asbestos MCLs are Million fibers/liter for fibers longer than 10 um.
[8]Chapter 17-302-530 Florida Administrative Code Recreation and Propagation of Freshwater Fish and Wildlife.
[9]Chapter 17-550 Florida Administrative Code Recreation and Propagation of Freshwater Fish and Wildlife.
[a]Acute lowest observed effect concentration (LOEL).
[b]Chronic LOEL.
[c]Hardness based criteria (based on 100 mg/ℓ as CaCO3).
[d]Acute criteria.
[e]Chronic criteria.
[f]Organoleptic, criteria based on odor and taste, not health. No health-based criteria available.
[g]Aldrin plus dieldrin sum.

Notes: MCL = Maximum Contaminant Level.
g/ℓ = microgram per liter.
MCLG = Maximum Contaminant Level Goal.
AWQC = Ambient Water Quality Criteria.
IND = Insufficient data.
PCB = polychloride biphenyls.

causing cancer in animals but inadequate evidence for causing cancer in humans. Class C chemicals are classified based on limited evidence from animal studies only.

Toxicological profiles for the chemicals of concern are contained in Appendix C.

5.1 SITE 19B, FORMER HANGAR MAINTENANCE AREA

5.1.1 Site Description Site 19B consists of the location of four former large aircraft maintenance hangars. These are shown in Figure 5-1. As described in Section 2.0, these hangars (former building numbers 1221, 1222, 1223, 1235) were built during WWII for the purpose of aircraft maintenance. These hangars were used as described below during periods of active flying operations until 1959 when the installation was deactivated and these aboveground structures demolished. Currently, buildings 2768 and 3029 occupy the site of former hangar 1223. The existing buildings were built in 1985 to house the existing emergency equipment and crash crew operations and storage areas. According to the OLF Barin fire chief, a total of 63 full-time personnel provide 24-hour emergency services for NAS Whiting field flight operations involving OLF Barin.

Figure 5-1 shows the relationship of the site, which has dimensions of approximately 350 feet by 1,460 feet (11.8 acres), to Site 20B, Underground Storage Tanks and Fuel Pit Area, and to interpreted groundwater flow direction. Based on the elevation of the land surface, groundwater at this site lies approximately at 15 to 20 feet BLS as discussed in Section 3.4. Figure 3-8 shows the interpreted surface drainage from the site.

As reported in the PA, maintenance shops were located at the northern end of each hangar area. Maintenance operations likely included cleaning and degreasing of aircraft and aircraft parts, corrosion control, inspection, and testing.

5.1.2 Waste Characteristics and Disposal History Between 1942 and 1959, the Site 19B hangars were periodically used for aircraft maintenance. The periods of activity mainly occurred during WWII and the Korean Conflict. Numerous types of solvents, oils, and fuels were reportedly used by maintenance personnel in these operations. Toluene, carbon tetrachloride, trichloroethylene, tetrachloroethylene, and trichloroethane as well as petroleum distillates were among the solvents likely used by maintenance personnel. The solvents used have not been documented. The above types of solvents are those used for aircraft maintenance during the time period. In addition, it is unknown whether corrosion control (painting) operations, Nondestructive Inspection (NDI) operations, or storage battery service occurred in the hangars. If so, wastes containing metals could have been used at the site. NDI operations involved the use of degreasers and X-ray-opaque salts such as barium. Battery rework may have involved electrolytes containing lead or dry cells containing nickel, cadmium, or mercury. The use rate of these materials is unknown.

The aircraft required oil changes every 40 hours of flying time. The waste oils were put into underground waste oil tanks at the north and south ends of each hangar. When the tanks were full, the wastes were reportedly pumped out by local contractors and transported off station (NEESA, 1989).

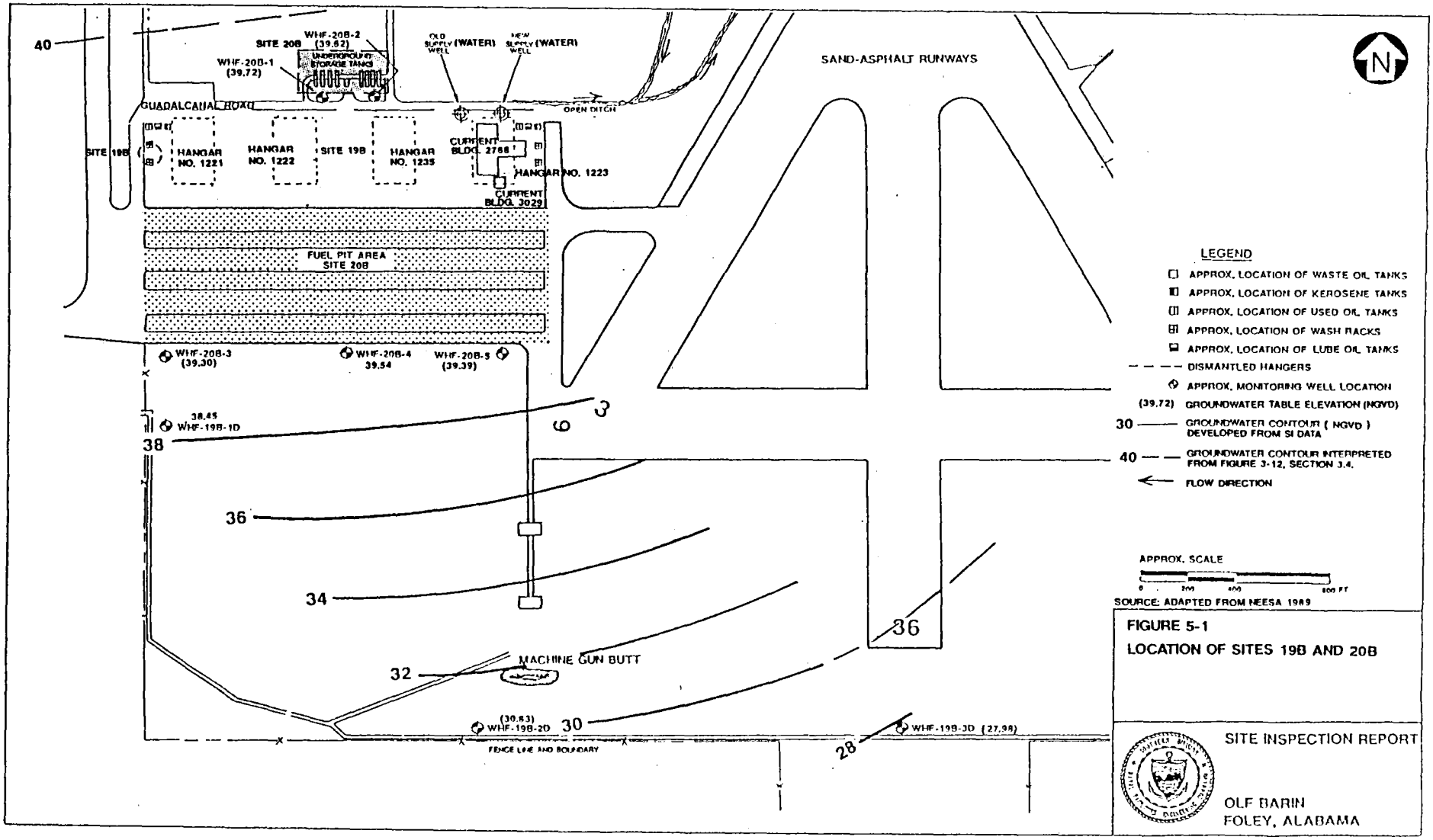


FIGURE 5-1
LOCATION OF SITES 19B AND 20B

SITE INSPECTION REPORT

OLF BARIN
FOLEY, ALABAMA

Typically, until the mid-1970's or later, halogenated and non-halogenated solvents and other flammable materials were routinely commingled with waste oils for disposal.

In the PA, inferred tanks locations were shown. Subsequent to the PA (NEESA, 1984), SOUTHNAVFACENGCOM has located and evaluated the UST's associated with the Former Hangars and with the aviation fuels storage and dispensing system identified as Site 20B. Site 20B is discussed in Section 5.2.

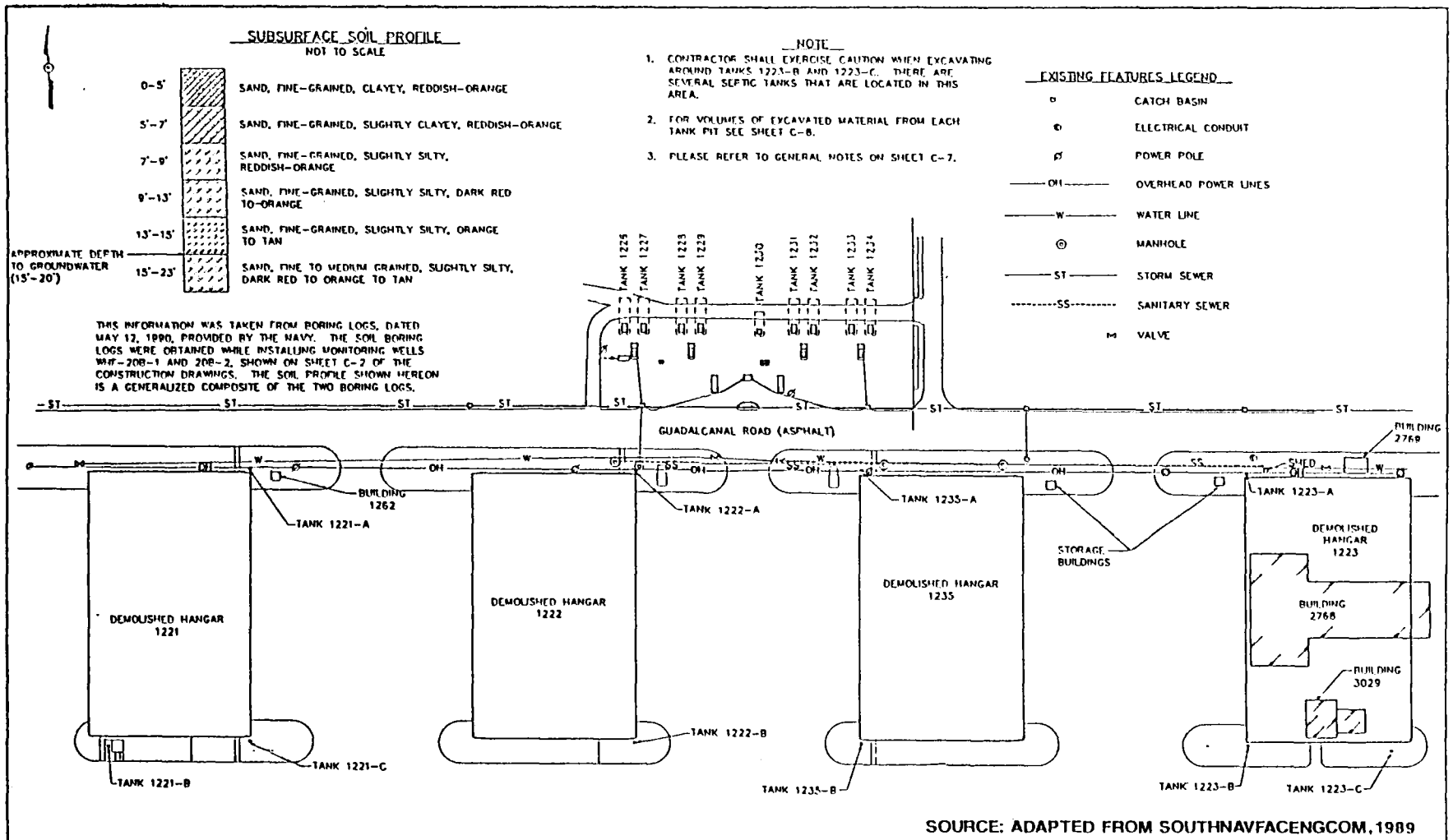
The UST program updated the PA by means of a field inspection. A remedial design has been completed (SOUTHNAVFACENGCOM, 1991 personal communication) and removal action is currently awaiting prioritization for fiscal year 1991 funding. Figure 5-2 and Table 5-4 show the updated location and status of the contents of each tank (SOUTHNAVFACENGCOM, 1991, personal communication). During the tank removal action, soil samples will be collected from beneath each tank.

Aircraft formerly were washed with kerosene at wash racks located at the east and west end of the hangars. The wash racks were reportedly connected to an oil/water separator designed to collect the kerosene and water run-off. The recovered kerosene was stored in three tanks located at each wash rack. The size of the tanks connected to the wash racks is unknown. The hangars were reportedly flanked on the east and west by used oil and lube oil, as well as kerosene tanks. The specific use of each tank does not appear in the SOUTHNAVFACENGCOM 1991 inventory. Local residents interviewed during the PA site visit reported that fishing in Sandy Creek had to be stopped while the field was active because of kerosene contamination. Kerosene use for washing airplanes was discontinued in the early 1950's because it left a slippery residue on the wings and fuselage.

The Former Hangar Maintenance Area is adjacent to grassy, non-paved areas to the east, west, and north along Guadalcanal Road. Any solvents, oils, or fuels spilled onto the concrete in these areas would be washed into the soil by either stormwater runoff or rinsing of the hardstand.

The total waste oil storage capacity at Site 19B was 6,310 gallons, based on the volumes of tanks 1221A through 1235B tabulated in Table 5-4. This amount of material would have been handled many times during the operation history. Currently no oily product exists in any of the tanks. Materials likely handled include: halogenated and nonhalogenated solvents, aliphatic and aromatic hydrocarbons, AVGAS (containing tetraethyl lead), kerosene, lube oils, and hydraulic fluids. Potentially paint (containing solvents and metals in pigments), corrosion products from airframes and internal aircraft parts, and possibly X-ray-opaque material from NDI may have been disposed. The quantities released through spills or leaks are unknown. Migration pathways available to any waste residuals are infiltration to groundwater, migration toward surface water via overland flow of contaminated soil particles, or migration as dissolved materials in runoff.

<u>5.1.3 Site Investigation Results</u> The scope of the field investigation at site 19B consisted of hydrogeologic assessment based on installation of eight soil boring and monitoring wells, estimation of aquifer properties by means of <u>in situ</u> aquifer testing, field screening of subsurface soils for the presence of VOCs,



SOURCE: ADAPTED FROM SOUTHNAVFACENGCOM, 1989

FIGURE 5-2

UST LOCATIONS AT THE FORMER HANGAR MAINTENANCE AND FUEL PIT AREA

SITE INSPECTION REPORT

OLF BARIN
FOLEY, ALABAMA

UST REMOVAL SCHEDULE
OUTLYING LANDING FIELD, BARIN, FOLEY, ALABAMA

NAVY TANK NO.	TANK CAPACITY (GALLONS)	MATERIAL OF CONSTRUCTION	TANK DIAMETER (INCHES)	TANK LENGTH (FEET)	COVER OVER TANK	DEPTH OF COVER (INCHES)	TANK CONTENTS	DEPTH OF FLUID		VOLUME OF CONTENTS IN TANK	
								PRODUCT	WATER	PRODUCT	WATER
1226	25,000	STEEL	126	39	CONCRETE VAULT AND SOIL	54	WATER WITH GASOLINE SHEEN	< 1/8 IN.	126 IN.	N/A	25,000 GAL.
1227	25,000	STEEL	126	39	CONCRETE VAULT AND SOIL	54	WATER WITH GASOLINE SHEEN	< 1/8 IN.	126 IN.	N/A	25,000 GAL.
1228	25,000	STEEL	126	39	CONCRETE VAULT AND SOIL	54	WATER WITH GASOLINE SHEEN	< 1/8 IN.	126 IN.	N/A	25,000 GAL.
1229	25,000	STEEL	126	39	CONCRETE VAULT AND SOIL	54	WATER WITH GASOLINE SHEEN	< 1/8 IN.	126 IN.	N/A	25,000 GAL.
1230	15,000	STEEL	120	26	CONCRETE VAULT AND SOIL	52	WATER WITH GASOLINE SHEEN	< 1/8 IN.	3 IN.	N/A	120 GAL.
1231	25,000	STEEL	126	39	CONCRETE VAULT AND SOIL	52	WATER WITH GASOLINE SHEEN	< 1/8 IN.	126 IN.	N/A	25,000 GAL.
1232	25,000	STEEL	126	39	CONCRETE VAULT AND SOIL	52	WATER WITH GASOLINE SHEEN	< 1/8 IN.	126 IN.	N/A	25,000 GAL.
1233	25,000	STEEL	126	39	CONCRETE VAULT AND SOIL	52	WATER WITH GASOLINE SHEEN	< 1/8 IN.	126 IN.	N/A	25,000 GAL.
1234	25,000	STEEL	126	39	CONCRETE VAULT AND SOIL	52	WATER WITH GASOLINE SHEEN	< 1/8 IN.	126 IN.	N/A	25,000 GAL.
1221-A	720	CONCRETE	48" (DEPTH) x 36" (WIDTH) [1]	8.0	CONCRETE MANWAY AND SOIL	24	WATER WITH FUEL OIL SHEEN	< 1/8 IN.	56 IN. [2]	N/A	740 GAL.
1221-B	175	CONCRETE	48" (DEPTH) x 24" (WIDTH) [1]	3.0	CONCRETE MANWAY AND SOIL	19	WATER WITH GASOLINE SHEEN	< 1/8 IN.	10 IN.	N/A	40 GAL.
1221-C	720	CONCRETE	48" (DEPTH) x 36" (WIDTH) [1]	8.0	CONCRETE MANWAY AND SOIL	24	SOIL [3]	N/A	N/A	N/A	N/A
1222-A	720	CONCRETE	48" (DEPTH) x 36" (WIDTH) [1]	8.0	CONCRETE MANWAY AND SOIL	24	WATER WITH FUEL OIL SHEEN	< 1/8 IN.	54 IN. [2]	N/A	740 GAL.
1222-B	720	CONCRETE	48" (DEPTH) x 36" (WIDTH) [1]	8.0	CONCRETE MANWAY AND SOIL	24	SOIL [3]	N/A	N/A	N/A	N/A
1235-A	720	CONCRETE	48" (DEPTH) x 36" (WIDTH) [1]	8.0	CONCRETE MANWAY AND SOIL	24	WATER WITH FUEL OIL SHEEN	< 1/8 IN.	48 IN.	N/A	720 GAL.
1235-B	720	CONCRETE	48" (DEPTH) x 36" (WIDTH) [1]	8.0	CONCRETE MANWAY AND SOIL	24	WATER WITH FUEL OIL SHEEN	< 1/8 IN.	61 IN. [2]	N/A	750 GAL.
1223-A	720	CONCRETE	48" (DEPTH) x 36" (WIDTH) [1]	8.0	CONCRETE MANWAY AND SOIL	24	WATER WITH FUEL OIL SHEEN	< 1/8 IN.	47 IN.	N/A	700 GAL.
1223-B	720	CONCRETE	48" (DEPTH) x 36" (WIDTH) [1]	8.0	CONCRETE MANWAY AND SOIL	24	SOIL [3]	N/A	N/A	N/A	N/A
1223-C	375	CONCRETE	48" (DEPTH) x 36" (WIDTH) [1]	4.0	CONCRETE MANWAY AND SOIL	24	SOIL [3]	N/A	N/A	N/A	N/A

FOOTNOTES

1. TANKS ARE RECTANGULAR CONCRETE VAULTS.
2. DEPTH OF EACH TANK IS 48". THE WATER LEVEL EXTENDS UP INTO THE MANWAY, THUS GIVING A DEPTH OF WATER GREATER THAN 48".
3. EACH OF THESE TANKS ARE FILLED, TO THE TOP OF THE MANWAY, WITH SOIL.

NOTES

ACTUAL CONTENTS AND THE VOLUME OF THE TANKS CONTENTS ARE BASED ON INFORMATION OBTAINED IN THE FIELD. ACTUAL CONTENTS AND VOLUME OF CONTENTS MAY VARY FROM THOSE INDICATED ABOVE AT THE TIME OF THE TANK REMOVAL PROJECT.

SOURCE: SOUTHNAVFACENGCOM, 1991

TABLE 5-4
UST STATUS AT OLF BARIN

SITE INSPECTION REPORT

OLF BARIN
FOLEY, ALABAMA

field analysis of pH and specific conductance, and sampling of groundwater for laboratory analysis of the TCL and TAL chemicals presented in Table 4-4. No samples from USTs or from surface soil were collected.

Based on the discussion presented in Sections 3.3 and 3.4, the unconsolidated sediments consisted of layers of silty sands with interspersed silts and clays. As shown in Table 3-2, the water table was encountered at depths ranging from 15 to 20 feet BLS at Site 19B, due to topographic relief. As shown in Table 3-3, the hydraulic conductivity in the upper part of the aquifer was 7.93×10^{-3} cm/sec. Groundwater flow direction is the from the north-northeast to the south-southwest across the site at a gradient of 2.26×10^{-4} ft/ft. Monitoring wells WHF-20B-1 and WHF-20B-2 are upgradient of the Former Maintenance Hangar Area potential contamination sources. Wells WHF-20B-3 through WHF-20B-5 and WHF-19B-1D through WHF-19B-3D monitor the water table and production zones, respectively, downgradient of sites 19B and 20B. The groundwater seepage velocity estimated under Site 19B was 0.020 feet per day due to the low gradient. The high hydraulic conductivity at the water table suggests that the flow gradient and seepage velocity are easily influenced by local perturbations. For example, pumping in the production zone at 100 feet BLS could create a cone of depression and change the flow direction to easterly. Also downgradient of the site at the installation boundary, seepage velocity might be expected to increase if gradient increased in the steeply scoping terrain to the south.

No evidence of subsurface VOC contamination was detected either by visual evidence of soil staining or the OVA readings. Borings were not placed directly in former waste discharge areas, however. The lithological data for the borings WHF-20B-1 through WHF-20B-5 and WHF-19B-1D through WHF-19B-3D are provided in Appendix A. The FID detector used by the OVA is highly sensitive to aromatic and aliphatic hydrocarbons such as predominate in fuels; however, the FID is essentially unable to detect halogenated solvents. At site 19B, it would be expected that fuel-related and solvent-related VOCs would be commingled.

Field Measurements. Field measurements of specific conductance and pH collected prior to sampling are presented as follows.

Well	pH Standard Units	Specific Conductance µmho/cm at 25 °C
Production Zone Wells		
WHF-19B-1D	6.0	175
WHF-19B-2D	7.8	200
WHF-19B-3D	7.8	92
Water table Wells		
WHF-20B-1	3.75	40
WHF-20B-2	3.8	20
WHF-20B-3	3.7	20
WHF-20B-4	4.3	70
WHF-20B-5	4.2	80

These data indicate that the water table zone of the aquifer is much less mineralized and more acidic than the production zone. The pH of the water table zone is indicative of acidic rain water and indicates local recharge in a noncalcareous environment.

Groundwater samples were collected from the eight SI monitoring wells for detection of contamination migrating from Sites 19B, 20B, and 22B. The samples were collected and analyzed as described in Section 4.0. Complete analytical results for the groundwater samples are tabulated in Appendix B and summarized in Table 5-5.

Metals. Eleven metals were detected in the eight groundwater samples. These metals include aluminum, calcium, iron, potassium, magnesium, and sodium which, although listed in the CERCLA TAL for inorganics, also are major-ion constituents of natural surface waters and groundwaters. Iron was detected in amounts in excess of the Alabama secondary drinking water MCL. None of these metals occur at levels suggesting a site-related release or exhibit an upgradient-downgradient pattern. The presence of iron at concentrations in excess of the 0.3 mg/ℓ secondary MCL is expected to occur naturally in shallow groundwater in silty or clayey sands of the type underlying OLF Barin. Further, the iron MCL is based on esthetics considerations (staining of clothes or fixtures), not health effects. Other metals detected were lead, arsenic, antimony, cadmium, and mercury. As shown in Table 5-1, soils naturally contain varying concentrations of the TAL metals. These metals are present in an aquifer partially as dissolved metals ions, as precipitates sorbed to the aquifer solids particles, or as components of the chemical structure of the aquifer solids. The fraction and total mass in each compartment is a function of soil type, redox conditions, pH, and other factors. Analysis of total metals, if any trace amounts of turbidity (aquifer solids) is present, produces an over estimate of the concentrations of any metal present in the dissolved state and capable of migrating with groundwater. Where turbidity is present, it is impossible to determine whether or if the metal is truly present in groundwater or bound to aquifer solids. The monitoring wells at OLF Barin contain some turbidity. Because of this factor, the presence of TAL metals must be interpreted carefully.

The Alabama and Federal primary drinking water MCL for arsenic is 0.05 mg/ℓ. Arsenic was detected in one monitoring well just at the limit of detection (0.001 mg/ℓ). Arsenic occurs naturally in soil (see Table 5-1) and occasionally at trace levels in groundwater. Arsenic at a concentration 0.001 mg/ℓ would not significantly affect aquatic life in Wolf Creek even if groundwater discharge made up the base flow of the stream. Table 5-3 shows the Ambient Water Quality Criteria for protection of fish and aquatic life is 0.190 mg/ℓ. Arsenic is not likely to have been used in aircraft maintenance operations; however, historically arsenicals have been used as pesticides or herbicides. It is unlikely that arsenic found in MW WHF-19B-1D is site related.

Antimony also was observed just at the limit of detection (0.1 mg/ℓ) in two production zone wells (WHF-19B-1D and in one replicate of WHF-19B-3D). Well WHF-19B-3D was sampled in duplicate. Alabama does not regulate antimony. A federal ambient water quality criterion (AWQC) for protection of human health of 0.146 mgℓ has been set for this metal. Antimony is a naturally occurring metal in soils (see Table 5-1) and some groundwaters (Kabata-Pendias and Pendias, 1984).

Table 5-5
Summary of Groundwater Quality Data

Site Inspection Report
OLF Barin, Foley, Alabama

Compound	WHF-19B-1D	WHF-19B-2D	WHF-19B-3D	WHF-19B-3D-D	WHF-20B-1	WHF-20B-2	WHF-20B-3	WHF-20B-4	WHF-20B-5
Total Phenols (mg/ℓ)									
Total phenols	0.011	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.006	<0.005
Total Metals (mg/ℓ)									
Aluminum	<0.5	<0.5	0.8	0.8	1.1	3.3	1.0	1.8	<0.5
Calcium	14	2.8	7.1	7.2	4	7.4	2.4	6.2	1.8
Iron	0.19	0.36	0.2	0.19	0.31	0.65	0.35	2	0.22
Mercury	0.0007	<0.0005	<0.0005	<0.0005	0.0058	0.0059	<0.005	<0.0005	<0.0005
Potassium	7.1	4.1	17	18	0.8	0.7	1.5	<0.6	<0.6
Magnesium	0.38	0.18	0.22	0.23	0.45	0.77	0.49	0.91	0.5
Sodium	12	9	7.3	8.1	1.6	1.3	0.9	0.9	2.5
Antimony	0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Lead	0.005	0.007	<0.004	<0.004	<0.004	0.007	<0.004	0.03	<0.004
Arsenic	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cadmium	<0.0002	0.0003	<0.0002	0.0002	<0.0002	<0.0002	<0.0002	0.001	<0.0002
Volatile Organic Chemicals (ug/ℓ)									
Toluene	<1	<1	<1	<1	2	<1	<1	<1	<1
Acetone	30J	<130 UJ	<130 UJ	<130 UJ	<130 UJ	<130 UJ	<130 UJ	44 J	<130 UJ
2-Butanone	43 J	113	<60 J	60 UJ	60 UJ	60 UJ	60 UJ	5 J	60 UJ
Vinyl acetate	<2	6	<2	<2	<2	<2	<2	<2	<2

Notes: All total cyanide, semivolatile organic chemicals (SVOC), pesticide, and polychlorinated biphenyls (PCB) samples were below detection limits.
BDL = below detection limits.
J = Concentration is estimated due to being <10 times the concentration in the method blanks (see Section 4.2).
UJ = Analyte is undetected, however, due to contamination in the method blanks the reported detection limit is elevated to account for inability to discriminate positive results that are less than 10 times the detection limit from potential blank contamination (see Section 4.2).

Because the element, when detected, was observed in two non-adjacent deep wells and in only one of the replicates from WHF-19B-3, its true presence at a detectable concentration is questionable. Antimony is used as a pigment component in paint; therefore, it could occur as a result of improper disposal of paint wastes.

Cadmium was detected in three samples, WHF-19B-2D, WHF-20B-4, and one replicate of WHF-19B-3D. With the exception of the 0.001 mg/ℓ concentration observed at MW WHF-20B-4, the results are at the limit of detection. Federal and Alabama standards for cadmium are 0.010 mgℓ. Cadmium also may occur naturally at low concentrations in groundwater. Cadmium is a component of metal alloys, batteries, and pigments.

Lead is a constituent of motor fuels, batteries, and aviation gasoline (AVGAS). It is also commonly found at trace concentrations in groundwaters. As shown in Table 5-5, it was observed in two of the production zone monitoring wells at 0.005 and 0.007 mg/ℓ. It also was detected in the station water supply well at 0.004 mg/ℓ in 1988 and at the time of the groundwater sampling event (see Section 5.3). The Alabama and Federal MCLs for lead are 0.02 mg/ℓ and 0.05 mg/ℓ respectively. Lead at 0.03 mg/ℓ at well WHF-20B-4, downgradient of Site 19B and the fuel pit area of Site 20B, violates the Alabama primary drinking water MCL. Lead was also detected at WHF-20B-2 at 0.007 mg/ℓ. Because of the presence of lead in the fuels handled at Sites 19B and 20B and the presence of lead in waste oils and in paints, it is possible that the lead observed in groundwater at downgradient well WHF-20B-4 is related to either Site 19B or Site 20B. However, no fuel related VOCs were detected in the wells.

Mercury was observed in two water table depth monitoring wells upgradient of Site 19B (WHF-20B-1 and WHF-20B-2). The concentrations of 0.0058 and 0.0059 mg/ℓ violate Alabama and Federal drinking water MCLs. Mercury is used in pressure measuring instruments, batteries, as a pigment, and as a fungicide. It could be expected to result from operations that occurred at Site 19B. It is not a component of AVGAS.

Because of the flat gradient and high hydraulic conductivity, groundwater flow at Site 19B may be highly sensitive to the pumping of the production well. The presence of mercury as a site-related chemical at Site 19B cannot be ruled out hydrogeologically. It was reported in the PA that a Baldwin County operated landfill existed to the west of the former OLF Barin west field (NEESA, 1989). Also, nonflightline maintenance activities of power and heat generation (using fossil fuels) occurred in the former "administrative area" upgradient of WHF-20B-01 and WHF-20B-02. The observed mercury may therefore result from a source further upgradient. Based on topographic considerations, any releases from the county landfill would be more likely to migrate toward Wolf Creek rather than toward the present OLF Barin property. Also, the distance to the other potential upgradient sources is probably beyond the distance that contaminants could migrate since OLF Barin was developed as discussed later in this section. Mercury occurs naturally at low concentrations in some soils (see Table 5-1). Because total rather than dissolved metals were analyzed the mercury reported may have come from aquifer solids present as turbidity and may not be present in the groundwater.

Extractable Organic Chemicals, Pesticides, and PCBs. With the exception of two samples in which total phenols were reported, no extractable TCL organic chemicals, pesticides, or PCBs were detected in groundwater at Site 19B. Total phenols were reported in monitoring wells WHF-19B-1D (0.011 mg/ℓ) and WHF-20B-4 (0.006 mg/ℓ). Total phenols are analyzed colorimetrically using 4-aminoantipyrine and concentrations are measured against a pure phenol standard. The test is non-specific but highly sensitive. In addition to phenol, many naturally occurring hydroxylated aromatic compounds may be detected as positive inferences. The test is highly sensitive to ortho- and meta-substituted phenols and to many chlorophenols. Because of the lack of specificity of the total phenol test and its potential for positive interference due to non-TCL chemicals, the groundwater total phenol results probably do not relate to contamination due to hazardous materials. No detectable acid-extractable organics were detected. As shown in Table 4-3 and in Appendix B, many of the acid extractables would be expected to be detected by the total phenol test. On the other hand, oxidation products in waste oils and weathered fuels may be phenolics. Concentrations of phenolics detected colorimetrically are at or slightly below the limit of detection of the GC/MS extractable organic method.

Volatile Organic Chemicals. Based on the history of operations at the Former Hangar Maintenance Area, the close relationship of Site 20B (the UST Area and Fuel Pits), and the presence of halogenated VOCs in the installation potable supply, VOCs were expected to be the major contaminants observed in groundwater. VOC results are shown in Table 5-5. No halogenated solvents were detected during the SI sampling event.

As discussed in Section 4.2, laboratory method blanks contained several VOCs. Method blanks analyzed with the groundwater sample delivery group were reported to contain the following VOC concentrations.

Acetone	<10 to 13 μg/ℓ
2-Butanone	3 to 6 μg/ℓ
2-Hexanone	<3 to 5 μg/ℓ
Methylene chloride	<3 to 6 μg/ℓ
4-Methyl-2-pentanone	<3 to 7 μg/ℓ
1,1,2,2-Tetrachloroethane	<2 to 6 μg/ℓ
1,1,2-Trichloroethane	<2 to 3 μg/ℓ

As a result, each of the VOC results in Table 5-5, except for toluene and vinyl acetate, are flagged as estimated and the detection limits elevated as described in Section 4.2. Toluene was detected in both the equipment and rinsate blanks and was frequently detected in method blanks for other VOC data sets. Because of these factors, with the exception of MEK at 113 μg/ℓ and vinyl acetate at 6 μg/ℓ in well WHF-19-2D, the VOC data can be interpreted as artifacts and are not site related. MEK is a major component of paint strippers and solvents. However, because of the age of the site and elapsed time since its use, it is highly unusual to find MEK in the absence of other halogenated organics. This is because MEK is more water soluble and volatile than the halocarbons and is readily transformed to carbon dioxide and water by microbial action. Its persistence in soils would be many times shorter than halocarbons. MEK was a

frequent artifact of other VOC method blanks. It is unlikely that MEK is related to Site 19B or Site 20B.

Vinyl acetate also is not a chemical likely to be associated with aircraft maintenance. Vinyl acetate is an industrial chemical heavily used as an intermediate or reactant in the formation of polyvinyl plastic products such as vinyl gloves and as a vehicle in latex paints. Vinyl acetate also is water soluble and volatile and therefore non-persistent in the soil environment.

5.1.4 Site Characterization, Significant Findings, and Conclusions The purpose of this section is to develop conclusions related to the contamination status of the Former Hangar Maintenance Area.

Based on the activity and disposal history, waste quantities are unknown. Potentially, hazardous wastes were stored in 10 concrete underground waste oil tanks located adjacent to the hangars. No data are available relative to the method of abandonment or the past or current integrity of the tanks. Contaminant release could have occurred either due to spills near the tanks or at the edges of the hardstand area or due to leakage from the tanks fuel lines or pumps. In unpaved areas, releases could infiltrate readily to the water table 15 to 20 feet BLS due to the permeability of the surface soils. Leakage from tanks also would reach groundwater easily. Surface releases also could be washed to the storm sewer and drainage ditch along Guadalcanal Road and infiltrate as they are transported in stormwater runoff. Because of the low gradient, groundwater contaminant migration in the vicinity of Site 19B would be slow (0.020 feet per day) but migration rate and direction could be easily influenced by supply well pumpage. Because of the subsurface nature of the USTs and the well sodded soil surface surrounding the hardstand, atmospheric migration due to the dispersal of particulates is not a significant pathway.

Results of sampling and chemical analysis did not confirm the expected presence of halogenated solvents or POL-related residual chemicals attributable to Site 19B. No evidence of subsurface soil contamination was obtained; however, soil borings were not directly into suspected source areas.

Groundwater data also did not confirm the presence of residual strong sources of VOCs or other organic chemicals. Water table depth monitoring wells were placed in appropriate locations based on flow direction. However, at approximately 500 feet downgradient of the site these wells are too far away to intercept dissolved contaminants migrating from past releases or any current residual contamination at Site 19B. The groundwater seepage velocity, or flow rate, has been estimated at approximately 7 feet per year in the area of Site 19B based on a gradient of 2.26×10^{-4} ft/ft. At this flow rate, contaminants released since the 1940's theoretically would not be expected to have reached the well locations. Based on an assumption that flow in the aquifer can be approximated by Darcy's Law, the theoretical travel time from the southern edge of the former hangar area to the water table monitoring wells is approximately 71 years without regard to retardation of contaminants on aquifer solids. Because actual groundwater flow rate may only be approximated by theoretical calculations, considering chemical retardation, travel time for contaminants may be larger. Contaminants, if released at 19B, would have been released from 1942 to 1959. Residuals left

after abandonment would continue to be released subsequent to the 1950's. The oldest contamination could have been released from 45 to 48 years ago. Therefore, assuming that source retardation of metals or organic chemicals would occur, it is doubtful that contaminants would have reached the wells.

In the aquifer zone monitored by the deeper wells, a similar situation exists. As estimated in Section 3.4.2, the overall gradient across the site is 3.20×10^{-3} feet/foot and the hydraulic conductivity in the production zone 100 feet BLS was estimated as 1.19×10^{-3} cm/sec. The groundwater flow rate can, therefore, be estimated as approximately 16 feet per year in the production zone. Time of travel to wells WHF-19B-1D, WHF-19B-2D, and WHF-19B-3D would theoretically be 31 years to reach WHF-19B-1 and over 100 years to reach wells WHF-19B-2D and WHF-19B-3D. In addition, well WHF-19B-1D appears too far west to intercept groundwater migrating from Site 19B.

Because of the interpreted hydrogeological relationship of the downgradient water table and production zone monitoring wells to Site 19B, it is not reasonable to attribute the trace levels of total phenols or antimony, arsenic, cadmium, lead, or downgradient mercury to activities at the Former Hangar Maintenance Area. At the concentrations and distribution observed, the metals show no increase from upgradient to downgradient and probably reflect a naturally occurring background condition or measurements of elements contained in turbidity. Further, they do not exceed water quality criteria. Total phenols are interpreted as being a positive interference in the colorimetric test because no acid extractable organics are present. Well WHF-19B-1D is crossgradient from the site. The disposal history on the undeveloped non-Navy land upgradient of this well is unknown, however.

The source of mercury in excess of primary drinking water standards in the upgradient monitoring wells WHF-20B-1 are WHF-20B-2 is unknown. It is unlikely to be related to fuels formerly stored in Site 20B. Further, lead, an indicator of past AVGAS releases, was not detected in these two wells. Possibly, contaminants running off of Site 19B to the Guadalcanal Road storm sewer could have infiltrated to the groundwater, or mercury from sources in the former Navy property to the North could be migrating across the site. The latter is unlikely due to travel time considerations similar to those previously discussed. Lead in monitoring well WHF-20B-4 maybe attributed to former activities but more likely is related to Site 20B than Site 19B.

Among the VOCs reported on the monitoring well samples, only the possible presence of traces of toluene in the upgradient monitoring well WHF-20B-1 is interpreted as representing site related contamination. This VOC was present in field blanks associated with groundwater sampling and in several of the other method blanks in the data set and, therefore, its presence is somewhat suspect because it is a common laboratory and sampling artifact. Monitoring well WHF-20B-1 is near the surface storm water drainage ditch from Site 19B but also downgradient from the UST portion of Site 20B. If present, toluene is more likely attributable to Site 20B because of the time since last activity at Site 19B. Because of the hydrogeological setting, MEK and vinyl acetate in WHF-19B-2D are unlikely to be present as site-related contaminants. Travel time from Site 19B or 20B to WHF-19B-2 exceeds 100 years. MEK, although at high concentrations

relative to the other observations in the data set, was present in the method blank. Vinyl acetate may be an artifact of handling of sampling or analytical equipment with vinyl disposable gloves. Acetone and MEK are interpreted as being artifacts of the analytical program due to method blank contamination.

The most likely source of halogenated VOCs in the water supply wells is Site 19B. Former hangar 1223 is adjacent but downgradient and the storm water drainage ditch from the area passes nearby. Induced flow and drawdown from the use of the production wells could have altered gradients and groundwater flow direction in the area of the wells and Site 19B and drawn contaminants into the well capture zone. The contamination of the water supply wells is discussed in Section 5.3.

Surface runoff from Site 19B is collected in a storm sewer and storm drainage ditch that flows east along Guadalcanal Road. Approximately 500 feet down ditch from Site 19B, soil samples were collected at three locations at a depth of 1.0-2.0 feet below the surface of the storm drainage ditch that drains Site 19B and 20B. These samples were collected and analyzed for lead and polynuclear aromatic hydrocarbons (PAH) to verify the presence of residual contamination in the ditch from the 2,000-gallon fuel spill that occurred in 1954. These samples were located at 100-foot intervals beginning at the end of Guadalcanal Road. Results of analysis are discussed in Section 5.6. No lead or PAHs were detected in these samples. These data indicate no evidence of migration of components of AVGAS, paints, or battery electrolytes 500 to 2,000 feet from the former hangar area to surface soils. Due to increased infiltration at the storm sewer outfall, contaminants may have leached deeper than 2 feet BLS.

PAH detection limits in soil sample WHF-SS-23B-1 were elevated by a factor of 20 to 200 μg/kg due to unknown organic interferences. Detection limits for the sample location further downgradient in the ditch were 10 μg/kg. The presence of organic matter could represent residuals from past hydrocarbon spills or may be due to natural organic matter.

In summary, the following conclusions can be drawn relative to the Former Hangar Maintenance Area (Site 19B).

- No visual evidence of contamination presently exists at the site. The contamination status of the 10 abandoned waste oil USTs has not been determined. Based on previous activities, unknown quantities of halogenated and nonhalogenated solvents, cleaners, fuels, and hydraulic fluids, and possibly batteries and paints were handled and stored. Release of solvents from Site 19B is not confirmed but suspected due to contamination of the old and new station supply wells with trace levels of halocarbon solvents and a transformation product. Based on these results and sampling and analysis results from similar sites at other military flightline maintenance operations, site 19B warrants further investigation.

- Groundwater contamination by metals and organic chemicals was not confirmed at Site 19B. However, based on the hydrogeologic setting wells were placed too far from the site to monitor for releases from the period of activity.

- No wells were placed in locations to determine the source of contamination of the water supply wells; however, Site 19B is the most likely source due to site hydrology and activity history.

- Levels of trace metals observed as total metals in the monitoring wells (with the exception of mercury in wells WHF-20B-1 and WHF-20B-2 and lead in WHF-20B-4) are likely natural background concentrations or due to turbidity. The mercury and lead concentrations in samples from the above wells violate primary drinking water MCLs. Sources of these metals may not relate to Site 19B.

- Primary potential contamination migration routes and/or exposure of receptor/target populations are as follows:

  - groundwater,

  - surface water to groundwater via infiltration in the Guadalcanal Road drainage ditch, and

  - soil exposure during UST excavation or due to any surface soil contamination.

  Atmospheric migration is not a significant pathway except potentially during UST remedial action and excavation.

- Based on historical records of the site, the following are the most likely hazardous or toxic chemicals to have been used, stored, and possibly released at Site 19B.

Class	Analyte	Probable Sources
Metals	Chromium	Chromate cleaners Paint pigments
	Cadmium Mercury Nickel	Batteries or paints
	Antimony	Paints
	Zinc	Corrosion control
VOCs	Halocarbons Ketones	Solvents and degreasers
	Aliphatic VOCs Aromatic VOCs	Solvents, degreasers, and fuels
SVOCs	Phenolics	Cleaners
	PAHs	Waste oil, and fuels

The soils and groundwater in the areas most likely to have received releases should be further evaluated as recommended in Section 6.0. Contamination has not

been verified at Site 19B. However, all potential threats to public health and the environment have not been ruled out. Further investigation, coordinated with the UST removal program, should be carried out to more completely evaluate the site status. The additional investigation should focus on the following:

- surface soils at the edge of the hardstand,
- the soils in the vadose zone under the waste oil USTs (to be coordinated with the removal action),
- soil in the Guadalcanal Canal Road drainage ditch and along the storm sewer line (to be coordinated with the assessment of POL storage wastewater discharges),
- the existing septic tanks north of present building 2718 (and former hangar 1223) if these were in service during aircraft maintenance activities,
- shallow and production zone groundwater quality monitoring should be in areas more appropriate to travel time from the site based on period of activity and locations where the relationship of the site to the supply well contamination can be established, and
- background soil and groundwater sampling to establish upgradient water quality and naturally occurring background for inorganics on an installation-specific basis.

5.2 SITE 20B, ABANDONED UNDERGROUND STORAGE TANKS AND FUEL PIT AREA.

5.2.1 Site Description Site 20B consists of the abandoned aircraft fuel storage and dispensing facility at OLF Barin. Figures 5-1 and 5-2 show the relationship of the site and its layout on the north and south sides of the Former Hangar Maintenance Area. The fuels system consisted of an aquafarm-type system installed in the 1940's and operated during the WWII period until 1947 and again in the 1950's until the installation was placed on inactive status in 1959. In an aquafarm system, AVGAS is stored in underground tanks and dispensed by displacement with water. To pump fuel, water flows into the bottom of the tanks, fuel flows out the top. When the tanks are refilled with AVGAS, water stored in the tanks is pumped to waste. In this manner the tanks are never empty. Based on Figures 5-1 and 5-2, Site 20B comprises an area of 19.8 acres and includes the 1-acre fuel USTs and pumping system area and the 18.8-acre hardstand area where the fueling pits are located.

Nine abandoned USTs, a reported 60 abandoned fuel pits, and 2.15 miles of underground fuel lines comprise Site 20B. All of the tanks, pits, and lines are reportedly still in place. Table 5-4 tabulates the details of the fuel storage tanks construction and status. The fuel lines to the fueling pits have not been previously located. The PA showed fuel lines running under Guadalcanal Road to dispense fuel via four rows of fuel pits. The lines from the aquafarm reportedly

ran west of Hangar 1222 and east of Hangar 1235, respectively. Based on the tank's diameters tabulated in Table 5-4 and depth of cover, the invert of the 25,000 gallon USTs can be estimated as 15 feet BLS, which is near the water table.

5.2.2 Waste Characteristics and Disposal History Nine underground tanks were used during operation of NAAS Barin as storage for AVGAS during WWII, and AVGAS or jet fuel during the 1950's. Eight of the underground tanks (25,000-gallon capacity each) are presently being used as water storage reservoirs for fire protection. The remaining tank (15,000 gallons capacity) is empty. There is no information available on procedures followed to abandon these facilities when the field was deactivated in 1959. During the tank reactivation for water storage in the mid-1980's and during the PA visit, an oily sheen and residue were noted within these tanks.

As discussed in Section 2.5, an UST removal action is being implemented for the USTs at Site 20B. Table 5-4, taken from the remedial design report, indicates that no detectable fuel is currently present in the tanks. The integrity of the tanks, lines, and pits are unknown.

During the dispensing of fuels, water for displacing the fuel was discharged to the storm sewer along Guadalcanal Road. Unknown quantities of water were discharged via this route. Such water would be expected to be contaminated by soluble components of the fuel including dissolved benzene, toluene, lead, and hydrocarbons. Depending on the fuel delivery rate and storage times, the discharged water could be expected to contain substantial quantities of lead and benzene derivatives.

Tetraethyl lead is not highly soluble but is relatively volatile. Tetraethyl lead is sorbed to soil organic matter and is biodegradable. Repeated discharge might be expected to result in the build-up of inorganic lead depending on the rate of volatilization compared to mineralization.

The water soluble components of jet fuel or gasoline are primarily aromatics (AD Little, Inc., 1987). Typical partioning coefficients between fuel and water for the small molecular weight (C_6-C_{12}) cyclic or aromatic hydrocarbons range approximately from 4 to 1. Cyclic or aromatic hydrocarbons in AVGAS or JP-5 might reach saturation concentrations in the discharged water. After discharge, the majority of the hydrocarbons would partition to soils. The fate of these chemicals in soils would be volatilize or to be degraded by aerobic soil microorganisms.

The quantity of fuel derived chemicals transported to groundwater would depend on the rate of infiltration. The shallow water table at this site would favor some release to groundwater. Because the last uses of the system for fuel storage were greater than 30 years in the past, the persistence of the one- and two-membered ring aromatics (benzenes and naphthalenes) or cyclohexanes is highly unlikely. During active fuel system use, atmospheric migration was a highly significant contaminant migration route. Currently, any residual contamination would be transported via groundwater. Air migration of particulates generated during the implementation of the tanks demolition and removal is a possible

migration route if dust control is not adequate. Grass and turf cover currently prevents significant atmospheric transport from Site 20B.

According to the PA report, a 2,000-gallon aviation fuel spill occurred in 1954 when vandals opened a release valve on one of the 25,000-gallon fuel tanks. Most of the fuel reportedly migrated to an unlined drainage ditch along the north side of Guadalcanal Road. Due to the porous nature of the soils at OLF Barin, it is likely that some of the fuel migrated through the soil to the water table, which lies between 15 and 20 feet below land surface. This spill is described in Section 5.6.

5.2.3 Site Investigation Results The groundwater investigation program at OLF Barin was focused on both Site 19B and Site 20B. Detailed assessments of the analytes detected and the hydrogeologic properties of the water table and production zone of the aquifer have been described in Section 3.4 and Section 5.1. Chemical water quality data were presented in Table 5-5. In contrast to their distance from Site 19B, the water table depth monitoring wells (WHF-20B-1 through WHF-20B-5) are located immediately downgradient of the former aviation fuel storage system or at the edge of the hardstand within 100 feet from the farthest south line of fuel pits. Each of these wells was screened above and below the water table to monitor for any undissolved petroleum hydrocarbons. The nearest production zone monitoring well (WHF-19B-1D), which appears to be crossgradient from the fuel pit area, is located 300 feet from the nearest potential source and 1,500 feet from the aquafarm fuel storage area. The other two downgradient production zone monitoring wells are located approximately 1,600 feet from the nearest fuel pits and 2,200 feet from the fuel storage tanks. Based on the hydrologic environment, the production zone monitoring wells are too far south (or west) to be monitoring any dissolved releases from Site 20B that might be carried into the deeper zone of the aquifer.

Undissolved hydrocarbons would be transported as floating, nonaqueous liquid along the top of the water table. None was observed in any of the monitoring wells. The time of travel south across Sites 19B and 20B from the fuels storage area to the southern edge of the fuel pit area is approximately 135 years. Although the fuel tanks appear to have retained their integrity, fuel line leaks in the vicinity of the tanks or at the pits may have occurred. Undissolved or dissolved hydrocarbons could be present in groundwater in the area between the upper set of wells (WHF-20B-1 and WHF-20B-2) and the lower set (WHF-20B-3 through WHF-20B-5). Dissolved lead also might be present.

The chemical groundwater quality data show no evidence of significant fuel releases with the exception of the detection of lead at 0.03 mg/ℓ in WHF-20B-4 and 0.007 mg/ℓ at WHF-20B-2. A trace of toluene (2 μg/ℓ) was observed in well WHF-20B-1. This, however, may be a laboratory artifact as discussed in Section 5.1. The mercury present in this well and in well WHF-20B-2 is not interpreted as being from site 20B. At the estimated rate of groundwater flow, contaminants from the lower 2/3 of the fuel pit area could be detected in wells WHF-20B-3, WHF-20B-4, WHF-20B-4, and WHF-20B-5. The lead concentration observed in sample WHF-20B-4 is greater than the Alabama primary drinking water MCL. It could represent site-related contamination as residuals from AVGAS leaks in the 1940's or 1950's in the fuel pit area. Acetone and MEK are not components of AVGAS or

jet aircraft fuels. As described in Section 5.1, these chemicals have been interpreted as artifacts of VOC analysis.

5.2.4 Site Characterization, Significant Findings and Conclusions The only residual contamination and/or contaminant migration that can be related to the USTs or fuel pits is the lead detected in well WHF-20B-4. This element was observed at a concentration level nearly 10 times the concentration observed in other monitoring wells or in the station water supply well. Section 5.3 discusses water quality in the production well. The trace of toluene that was detected near the aquafarm USTs is not interpreted as site related due to its frequent presence in blanks. The eight 25,000-gallon USTs are currently used for water storage and appear to be free from leaks. The integrity of the existing piping or fuel pits is unknown. Although the water table monitoring wells are placed to detect former major releases from the fuels storage area and the lower portion of the fuel pits area, dissolved or undissolved fuel related contamination discharged 33 to 48 years in the past could underly the central portion of the Site 19B and Site 20B area and be undetected by the present program. Soil data from the storm drainage ditch tend not to support long distance migration of lead or lead contaminated soil as a result of wasting of aquafarm water (see Section 5.6).

In conclusion, very limited evidence for fuel-related contamination was detected during the SI field program; however, additional monitoring locations for shallow and production zone groundwater are required to verify the status of this matrix. Sampling of the surface and vadose zone soils is required to evaluate residuals due to leaks from the USTs, piping, or fuel pits and the discharge of water from the aquafarm. Specific findings and calculations are as follows:

- Lead detected at WHF-20B-4 has been interpreted as site related.

- Mercury in WHF-20B-1 and WHF-20B-2 has been interpreted as unrelated to Site 20B fuels release.

- Additional groundwater monitoring locations are necessary to evaluate the extent of lead contamination of groundwater and to verify existence of other contaminants. The additional investigation should focus on the following:

  - Groundwater, surface soils, and subsurface soils should be analyzed for lead, VOCs (especially benzene, toluene, xylene, and ethyl benzene by GC analysis), petroleum hydrocarbons, and PAHs.

  - Soils investigation may be facilitated by the use of a soil gas survey focused on the former fuel line and pit areas. Soil samples should be analyzed for the same group of analytes as above. This program should be closely coordinated with the UST removal program.

  - Contaminant migration routes of significance include groundwater, surface water particulate transport, and subsequent

leaching to groundwater. Atmospheric transport of particulates could occur when contaminated soil is excavated.

Specific recommendations relative to further explorations are outlined in Section 6.0.

5.3 OUTLYING LAND FIELD (OLF) BARIN WATER SUPPLY WELLS. A new station water supply well was drilled in 1988 when OLF Barin was recommissioned. The well replaced an old supply well about 200 feet due west of the new well (see Figure 5-1). In late July 1988 water from the new supply well was discovered to be contaminated with trans-1,2-dichloroethylene, tetrachloroethylene, and trichloroethylene. The old water supply well was also sampled in 1988 and was found to contain tetrachloroethylene and trichloroethylene. The old supply well has been abandoned and grouted. The State of Alabama permitted use of the new installation water supply well for human consumption after installation of an approved granulated activated charcoal (GAC) filter system. These analytical results have been previously discussed in Section 3.8.1 and tabulated in Table 3-8.

Prior to installation of the groundwater monitoring wells, one sample was collected and analyzed from the current water supply well. The groundwater sample was obtained after it had passed through the GAC filter to verify that the filter was effectively removing the chlorinated hydrocarbon contamination. Results of the chemical analyses are contained in Appendix A. No VOCs, SVOCs, total phenols, pesticides, or PCBs were detected in the water sample. Acetone at 12 $\mu g/\ell$ was detected in the method blank associated with this sample.

Inorganic chemicals (major ion metals and trace metals) were detected in the April 1990 treated supply well sample. These are compared below to the 1988 results.

Analyte	Sample Date	
	July 29, 1988	April 30, 1990
	Concentrations in mg/ℓ	
Silver	<0.0001	<0.0002
Arsenic	<0.001	<0.001
Barium	<0.1	<0.1
Cadmium	<0.0001	0.0002
Chromium	0.01	0.01
Mercury	<0.0001	<0.0005
Sodium	3	3.5
Lead	0.004	0.004
Selenium	<0.001	<0.003
Calcium	<0.01	1.4
Copper	<0.01	<0.03

Analyte	Sample Date	
	July 29, 1988	April 30, 1990
	Concentrations in mg/ℓ	
Iron	0.31	<0.03
Magnesium	0.88	0.74
Manganese	<0.01	<0.01
Zinc	<0.01	<0.01

Aluminum, beryllium, cobalt, potassium, nickel, antimony, thallium, and vanadium were analyzed in the 1990 sample but not 1988. Potassium was detected 0.68 mg/ℓ. The remaining metals were undetected. The lead concentration measured in the samples at 0.004 mg/ℓ is below the Federal and Alabama MCL for lead in drinking water of 0.05 and 0.02 mg/ℓ, respectively.

The chlorinated hydrocarbon contamination historically detected in both water supply wells was not found in any of the groundwater samples from the monitoring wells. As shown in Table 3-8, trichloroethylene exceeded Federal and Alabama primary drinking water MCLs on September 7, 1988, in both wells. The chemical trans-1,2-dichloroethylene did not exceed the Federal Maximum Contaminant Limit Goal (MCLG) and proposed MCL of 70 μg/ℓ. The MCLG for tetrachloroethylene is 0 because of its status as a possible human carcinogen. A proposed Federal primary drinking water MCL of 5 μg/ℓ is currently being reviewed. Tetrachloroethylene exceeded this concentration in both wells.

As discussed, none of the SI monitoring wells are placed to intercept contaminants migrating either from upgradient (e.g., north of the water supply wells) or from the Former Hangar Maintenance Area (Site 19B) (east and south of the supply wells). The probable source area of contamination of the supply wells is Site 19B as a result of an induced east-west gradient created by pumping the supply wells.

Pre-1950 drawings of the former northern administrative area of the installation do not indicate industrial operations were nearer than 1,600 feet north of the water supply wells. It is unlikely that halocarbon contaminants released from the formerly owned area to the north would have had travel time sufficient to reach the potable supply wells under the natural rate of groundwater movement of 16 feet per year in the production zone. Trichloroethylene and tetrachloroethylene did not come into general use as degreasers until the late 1940's. The chemical trans-1,2-dichloroethylene is one of the most common transformation products of both of these solvents. Trichloroethylene also may be a transformation product of tetrachloroethylene.

Because of the specific halocarbons detected and the failure to detect carbon tetrachloride, which was the primary degreasing and dry cleaning agent in the mid-1940's, it is highly likely that the source of halocarbons is much closer to

the wells than the former industrial or laundry buildings. The actual travel time is difficult to estimate because the pumpage history and its effect on the hydraulic gradient are unknown.

Further investigation of the source of halocarbon contamination is necessary. This should be done as a component of the investigation of Site 19B previously described. A soil gas survey program and, as appropriate, well installation should be designed to rule out any contaminant sources or migration from the north and to confirm the route(s) and source(s) of contamination.

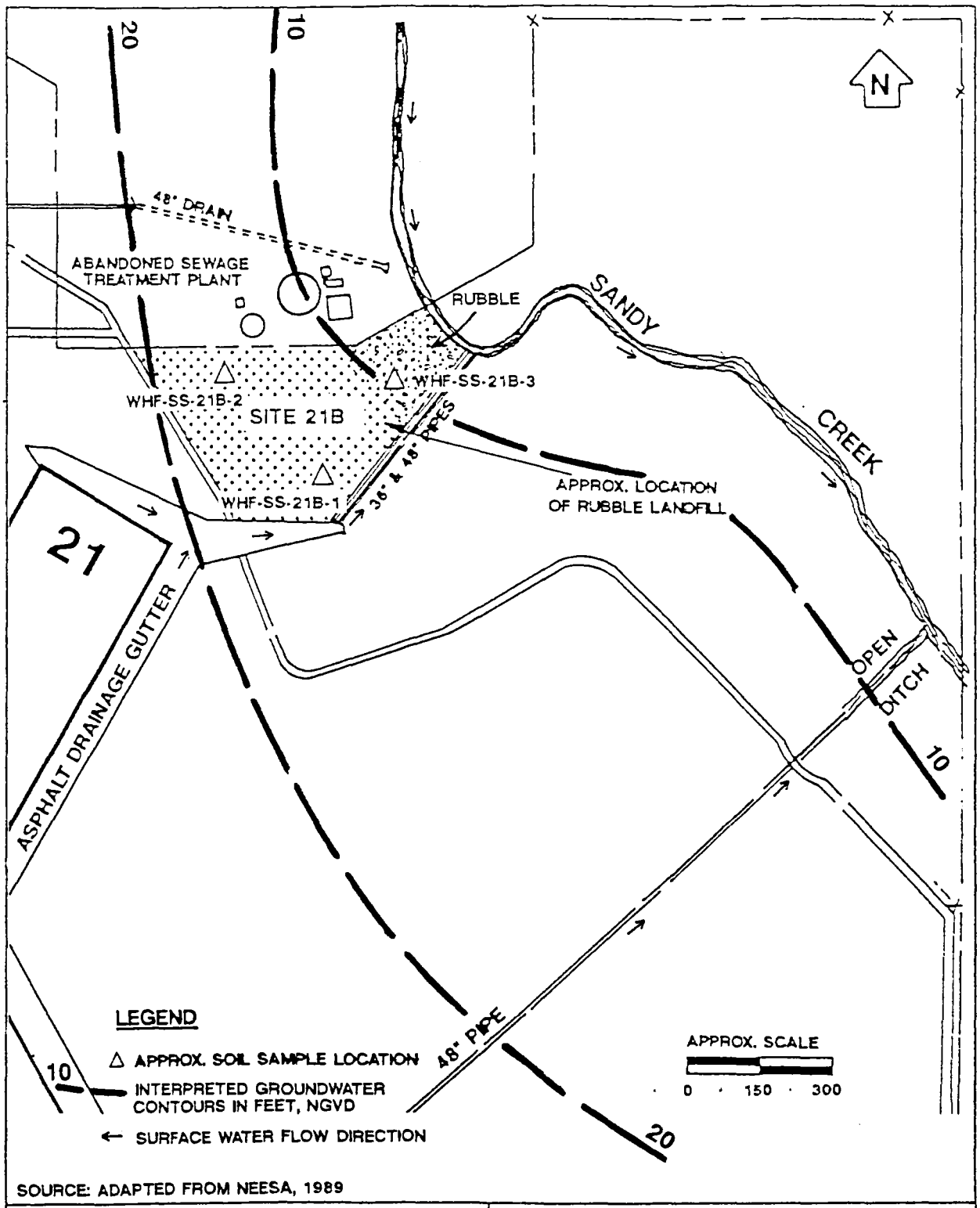
Recommended further action is outlined in Section 6.0. Sampling of the raw water from both the production wells is necessary. Halogenated and nonhalogenated VOC analyses should be conducted using gas chromatography confirmed by GC/MS to specifically detect vinyl chloride, if present, and to provide adequate sensitivity for attribution of low concentrations of halocarbons to sources.

5.4 SITE 21B, RUBBLE LANDFILL

5.4.1 Site Description The Rubble Landfill is located in the northeast section of OLF Barin as shown in Figure 5-3. This fill area reportedly received debris from dismantled buildings that were destroyed when the station was decommissioned and the north and west areas released in 1959. The landfill appears to be approximately 3.1 acres in area and lies just to the west of Sandy Creek. It borders a drainage pipe and ditch for approximately 350 feet. The fill appears to be free of surface debris except in the northeast edge bordering the drainage pipe. The remainder of the surface area is covered with vegetation, appears relatively smooth, and slopes slightly towards Sandy Creek providing an avenue for surface runoff from the landfill toward the creek. To the east of the drainage pipes, the fill slopes abruptly to the floodplain of Sandy Creek. The vertical distance from the top of the fill to the floodplain is approximately 15 feet.

5.4.2 Waste Characteristics and Disposal History According to the PA (NEESA, 1989), only waste debris from dismantled buildings was discarded on this site. No burial of the rubble was reported and all disposal was on the surface. During the PA site visit, no evidence of drums or other containers that might have contained hazardous waste were located. The site is overgrown with Kudzu vine so visibility was limited. The soils covering the landfill are porous and any leachate or runoff from the site would most likely migrate to Sandy Creek approximately 50 to 100 feet northeast of the site. Leachate may discharge onto the floodplain immediately east of the storm drain, or may be collected in the storm drain depending on the integrity of the storm drain construction.

5.4.3 Site Investigation Results The exploration program at the Rubble Landfill consisted of a thorough surface reconnaissance of the entire landfill area. Soil samples were taken at three locations on the fill as shown in Figure 5-3. No evidence of drums or containers were observed during the visual inspection that might indicate the disposal of hazardous waste.



SOURCE: ADAPTED FROM NEESA, 1989

FIGURE 5-3
LOCATION OF SITE 21B, RUBBLE LANDFILL

SITE INSPECTION REPORT

OLF BARIN
FOLEY, ALABAMA

Soil samples were collected at 1 to 2 feet depth at locations that had the best chance of being contaminated considering possible contaminant migration routes. Collection and analyses of surface soil samples were described in Section 4.1.3. A summary of the analytical results for the three soil samples collected from the rubble landfill is presented in Table 5-6. The purpose of sampling surface soils was to evaluate any potential threat to public health or the environment because, reportedly, no cover material had been placed over the rubble fill.

Table 5-6
Summary of Surface Soil Data, Rubble Landfill, Site 21B

Site Inspection Report
OLF Barin, Foley, Alabama

Compound	Soil Sample Location			
	WHF-SS-21B-1	WHF-SS-21B-2	WHF-SS-21B-3	WHF-SS-21B-3-D
Inorganic Chemicals (mg/kg)				
Aluminum	1,711	4,842	24,167	13,187
Barium	7.4	8.4	24	18
Calcium	63	89	167	130
Chromium	1.1	1.1	24	12
Copper	<1.6	3.2	11	4.4
Iron	2,526	2,737	11,611	6,923
Potassium	49	36	117	60
Magnesium	79	95	167	66
Manganese	7.4	44	<0.56	<0.55
Arsenic	0.63	0.68	2.20	1.65
Vanadium	<11	11	40	24
Zinc	1.1	2.6	6.1	<1.1
Volatile Organic Chemicals (μg/kg)				
Toluene	180 UJ	<180 UJ	<180 UJ	21 J
Methylene chloride	<32	<32	448	<33

Notes: All analyses for total phenols, cyanide, semivolatile organic chemicals (SVOC), pesticides, and polychlorinated biphenyls (PCB) were below detection limits.

mg/kg = milligram per kilogram.
μg/kg = microgram per kilogram.
J = Concentration is estimated due to being <10 times the concentration in the method blanks (see Section 4.2).
UJ = Analyte is undetected; however, due to contamination in the method blanks the reported detection limit is elevated to account for inability to discriminate positive results that are less than 10 times the detection limit from potential blank contamination (see Section 4.2).

Toluene was reported in the method blanks associated with this sample set at 18 $\mu g/\ell$. Because of this factor, the detection limit for toluene has been elevated by a factor of 10 times. Concentrations below this level cannot be interpreted as distinguishable from laboratory contamination. The estimated value of 21 $\mu g/kg$ in one replicate of sample WHF-SS-21B-3 is interpreted as such an artifact and not environmental contamination. Methylene chloride was found in the one field replicate at sample location WHF-SS-21-B-3 at a reported concentration of 448 $\mu g/kg$, approximately 14 times the normal detection limit. Methylene chloride was not detected in the other replicate, field blanks, or method blanks for this sample set, but methylene chloride was reported in other method blanks in the analytical program. It is somewhat unusual for one of two field replicate to contain such a high concentration and the other none detectable. As with toluene, the methylene chloride present in a single replicate is suspected to be a laboratory artifact and not an environmental contaminant. The inorganics data suggest that the immediate area of sample location WHF-SS-21B-3 is highly heterogenous. However, methylene chloride was found in two sediment samples from Sandy Creek. These results are presented in Section 5.6. In the sediments also, the methylene chloride was found in only one replicate of the field duplicate. These results suggest an analytical or sample handling artifact. However, environmental contamination by this VOC cannot be totally ruled out. No other organic chemicals (SVOCs, pesticides, or PCBs) were detected in the soil samples from Site 21B.

The metals detected in the soil samples from Site 21B have been tabulated in Table 5-6. These have been compared to the average and range of background soil concentrations tabulated in Table 5-1. No site-specific background soil samples were collected in the conduct of the SI. Soils contain natural background levels of inorganic elements. In general, soil mineral concentrations reflect the makeup of their parent material transformed via geochemical reactions. As a result, soil can frequently contain percent level concentrations of the major minerals aluminum, calcium, magnesium, iron, potassium, and sodium as a natural background. Secondly, because of natural microbiological and chemical transformation processes, soil frequently contains several percent of non-living organic material as well as microorganisms. Refractory organic matter (frequently tannins, lignins, and other organic complex multiple aromatic structures) which are phenoloc residues or PAHs are present. PAHs may also be a component of soils chemical background as products of wild fires, weathering products of woody vegetation, or in urban environments deposition of partially combusted products of the burning of fossil fuels. In many environments, trace concentrations of pesticides may be components of "natural" background to be considered due to the widespread, long-term use of pesticides in agriculture.

Table 5-1 presents mean concentrations of metals in uncontaminated surface soils in the Eastern United States as a whole and in clay or clay loam, sandy, and alluvial soils. These data were developed from a data set of more than 1,000 soil samples. None of the metals observed in surface soils at site 21B exceeds its respective tabulated mean concentration or is in the upper portion of any of the ranges in concentration for background. The soil from sample location WHF-SS-1B-3 is generally richer in metals that the other two sites. The differences probably reflect natural variability. Sample locations WHF-SS-21B-2 and WHF-SS-21B-3 are on the downslope side of the landfill surface.

5.4.4 Site Characterization, Significant Findings, and Conclusions The Rubble Landfill, Site 21B, appears to be a filled area at the beginning of the drop off in topography from the installation runway area to Sandy Creek. If the reported disposal of rubble is correct, the material filled a location from the natural edge of the slope to a pair of large storm water drainage culverts. No visual evidence of a large rubble fill area exists and no evidence of leachate seeps are present at the apparent toe of the fill along the culverts.

Surface soils at this location do not generally appear to be contaminated by TCL chemicals or TAL elements above natural metals background concentrations. The exception to this is the possible presence of methylene chloride. This chemical was observed in one of the field replicates. No other VOCs not easily attributed to the method blanks were detected. The presence of methylene chloride in other method blanks not replicated in the duplicate sample suggests that it results from a sampling or laboratory artifact.

Methylene chloride is the most commonly observed laboratory artifact in VOC analysis. Methylene chloride was also detected in sediment samples from Sandy Creek (see Section 5.6). These samples also were analyzed during the same time period as the Site 21B soil, and laboratory contamination is suspected. However, because of the conservative screening nature and objectives of the SI, the presence of methylene chloride cannot be ruled out. Verification of its presence or absence is recommended in Section 6.0. No Federal or Alabama standards exist in soil for methylene chloride. In the absence of standards, the HRS II "benchmark" screening concentration of 2,100 μg/kg of methylene chloride represents the predicted 10^{-6} individual excess cancer risk under the extreme conservative conditions of daily exposure of a child age 6 to 18 ingesting soil during a 4-hour play time. "Benchmark" concentration development and concentrations are presented in Section 5.7. The observed concentration of 448 μg/kg does not exceed the "benchmark" for potential carcinogenic effects. The screening "benchmark" concentration for chronic toxic effects due to methylene chloride based on the verified reference dose (RfD) of 0.0075 (mg/kg/day) is 27,000 μg/kg.

No immediate threat to biota is expected if methylene chloride is present at 448 μg/kg. Based on comparison of the chronic toxicity human reference dose and mammalian bioassay data and the AWQC for aquatic biota of 11,000 μg/ℓ, no chronic toxic effects to biota would be expected at concentrations not posing a significant potential for human risks.

Site 21B could pose a long-term public health threat if methylene chloride is present at concentrations in excess of 2,100 μg/kg, but does not pose an immediate significant public health risk or environmental threat. Although this site is located in a remote area of OLF Barin and potential exists for public access, the site is not attractive for play activities. However, the surface soil sampling does not adequately characterize the nature of the landfill nor does it address all contamination migration pathways. Nothing is known relative to the contamination status of the subsurface soils. As discussed in Section 5.6, contaminants were detected in Sandy Creek adjacent to the Rubble Landfill. Contaminant migration via contaminated groundwater, if present, could result in discharge of contaminants to the floodplain or directly into Sandy Creek. Depending on verification of the absence of methylene chloride in surface soils,

overland flow would not appear to be a contamination migration route of significance because only apparent background soils metals are present at the surface and no other TCL organic chemicals were detected.

In conclusion, surface soils at the Rubble Landfill do not appear to pose an immediate public health or environmental threat, subject to confirmation of the absence of methylene chloride. If methylene chloride is present, a quantitative risk assessment is necessary to estimate the long-term human health threat. However, additional investigation is necessary to accomplish the following.

- verify the presence or absence of methylene chloride,
- define the boundaries and nature of the landfill to ensure that sampling was adequate and to site additional sampling locations for the purposes identified below,
- sample the floodplain surface soils in locations where leachate might be expressed to evaluate the groundwater discharge to surface pathways, and
- install and sample monitoring wells appropriate to evaluate potential groundwater quality impacts.

A recommended program for additional work at Site 21B is outlined in Section 6.0.

5.5 SITE 22B, OLD FIREFIGHTING DEMONSTRATION AREA

5.5.1 Site Description The exact location of the Old Firefighting Demonstration Area is not known, but the PA (NEESA, 1989) locates it just west of the machine gun butt. The suspected location is shown in Figure 5-4. The suspected location is a level, poorly vegetated area with poor drainage. More than 45 years have elapsed since firefighting exercises were staged in this area. The last firefighting demonstrations to take place occurred during World War II and probably numbered fewer than 12 to 15 total demonstrations. The area does not show on any of the historical plans or aerial photographs.

5.5.2 Waste Characteristics and Disposal History Discussions with station firefighting personnel resulted in an estimate of 400 to 1,000 gallons of combustible liquids including contaminated fuel that could have been ignited on a wrecked aircraft for each demonstration. During WWII it is likely that oils and spent solvents were commingled with the fuel. No records exist describing the total amount of liquid flammables that were actually used during the WWII demonstrations.

Because of the age of the site, it is expected that any mobile and degradable constituents would likely have migrated or disappeared. Probable contaminants would have included tetraethyl lead from AVGAS, volatile and semivolatile fuel hydrocarbons, combustion products such as PAHs, as well as any solvents, cleaners, or other materials that may have been commingled with the materials used in the practices and demonstrations. It would be expected that degradable

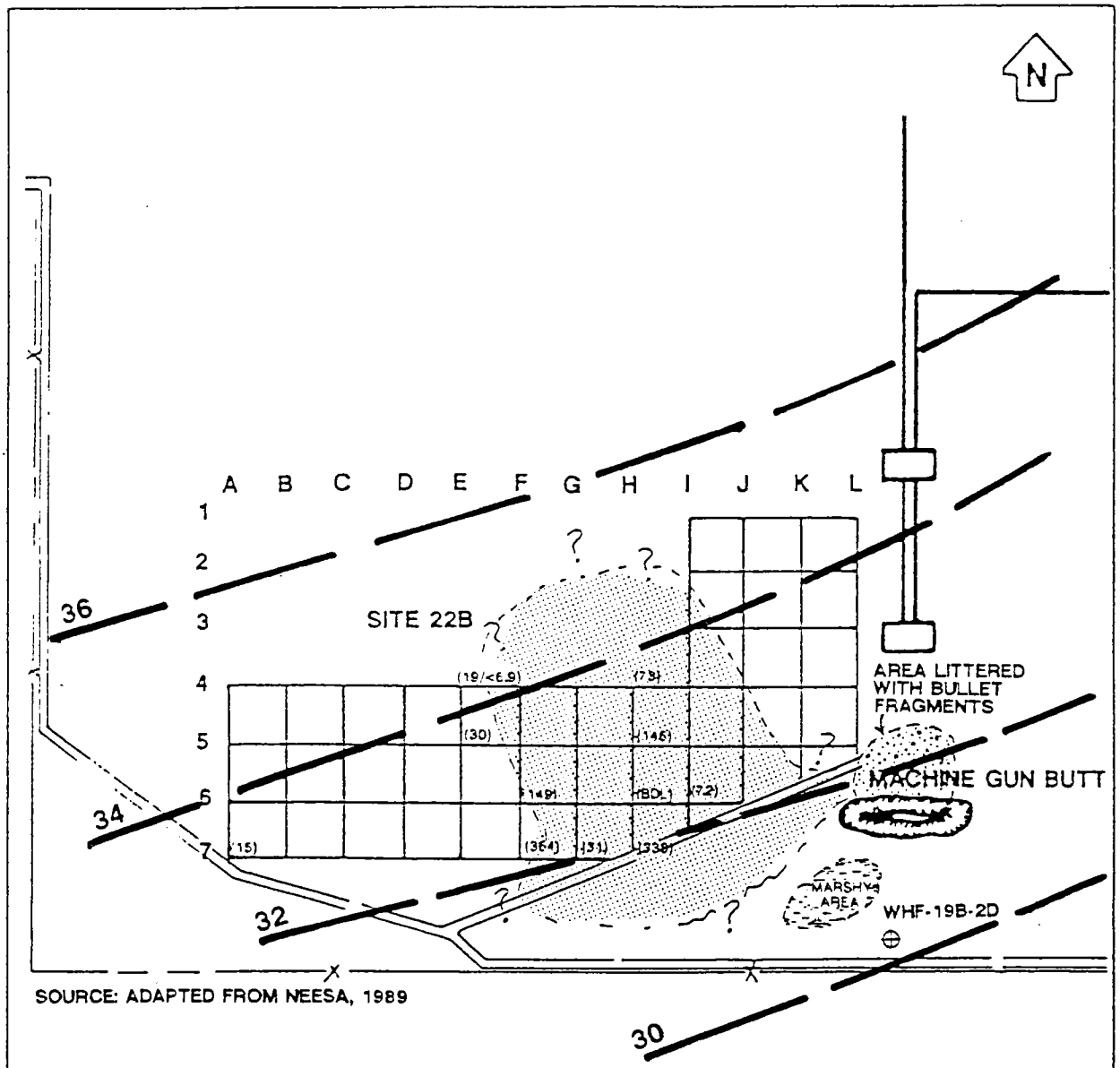
or volatile materials such as hydrocarbons and solvents would have disappeared from the soil surface layers. Residual chemicals such as lead or PAHs might remain if sorbed to soils.

Migration pathways for existing residual contaminants would be overland transport in surface water runoff, vertical transport to the water table with infiltrating rainwater followed by migration in groundwater, and atmospheric transport as suspended particulates. The latter transport is significant due to the poorly vegetated, sandy nature of the area where the site is suspected to have been located. Because both the residual lead and PAHs are strongly bound to soil, migration along with infiltrating water in the vadose zone and further migration in groundwater would be expected to be slow or non-existent.

5.5.3 Site Investigation Results The sampling SI program consisted of the collection of surface soils in a grid pattern designed to delineate the approximate position of the Old Firefighting Demonstration Area. A total of 54 sample locations were explored. Soil samples, including five duplicate samples, were collected from a depth of between 1 and 2 feet on a 100-foot grid pattern (see Figure 5-4). These samples were analyzed for lead, because it was considered the most likely residual constituent of AVGAS that might remain to support location of the site.

Ten of the soil samples contained detectable levels of lead, ranging from 15 mg/kg in WHF-SS-22B-A7 to 364 mg/kg in WHF-SS-22B-F7. Table 5-7 presents a summary of the lead analytical data which are arrayed on Figure 5-4. All other samples were free from detectable lead. Detection limits ranged from 6.8 to 8.3 mg/kg. Nine of the 10 samples containing detectable lead were collected between grid locations E4-7 and I4-7. The highest lead concentrations are located at the southern portion of the grid at grid positions F7 and H7. Figure 5-4 depicts the area of elevated lead. Background lead in the area sampled appears to be below the limit of detection. The lead content of the samples greater than 15 to 20 mg/kg is in excess of geometric mean concentrations for clay, clay loams, and sandy soils (Kabata-Pendais and Pendais, 1984) as tabulated in Table 5-1.

Although the maximum lead concentrations listed as background in Table 5-1 are approximately the same as the highest concentrations observed at Site 22B, the configuration of high concentrations suggests that the partially delineated area in Figure 5-4, represents the probable location of a former release. As shown in Figure 5-4 the east-west dimensions of the area appear to be defined at about 400 to 450 feet. The concentration gradient to the north suggests that the northern extent has been nearly defined by the present sampling. To the south and from east to west at the southern edge of the grid the extent is undefined. Because the sampling area is extremely flat, it is not known whether the concentration distribution is a function of localized drainage patterns or whether the elevated lead concentrations extend to the marshy area to the south. Because only lead was analyzed, the observed high lead concentrations cannot be unequivocally attributed to residual from combustion of AVGAS. The Machine Gun Butt is located approximately 300 feet east of the area of high lead concentrations. As discussed in Section 5.5.6, a substantial area of the land surface in front of the Machine Gun Butt is littered or nearly covered with spent bullets



SOURCE: ADAPTED FROM NEESA, 1989

LEGEND

- SOIL SAMPLING GRID
- (364) LEAD CONCENTRATION (mg/kg)
- MONITORING WELL
- GROUNDWATER CONTOUR LINES IN FEET NGVD
- AREA OF ELEVATED LEAD CONCENTRATION

APPROX. SCALE

0 150 300

FIGURE 5-4

LOCATION OF SITE 22B
OLD FIREFIGHTING DEMONSTRATION
AREA AND SOIL SAMPLING GRID

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and bullet fragments. During the HRS II site visit the littered area was estimated at 50 to 75 by 100 to 150 feet or approximately 0.1 to 0.2 acre. Lead and copper corrosion products may be migrating west via either surface runoff or by atmospheric dispersion. No testing has been done at the location of the bullet deposit at the Machine Gun Butt.

Table 5-7
Summary of Positive Results for Lead of Surface Soils Samples, Old Firefighting Demonstration Area, Site 22B

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Sample No.	Lead Concentration (mg/kg)	Sample No.	Lead Concentration (mg/kg)
WHF-SS-22B-I6	72	WHF-SS-22B-F6	149
WHF-SS-22B-H4	73	WHF-SS-22B-F7	364
WHF-SS-22B-H5	146	WHF-SS-22B-E4	19/<6.9
WHF-SS-22B-H7	338	WHF-SS-22B-E5	30
WHF-SS-22B-G7	31	WHF-SS-22B-A7	15

Note: Sample WHF-SS-E4 duplicate was non detect (<6.9 mg/kg).
All other samples were below detection limits.
mg/kg = milligram per kilogram

5.5.4 Site Characterization, Significant Findings, and Conclusions Elevated lead concentrations in surface soil identified in the SI soil sampling program may be attributed to the former Firefighting Demonstration Area or may have migrated from the Machine Gun Butt. Maximum concentrations of lead in surface soils far exceed the "background" concentrations for lead. As indicated in Section 5.7, the assessment of potential health effects of lead in soils is in a state of flux. Currently, USEPA (1989) has designated an interim action level of 500 mg/kg in soils for a residential area. Observed lead concentrations are below this level. Because of the status of regulatory health effects criteria for lead, no screening "benchmark" concentration can be developed using the HRS II approach. Because the area of Site 22B is restricted, significant potential for exposure is limited to station personnel who may enter the area for incidental activities. Terrestrial biota, however, may be exposed to levels of lead having significant effects. The area of elevated lead levels has not been completely delineated. Concentrations of lead and copper in soils in the littered area near the Machine Gun Butt are unknown. Lead and copper corrosion products or bullets and fragments may represent an attraction for small mammals, which gnaw at these materials as a source of salt. Such activity may result in high lead doses.

This area requires further characterization and may be a candidate for an interim remedial action to remove or contain lead contaminated soils or lead fragments and prevent further migration or biotic exposure. Specific conclusions are as follows.

- Elevated lead concentrations in the shallow soil may indicate the location of the Old Firefighting Demonstration Area. Additional sampling is necessary to define the horizontal and vertical extent of lead contamination.

- Additional parameters should be analyzed on a limited number of samples in one soil boring to confirm the disposal is the Old Firefighting Demonstration Area. These are:

  PAHs, long-term remedial oil weathering and combustion products; and

  Copper, to evaluate whether the site represents migration from the Machine Gun Butt.

- The possibility exists that the lead measured in the sampling grid may have migrated from the Machine Gun Butt. Sampling and analysis of lead and copper to characterize the extent of contamination at the Machine Gun Butt and it relationship to the area thought to be the Old Firefighting Demonstration Area should be conducted. This should be coordinated with a thorough evaluation of local surface drainage patterns in the area.

- Migration routes include atmospheric dispersion via particulate transport, leading to the water table, and transport of contaminated particulates via overland flow of surface runoff.

- Restricted access prevents significant current human exposure. Exposure to lead by biota appears to be ongoing and may represent an environmental threat.

Recommendations are outlined in Section 6.0 to fully characterize the extent of surface soils contamination and biotic risks, to confirm the location of the Old Firefighting Demonstration Area, to confirm the vertical extent of soils contamination and the threat to groundwater, and to support an interim remedial action to mitigate lead risks to biota and contain further contaminant migration.

5.5.5 Machine Gun Butt Further investigation will be necessary to fully characterize the lateral and vertical extent of lead in soils in the area south of the runway. During the SI and also the HRS II site visit, spent lead, steel, and copper jacketed bullets, shotgun lead shot, and bullet fragments (ranging from 0.22 caliber to 0.50 caliber) were observed littering the ground around the machine gun butt (Figure 5-4). The corrosion products of bullet fragments may have contaminated soils in the area with copper and lead. The metals contamination at the Machine Gun Butt makes soil sampling results for the Former Firefighting Demonstration Area difficult to interpret due to potential migration of soil contaminated by lead and/or copper from the Machine Gun Butt, as described in Sections 5.5.3 and 5.4.4.

5.6 SITE 23B, DRAINAGE DITCH LEADING TO SANDY CREEK.

5.6.1 Site Description The drainage ditch system (Figure 5-5) runs east from Guadalcanal Road, turning north approximately 500 feet east of the Command Building (Building 2768), travels approximately 2,500 feet north, and intersects another open ditch, which flows approximately 2,000 feet east to Sandy Creek. This drainage ditch is unlined throughout its length from Guadalcanal Road to the ends of the runway. The ditch exists only as a swale along the north end of the runway. Soil in the ditch sides and bottom is similar to the soil types found in the relevant part of the installation, Lakeland loamy fine sand (see Figure 3-7). This latter drainage ditch, travels around the ends of Runways 15, 18, and 21 and into an asphalt drainage gutter. The gutter diverts flow around the Rubble Landfill and through a concrete drainage pipe to a small stream that discharges into Sandy Creek.

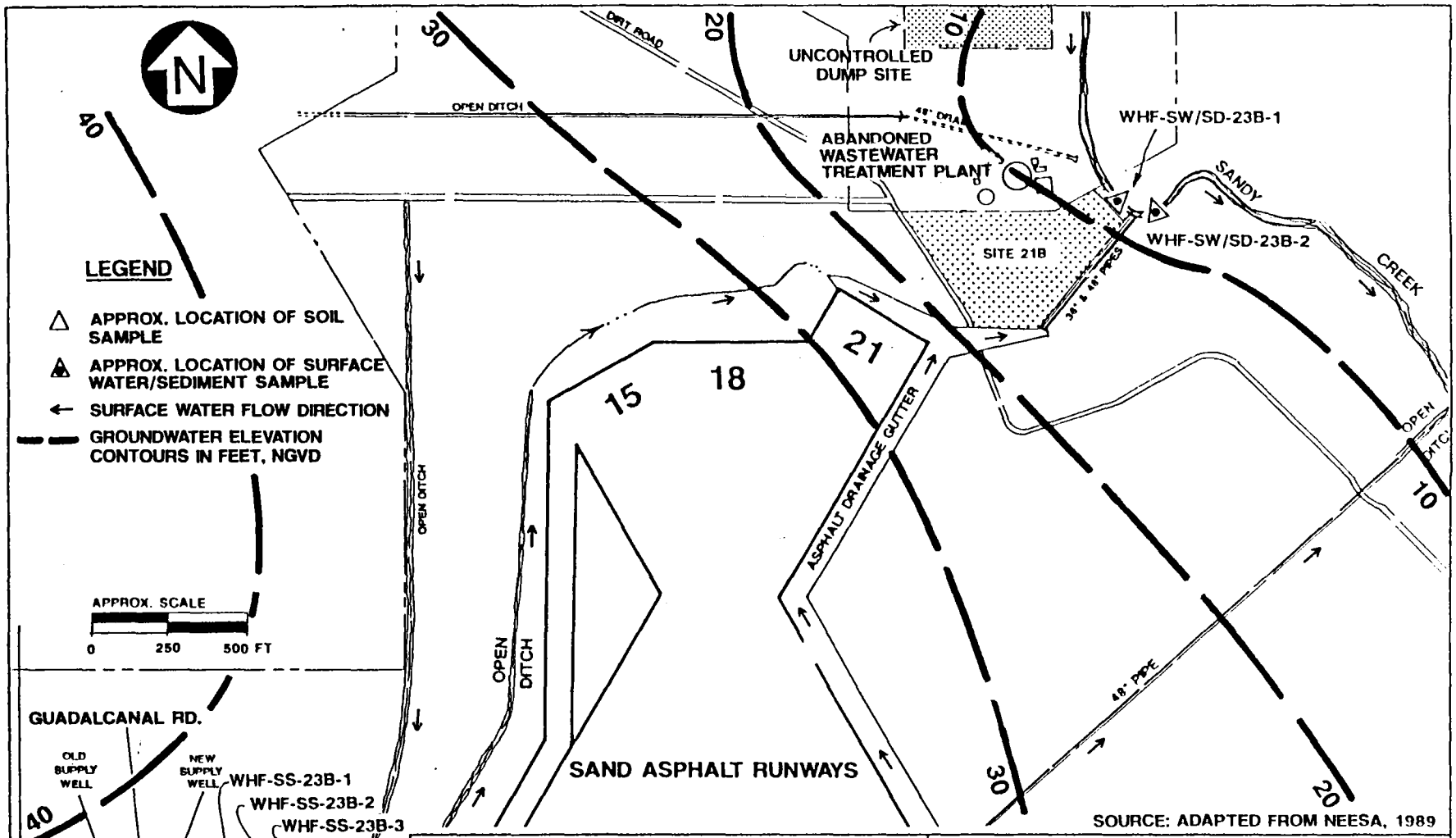
5.6.2 Waste Characteristics and Disposal History The drainage ditch system carried runoff from the Former Hangar Maintenance Area, Site 19B, as well as discharged water from the aquafarm fuel system (Site 20B) and provided an avenue for contaminants to travel toward Sandy Creek. A 2,000-gallon fuel spill, which occurred in 1954, migrated toward Sandy Creek via the drainage ditch. During the 1940's, aircraft were washed on wash racks in the Former Hangar Maintenance Area using kerosene as a cleaner. Reportedly (NEESA, 1984), kerosene was reclaimed through the use of an oil/water separator. Discharge of rinse water through the oil/water separators was conveyed toward Sandy Creek via the Site 23B ditch.

Sandy Creek was reported to be unfishable due to kerosene contamination when the aircraft washing operations were underway at OLF Barin. Fishing in Sandy Creek was discontinued in the early 1950's according to the PA (NEESA, 1989).

The potential releases to the upper reaches of the storm drainage ditch via the storm sewer along Guadalcanal Road include solvents, battery electrolyte, and cleaners from the Former Hangar Maintenance Area, as well as the fuel spill and discharge water from the aquafarm. The use of the ditch as a receptor for contaminants from Sites 19B and 20B has been described in Sections 5.1, 5.2, and 5.3.

5.6.3 Site Investigation Results The SI exploration program for Site 23B was conducted at two general locations. The first consisted of collection of soil samples from the upper end of the drainage ditch. The second consisted of collection of surface water and sediment samples from two locations in Sandy Creek. The rationale and scope of these studies was summarized in Section 4.1. Sample locations are shown in Figure 5-5.

Drainage Ditch. A total of four soil samples, including one duplicate sample, were collected from three locations in the drainage ditch at the east end of Guadalcanal Road and analyzed for total lead and PAHs. Both of these analyte groups are residual constituents of AVGAS. The soil samples were taken at depths between 1 and 2 feet BLS starting at the storm sewer outfall on Guadalcanal Road and extending down the ditch at 100-foot intervals (see Figure 5-5). The purpose of this program was to assess the presence of residual fuels from the 1954 fuel spill, presumed to be AVGAS.



SOURCE: ADAPTED FROM NEESA, 1989

FIGURE 5-5
SAMPLING LOCATIONS IN DRAINAGE DITCH (SITE 23B) AND SANDY CREEK

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Results of lead and PAH analyses are presented in Appendix B. No lead or PAHs were detected from the soils in the upper reaches of the ditch. Lead detection limits ranged from 7.1 to 7.5 mg/kg in the four samples. The detection limits for PAHs was 10 μg/kg in the samples collected 100 and 200 feet downstream of the storm sewer outfall. Due to the presence of unidentified interferences, the detection limit at sample location WHF-SS-23B-1 was elevated by a factor of 20 to 200 μg/kg. Because the PAH are analyzed by high performance liquid chromatography (HPLC), the interference cannot be identified from the available data. Many types of naturally occurring organic matter present a positive signature to an ultraviolet and/or fluorescence HPLC detector. Located at the storm sewer outfall, sample location WHF-SS-23B-1 might be expected to receive more organic deposition than farther down-ditch. In addition, this area would probably sustain significant induced infiltration of stormwater compared to the area down-ditch. The outfall area also is the location where hazardous contaminants migrating in the storm sewer from Sites 19B and 20B would be discharged to soil. The finding of no detectable lead or PAHs near the soil surface could possibly reflect leaching of the surface layers of soil or burial by soil deposition rather than lack of contamination. Secondly, contaminants other than residuals of weathered fuels may be present at greater depths.

Surface Water and Sediment. Two surface water and two sediment samples were collected at the confluence of the drainage ditch and Sandy Creek (see Figure 5-5). One surface water and sediment sample set was collected approximately 50 feet upstream of the drainage ditch discharge point and the other sample set was collected approximately 50 feet downstream of the discharge point. The downstream set was collected in duplicate. Analytical results are summarized in Tables 5-8 and 5-9.

Surface water quality results are tabulated in Table 5-8. No detectable organic chemicals (VOCs, SVOCs, pesticides, PCBs, or total phenols) were detected at either sampling location. Complete results are contained in Appendix B. As shown in Table 5-8, none of the metals with the exception of the typical major dissolved constituents of uncontaminated surface water, were detected.

A trace of total cyanide (0.006 mg/ℓ) was detected in the upstream sample from Sandy Creek. As shown in Figure 5-5, this sampling location may not be upstream of groundwater discharge from the Rubble Landfill. Cyanide is measured by colorimetric analysis after distillation. In general, distillation removes positive interferences. Cyanide, unless complexed with certain metals, is rapidly oxidized in surface waters or, at low concentrations, degraded microbially. In an anaerobic or low redox environment such as a leachate or when complexed with certain metals, cyanide is stable. Cyanide in the Sandy Creek sample at WHF-SW-23B-1 may be related to a release from the Rubble Landfill (Site 21B) or may be migrating from farther upstream. Cyanide is a component of metal plating waste, color photographic processing, and metal polishing and is an ingredient in some types of fungicides and pesticides.

Table 5-9 is a summary of the results of analyses of sediments from WHF-SD-23B-1 and the duplicate analysis of WHF-SD-23B-2. The results of metals analyses of the sediments can be compared with results of surface soils analyses (Table 5-6) at the Rubble Landfill (Site 21B) and with Table 5-1, which presents the mean and range of metals in background soils in the Eastern United States, the Gulf Coast

Table 5-8
Summary of Surface Water Data, Drainage Ditch Leading to Sandy Creek, Site 23B

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	Surface Water Sample Location		
Compound	WHF-SW-23B-1-1	WHF-SW-23B-2-1	WHF-SW-23B-2-D1
Inorganic Chemicals (mg/ℓ)			
Total aluminum	0.5	<0.5	<0.5
Total calcium	2.8	2	1.7
Total cyanide	0.006	<0.005	<0.005
Total iron	0.36	0.32	0.3
Total potassium	0.8	0.8	0.7
Total magnesium	1.7	1.7	1.7
Total manganese	0.03	<0.01	<0.01
Total sodium	3.5	3.1	3
Total zinc	0.05	<0.01	<0.01

Notes: All surface water sample results for total phenols, semivolatile organic chemicals (SVOC), pesticides, polychlorinated biphenyls (PCB), and volatile organic chemicals (VOCs) were below detection limits (see Appendix B).

All other metals were below the following detection limits:

Total silver	<0.002
Total arsenic	<0.001
Total barium	<0.1
Total beryllium	<0.01
Total cadmium	<0.0002
Total cobalt	<0.05
Total chromium	<0.01
Total mercury	<0.0005
Total nickel	<0.05
Total lead	<0.004
Total antimony	<0.1
Total selenium	<0.003
Total vanadium	<0.2
Total thallium	<0.4

mg/ℓ = milligram per liter

Table 5-9
Summary of Sediment Data, Drainage Ditch Leading to Sandy Creek, Site 23B

Site Inspection Report
OLF Barin, Foley, Alabama

	Sediment Sample Location		
Compound	WHF-SD-23B-1-1	WHF-SD-23B-2-1	WHF-SD-23B-2-D1
Total Phenols (mg/kg)			
Total phenols	3.6	3.8	0.35
Inorganic Chemicals (mg/kg)			
Silver	<0.014	0.021	0.014
Aluminum	979	5,417	3,056
Barium	<7.1	9	<6.9
Calcium	<71	136	132
Chromium	<0.71	4.9	2.8
Copper	<2.1	2.8	<2.1
Iron	407	2,639	1,215
Potassium	<43	69	65
Magnesium	17	76	47
Manganese	<0.71	0.71	<0.70
Sodium	20	<14	14
Arsenic	0.21	0.69	0.42
Selenium	<0.21	0.28	0.21
Zinc	<1.4	1.4	2.1
Pesticides and polychlorinated biphenyls (PCB) (μg/kg)			
4,4'-DDD	<1.0	2	2
4,4'-DDE	<1.0	5	4
4,4'-DDT	<1.0	14	10
Dieldrin	<1.0	10	8
Volatile Organic Chemicals (μg/kg)			
Toluene	229	115J	155J
2-Butanone (MEK)	43	<38	56
Methylene chloride	100	<38	113
Ethylbenzene	57	26	42
Total xylenes	286	128	226

Notes: All samples for acid extractables and base neutrals were below detection limits (see Appendix B).
mg/kg = milligram per kilogram.
μg/kg = microgram per kilogram.
4,4'-DDD = Dichlorodiphenyl dichloroethane.
4,4'-DDE = Dichlorodiphenyl dichloroethylene.
4,4'-DDT = Dichlorodiphenyl trichloroethane.

of Florida and Alabama, and clay, clay loam, sandy, and alluvial soils. None of the metals found in the sediments were greater than the expected mean forback-ground soils. No upstream-downstream trends of significance were observed. The sampling locations were only approximately 100 feet apart; however, the reach sampled is adjacent to the Rubble Landfill and upstream and downstream of a major stormwater outfall.

Total phenols were detected at 0.35, 3.6, and 3.8 mg/kg. No acid-extractable organic chemical were detected at detection limits of 0.47 to 3.6 mg/kg for individual TCL phenolics. In soils and sediments, organic matter containing naturally occurring hydroxylated aromatic compounds are frequently present. These result from microbial activity, decomposition of wood, and other plant materials. Frequently, these natural decomposition products cause positive total phenol results. In the absence of any of the TCL phenols (several of which the total phenol test is highly sensitive for) or phenol itself, the total phenol results are interpreted as likely being a result of the natural decaying organic material. Phenols also may be the result of the weathering of hydrocarbons in fuels, however. As discussed below, there is evidence of fuel-related contamination of Sandy Creek at the sediment sampling locations. However, in general, weathering fuel oils would result in generation of PAHs as well as phenols and likely in much greater concentrations than phenols. No PAHs were detected in Sandy Creek sediments.

Evidence of fuel-related contamination of Sandy Creek is present in the sediment samples. Toluene, ethyl benzene, and xylenes were present at consistent concentrations in the upstream sample and both replicates at the downstream location as shown in Table 5-9. Toluene, however was observed at 18 $\mu g/\ell$ in the accompanying method blanks. All toluene releases in the sediment data not below 180 $\mu g/kg$ were therefore flagged "J" as an estimated value. This is because much of the concentration may not be unequivocally interpreted as resulting from the environmental sample and not from the method blank. Ethyl benzene, toluene, and xylenes, when present together (and usually also accompanied by benzene) are characteristic of gasoline, aviation fuel, diesel fuel, or light fuel oil contamination.

MEK and methylene chloride were detected in one of the downstream replicates and in the upstream sample. Because of the frequent encountering of these chemicals as laboratory artifacts and the poor replication compared to toluene, ethyl benzene, and xylene, their presence is suspected to be the result of sample handling or a laboratory artifact. Methylene chloride and MEK are not fuel related contaminants. Methylene chloride was observed in the Rubble Landfill soil sample nearest the upstream Sandy Creek location.

Residual persistent chlorinated pesticides were detected in both replicates of the downstream Sandy Creek location (samples WHF-SD-23B-2-1 and WHF-SD-23B-2D1). The chemicals detected were 1,1,1-trichloro 2,2-bis (p-chlorophenyl)ethane (4,4'-DDT), 1,1,-dichloro 2,2-bis(p-chlorophenyl)ethane (4,4'-DDD), 1,1,-dichloro 2,2-bis (p-chlorophenyl)ethylene (4,4'-DDE), and dieldrin. No longer used in agriculture or military pest control, these chemicals have environmental half-lives in excess of 10 years and are frequently observed in low concentrations in the sediments of streams draining agricultural lands. Their presence in only the downstream sample suggests that they may either have migrated from the landfill or have been transported by storm water runoff from OLF Barin. Because the

chlorinated pesticide residues are extremely hydrophobic and therefore insoluble in water, their presence in leachate and for groundwater transport in an aqueous phase is unlikely. They are, however, strongly bound to soil. Transport in surface water bound to particulates is the principal means of transport for DDT and its transformation products, and dieldrin. The concentrations observed are two to four times higher than typical for agricultural runoff in the absence of a nearby source; however, the range of concentration in sediments from agricultural drainage is very wide and individual locations are highly dependent on specific hydrological attributes and deposition rates.

5.6.4 Site Characterization, Significant Findings, and Conclusions Site 23B, Drainage Ditch leading to Sandy Creek, consists of two separate subareas studied during the SI field program. The first is the Guadalcanal Road storm sewer, its discharge outfall, and the upper reaches of the storm drainage ditch. The second area is Sandy Creek in the reach adjacent to the Rubble Landfill, immediately upstream and downstream of the storm drainage outfall (see Figure 5-5). Site characterization, significant findings, and conclusions are presented separately for each of the subsites. In addition, during the HRS II site visit, two additional potential sites were identified along Sandy Creek, upstream of the sampling locations and the Rubble Landfill. These latter areas were not sampled during the SI field program. They are discussed in Sections 5.6.5 and 5.6.6.

Upper Storm Drainage Ditch. As discussed in Section 5.6.3, no fuel related residual contamination, as measured by lead and PAHs, was detected. As discussed in Sections 5.1 through 5.3, the upper ditch may have received past releases from Site 19B, which have resulted in mercury contamination of the shallow groundwater at wells WHF-20B-1 and WHF-20B-2 and possibly the halocarbons that have been detected in the station water supply wells. The sewer outfall area would be expected to receive contaminants from surface runoff from Site 19B and aquafarm waste water. Infiltration of these to the water table (15 to 20 feet BLS) and subsequent migration in groundwater could occur.

Specific conclusions, related to the first 300 feet of the ditch downstream of the Guadalcanal Storm Sewer Outfall are presented below. Including the storm sewer, this upper portion of the ditch represents a source of potential contamination. Although no lead or PAHs were detected, other contaminants may be present and due to enhanced infiltration, the contamination may have infiltrated deeper than 2 feet BLS.

Based on the potential for contaminants related to runoff from the Former Hangar Maintenance Area and aquafarm, additional characterization of VOCs, SVOCs, and metals is required in the surface soils, subsurface soils, and along the upper storm sewer. Contaminant migration routes of significance at this location are overland flow via stormwater runoff and infiltration to the water table and groundwater transport. Conclusions supporting further investigations for this component of Site 23B are as follows.

- No evidence for residual contamination due to the 1954 fuel spill exists at this location to a depth of 2 feet BLS. At the outfall, interferences elevated the PAH detection limit. No lead, an expected AVGAS residual, was detected, however.

- Other runoff from the Former Hangar Maintenance Area and/or all of the aquafarm system may have released other contaminants. Enhanced infiltration may have driven existing lead and/or PAH below the zone sampled or sediment deposition may have buried the contaminated soils subsequent to the activity.

- Additional characterization of the soil column is necessary to verify that the upper portion of the ditch is not a significant threat to public health or the environment.

Recommended sampling and analysis of the soil column and shallow groundwater to rule out the ditch as a source of VOCs, metals, or SVOCs is presented in Section 6.0.

Sandy Creek. Apparent fuel-related aromatic VOCs, cyanide, and chlorinated pesticide residues that may be above background levels were detected in Sandy Creek upstream and/or downstream of the stormwater outfall.

The nature of this contamination has been described in Section 5.6.3. In addition, the presence of methylene chloride was detected in one soil sample from the Rubble Landfill and in one Sandy Creek sediment sample. This chemical, and MEK also detected in Sandy Creek, were present in substantial concentrations not directly attributable to method blanks contamination. However, the poor agreement among field replicates and the common occurrence of methylene chloride and MEK as analytical artifacts render these VOC data suspect.

The reach of Sandy Creek adjacent to OLF Barin is likely an area of groundwater discharge based on interpreted groundwater elevation and surface topography. It is likely therefore that a contamination migration route of significance is via surface water, either as transport of dissolved materials or sediment transport. Groundwater may discharge to the creek, underflow the creek, or migrate downstream as subsurface flow.

Cyanide exceeds the Federal AWQC for protection of freshwater aquatic life from chronic toxic effects of cyanide. In addition, the concentrations of DDT, its metabolites, and dieldrin could cause chronic toxic effects to biota because of the potential for bioaccummulation. These pesticide residues are possible human carcinogens. In the reach of Sandy Creek where these chemicals were detected, access for human exposure is severely restricted by the wooded, swampy floodplain. Based on the soil exposure assumptions, which are also appropriate for direct contact with sediments, the DDT, DDD, and DDE do not exceed the "benchmark" concentrations based on the projected 10^{-6} excess cancer risk rate threshold for children between ages 6 and 18 who might play in sediments contaminated by these pesticides. The concentration of dieldrin does exceed the benchmark. These benchmark screening concentrations are presented in Section 5.7.

Neither methylene chloride, MEK (if present), nor the aromatic VOCs (toluene, ethyl benzene, or xylenes) exceed their "benchmark" concentrations.

As previously indicated, the sediment and water contaminants cannot be definitively linked to either drainage to Sandy Creek from the Site 23B storm drainage system or the Rubble Landfill, Site 21B. Two potential sites are within 250 feet upstream of the storm drainage outfall and Rubble Landfill. The abandoned OLF Barin Wastewater Treatment Plant lies less than 150 feet upstream. This system has been out of service since 1959; however, the status of flow through the abandoned sewer lines and the location of former sewage sludge drying beds is unknown. These could represent sources of contamination to Sandy Creek. The Abandoned Wastewater Treatment Plant is described in Section 5.6.5. The location of this section is shown on Figure 5-5.

Approximately 100 feet farther upstream of the Abandoned Wastewater Treatment Plant is an Uncontrolled Dumpsite. This site was identified during the HRS II site visit and partially explored. The approximate site location is shown in Figure 5-5. Details of the site exploration are presented in Section 5.6.6. Potential disposal of hazardous materials could be ongoing adjacent to Sandy Creek or on the steep lands of the floodplain.

Relative to Sandy Creek, pesticide and aromatic VOC contamination of the creek sediments and cyanide contamination of creek water was observed. Further site characterization is required to evaluate the source(s) of this contamination. The evaluation should be coordinated with verification of the contamination status of the Abandoned Wastewater Treatment Plant, the Uncontrolled Dumpsite, and to development of a background concentration of metals and pesticides in the sediments of Sandy Creek. The background characterization is necessary because Sandy Creek has an extensive drainage basin upstream of OLF Barin where long-term land use has primarily been cropland agriculture. Specific conclusions are listed below. They are the basis for recommended additional site explorations in Section 6.0. These explorations relate to the verification and characterization of contamination at the newly identified sites upstream.

- Trace concentrations of contaminants (cyanide, chlorinated pesticides, and fuel-related aromatic VOCs) are present in Sandy Creek. Cyanide and dieldrin exceed screening benchmark concentrations.

- Three potential sources exist along or upstream of the reach of the stream in which contaminants were detected. These are:

  - Rubble Landfill (Site 21B),
  - Abandoned Wastewater Treatment Plant, and
  - Uncontrolled Dumpsite.

- The source(s) of contamination is not defined.

- Contaminants may be migrating from either the residential development or agricultural lands to the north of Navy property.

- As described in Section 5.6.6, a breach in the boundary fence allows unrestricted access to Sandy Creek upstream of the Wastewater Treatment Plan, and access to the Uncontrolled Dumpsite.

- Materials observed at the Dumpsite suggest that dumping is ongoing. However, based on the observed presence of old paint cans, drums, oil cans, etc., potential exists for contamination from this source.

- Further characterization of the distribution of contaminants in stream sediments is required to delineate source(s) and to provide an estimate of maximum concentrations. This should include:

  - VOCs,
  - SVOCs,
  - pesticides and PCBs, and
  - inorganics (metals and cyanide).

  Samples of both water and sediments should be collected. This program should be coordinated with site-specific investigations at the two new sites and additional explorations at Site 21B.

- Background samples should be collected where Sandy Creek enters the installation and analyzed for the above suite of analytes.

- Restriction of access should be considered to prevent further uncontrolled dumping in the floodplain of Sandy Creek and to prevent play and fishing activities in Sandy Creek where the contamination status is unknown.

A recommended sampling and analysis program for Sandy Creek is outlined in Section 6.0. This program is coordinated with explorations at the Abandoned Wastewater Treatment Plant and the Uncontrolled Dumpsite.

5.6.5 Abandoned Wastewater Treatment Plant The OLF Barin Wastewater Treatment Plant was taken out of service in 1959 when the installation was inactivated and the Administrative Area and West Field excessed. The current status of underground sanitary sewer lines leading from the administrative areas and/or Former Hangar Maintenance Area has not been determined. Contaminant residuals, especially metals, may exist in former sludge drying beds depending on the building served by the sanitary sewerage system. Contaminants may have migrated along the sewer lines in the past and be slowly mobilized due to infiltration.

Recommended explorations are presented in Section 6.0. These have been designed to:

- locate plans of the former sanitary sewer system to investigate locations where possible hazardous materials may have been disposed in the past;

- locate and sample the sludge drying beds for metals, pesticides, and PCBs; and

- sample any liquids accumulated in pits or lines at the plant or which can flow to Sandy Creek.

These activities may lead to recommended additional sampling and analysis.

5.6.6 Uncontrolled Dumpsite This site comprises an area estimated as 0.5 to 0.75 acre located at the northeastern boundary of OLF Barin where the boundary fence has been torn down. Motor vehicle access is possible to the area and it has become a dump area for used appliances, paint cans, garbage, as well as tires, auto parts, and used motor oil cans. Three rusted 55-gallon drums were observed during the limited inspection. Much of the site is overgrown with vines and brush, restricting visibility.

In addition to uncontrolled dumping of trash, garbage, and unknown material which appears to be ongoing, the area also represent an attractive play area for children. A housing area consisting of approximately 30 homes and mobile homes is located from 500 to 1,500 feet north of the dumpsite also U.S. Highway 98. During the HRS II site visit there was abundant evidence of fishing activities, picnicking, and body contact water sports activities.

Potential exists for ongoing contamination as well as exposure to contaminants by the general public. Contamination migration may occur either by runoff into Sandy Creek and by infiltration to the groundwater and subsequent discharge.

Recommendations for control, sampling, and analysis at this site are presented in Section 6.0, which include:

- restriction of access,
- removal of any potentially hazardous materials identified,
- detailed physical exploration and soil and waste sampling appropriate to evaluate potential contamination releases or release threats, and
- sampling of Sandy Creek water and sediments upstream and downstream of the area, coordinated with the other explorations along the creek.

5.7 SUMMARY OF WASTES AND HAZARDOUS SUBSTANCES FOUND. The purpose of this section is to summarize the nature of the wastes and probable or detected releases from each of the sites at OLF Barin and to tabulate specific toxicological and chemical properties of the chemicals that were detected and attributed to site related contaminant releases. Table 5-10 is a tabular summary of the waste chemicals of concern and contaminated or potentially contaminated environmental matrices for each of the sites. This table has been based on the discussions in Sections 5.1 through 5.6, for the specific chemicals of concern detected in the SI field program. The necessary chemical and toxicological properties are summarized in Table 5-11. The summarized chemical and toxicological properties are those required for developing toxicity, mobility, and persistence factor scores according to the HRS II (USEPA, 1990).

Table 5-10
Summary of Wastes and Hazardous Substances By Site

Site Inspection Report
OLF Barin, Foley, Alabama

Site Name and Number	Contaminated Media		Wastes Potentially Present	Hazardous Substances Detected
	Observed	Potential		
Former Hangar Maintenance Area Site 19B (see Section 5.1)	None	Groundwater Surface soils Subsurface soils Stormwater runoff	Solvents Waste oils Fuels Battery residues and electrolytes	Mercury
Abandoned Underground Storage Tanks and Fuel Pits Area Site 20B (see Section 5.2)	None	Groundwater Surface soils Subsurface soils Stormwater runoff	Aviation fuels Lead	Lead
OLF Barin Supply Wells (see Section 5.3)	Groundwater	Not applicable	Solvents	trans-1,2-Dichloroethylene Trichloroethylene Tetrachloroethylene
Rubble Landfill, Site 21B (see Section 5.4)	Surface soils	Subsurface soils Surface Water Sediments Groundwater	Unknown	Methylene chloride
Old Firefighting Demonstration Area, Site 22B (see Section 5.5)	Surface soils	Subsurface soils Air Groundwater Stormwater	Lead PAH	Lead
Machine Gun Butt (see Section 5.5)	Surface soils	Subsurface soils Air Groundwater Stormwater	Lead Copper	Not sampled
Drainage ditch leading to Sandy Creek, Site 23B (see Section 5.6)				

Table 5-10 (Continued)
Summary of Wastes and Hazardous Substances By Site

Site Inspection Report
OLF Barin, Foley, Alabama

Site Name and Number	Contaminated Media		Wastes Potentially Present	Hazardous Substances Detected
	Observed	Potential		
Upper ditch	None	Subsurface soils Groundwater	Solvents Fuel residues Waste oils Battery residues and electrolyte	None
Sandy Creek	Surface water Sediments	–	Unknown, (however, see Site 21B and below)	Cyanide (surface water) Toluene (sediments) Ethyl benzene (sediments) Xylene (sediments) Methylene chloride (sediments) 4,4-DDT (sediments) 4,4-DDD (sediments) 4,4-DDE (sediments) Dieldrin (sediments)
Abandoned Wastewater Treatment Plant (see Section 5.6)	None	Surface soils Subsurface soils Groundwater Surface water Sediments	Dried sewage sludge (unknown)	Not sampled
Uncontrolled Dumpsite (see Section 5.6)	None	Surface water Sediments Surface soils Subsurface soils Groundwater	Household trash Waste oils/solvents Paints Unknown	Not sampled

Note: PAH = Polynuclear aromatic hydrocarbon

Table 5-11
Summary of Chemical and Toxicological Properties of Hazardous Chemicals from Outlying Landing Field (OLF) Barin

Site Inspection Report
OLF Barin, Foley, Alabama

Chemical	Chemical/Physical Properties				Human Health Toxicological Properties/Factors						Ecological Toxicity Factors				CAS Registry No.
											AWQC				
	Water Solubility	Log_{10} K_{ow}	Vapor Pressure	Henry's Law Constant	Federal MCL	Federal MCLG	Alabama MCL	RfD	Cancer Slope Factor	CAG (Wt. of Evidence)	Acute	Chronic	Lowest Acute LC_{50}	Bioconcentr-ations Factors	
Units	mg/ℓ at 25 °C (unless otherwise specified)		Torr 25 °C (unless otherwise specified)	Atm-m^3/mole	mg/ℓ	mg/ℓ	mg/ℓ	(mg/kg/day)	(mg/kg/day)$^{-1}$		µg/ℓ	µg/ℓ	As shown	No units	
Toluene	535	2.73 (A)	28.4 (A)	5.94×10^{-3} (A)	N/A	N/A	N/A	0.3	N/A	(D)	1,400 (6)	40 (6)	5,000 mg/kg (rat)	1.0 est. (4)	108-88-3
Ethyl benzene	161	3.15	9.53 (B)	8.44×10^{-3} (B)	N/A	0.68	N/A	0.1	N/A	(D)	32,000 (6)	N/A	3,800 mg/kg (rat)	1.19 (fish) (B)	100-41-4
Xylenes	175	3.20	6.6 (A)	7.68×10^{-3} (A)	N/A	0.44	N/A	2.0	N/A	(D)	N/A	N/A	4,300 mg/kg (rat)	1.33 (eel) (A)	1330-20-7
Methylene chloride	1.3×10^{4} (A)	1.25	435 (A)	2.68×10^{-3} (A)	N/A	N/A	N/A	0.06	0.0075 (oral)	(B2)	N/A	N/A	1,600 mg/kg (rat)	5 est. (5)	75-09-2
1,2-dichlorethylene	6.300 (A)	2.06	340 (A)	6.72×10^{-3} (A)	N/A	0.070	N/A	0.02	N/A	(noncar-cinogen)	11,600	N/A	7,902 mg/kg (rat)	22 est. (5)	156-60-5
Trichloroethylene	1,100 (A)	2.42	69 (A)	1.03×10^{-2} (A)	0.005	0	0.005	N/A	1.1×10^{-2} (oral)	(B2)	41,000	29,000		17-29 (A)	79-01-6
Tetrachloroethylene	1,503 (A)	3.40	18.5 (A)	1.49×10^{-2} (A)	0.005 (propo-sed)	0	N/A	0.01	5.1×10^{-2}	(B2)	5,280	840	2,629 mg/kg (rat)	39-49 (A)	127-18-4
4,4-DDD	0.16 D	5.99	10.2×10^{-7} (D)	2.14×10^{-4}	N/A	N/A	N/A	N/A	0.24	(B2)	N/A	N/A	113 mg/kg (rat)	9,120-82,3-00 (D)	72-54-8
4,4'-DDE	0.12 (D)	5.69	6.5×10^{-6} (D)	not available	N/A	N/A	N/A	N/A	0.34	(B2)	N/A	N/A	700 mg/kg (mouse)	27,000-180,-000 (D)	72-55-9
4,4'-DDT	0.0034 (D)	3.98	1.5×10^{-3} (20 °) (D)	3.8×10^{-3} (D)	N/A	N/A	N/A	5×10^{-4}	0.34	(B2)	1.1	0.001	7.6 mg/kg (frog)	600-690,000 (D)	50-29-3

Table 5-11 (Continued)
Summary of Chemical and Toxicological Properties of Hazardous Chemicals from Outlying Landing Field (OLF) Barin

Site Inspection Report
OLF Barin, Foley, Alabama

Chemical	Chemical/Physical Properties				Human Health Toxicological Properties/Factors						Ecological Toxicity Factors				CAS Registry No.
											AWQC				
	Water Solubility	Log_{10} K_{ow}	Vapor Pressure	Henry's Law Constant	Federal MCL	Federal MCLG	Alabama MCL	RfD	Cancer Slope Factor	CAG (Wt. of Evidence)	Acute	Chronic	Lowest Acute LC_{50}	Bioconcentr-ations Factors	
Dieldrin	0.195 (D)	3.87	7.8×10^{-7} (D)	N/A	N/A	N/A	N/A	5×10^{-5}	16	(B2)	1.0	0.0019	3 mg/kg (monkey)	3-6,000 (fish) (D)	60-59-1
Cyanide	4.8×10^{5} KCN (C)	N/A	N/A	N/A	N/A	N/A	N/A	0.02	Not applicable	(D)	22	5.2	3 mg/kg (mouse)	0.3 est. (5)	57-12-5
Lead	(1)	N/A	N/A	N/A	0.05	0.020	0.020	N/A	N/A	(B2)	5.7 (3)	0.22 (3)	* (4)	17-2,512 (D)	7,439-92-1
Mercury	(2)	N/A	N/A	N/A	0.002	0.002	0.002	3×10^{-4} (methyl mercury)	Not applicable	(D)	2.4	0.012	* (4)	1,400-2,800 (D)	7,439-97-6

Notes:
(1) lead sulfide 120 mg/ℓ (E)
lead oxide 23 mg/ℓ (E)
lead nitrate 5.5×10^{5} mg/ℓ (E)
(2) mercury sulfide 0.01 mg/ℓ (D)
mercury oxide 50 mg/ℓ (D)
mercuric acetate 2.5×10^{5} mg/ℓ (10°) (D)
(3) Depends on water hardness concentration given for total hardness of 12.4 mg/ℓ as $CaCO_3$. Based on calculations of hardness in Sandy Creek from Ca and Mg concentrations
(4) Wide range of toxicity, highly dependent on exact chemicals and route of exposure. Organic compounds many times more toxic than inorganic.
(5) Estimated from solubility and K_{ow}
(6) No AWQC available, value represents lowest observed effects level.

Log_{10} = CAS = Chemcial Abstract Service
K_{ow} = octanol-water partition coefficient
mg/ℓ = milligram per liter
MCL = maximum contaminant limit
°C = degrees centigrade
MCLG = maximum contaminant limit goal
ug/ℓ = micrograms per liter
RfD = verified reference dose
N/A = Not available
CAG = Cancer Assessment Group
4,4-DDD = dichlorophenyl dichloroethane
AWQC = ambient water quality criteria
4,4-DDE = dichlorophenyl dichloroethylene
LC_{50} = concentration at which 50 percent of organisms die
4,4-DDT = dichlorophenyl trichloroethane

References:
(A) Howard, P.H., Fate and Exposure Data for Organic Chemicals, Vol. II, Solvents, 1990, Lewis Publishers, Inc.
(B) Howard, P.H., Fate and Exposure Data for Organic Chemicals, Vol. I, Large Production and Priority Pollutants, 1989, Lewis Publishers, Inc.
(C) Weast, R.C., Ph.D., CRC Handbook of Chemistry and Physics, 67th Edition, 1989, CRC Press, Inc.
(D) Hazardous Substance Data Based from TOMES, Vol. 8, expires 4/30/91.
(E) Dean, J.A., Lange's Handbook of Chemistry and Physics, Thirteenth Edition, 1985, McGraw-Hill Book Company.

The chemical properties relevant to the scoring of persistence and mobility are water solubility, $\log_{10}$ of octanol-water partition coefficient (log K_{ow}), vapor pressure, and Henry's Law Constant. Toxicological properties and factors required to evaluate the toxicity and classify the level of concern score for human and environmental "targets" or receptors are chronic RfD for non-carcinogens, the cancer slope factor and USEPA Cancer Assessment Group (CAG) weight of evidence for possible and known human carcinogens, non-zero Federal Safe Drinking Water Act MCLGs and Federal MCLs, Alabama MCLs, Ambient Water Quality Criteria, Acute and Chronic LC_{50} or EC_{50}, bioconcentration factors, and risk-based "benchmark" screening concentrations. The benchmarks are defined in Section 2.5.2 of the HRS II Scoring procedure (USEPA, 1990) as follows.

- "Screening concentration for cancer corresponding to that concentration that corresponds to the 10^{-6} individual cancer risk for inhalation exposures (air migration pathway) or for oral exposures (groundwater migration pathway; drinking water and human food chain threats in surface water migration pathway; and soil exposure pathway)" (USEPA, 1990).

- "Screening concentration for noncancer toxicological responses corresponding to the RfD for inhalation exposures (air migration pathway) or for oral exposures (groundwater migration pathway; drinking water and human food chain threats in surface water migration pathway; and soil exposure pathway)" (USEPA, 1990).

Quantitative risk assessment is not appropriate at the SI stage in the CERCLA process because the nature and extent of contamination has generally not been totally defined. Risk-based screening or "benchmark" concentrations for the projected 10^{-6} individual excess cancer risk and the RfD dose for toxic chemicals were developed based on default exposure parameters taken from "Risk Assessment Guidance under Superfund" (USEPA 1989). These exposure assumptions are presented in Table 5-12.

The "benchmark" concentrations were estimated using the specific exposure parameters tabulated in Table 5-13. Toxicological profiles for each of the chemicals are contained in Appendix C.

Based on the available toxicological data, benchmark concentrations have been developed as discussed previously in this section for the chemicals of concern with the exception of lead. The toxicological classification of lead is in a state of flux. Although lead is listed as a group B2, possible human carcinogen, by the CAG and has shown to be highly toxic, especially to children, no accepted RfD or cancer slope factor exists. In quantitative risk assessment, health effects predictions are generally made based on a biokinetic model that predicts blood lead levels based on exposure doses. This approach requires detailed development of exposure parameters, and population characteristics and activities. In 1989, however, USEPA promulgated "Draft Interim Guidance on Establishing Soil Lead Cleanup Levels at Superfund Sites" (USEPA Office of Solid Waste and Emergency Response, OSWER Directive 9355.4-02, June 13, 1989). This document established target cleanup levels of lead for residential area soils at 500 to 1,000 mg/kg. 500 mg/kg of lead in soil or sediments was used as a screening benchmark for soil lead contamination at OLF Barin.

Table 5-12
Exposure Assumptions

Site Inspection Report
OLF Barin, Foley, Alabama

Exposure	Assumptions
1. Drinking water exposure	70 kg average adult individual 2 ℓ per day consumption 365 days per year 70 year lifetime 100% absorbed dose
2. Inhalation exposure (not applicable)	70 kg average adult individual 20 m^3 per day air respired 365 days per year 70 years lifetime 100% absorbed dose
3. Soil ingestion	
Child exposure	
A. Age 1-6	200 mg per day soil ingestion 16 kg body weight 365 days per year 6 years exposure duration 4 hours exposure per day 100% absorbed dose
B. Age 6-18	100 mg per day soil ingestion 45 kg average body weight 365 days per year 12 years exposure duration 4 hours exposure per day 100% absorbed dose

Notes: kg = kilograms; m^3 = cubic meter; ℓ = liter; mg = milligram

Benchmarks for other identified contaminants were developed based on either chronic toxicity (toluene, xylenes, ethyl benzene, trans-1,2-dichloroethylene, cyanide, and mercury) or excess cancer risk of 10^{-6} (methylene chloride, trichloroethylene, tetrachloroethylene, 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, and dieldrin). Methylene chloride benchmarks were developed for both chronic toxicity and potential excess cancer risks.

Table 5-13
Estimated Risk Based Screening Concentration Benchmarks

Site Inspection Report
OLF Barin, Foley, Alabama

Chemical	Effect[1]	Drinking Water (mg/ℓ)	Soil Ingestion (mg/kg) Child's Age	
			1-6 years	6-18 years
Toluene	T	10.5	24	135
Ethyl benzene	T	3.5	8	45
Xylenes	T	70	160	900
Methylene chloride	C	0.005	0.75	2.10
	T	2.1	4.8	27
trans-1,2-Dichloroethylene	T	0.70	1.6	90
Trichloroethylene	C	0.005[2]	0.51	1.43
Tetrachloroethylene	C	0.0007	0.11	0.31
4,4'-DDD	C	1.46×10^{-4}	0.002	0.07
4,4'-DDE	C	1.03×10^{-4}	0.002	0.05
4,4'-DDT	C	1.03×10^{-4}	0.002	0.05
Dieldrin	C	2.2×10^{-6}	3.5×10^{-4}	9.8×10^{-4}
Cyanide	T	0.70	1.6	9.0
Lead	T	0.02[2,3]	500[4]	500
Mercury	T	0.002[2]	0.02	0.14

Notes: [1] T = chronic/acute toxicity.
C = potential increased excess cancer risk.
[2] Lowest MCL (see Table 5-11).
[3] Lead RfD and slope factor are not used for risk characterization.
[4] Based on USEPA interim action level for lead in residential soils.

mg/ℓ = milligram per liter.
4,4-DDD = dichloroephenyl dichloroethane.
4,4-DDE = dichloroephenyl dichloroethylene.
4,4-DDT = dichloroephenyl trichloroethane.

6.0 RECOMMENDED FURTHER ACTION

The purpose of Section 6.0 is to outline specific recommendations for further or follow-on action within the IR Program at OLF Barin. These recommendations are based on the SI results and the conclusions drawn in Section 5.0. Based on the SI field program, none of the five identified sites can be recommended for "no further action" or "monitoring only" due either to existing data gaps or the presence of contaminants in soil, sediment, surface water, or groundwater. Because of the nature of detected and potential contamination, it is recommended that HRS II scoring be done on a set of site groups rather than the installation as a whole. Data are adequate to proceed with the HRS II scoring. Additional sampling and analysis are required for contamination confirmation and verification.

A Phase I Remedial Investigation is recommended as described in this section to more completely describe the nature and extent of contamination at the five identified sites and to verify the contamination status of the three additional areas of potential contamination identified during the SI. The recommended program includes installation-wide and site-specific sampling and analysis. The Phase I RI approach should be organized to address two groups of sites based on their status. These are: (1) confirmed RI sites at which the overall nature and extent of contamination is explored, and (2) potential sources of contamination (PSC) at which site screening for verification of the presence of contamination is required.

For two sites identified in the SI program, the sampling and analysis program would also provide sufficient data to support design of interim remedial actions. These sites are the Machine Gun Butt and the Uncontrolled Dumpsite. At the Machine Gun Butt, lead in surface soils and lead and copper bullet fragments potentially represents an ecological threat and may be causing on-going spread of contamination. At the Uncontrolled Dumpsite, immediate action is recommended to restrict entry by the public and prevent further dumping to remove any waste posing an imminent threat to public health or the environment and to contain waste which may spread contamination if not controlled.

Section 6.0 is organized as follows. Section 6.1 provides a recommended approach for the HRS II scoring. Section 6.2 presents a limited installation-wide background data collection program designed to support site-specific contamination assessment and baseline risk assessment. This section also presents summary tables of the overall RI field program explorations, sampling, and the analysis schedule. Sections 6.3 through 6.7 outline site-specific RI sampling and analysis recommendations.

6.1 HAZARD RANKING SYSTEM II (HRS II) SCORING RECOMMENDATIONS. OLF Barin is typical of DOD facilities in that contamination sources are located at sites distributed over a wide area. Because of this, sites or groups of sites frequently have unique sets of hydrogeologic and environmental factors that affect contaminant migration, unique sets of contaminants, and unique sets of receptors or targets. Such groups may be different from other groups of sites at the facility. Because of this, HRS II scoring of multi-site Federal

facilities requires consideration of these factors to ensure an appropriate score for prioritization.

At OLF Barin, three groups of sites are apparent based on site location, contaminant migration pathways, and receptors. These groups are shown on Figure 6-1. Additionally, these three groups are located in different areas of the installation and are from 2,000 to 5,000 feet apart. The site groupings are as follows:

Group 1. Site 19B, Former Hangar Maintenance Area
Site 20B, Abandoned USTs and Fuel Pits Area
Installation Production Wells
Site 23B, Drainage Ditch to Sandy Creek
Sandy Creek downstream of the Storm water Outfall

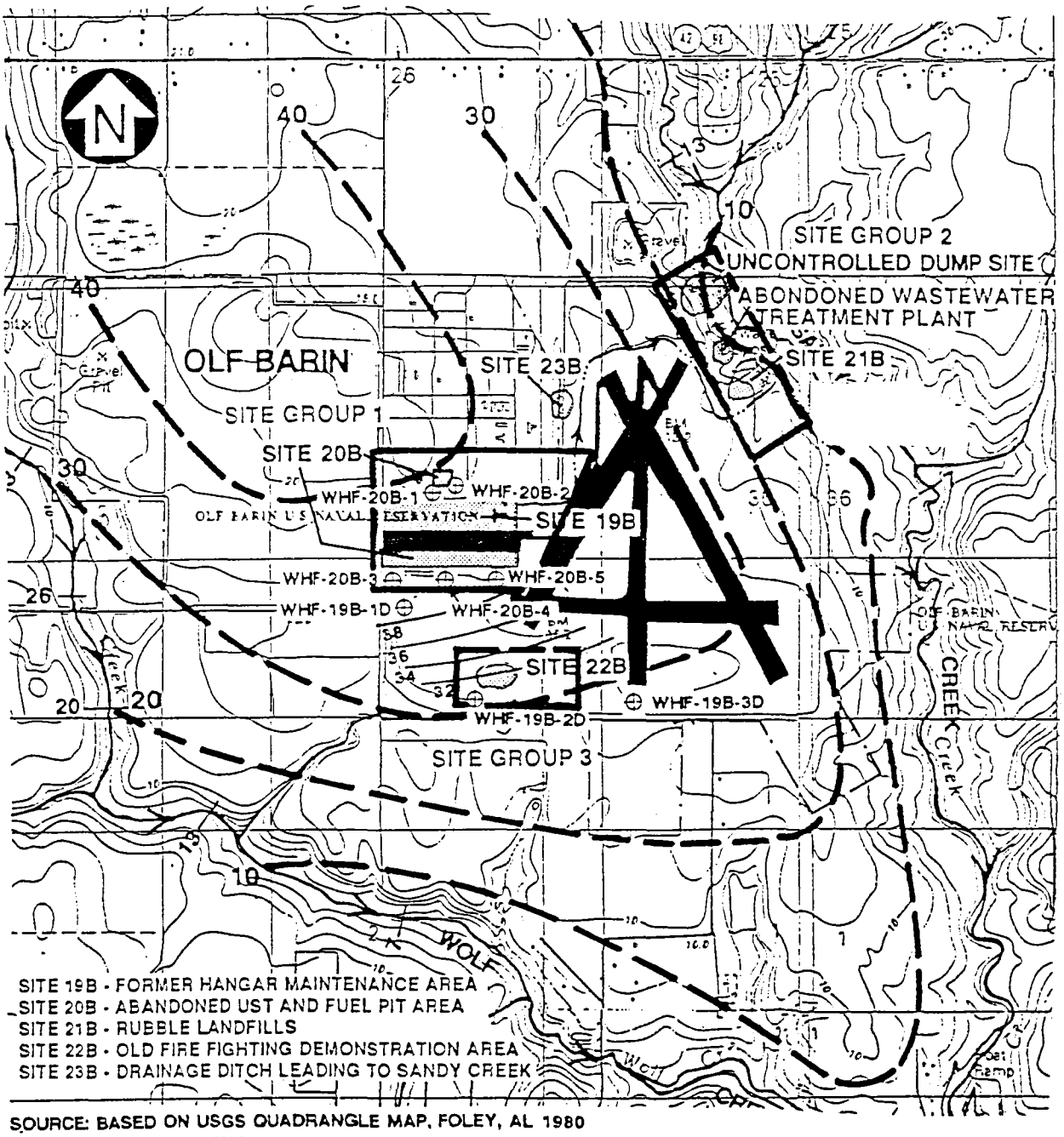
Group 2. Site 21B, Rubble Landfill
Uncontrolled Dumpsite
Abandoned Waste Water Treatment Plant
Sandy Creek

Group 3. Site 22B, Old Firefighting Demonstration Area
Machine Gun Butt

HRS II scoring is recommended for each grouping. The OLF Barin score should be selected as the maximum of the three scores. The sites were grouped and based on rationale as follows.

Group 1. The source areas for this group are Sites 19B and 20B, the Abandoned UST and Fuel Pit Area, and the Former Hangar Maintenance Area. These are located together in the western portion of the installation. Contaminant migration pathways are the same (groundwater and stormwater runoff). Distance to, number, and types of offsite receptors are the same as is onsite worker exposure. The installation water supply wells are also potentially receiving impact from these sources. Migration as runoff from the sites is either to the south by overland flow or along the Site 23 Drainage Ditch leading to Sandy Creek. In evaluating the ditch and Sandy Creek as a migration route and/or receptor area, consideration must be given to the downstream sampling locations in Sandy Creek.

Group 2. This group consists of sites adjacent to the west bank of Sandy Creek, from its entry onto OLF Barin downstream past the Rubble Landfill, Site 21B. Because of the location of this group of sites adjacent to a break in the OLF Barin boundary fence, and evidence of intrusion by the public, the human population targets and attractiveness and accessibility of this area are significantly different from groups 1 and 3. Group 2 also requires careful consideration in developing factor scores for waste types, quantities, etc., because no detailed exploration has been made of the Abandoned Wastewater Treatment Plant or the Uncontrolled Dumpsite. Also, adding to the complexity in scoring this site is the consideration of Sandy Creek. Because the source(s) of sediment contamination in the creek are not clearly defined, Group 2 should be scored both by considering Sandy Creek as a receptor and as a source.



SOURCE: BASED ON USGS QUADRANGLE MAP, FOLEY, AL 1980
SEE SECTION 6.1 OF TEXT
FOR KEYS TO SITE GROUPS

APPROXIMATE SCALE IN FEET
0 2000 4000 8000

INSTALLATION BOUNDARY
STREAM FLOW DIRECTION
INFERRED AREA WIDE WATER TABLE CONTOURS
ON SITE WATER TABLE CONTOURS BASED ON SI
MONITORING WELLS
WATER TABLE ELEVATIONS IN FT/NGVD

FIGURE 6-1
RECOMMENDED SITE GROUPINGS
FOR HRS II SCORING

SITE INSPECTION REPORT

OLF BARIN FIELD
FOLEY, ALABAMA

Group 3. Group 3 is a logical grouping based on location, mutual types of contaminants, possible physical linkage, migration route, onsite receptor types, and distance to offsite receptors.

6.2 RECOMMENDED INSTALLATION-WIDE EVALUATION. Significant data gaps exist for evaluating the presence of inorganic chemicals in soils and sediments, surface water, and groundwater, as well as PAHs and pesticides in soils and sediments, because no site-specific background or upgradient data exist. To properly evaluate the significance of these analytes and their relationship to site-specific releases, six to eight background soil samples should be collected on OLF Barin. These should be located in areas remote from past activities. Three of these should be collected in the Scranton Loamy Fine Sand Series (characteristic of the Old Firefighting Demonstration Area and Machine Gun Butt) and 3 to 5 samples should be collected in the Lakeland Fine Sand Series (which represents the soil type most prevalent on the installation and in the upstream drainage basin of Sandy Creek). Each of these samples should be analyzed for the TAL metals, pesticides and PCBs, and PAHs. The location of the soil associations was depicted in Figure 3-7. Figure 6-2 shows the proposed location of the background soil samples. The overall recommended exploration program and environmental sampling and analysis schedule are presented in Tables 6-1 and 6-2. Recommended background soil analyses are shown on these tables.

Background or upstream concentrations of metals, cyanide, and pesticides must be documented in sediments and surface water in Sandy Creek as it enters OLF Barin to adequately evaluate contamination from the Uncontrolled Dumpsite, the Abandoned Wastewater Treatment Plant, the Rubble Landfill (Site 21B), and the storm drainage ditches. The sample location is shown in Figure 6-2. The analytical matrix is presented in conjunction with the Sandy Creek drainage system described in Section 6.7.

Installation of additional monitoring wells recommended for follow-on action will provide sufficient groundwater elevation data to establish depth to groundwater and flow gradients in the northeast corner of the installation. Establishing background metals concentrations in groundwater is essential to properly evaluate potential contamination of the aquifer due to metals (especially lead and mercury) from Sites 19B and 20B, and to evaluate the Rubble Landfill, Site 21B. Upgradient wells will be installed at each of these locations. At the Rubble Landfill, inorganic chemicals (TAL metals and cyanide) are the background parameters recommended to be analyzed upgradient. At the western part of the installation (upgradient of Sites 19B and 20B) the complete TCL and TAL should be analyzed to rule out sources upgradient of these sites on or off current Navy property. These wells are shown in Figure 6-2 and discussed along with their respective sites in Sections 6.4 and 6.5.

6.3 RECOMMENDED PRODUCTION WELL SAMPLING AND TESTING. To compare with the groundwater quality data in the Site 19B and Site 20B monitoring wells, the raw water from the old and new production wells (see Figure 6-2 for well locations) should be sampled for a full TCL/TAL program during the next sampling episode. Additionally, to evaluate the relationship between production well contamination and the nearby potential sources, two new production zone monitoring wells should be installed (see Section 6.4). To evaluate the hydrogeologic relationship between the production zone and the source areas and the potential contaminant

Table 6-1
Summary of Monitoring Wells, Soil Borings, and Other Field Exploration Recommended For Outlying Landing Field (OLF) Barin Phase I Remedial Investigation

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Site	Geophysics EM/GPR	Soil Gas	Monitoring Wells		Soil Borings	Test Pits	Surface Soil Samples	Surface Water and Sediment Samples
			Production Zone	Water Table				
Site Wide Background	0	0	(see Sites 19B/20B)	(see Site 21B and Sites 19B/20B)	0	0	8	(see Sandy Creek)
Former Hangar Maintenance Area and Abandoned USTs and Fuel Pits Area Sites 19B and 20B	0	100 points	2	10		40	20 (from test pits or tank contents)	0
Rubble Landfill Site 21B	3.1 acres	0	0	3	0	3, but depends on geophysics	3	0
Old Firefighting Demonstration Area, Site 22B and Machine Gun Butt	0	0	0	0	2	0	38	0
Drainage Ditch Leading to Sandy Creek, Site 23B								
Upper Ditch at Guadalcanal Road	0	0	0	0	1	0	0	0
Southern Ditch Outfall	0	0	0	0	0	0	1	0
North Area Ditch Outfall	0	0	0	0	0	0	1	0
Sandy Creek	0	0	0	0	0	0	0	9
Uncontrolled Dumpsite	0	0	0	0	0	0	5	0
Abandoned Wastewater Treatment Plant	0	0	0	0	0	0	3	0
Total Installation	3.1 acres	100 points	2	13	3	43	79	9

Notes: EM = Electromagnetic Induction
GPR = ground penetrating radar

Table 6-2
Summary of Sampling and Analysis Schedule Recommended For Outlying Landing Field Barin
Phase I Remedial Investigation

Site Inspection Report
OLF Barin, Foley, Alabama

Site	Type of Sample	Chemical Analysis: VOC by GC (Including Xylenes and MTBE)	VOC by GC/MS	SVOCs by GC/MS	Pesti-cides/PCBs	PAHs by HPLC	Petroleum Hydrocarbons	Metals: TAL	Metals: Lead only	Metals: Copper only	Total Cyanide	TCLP: Lead only	TCLP: Complete List
Site Wide Background	GW	--	--	--	--	--	--	--	--	--	--	--	--
(Groundwater background included with upgradient	SW	--	--	--	--	--	--	--	--	--	--	--	--
wells for Sites 19B/20B, and 21B; Surface Water and	SD	--	--	--	--	--	--	--	--	--	--	--	--
Sediment with Sandy Creek)	SO	--	--	--	8	8	--	8	--	--	--	--	--
Former Hangar Maintenance Area and Abandoned	GW	39	8	12	12	--	--	28	--	--	12	--	--
UST and Fuel Pits Area Sites 19B/20B	SW	--	--	--	--	--	--	--	--	--	--	--	--
(includes production well; pumping test; newly	SD	--	--	--	--	--	--	--	--	--	--	--	--
installed wells, 2 deep, 10 shallow; plus 8 existing wells)	SO	--	20	10	10	10	10	10	10	--	10	--	4
Rubble Landfill Site 21B	GW	--	3	3	3	--	--	3	--	--	3	--	--
	SW	--	--	--	--	--	--	--	--	--	--	--	--
	SD	--	--	--	--	--	--	--	--	--	--	--	--
	SO	--	6	6	6	--	--	6	--	--	6	--	--
Old Firefighting Demonstration Area, Site 22B, and	GW	--	--	--	--	--	--	--	--	--	--	--	--
Machine Gun Butt	SW	--	--	--	--	--	--	--	--	--	--	--	--
	SD	--	--	--	--	--	--	--	--	--	--	--	--
	SO	--	--	--	--	4	--	--	44	44	--	3	--
Drainage Ditch Leading to Sandy Creek, Site 23B	GW	--	--	--	--	--	--	--	--	--	--	--	--
Upper Ditch, soil boring 3 samples; Ditch Outfall, and	SW	--	--	--	--	--	--	--	--	--	--	--	--
North Area Ditch Outfall surface soils one sample	SD	--	--	--	--	--	--	--	--	--	--	--	--
each)	SO	--	5	5	5	--	--	5	--	--	5	--	--
Sandy Creek	GW	--	--	--	--	--	--	--	--	--	--	--	--
	SW	--	8	8	8	--	--	8	--	--	8	--	--
	SD	--	8	8	8	--	--	8	--	--	8	--	--
	SO	--	--	--	--	--	--	--	--	--	--	--	--

Table 6-2 (Continued)
Summary of Sampling and Analysis Schedule Recommended For Outlying Landing Field Barin
Phase I Remedial Investigation

Site Inspection Report
OLF Barin, Foley, Alabama

Site	Type of Sample	Chemical Analysis: VOC by GC (Including Xylenes and MTBE)	VOC by GC/MS	SVOCs by GC/MS	Pesti-cides/PCBs	PAHs by HPLC	Petroleum Hydrocarbons	Metals: TAL	Metals: Lead only	Metals: Copper only	Total Cyanide	TCLP: Lead only	TCLP: Complete List
Uncontrolled Dumpsite	GW	–	–	–	–	–	–	–	–	–	–	–	–
	SW	–	–	–	–	–	–	–	–	–	–	–	–
	SD	–	–	–	–	–	–	–	–	–	–	–	–
	SO	–	5	5	5	–	5	5	–	–	5	–	3
Abandoned Wastewater Treatment Plant	GW	–	–	–	–	–	–	–	–	–	–	–	–
	SW	–	–	–	–	–	–	–	–	–	–	–	–
	SD	–	–	–	–	–	–	–	–	–	–	–	–
	SO	–	–	3	3	–	–	3	–	–	–	–	–
Total Installation	GW	39	11	15	15	–	–	31	–	–	15	–	–
	SW	0	8	8	8	–	–	8	–	–	8	–	–
	SD	0	8	8	8	–	–	8	–	–	8	–	–
	SO	0	36	29	37	25	10	37	54	44	26	3	7

Notes:
VOC = Volatile organic chemicals
GC = gas chromatography
MTBE = Methyl tert-butyl ether
GC/MS = Gas chromatography/mass spectrography
PCBs = polychlorinated biphenyls
PAHs = polynuclear aromatic hydrocarbons
HPLC = high performance liquid chromatography
TAL = target analyte list
TCLP = toxicity characteristicsleaching procedure
GW = groundwater
SD = sediments
SO = soil

18 GC samples for VOCs will be analyzed by field GC during the pumping test of the production well

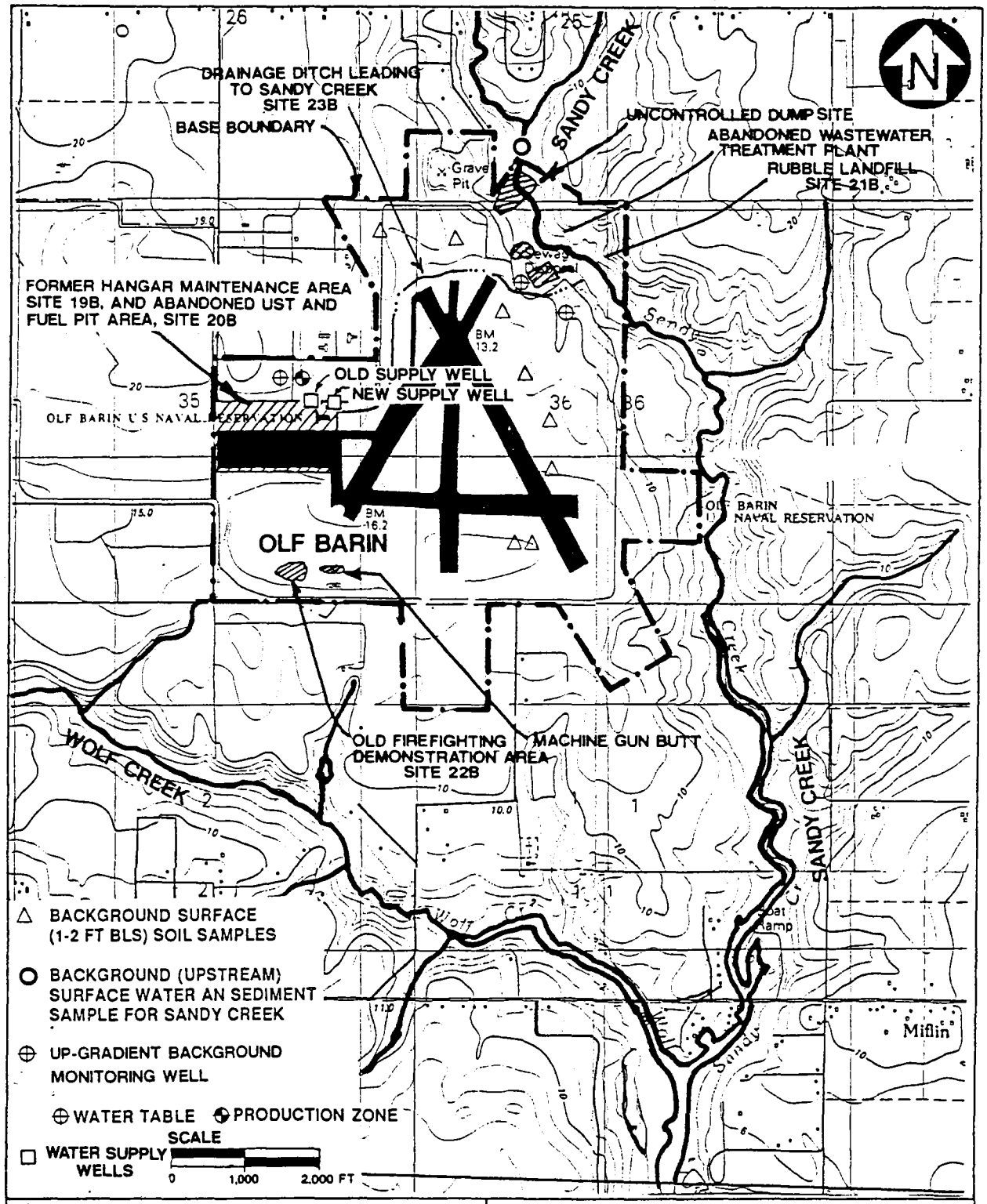

FIGURE 6-2
LOCATION OF INSTALLATION-WIDE RECOMMENDED SAMPLING LOCATIONS

SOURCE: MODIFIED FROM USGS 7.5' QUADRANGLE MAP, FOLEY AL, 1980

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migration in the aquifer, a 72-hour aquifer pumping test is recommended. Gas chromatographic analysis for halocarbon and aromatic VOCs including xylenes and methyl tert-butyl ether should be performed on raw production well water and five selected new monitoring wells (three shallow and two deep) while the test is ongoing. A total of three samples per well will be analyzed as shown in Table 6-2. One sample should be collected at the beginning of pumping, at the end of the pumping of the production well, and after recovery.

6.4 RECOMMENDED SITE 19B, FORMER HANGAR MAINTENANCE AREA, AND SITE 20B, UNDERGROUND STORAGE TANKS (USTs) AND FUEL PITS AREA PROGRAM. Recommended follow-on action at Sites 19B and 20B is required to confirm the status of the sites as a source of groundwater contamination, evaluate the existence of residual soils contamination, and to evaluate any relationship to the mercury observed in groundwater at wells WHF-20B-1 and WHF-20B-2 and to the halocarbons found in the production wells. Investigation at these sites should be coordinated with the UST Removal Action and with explorations of the upper portion of the Drainage Ditch Leading to Sandy Creek, Site 23B (see Section 6.7).

The recommended program for Sites 19B and 20B consists of soil gas explorations, test pit installation, and soil sampling coordinated with the tanks removal action. This should be followed by monitoring well installation and sampling, coordinated with the production well pumping test. Each of the existing eight monitoring wells should be sampled as a component of the groundwater sampling program.

For Sites 19B and 20B, a soil gas survey of up to 100 points (40 in the demolished hangar area, 30 in a quadrant or fuel pits area, and 30 to be decided in the field). At least five of these will be upgradient of Site 19B and five will be along the storm sewer and drainage ditch. On the basis of the soil gas survey, up to 40 test pits will be excavated and up to 20 soil samples collected for analyses. Because of the permeability of the substrate, soil gas sampling and test pit excavation will be conducted directly in suspected source areas. Little lateral spread of soil contaminants is expected in the vadose zone.

Ten water table depth monitoring wells will be installed in the site area based on results of the soil gas survey and test pit observations for confirmation. Two deep monitoring wells will be installed to evaluate contamination in the production zone of the aquifer and to establish vertical gradients.

The recommended well installation method is to install wells through hollow-stem augers. Wells must be screened across the water table to evaluate presence of floating product in the center of the study area. This precludes the use of a drive point system, which has a very short screen. Because of the permeability, jetting in wells would cause unacceptable perturbation of the aquifer and would require a large development effort and treatment of a large volume of waste water. With shallow depths to groundwater, permanent wells installed using a drill rig are likely as cost effective as 10 temporary wells followed by installation or 4 to 6 permanent shallow wells. Because of the slow rate of travel in groundwater (7 feet/year), wells must be located within 5 to 250 feet of sources to evaluate concentration gradients. It is recommended that

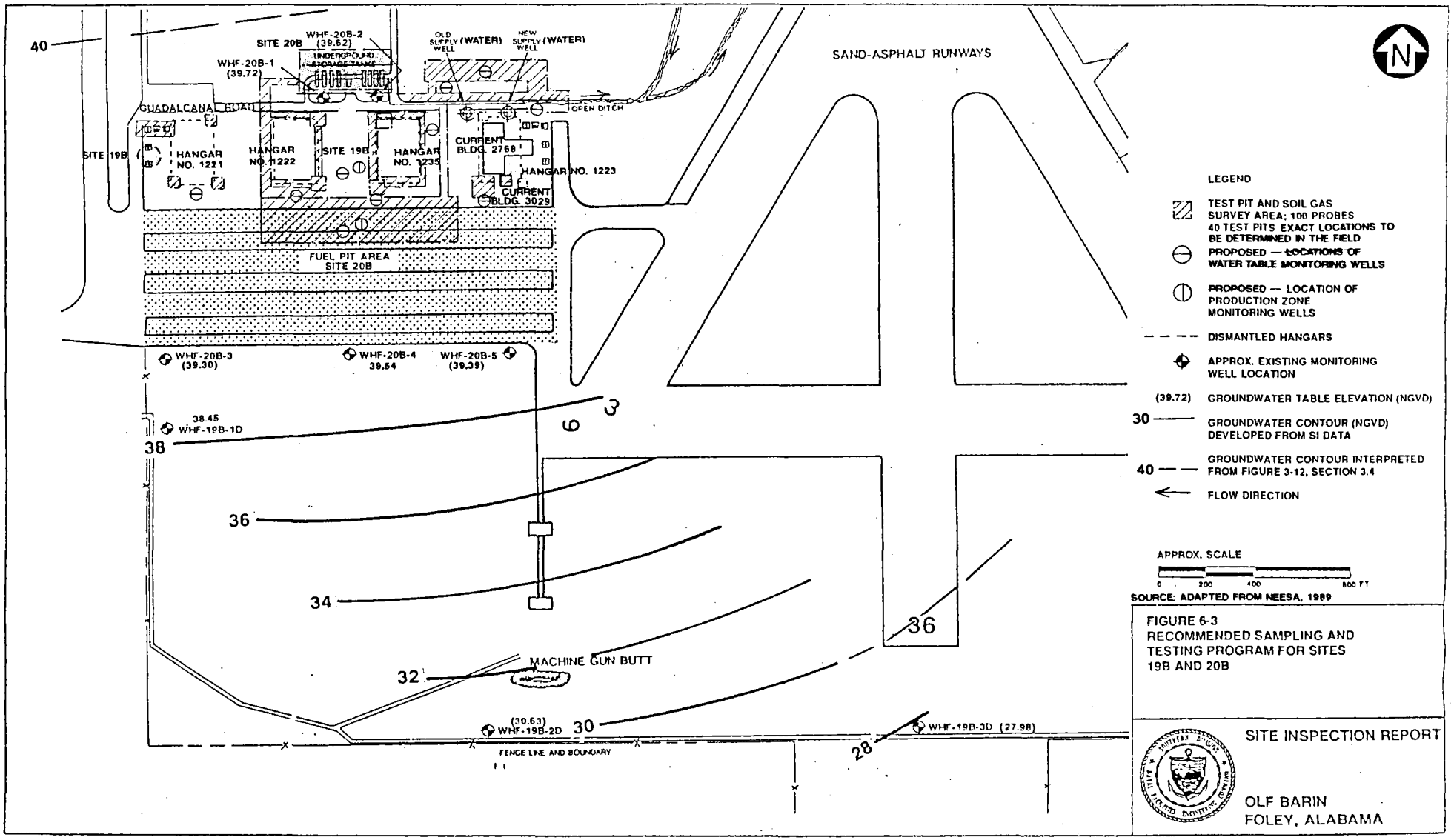
groundwater samples be analyzed for VOCs (by USEPA Methods 601 and 602 including xylenes and methyl tert-butyl ether using GC methodology to detect trace levels of contaminants) inorganics, and if free product is present, for SVOCs also. Eight of the VOC samples will be split and confirmed by GC/MS.

Soil samples from the soil-filled tanks and the vadose zone below the tanks should be analyzed for VOCs, PAHs, lead, and petroleum hydrocarbons under the abandoned fuel tanks and pits and for the complete TCL and TAL under and in the waste oil tanks. The soil from each of the soil-filled waste oil tanks should be tested in accordance with the RCRA Toxicity Characteristics Leaching Procedure (TCLP) to evaluate proper disposal alternatives if not a component of the tanks removal program. Soil gas exploration area, prospective test pit locations, and prospective monitoring well placement are shown in Figure 6-3 and summarized in Table 6-1. The recommended sampling and analysis schedule is tabulated in Table 6-2.

6.5 RECOMMENDED SITE 21B, RUBBLE LANDFILL PROGRAM. The recommended program at the Rubble Landfill consists of an Electromagnetic Induction (EM) and Ground Penetrating Radar (GPR) survey to characterize the nature and extent of the fill area, soils sampling of the floodplain soil downslope from the filled area, and installation and sampling of three water table depth monitoring wells. If the geophysical survey indicates the probable existence of buried wastes, test pits will be excavated to characterize the buried material. During the demolition of OLF Barin it was reported that demolition wastes were also taken to the Baldwin County Landfill located just west of the West Field of OLF Barin. Because of this, the extent of filling at Site 21B needs to be defined. The locations of the soil samples, geophysical explorations, and monitoring wells are depicted in Figure 6-4. It has been assumed that six soil samples will be collected, three from downslope and three from the test pits. The explorations are summarized in Table 6-1. Samples of soil and groundwater will be analyzed for the TCL and TAL parameters is shown in Table 6-2.

6.6 RECOMMENDED SITE 22B, OLD FIREFIGHTING DEMONSTRATION AREA AND MACHINE GUN BUTT PROGRAM. Conclusions related to required follow-on actions at the Old Firefighting Demonstration Area and Machine Gun Butt were presented in Section 5.5.4 and 5.5.5.

For the Old Firefighting Demonstration Area and the Machine Gun Butt area, collection of surface soil samples on a sample grid will be implemented. Historical aerial photographs, either from Naval archives or the U.S. Department of Agriculture Soil Conservation Service, will be reviewed, if available, to attempt to more accurately locate the old Firefighting Demonstration Area. Secondly, the drainage patterns will be carefully evaluated to focus additional surface soil sampling. Tentative grid locations including sampling the marshy area, are shown in Figure 6-5. Samples will be analyzed for lead and copper to assess their potential origin. Two soil borings will be installed to the water table and sampled to evaluate vertical migration. One of these will be in the Old Firefighting Demonstration Area, (Site 22B) the other in the portion of the grid in front of the Machine Gun Butt. Soil samples from the surface, 3 feet BLS, 10 feet BLS, and at the water table, will be collected and analyzed for lead and copper at both locations. The samples from the Site 22B soil column will be



SOURCE: ADAPTED FROM NEESA, 1989

FIGURE 6-3
RECOMMENDED SAMPLING AND TESTING PROGRAM FOR SITES 19B AND 20B

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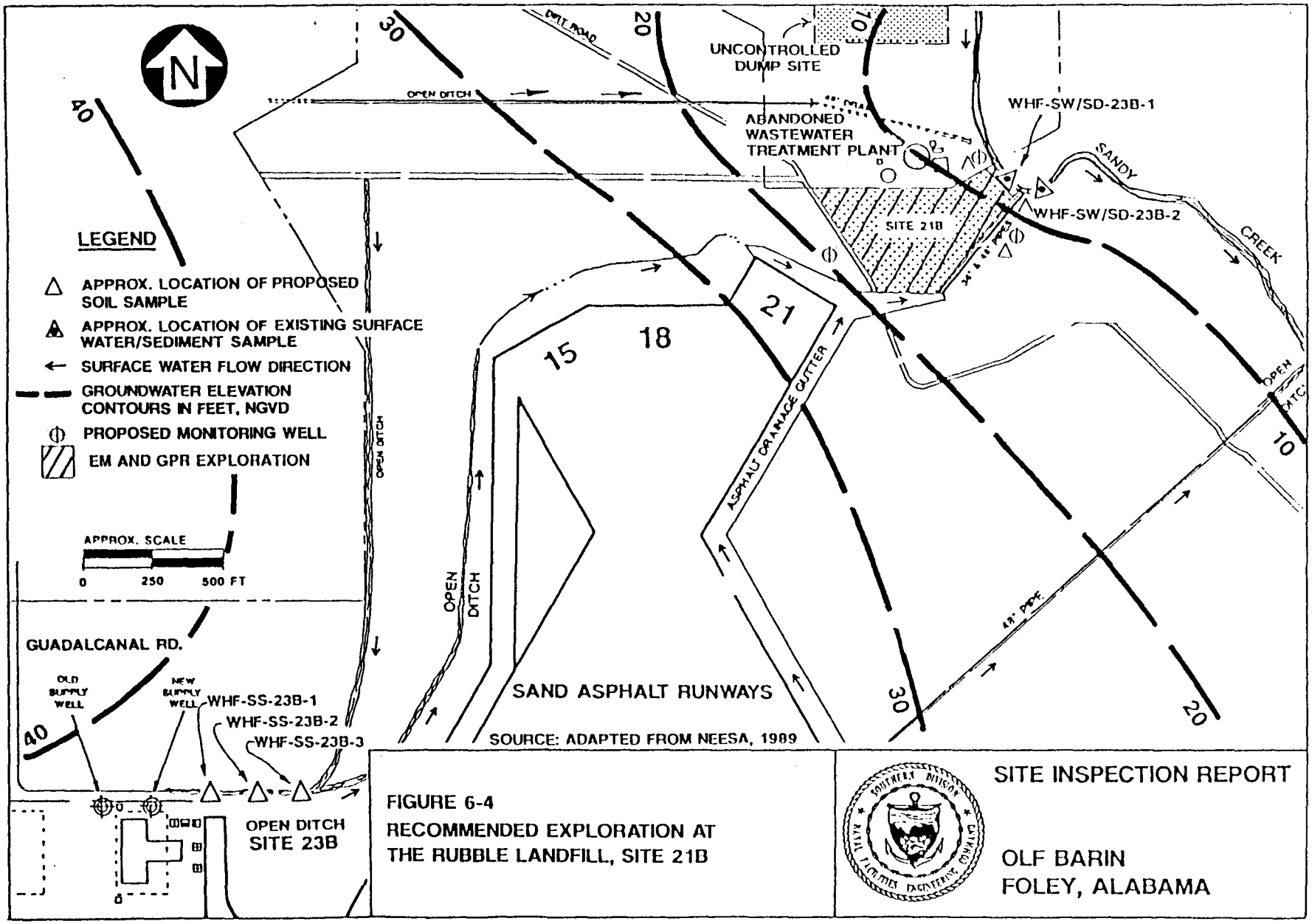

SOURCE: ADAPTED FROM NEESA, 1989

FIGURE 6-4
RECOMMENDED EXPLORATION AT THE RUBBLE LANDFILL, SITE 21B

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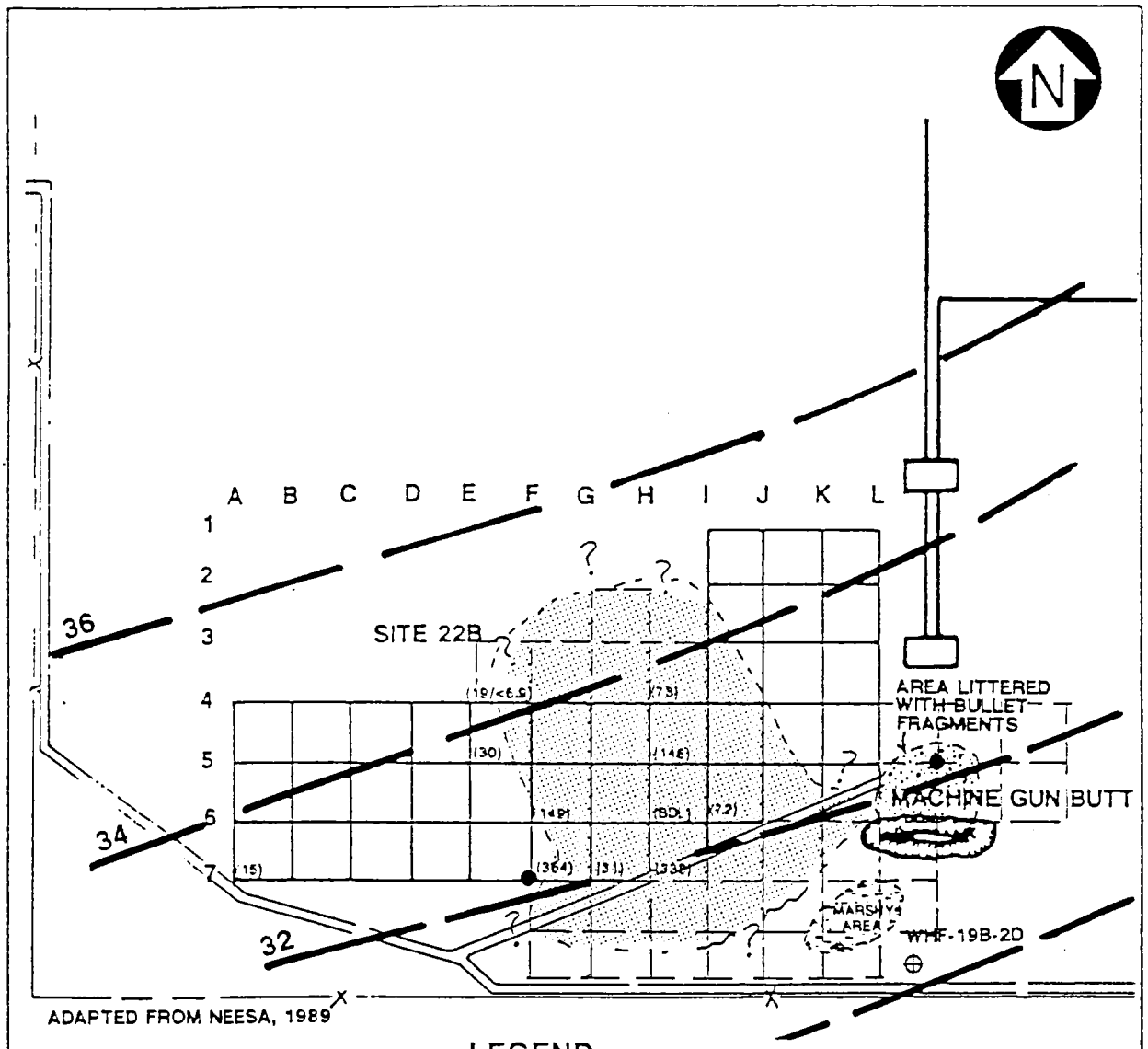

LEGEND

- NEW GRID SECTION SOIL SAMPLING LOCATIONS
- SOIL BORING LOCATION
- SOIL SAMPLING GRID
- (364) LEAD CONCENTRATION (mg/kg)
- MONITORING WELL- EXISTING
- GROUNDWATER CONTOUR LINES IN FEET NGVD
- AREA OF ELEVATED LEAD CONCENTRATION

APPROX. SCALE

0 150 300

FIGURE 6-5
RECOMMENDED SOIL SAMPLING GRID AT OLD FIREFIGHTING DEMONSTRATION AREA AND MACHINE GUN BUTT

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analyzed for PAHs also. To support any interim remedial action requiring soil removal or containment, the TCLP is recommended for leachable lead in surface soils. As shown on Table 6-2, three samples have been recommended. The explorations and sampling and analysis recommended are summarized in Table 6-1 and Table 6-2. The areal extent of bullet-littered soil will be surveyed in order to support a remedial design for controlling lead exposure and migration based on evaluation of the SI and Phase I RI surface soil lead contamination data.

6.7 RECOMMENDED PROGRAM, SITE 23B, DRAINAGE SYSTEM LEADING TO SANDY CREEK. As described in Section 5.6, Site 23B consists of two subsystems, the upper ditch, and Sandy Creek and its flood plain. The upper reach of the drainage ditch is where the 1954 fuel spill migrated and which receives surface runoff and storm sewer discharges from the former hangar and fuel storage areas, Sites 19B and 20B. Sandy Creek and its floodplain receive any contamination migrating onto OLF Barin from upstream or from several sources adjacent to the floodplain. These are: Site 21B, the Rubble Landfill, the Abandoned Wastewater Treatment Plant, and the Uncontrolled Dumpsite.

The recommended sampling program has been based on the conclusions drawn in Section 5.6.4 and from the site descriptions developed in Sections 5.6.5, 5.6.6, and 5.6.7. The program for each site in this system is described in the following paragraphs. Explorations are summarized in Table 6-1, sampling locations are shown in Figure 6-6. The recommended sampling and analysis program is summarized in Table 6-2.

6.7.1 Upper Ditch Soils No lead or PAHs were detected in the upper drainage ditch (see Section 5.6.4); however, due to the potential that enhanced infiltration has driven contaminants below the zone that was sampled, a soil boring to the water table (15 to 20 feet BLS) is recommended at the location of the storm sewer outfall at the end of Guadalcanal Road. Depending on OVA readings and visual observations, up to three soil samples will be collected and analyzed for VOCs, SVOCs, and inorganics. The expanded list is necessary due to the potential for non-AVGAS contaminant migration from Site 19B, the Former Hangar Maintenance Area. These analyses are summarized in Table 6-1. Location of this soil boring is shown in Figure 6-6.

6.7.2 Storm Drainage Ditch Soil Samples A surface soil or sediment sample should be collected from the two storm drainage ditches immediately prior to their discharge to Sandy Creek to evaluate potential migration from Site 19B, Site 20B, the runway areas on OLF Barin, or from the Former North Administration Area. These should be analyzed for the TCL/TAL. Tentative sample locations are shown in Figure 6-6. The explorations and analyses are summarized in Tables 6-1 and 6-2.

6.7.3 Sandy Creek Figure 6-6 depicts the recommended sediment and surface water sampling locations in Sandy Creek. Nine surface sediment and surface water sampling locations are recommended at the following locations:

(1) at the northern installation boundary where Sandy Creek enters OLF Barin,

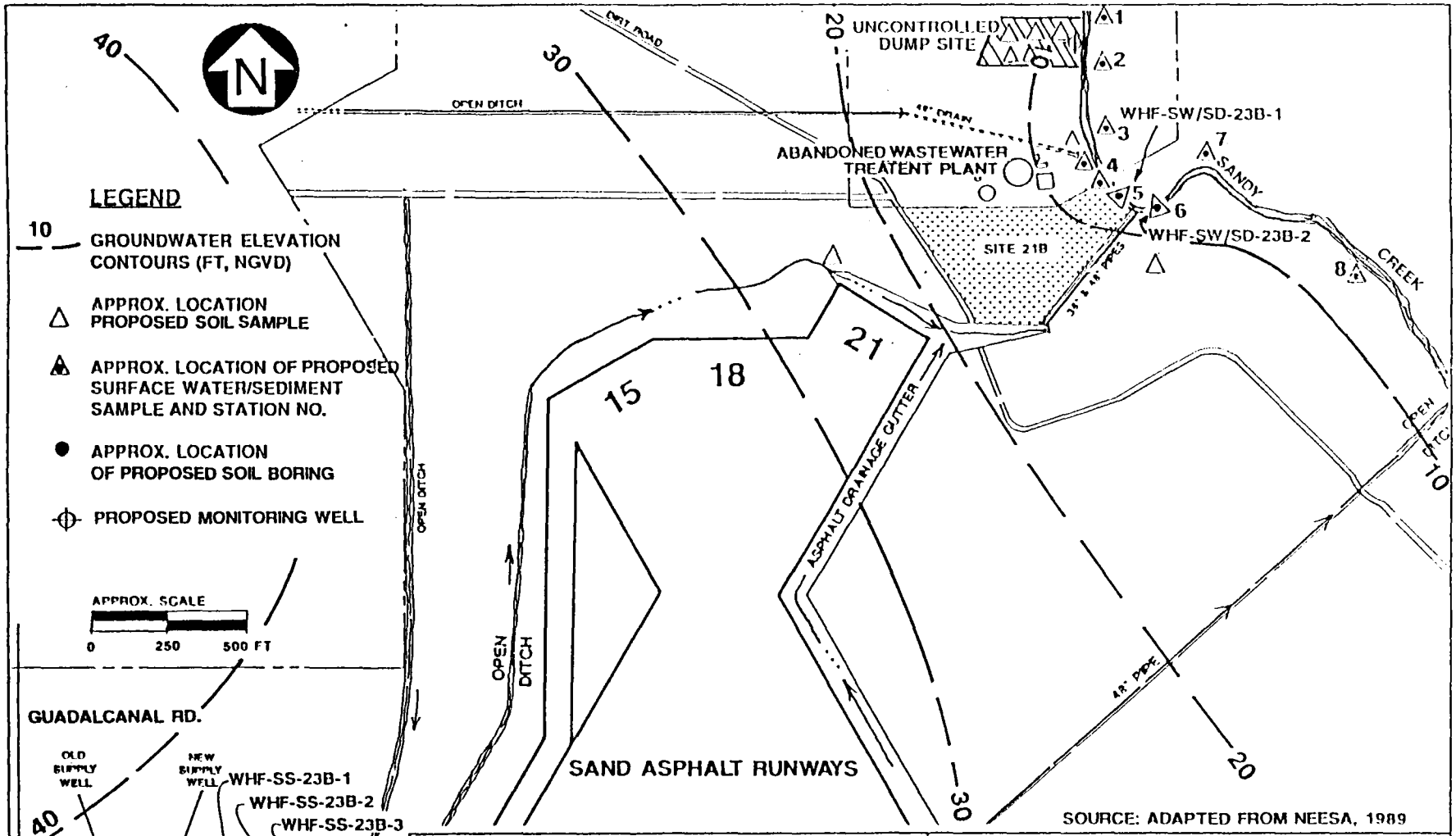

FIGURE 6-6

RECOMMENDED MONITORING WELL, SOIL, SEDIMENT, AND SURFACE WATER SAMPLING LOCATIONS ALONG SANDY CREEK

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(2) downstream of the north area storm drain outfall but upstream of the Uncontrolled Dumpsite,

(3) downstream of the Uncontrolled Dumpsite but upstream of the Abandoned WWTP outfall,

(4) downstream of the Abandoned WWTP Outfall but upstream of the Rubble Landfill and the second storm drain outfall,

(5) at WHF-SSD-23B-1 (resample for confirmation),

(6) at WHF-SSD-23B-2 (resample for confirmation),

(7) 100 feet downstream of the storm drain outfall and WHF-SW/SD-23-2 to evaluate the downstream extent of pesticide and aromatic VOC contamination migration, and

(8) 600 feet downstream of sample (7) to evaluate the downstream migration potential from upstream sources.

Based on the unknown nature of the potential sources of contamination, each of these samples should be analyzed for the complete TCL/TAL. The schedule of samples and analyses are summarized in Table 6-1.

6.7.4 Uncontrolled Dumpsite As previously discussed, a detailed reconnaissance is required at the Uncontrolled Dumpsite as well as restriction of access to prevent further dumping. Depending on the findings, up to five surface soil samples should be collected and analyzed for TCL/TAL parameters appropriate to the suspected nature of the wastes. Three samples are shown to be assessed by the TCLP to support any immediate action. The actual number and types will depend on the reconnaissance. The explorations, samples, and analyses are tabulated in Tables 6-1 and 6-2. Depending on the sampling and analysis findings, an immediate removal design and implementation may be required to control any ongoing or imminent potential contaminant migration to Sandy Creek.

6.7.5 Abandoned Wastewater Treatment Plant The contamination status of the Abandoned Wastewater Treatment Plant has not been assessed. A visual reconnaissance of the site and an evaluation of the sanitary sewer plans and current status is required to assess whether this former operation has potential for significant contamination and contaminant migration to Sandy Creek. The possibility exists for past migration of contaminants from installation support or aircraft maintenance areas to the existing tanks of the WWTP or to the sludge drying beds. Tables 6-1 and 6-2 show an assumed requirement to sample three soil or sludge and sediment samples for non-volatile analytes.

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APPENDIX C

TOXICOLOGICAL PROFILES FOR CHEMICALS OF CONCERN AT OLF BARIN

C.1 CYANIDE.

C.1.1 Introduction Cyanide is a compound that may exist as a gas (e.g., hydrogen cyanide [HCN]) or as a salt (e.g., potassium cyanide [KCN] or sodium cyanide [NaCN]. Most cyanides, with the exception of several metallocyanides, are relatively soluble in water.

C.1.2 Human Toxic Effects

C.1.2.1 **Acute Toxic Effects** Inhalation of 100 ppm HCN for 0.5 to 1 hour has been fatal to humans. Numerous occupational exposures to cyanide have been reported; however, no levels of exposure are available. Exposure to HCN resulted in palpitations, shortness of breath, pain over the heart, vertigo, and involuntary eye movements (Carmelo, 1955), cyanosis, headache, altered electroencephalogram (EEG), and left-sided blindness (Sandberg, 1967). A photographic laboratory worker was exposed to potassium cyanide when a bag of the compound burst in his face. He developed abdominal pain, pallor, and collapsed, but recovered after treatment (Thomas and Brooks, 1970).

When monkeys were exposed to 87 to 196 ppm HCN, severe disruptive changes in respiration and unconsciousness were noted. Tremors, convulsions, loss of equilibrium, dyspnea, nausea, exaggerated intestinal peristalsis, and diarrhea were noted in dogs exposed to 45 ppm HCN for varying durations (USEPA, 1984h).

C.1.2.2 **Chronic Toxic Effects** When rats were exposed by inhalation to HCN at low concentrations, cardiac enzyme changes resulted (O'Flaherty and Thomas, 1982). The previously cited study of monkeys exposed to 87 to 196 ppm HCN from pyrolyzed polyacrylonitrile also found cardiovascular effects, including rapid induction of a semiconscious state and severe disruptive changes in respiration.

Several occupational studies of workers exposed to HCN indicated that exposure resulted in thyroid abnormalities. In a case-control study of electroplating workers exposed to HCN for five to 15 years, 56 percent of the exposed group had enlarged thyroid glands and significantly elevated hemoglobin levels and lymphocyte counts. It should be noted that these workers were also exposed to volatiles, exposure levels varied, and unmatched controls were used (El Ghawabi et al., 1975).

Workers in a silver-reclaiming factory exposed to HCN developed headaches, dizziness, and mild thyroid abnormalities (Blanc et al., 1985).

C.1.2.3 **Reproductive Effects** Numerous studies of orally exposed pregnant animals have found maternal toxicities and developmental abnormalities in the offspring. Pregnant hamsters exposed to cyanide exhibited maternal toxicity at 250 mg/kg and greater. Dose-related abnormalities were found in fetuses examined at 15-days gestation (ATSDR, 1988).

C.1.2.4 **Ambient Water Quality Criteria** The Ambient water quality criterion for protection or human health from the effect or cyanide is 200 $\mu g/\ell$ (USEPA, 1985).

C.1.3 Ecological Effects.

C.1.3.1 **Bioconcentration** Cyanide has been detected in the tissues of fish exposed to rapidly lethal cyanide levels (Murachi et al., 1978 and Holden and Marsden, 1964) but bioconcentration has not been demonstrated (EPA, 1985).

C.1.3.2 **Aquatic Toxicity** The acute toxicity of free cyanide to freshwater species range from 44 $\mu g/\ell$ to 2,490 $\mu g/\ell$ with values above 400 $\mu g/\ell$ being for invertebrates (EPA, 1985). A long-term survival, partial and life-cycle test with fish gave chronic values of 13.6, 7.8 and 16.4 $\mu g/\ell$, respectively, Chronic values for two freshwater invertebrate species were 18 and 34 $\mu g/\ell$ (EPA, 1985).

C.1.3.3 **Standards and Guidelines for the Protection of Aquatic Life** The acute and chronic AWQC values for cyanide for the protection of aquatic life are 5.2 and 22 $\mu g/\ell$, respectively (EPA, 1985).

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C.2 DDT, DDE, DDD.

C.2.1 Introduction From 1946 to 1972, DDT was one of the world's most widely used agricultural insecticides. It was also used extensively for the control of malaria, typhus and other insect transmitted diseases. All U.S. uses of DDT, with the exception of emergency public health uses, were banned in 1973. DDE is a degradation product of DDT and is found as a contaminant in technical grade DDT. DDE is also present in mammalian systems as a DDT metabolite. DDD has been used as a pesticide. The o,p-DDD isomer was used medically for treatment of cancer of the adrenal gland. DDT and its metabolites are virtually ubiquitous and are continually being transformed and redistributed in the environment (ATSDR, 1988).

C.2.2 Human Toxic Effects The symptoms of DDT poisoning are paresthesia and tremor of the extremities, confusion, malaise, headache, and vomiting. A single dose of 10 mg/kg produced illness in some subjects, but no vomiting or convulsions occurred. When the dosage was 16 mg/kg or greater, convulsions occurred frequently. Doses as high as 285 mg/kg have been ingested without fatal results. After absorption in mammals, including man, DDT is degraded to DDE is stored for an indefinite period of time in adipose tissue. The distribution of DDE in the organs usually parallels their fat content. DDE is then converted to DDD. This conversion occurs with considerable latency because the biological half-life of DDE is approximately 8 years. DDD is further metabolized to DDA which is relatively water soluble.

Hayes et al. (1956, 1971) conducted two chronic exposure studies with volunteers given DDT orally. In the first study, volunteers received doses of 0, 3.5, or 35 mg per person daily for up to 18 months. None complained of any symptoms or showed signs of any illness. In the second study, the same doses were ingested for 21.5 months and were observed for an additional 25.5 months with six being followed for 5 years. There was no clinical evidence for adverse effects in any of the volunteers.

The only human data available for DDD are related to its use in the treatment of adrenal cortical carcinoma. Toxic symptoms have been observed in 87% of the patients ingesting DDD. These include nausea, vomiting, CNS depression, and skin rash. The lowest lethal dose reported is 5000 mg/kg.

Morgan and Roan (1973) conducted the only study on chronic DDE administration. They administered one volunteer an oral dose 5 mg per day for 92 days. No abnormalities were detected.

C.2.2.1 Acute Animal Toxicity The LD_{50} values reported in rats exposed to single oral doses of DDT ranged from 113 to 800 mg/kg. The vehicle in which DDT is administered plays a role in its toxicity. DDT is more toxic when administered as a solution in vegetable oil or animal fat than when administered in some petroleum fraction (ATSDR, 1988; Clayton and Clayton, 1982). The oral LD_{50} value for DDE was 113 mg/kg in rats; the values for DDD range from 400 to 4000 mg/kg (ATSDR, 1988). Toxic effects are primarily on the CNS. These include tremors and convulsions. Mild effects are seen in the liver.

C.2.2.2 Chronic Animal Toxicity Subchronic and chronic exposure to DDT results in liver hyperplasia and necrosis. These effects have been reported in rats exposed to 10 to 40 mg/kg/day for 24 to 27 months (Deichmann et al., 1967). Administration of 12 mg/kg/day of DDE for 78 weeks resulted in liver necrosis (NCI, 1978). Kidney necrosis and hemorrhaging were seen in rats given oral doses of up to 10 mg/kg/day for 27 months (Deichmann et al., 1967).

C.2.2.3 Carcinogenic Effects Evidence exists from animal studies to consider DDT, DDE and DDD probable human carcinogens. Doses as low as 0.26 mg DDT/kg/day, produced liver tumors, primarily hepatomas in many strains of mice (Innes et al., 1969; Thorpe and Walker, 1973; Tomatis et al., 1972). Pulmonary adenomas occurred in mice at doses of 1.3 to 32.5 mg DDT/kg/day and malignant lymphomas occurred in mice exposed to 10 mg DDT/kg/day for 80 weeks (Kayshap et al., 1977; Shabad et al., 1973). Liver tumors occurred in rats given doses of 6.25 to 42 mg DDT/kg/day for 120 weeks and adrenal tumors occurred in hamsters given 83 mg DDT/kg/day for 120 weeks (Cabral et al., 1982; Rossi et al.,1983).

DDD caused thyroid tumors in rats fed 1647 to 3294 ppm (NCI, 1978). Liver tumors were induced in mice fed 148-261 ppm DDE and hamsters fed 500-1000 ppm DDE (Rossi et al., 1983; Tomatis et al., 1974)

C.2.2.4 Mutagenic Effects DDT, DDE, and DDD have given negative results in in vitro bacterial tests, however, in nonhuman test systems, chromosomal damage was observed after in vitro and in vivo exposures (ATSDR, 1988). Rebello et al. (1975) reported a significant increase in chromosome damage in workers occupationally exposed to DDT.

C.2.2.5 Reproductive and Teratogenic Effects Both DDT and DDE exhibit estrogenic activity as evidenced by uterotrophic effects. Intermediate oral exposure to DDT (25-50 mg/kg/day) in experimental animals has been shown to produce developmental effects such as infertility and slow development. DDT exposure of intermediate duration (15 days to one year) produced several adverse reproductive effects including a decrease in the frequency of implanted ova and decreases in ovary and testes weights. Reproductive effects were also reported for chronic or multigeneration exposures. These included stillbirths, delayed estrus and lack of mammary gland development in dogs exposed to 12 mg/kg/day for 14 months (ATSDR, 1988).

C.2.2.6 Standards and Guidelines for the Protection of Human Health USEPA has classified DDT, DDE, and DDD as Group B2 carcinogens. The OSHA PEL for DDT is 1.0 mg/m^3 as an 8 hour TWA. ACGIH has the same TLV. The carcinogenic slope factor for DDD and DDT are $2.4x10^{-1}$ and $3.4x10^{-1}$, respectively (IRIS, January 1991). The oral chronic RfD for DDT is $5.0x10^{-4}$ mg/kg/day (IRIS, January 1991).

C.2.3 Ecological Effects

C.2.3.1 Bioavailability For aquatic plants, reported bioconcentration factors for DDT range from 495 for soft-stem bullrush to 21,580 for *Cladophora* sp. (USEPA, 1980). Phytoplankton may concentrate DDT residues to as much as 270 times the water concentration (Vance and Drummond, 1969).

Reported bioconcentration factors for DDT taken up from water by invertebrates range from 1,947 for the crayfish (*Procambarus allenia*) to 12,500 for clams (a composite of five species) (USEPA, 1980).

For chemical compounds with long half-lives (such as DDT), the use of laboratory BCFs (kinetic or steady state) underestimates residues in fish tissues in the field (Oliver and Nimi, 1985). High field BCFs indicate that the rate of uptake of the chemical by the fish exceeds its ability to eliminate the chemical. It is further suggested that the higher field BCFs indicate that the primary route of fish exposure for DDT is consumption of contaminated food (Oliver and Nimi, 1985).

Reported laboratory-derived BCFs for 22 freshwater fish species as reported by USEPA for use in derivation of water quality criteria range up to 4.43×10^6 for the bloater (*Coregonus hoyi*). The geometric mean of lipid-normalized bioconcentration factors for DDT (the BCF value divided by the percent lipid value for the same species) for freshwater and saltwater aquatic life is 17,870. The reported ratio for field derived BCF values to laboratory-derived BCF values for DDE is 220.

C.2.3.2 **Aquatic Toxicity** Toxicity information is available for four species of aquatic plants (USEPA, 1980). Sensitivity varies by a factor 2,700, with the lowest value of 0.3 $\mu g/\ell$ DDT inhibiting growth and disrupting morphologic characteristics in the alga, *Chlorella* sp. (Sodergren, 1968).

Acute toxicity information for DDT and its metabolites is available for 18 fresh water invertebrates (USEPA, 1980). Acute toxicity (as LC_{50} values) ranged from 0.18 $\mu g/\ell$ for the crayfish (*Orconectes nais*) to 1,800 $\mu g/\ell$ for stonefly larvae (*Pteronarcys californiaca*). Chronic toxicity test values are not available for aquatic invertebrates.

Acute toxicity information (96hr LC_{50}s) is available for 24 freshwater fish species (USEPA, 1980). Sensitivities to DDT ranged from 0.6 $\mu g/\ell$ for the yellow perch (*Perca flavescens*) to 180 $\mu g/\ell$ for the goldfish (*Carassius auratus*) (USEPA, 1980).

Chronic toxicity values for DDT are available for only one freshwater fish species, the fathead minnow (*Pimephales promelas*), 0.74 $\mu g/\ell$ (Jarvinen et al., 1977).

Additional information is available regarding DDT concentrations that result in physiological or behavioral effects for fish (USEPA, 1980). The lowest reported concentration is DDT that caused adverse physiological or behavioral effects was 0.008 $\mu g/\ell$ for hyperactive locomotor response observed in the bluegill (*Lepomis macrochirus*) (Ellgaard et al., 1977).

Tissue residues of DDT in fish are associated with impaired reproduction and biochemical effects. These effects occur at concentrations as low as 2.75 mg/kg (Campbell et al., 1974).

C.2.3.3 Standards and Guidelines for the Protection of Aquatic Life

Surface Water. For DDT and its metabolites the criterion to protect freshwater aquatic life as derived using current USEPA guidelines is 0.0010 $\mu g/\ell$ as a 24-hour average and the concentration should not exceed 1.1 $\mu g/\ell$ at any time (USEPA, 1980).

The 0.0010 $\mu g/\ell$ criteria value for DDT is a final residue protective of wildlife that consume aquatic organisms.

Sediments. For DDT the mean Sediment Quality Criteria is 0.828 $\mu g/gC$ with 95 percent confidence limits of 0.183 $\mu g/gC$ and 3.80 $\mu g/gC$ (gC = gram of organic carbon) (USEPA, 1988).

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C.3 DIELDRIN.

C.3.1 Introduction Dieldrin is an insecticide first used by cotton growers in the 1950's. It was subsequently used to control various vector-borne diseases, and for mothproofing woolen goods. In 1974, the registration of products containing dieldrin was canceled due to evidence of its toxicity (Clayton and Clayton, 1981).

C.3.2 Human Toxic Effects

C.3.2.1 Acute Toxic Effects Dieldrin is acutely toxic by both inhalation and ingestion routes of exposure. Several human fatalities have resulted from drinking emulsions or solutions of dieldrin. Nonlethal doses have produced convulsions with loss of consciousness. Symptoms of acute dieldrin poisoning appeared weeks or months after the last exposure (Klaasen et al., 1986). Following inhalation exposure, dieldrin is readily absorbed through the gastrointestinal and respiratory tracts. In man, overdoses have produced headache, vertigo, nausea, and vomiting, followed occasionally by muscle twitchings and convulsions (Clayton and Clayton, 1981).

C.3.2.2 Chronic Toxic Effects Tests conducted on workers exposed during the manufacture of dieldrin from 1954 to 1968 revealed no abnormalities (Clayton and Clayton, 1981). Chronic exposure in experimental animals resulted in histologic changes in the liver (Klaasen et al., 1986).

C.3.2.3 Carcinogenic Effects There are conflicting reports of dieldrin's carcinogenicity in laboratory animals. Deichmann and MacDonald found that overall tumor incidence in rats fed dieldrin was lower than in controls (Deichmann and MacDonald, 1971). However, a later study conducted by the National Cancer Institute (NCI) found a significant increase in hepatocellular cancers in male mice (NCI, 1978c). A working group of the IARC concluded that dieldrin is hepatocarcinogenic in mice (IARC, 1974). USEPA has classified dieldrin as a B2 carcinogen.

C.3.2.4 Mutagenic Effects Dieldrin was not found to be mutagenic in bacteria. Studies of mouse and Chinese Hamster cells treated with dieldrin revealed no chromosomal aberrations. Blood cells of workers exposed to dieldrin also did not show any chromosomal damage (Clayton and Clayton, 1981).

C.3.2.5 Standards and Guidelines for the Protection of Human Health Dieldrin is classified as a class B2 carcinogen with a carcinogenic slope factor of 16 (IRIS, January 1991). The chronic RfD for dieldrin is 5.0×10^{-5} (IRIS, January 1991).

C.3.3 Ecological Effects

C.3.3.1 Standards and Guidelines for the Protection of Aquatic Life The AWQC for the protection of freshwater aquatic life from acute and chronic effects are 1.0 $\mu g/\ell$ and 0.0019 $\mu g/\ell$, respectively (EPA, 1986).

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C.4 ETHYLBENZENE.

C.4.1 Introduction Ethylbenzene is a volatile aromatic compound with a high log K_{ow}, indicating that it adsorbs onto organic particles in the soil, slowing its transport to groundwater and surface water. Small amounts of ethylbenzene can leach into groundwater from soil (especially sandy soil) and may biodegrade in subsurface soils. The half-life of ethylbenzene in air is 35 hours; in water, it is approximately 1.5 to 7.5 days. The primary loss mechanisms from the soil surface is expected to be evaporation (USEPA, 1980).

C.4.2 Human Toxic Effects Bardodej and Bardodejava (1970) reported no toxic effects in volunteers after inhalation exposure to 100-ppm ethylbenzene for 8 hours. Their exposure to an increased concentration of ethylbenzene resulted in fatigue, headache, and mild eye and respiratory irritation.

C.4.2.1 **Acute Animal Toxicity** Acute LD_{50} values of 3.5 to 5.46 g/kg were reported in rats. Toxic effects were observed predominantly in the liver, kidney, and central nervous system (USEPA, 1987).

C.4.2.2 **Chronic Animal Toxicity** Liver and kidney effects were observed in rats given oral doses of 408 or 680 mg/kg/day in olive oil for 6 months. No effects were observed at doses of 13.6 and 136 mg/kg/day (Wolf et al.,1956).

C.4.2.3 **Carcinogenic Effects** Ethylbenzene has not been evaluated for carcinogenicity. The National Toxicology Program has plans to initiate a bioassay.

C.4.2.4 **Mutagenic Effects** Ethylbenzene has not induced mutagenic effects in bacteria, gene conversion in yeast or chromosome damage in rat liver epithelial cells (USEPA, 1987).

C.4.2.5 **Reproductive and Teratogenic Effects** Ethylbenzene did not elicit embryotoxicity, fetotoxicity or teratogenicity in inhalation studies at concentrations of up to 1000 ppm in rats and rabbits exposed for 6 to 7 hours daily on days 1 to 19 and 1 to 24 of gestation, respectively (Hardin et al., 1981).

C.4.2.6 **Standards and Guidelines for the Protection of Human Health** USEPA has classified ethylbenzene as a Class D carcinogen. The ACGIH TLV of 100 ppm for ethylbenzene was set to protect against its irritant effects. OSHA has established a PEL of 100 ppm and a STEL of 125 ppm. USEPA has proposed a drinking water MCL and MCLG of 700 $\mu g/\ell$ and an SMCL of 30 $\mu g/\ell$.

C.4.3 Ecological Effects

C.4.3.1 **Bioavailability** Information is not available on the bioconcentration of ethylbenzene by aquatic organisms.

C.4.3.2 **Aquatic Toxicity** The acute toxicity of ethylbenzene for 7 species of freshwater fish range from 14,000 $\mu g/\ell$ for rainbow trout (Johnson & Finley, 1980) to 425,000 $\mu g/\ell$ for channel catfish (Johnson & Finley, 1980). Chronic toxicity information is not available.

C.4.3.3 Standards and Guidelines for the Protection of Aquatic Life There is not currently enough information available to derive AWQC for ethylbenzene. The lowest acute EC_{50} for ethylbenzene is 32,000 $\mu g/\ell$ (USEPA, 1986).

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C.5 LEAD.

C.5.1 Introduction Lead is a toxic heavy metal used in batteries, paint and pesticides, and as a gasoline additive. Lead is not very mobile in the environment and can form insoluble compounds. Lead particles are removed from the atmosphere primarily by deposition, with an average residence time of 7 to 30 days. Long-range transport of lead in the atmosphere occurs to thousands of kilometers. Lead is extremely persistent in both water and soil.

C.5.2 Human Toxic Effects Because of decades of medical observation and scientific research on lead, the degree of uncertainty about the health effects of lead is quite low. It appears that some of the observed health effects (e.g., changes in the levels of specific blood enzymes and changes in children's neurological development) may occur at blood lead levels so low as to be essentially without a threshold. There is evidence that exposure to lead can cause renal toxicity, CNS depressions, and hemolytic effects.

IARC (1982) concluded that there is inadequate evidence that lead and lead compounds cause cancer in humans. Epidemiology studies conducted on lead smelter workers have found significant excesses of respiratory and digestive cancers; however, the workers were exposed to a number of toxic compounds, thereby preventing the establishment of a causal relationship. An insignificant increase in skin cancers has been noted in workers exposed to tetraethyl lead (IARC, 1982).

Toxic effects resulting from chronic lead exposure are well-documented and many have been associated with accompanying blood-lead (PbB) levels. Children have been found to develop symptoms at lower (PbB) levels than adults. The most serious effects associated with lead intoxication are the neurotoxic effects. Lead encephalopathy can result from blood lead levels greater than 100 μg/100 ml and is characterized by irritability, loss of memory and ability to concentrate, delirium, hallucinations, cerebral edema, and coma (USEPA, 1980). Less severe neurotic effects have been observed at lower (PbB) levels. For example, lowered nerve conduction velocities, indicative of peripheral nerve dysfunction, have been noted in adults at PbB levels of 30 to 40 μg/100 ml (USEPA, 1985).

Hematologic effects appear to be among the most sensitive indicators of lead absorption. Lead interference with heme synthesis has been noted in humans and other mammalian species at levels below 10 to 15 μg/100 ml. The step most sensitive to lead in the heme synthetic is that mediated by the enzyme &-aminolevulinic acid dehydratase (&-ALAD). (The health significance of &-ALAD inhibition at low PbB levels is unclear.) Lead can also lead to the accumulation of porphyrin in erythrocytes with elevated levels of erythrocyte protoporphyrin associated with PbB levels of 25 to 30 μg/100 ml in adults and 15 μg/100 ml in children (USEPA, 1985). Anemia is characteristic of more severe cases of lead poisoning, resulting from erythrocyte destruction and reduced hemoglobin syntheses (USEPA, 1977).

Renal toxicity has also been observed in victims of lead intoxication. Reversible proximal tubule damage has been observed primarily in cases of short-term exposure with reduced glomerular function associated with more chronic exposures (USEPA, 1980). There is also evidence that lead affects other systems of the body. The GI system is one of the earliest to show symptoms of lead

intoxication; colic (i.e., acute abdominal pain) is considered a consistent early symptom of lead poisoning. Colic is most often seen in cases of occupational lead exposure and has been reported in workers with PbB levels as low as 30 μg/100 ml (USEPA, 1983).

Recently, environmental epidemiological studies have produced results suggestive of possible lead-induced reproductive effects. The authors of one study of women living within a 30- to 50-mile radius of a lead mining area of Missouri reported an increased incidence of premature fetal membrane rupture in term and preterm infants (17 percent), as compared to the rate reported for women living in an urban area of Missouri (0.44 percent). It was also reported that average maternal and fetal PbB levels in cases of membrane rupture were significantly higher than the average levels found for normal deliveries (USEPA, 1980).

C.5.2.1 Acute Animal Toxicity The early signs of acute lead intoxication are fatigue and sleep disturbances followed by colic, anemia, and neuritis. When lead is attached to moieties such as arsenate and chromate, which have contributory toxicities, the acute toxicity for laboratory animals increases. When lead is combined with organic acids, as in oleate and naphthenate, acute toxicity is lowered (Clayton and Clayton, 1981).

C.5.2.2 Chronic Animal Toxicity Kopp et al. (1980) reported that administration of lead acetate (5 mg Pb/ℓ water) to female Long-Evans rats for 20 months produced slight effects on conduction tissue excitability, systolic blood pressure and cardiac ATP concentrations. This represents the lowest concentration at which chronic exposure to lead in drinking water or diet has been demonstrated to cause adverse effects.

C.5.2.3 Carcinogenic Effects Rats appear to be the most sensitive species for lead-induced carcinogenic effects. Mice appear to be less sensitive and hamsters appear to be insensitive. Azar et al. (1973) exposed rats to 0 to 2000 ppm lead acetate in the diet for 2 years and found a statistically significant increase in kidney tumors at levels of 500 to 2000 ppm. No kidney tumors were found at dietary levels of 100 ppm or lower. Renal carcinoma was found in 7 of 25 mice exposed to 0.1 percent lead subacetate in the diet. Substantial death was reported at the 1.0 percent level. Hamsters exposed to 0.5 or 1.0 percent in the diet experienced no significant increase in renal neoplasms (Van Esch and Kroes, 1969).

C.5.2.4 Mutagenic Effects Mutagenicity tests of lead acetate, lead nitrate and lead chloride in microbial systems have consistently given negative results. Conflicting results were obtained for <u>in vitro</u> and <u>in vivo</u> mammalian test systems (ATSDR, 1988).

A number of studies that involved cytogenetic investigations of the cells of lead-exposed workers have reported an increased incidence of chromosomal aberration. The results are conflicting, however, as a number of similar studies reported negative results (IARC, 1982).

C.5.2.5 Reproductive and Teratogenic Effects Numerous oral teratogenicity studies in rats and mice have provided no evidence that oral exposure to lead causes malformations (ATSDR, 1988). Testicular damage was seen in male rats treated orally with lead acetate at 100 ug per day (0.29 mg/kg/day Pb) for 30

days (Hilderbrand et al., 1973). Grant et al. (1980) reported delayed vaginal opening in rats that were exposed to 25, 50 or 100 ppm lead (as lead acetate) in drinking water indirectly through their dams during gestation and lactation and then directly. This effect was not seen at 25 ppm.

C.5.2.6 Standards and Guidelines for the Protection of Human Health USEPA has classified lead as a B2 carcinogen. Under the National Primary Drinking Water Regulations, the MCL for lead is 50 $\mu g/\ell$. The proposed MCL is 20 $\mu g/\ell$. The proposed MCLG is zero. OSHA has a PEL of 50 $\mu g/m^3$ averaged over an 8-hour period. The ACGIH has established a TLV of 0.15 mg/m^3 and a STEL of 0.45 mg/m^3 for "inorganic compounds, dust and fume, as Pb." No cancer slope factor has been developed for lead.

In the presence of adequate and appropriate population characterization data and exposure data, site-specific quantitative risks assessment for lead is developed rising a biokinetic uptake model for predicting blood lead levels. In the absence of adequate data USEPA has set interim draft guidance for actio levels for lead in soils at 500 ppm for residential saturations and up to 1,000 ppm for industrial areas USEPA, 1989.

C.5.3 Ecological Effects

C.5.3.1 Bioconcentration Bioconcentration factors for four invertebrate species and two fish species range from 42 to 1,700 (EPA, 1986).

C.5.3.2 Aquatic Toxicity The toxicity of lead to freshwater aquatic organisms decreases with increasing water hardness. At a hardness of 50 mg/ℓ as CaCO3 acute toxicity values (LC_{50}s) for 10 species range from 143 $\mu g/\ell$ for an amphipod to 235,900 $\mu g/\ell$ for a midge (EPA, 1986). Chronic toxicity values for a cladoceran exposed to lead are 12 and 128 $\mu g/\ell$ in soft and hard water, respectively (EPA, 1986).

C.5.3.3 Standards and Guidelines for the Protection of Aquatic Life The AWQC for lead are hardness dependant. At hardnesses of 50, 100 and 200 mg/ℓ as CaCO3, respectively, the acute AWQC values for the protection of aquatic life are 34, 82 and 200 $\mu g/\ell$. The respective chronic values are 1.3, 3.2 and 7.7 $\mu g/\ell$ (EPA 1986).

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C.6 MERCURY.

C.6.1 Introduction Mercury ore is found in limestone, calcareous shales, sandstone, and serpentine. Mercury is most commonly used in electrical apparatus and as a catalyst in polyurethane foams. Organomercuric compounds are used as fungicides. Mercury forms organic compounds that are toxicologically and environmentally significant, particularly methyl mercury, and to a lesser extent, phenyl mercury (USEPA, 1984a).

The mobility of mercury in the soil is minimal. Mercury is strongly bound to soil and therefore the possibility of groundwater contamination through soil leaching appears unlikely. The major removal mechanism from a natural water system is absorption onto the surfaces of particulates and settling to the bed sediment (Callahan et al., 1979). Mercury is present in trace amounts in the atmosphere as elemental mercury vapor from electrical and chlor-alkali industries and the burning of fossil fuels (USEPA, 1984a). The residence time of this form of mercury in the atmosphere is on the order of months, possibly years.

C.6.2 Human Toxic Effects Mercury enters the body primarily through respiratory and oral exposures. Approximately 80 percent of inhaled elemental mercury is retained and transported to the tissues of the body. Most dietary inorganic mercurials dissociate to divalent mercury in the gastrointestinal tract which results in poor absorption while absorption rates of greater than 90 percent have been observed for lipophilic mercurials such as methyl mercury which is the most important form in terms of toxicity (USEPA, 1984a).

Although mercury becomes widely distributed in the body, it tends to concentrate in specific areas. Both inorganic and organic mercury usually concentrate primarily in the kidneys (Magos, 1973) with the liver, blood, spleen, and thyroid containing appreciable amounts (Nordberg and Skerfving, 1972).

Acute ingestion of high levels of mercuric mercury causes severe abdominal cramps due to corrosive ulceration, bleeding, and necrosis of the gastrointestinal tract, accompanied by shock and circulatory collapse. If death does not occur, renal failure occurs due to necroses of the renal tubules leading to anuria and uremia. Not all renal damage is irreversible.

Occupational studies have demonstrated that chronic exposure to metallic mercury vapor primarily affects the central nervous system and the kidneys. Nonspecific effects associated with the lowest exposure levels (<100 ug mercury/m^3) include insomnia, anxiety, and biochemical alterations. Exposure to higher levels can result in memory loss, personality changes, and body tremors, and damage to lung tissue has been reported for exposures >1 mg mercury/m^3. Workers chronically exposed to inorganic mercury compounds have reduced nerve conduction velocities (Singer et al., 1987).

The diet is by far the dominant, if not sole, source of human exposure to methyl mercury. Methyl mercury compounds are known to be toxic via oral exposures, and prenatal and newborn infants are particularly susceptible. Subchronic methyl mercury poisoning has occurred in humans consuming contaminated fish from Minamata Bay in Japan. The median level of total mercury in fish caught in Minamata Bay during this period was estimated to be about 11 mg/kg fresh weight (Klaasen et al., 1986). Methyl mercury poisoning also occurred from ingesting

bread produced from seed grain dressed with methyl mercury fungicide. Nerve damage causing "pins and needles" sensations in the hands and feet occurred at an estimated body burden of 25 mg of methyl mercury (Bakir et al., 1973).

C.6.2.1 Acute Animal Toxicity Exposure of rabbits to mercury vapor for four hours at an average concentration of 28.8 mg/m^3 produced severe damage to kidneys, liver, brain, heart and lungs (USEPA, 1984b).

C.6.2.2 Chronic Animal Toxicity Rats exposed for up to 12 weeks to mercuric chloride by subcutaneous injection displayed kidney damage and proteinuria (Druet et al., 1978). Fitzhugh et al. (1950) administered dietary mercury acetate to rats for up to two years. Kidney changes were noted at the two highest dose levels (2.0 and 8.0 mg/kg).

C.6.2.3 Carcinogenic Effects No confirmed, positive reports of mercury carcinogenicity in man have appeared to date, and animal experiments have generally yielded negative results (Leonard et al., 1983; USEPA, 1984a). Mitsumori et al. (1981) and, from the same laboratory, Hirano et al. (1986) reported that methyl mercury chloride in the diet at 0.9 mg/kg/day or more for up to 98 weeks caused renal tumors in ICR male mice but not in female mice nor in Sprague-Dawley rats (Mitsumori et al, 1984). These studies lack confirmation from another laboratory.

C.6.2.4 Mutagenic Effects Methyl mercury and mercury chloride are associated with increased mutations as measured by sister chromatid exchange in vitro. This effect was antagonized by sodium selenite (Morimoto et al., 1986). A recent study of eskimos has indicated a correlation between mercury in the blood and mutagenic effects as measured by sister chromatid exchange (Wulf et al., 1986). Cantoni and Costa (1983) have presented data suggesting that the genotoxic effects of mercury are related to inhibition of DNA repair rather than direct interaction with the DNA.

C.6.2.5 Reproductive and Teratogenic Effects Baranski and Szymczyk (1973) exposed female rats for 21 days to 2.5 mg elemental mercury/m^3. They noted changes in the estrus cycle and CNS symptoms. Prenatally exposed rats displayed high mortality, but no teratogenic effects were observed. Increased abortions have been observed in monkeys given 0.5 mg methyl mercury chloride/kg body weight orally during pregnancy (Dougherty et al., 1974).

C.6.2.6 Standards and Guidelines for the Protection of Human Health USEPA classifies inorganic mercury as a Group D compound. Methyl mercury has not been evaluated for its carcinogenic potential. The American Conference for Governmental and Industrial Hygienists has a time-weighted-average threshold limit value for mercury vapor and inorganic mercury of 50 and 100 $\mu g/m^3$, respectively. Under the National Primary Drinking Water Regulations, the MCL for mercury is 2 $\mu g/\ell$. The proposed MCLG is 2 $\mu g/\ell$. An RfD for methyl mercury has been set at 3×10^{-4} mg/kg/dry, IRIS, 1991.

C.6.3 Ecological Effects

C.6.3.1 Bioavailability Mercury accumulated in freshwater fish flesh is predominantly in the form of methylmercury compounds (Goldwater and Clarkson, 1972). Bioconcentration factors (BCFs) determined under laboratory conditions for freshwater fish and invertebrates for methylmercury range from 10,000 to 85,7000 (USEPA, 1985).

C.6.3.2 Aquatic Toxicity Available information for various organomercury compounds and mercurous nitrate indicates that these compounds are 4 to 31 times more accurately toxic to aquatic organisms than inorganic mercury (USEPA, 1985). Acute toxicity information is available for 28 freshwater invertebrate and fish genera with the cladoceran *Daphnia magna* and rainbow trout being the most sensitive organisms tested (USEPA, 1985). Methylmercury is the most chronically toxic of the tested mercury compounds. Chronic toxicity testing of methylmercury with *Daphnia magna* and brook trout resulted in values less than 0.07 $\mu g/\ell$ while testing with mercury (II) with *D. magna* resulted in values of about 1.1 $\mu g/\ell$ (USEPA, 1985).

Sublethal effects of mercury on aquatic organisms include adverse effects on reproduction, growth, behavior, metabolism, blood chemistry, osmoregulation and oxygen exchange of freshwater fish (Eisler, 1987).

Accumulated tissue levels of 5-7 mg Hg/kg as methylmercury were associated with death in the brook trout (*Salvelinus fontinalis*) (McKim et al., 1976) while 20 to 30 mg/kg as methylmercury were associated with reduced appetite, loss of equilibrium and hyperplasia of gill epithelium in the rainbow trout (*Salmo gairdneri*) (Nimi and Lowe-Jinde, 1984).

Aquatic plants are not as sensitive as aquatic invertebrates or fish to mercury. The blue alga *Microcystiis aeruginosa* was the most sensitive of the algae tested with an 8-day incipient inhibition level of 5 $\mu g/\ell$ of mercury (II). Other toxicity values for algae exposed to mercury (II) range from 53 to 3,400 $\mu g/\ell$ (EPA, 1985). Methylmercury is more toxic to algae than mercury (II) with toxicity values ranging from 0.8 to 6.0 $\mu g/\ell$ (EPA, 1985).

C.6.3.3 Standards and Guidelines for the Protection of Aquatic Life Application of the procedures described in the "Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses" (USEPA, 1986) indicate that, except possibly where a locally important species is very sensitive, freshwater aquatic organisms and their uses should not be affected unacceptably if the four-day average concentration of mercury does not exceed 0.012 $\mu g/\ell$ more than once every three years on the average and if the one-hour average conentration does not exceed 2.4 $\mu g/\ell$ more than once every three years on average (USEPA, 1985).

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C.7 METHYLENE CHLORIDE.

C.7.1 Introduction Methylene chloride (also known as dichloromethane) is widely used in a variety of industrial and commercial applications including metal degreasing, paint stripping, and solvent extraction in the food processing industry. It replaced trichloroethylene as the caffeine extractant in the production of decaffeinated coffee. It is also used to extract spice oleoresins and the beer flavoring in hops. It has additional uses as an aerosol propellent, an insecticidal fumigant and as a solvent in the manufacture of photographic film and synthetic fiber (ADL, 1985).

C.7.2 Human Toxic Effects Exposure to methylene chloride can be fatal in humans following inhalation and ingestion. One case of accidental death resulted from acute methylene chloride exposure during paint stripping operations (Bonventre et al., 1977). A primary adverse health effect associated with short-term exposure to methylene chloride is impairment of CNS functions. Inhalation of methylene chloride for up to 5 hours decreased visual and auditory functions and various psychomotor functions (Fodor and Winneke, 1971; Winneke, 1974). Longer-term exposure also produced CNS effects. Neurotoxicity was the most prominent symptom complex reported in over 100 cases involving occupational exposure to methylene chloride.

C.7.2.1 **Acute Animal Toxicity** Short-term inhalation studies showed that methylene chloride produced central nervous system effects. Acute studies showed that methylene chloride altered liver structure and cytochrome activity.

C.7.2.2 **Chronic Animal Toxicity** Long-term exposure to methylene chloride caused liver toxicity. Continuous inhalation exposure to methylene chloride (100 ppm) for 10 weeks resulted in centrilobular fat accumulation in mice. The increase in fat was accompanied by a decrease in glycogen that persisted after termination of the study (Weinstein and Diamond, 1972).

Methylene chloride produces cardiotoxic effects; however, these effects are most likely mediated by CO via CO-Hb. Data from experimental exposure studies indicate that blood CO-Hb levels, following exposure to methylene chloride, are elevated in a manner that is dependent on the inhaled concentration of methylene chloride and the length of exposure (ATSDR, 1988).

C.7.2.3 **Carcinogenic Effects** Several studies were found in the literature that demonstrated the carcinogenic potential of methylene chloride. Lung and liver tumors were reported in mice of both sexes following exposure through inhalation for a lifetime (NTP, 1986). Inhalation studies involving rats and hamsters revealed sarcomas in the salivary gland region of male rats, but no malignant responses were reported in female rats and in hamsters of both sexes (Burek et al., 1984). The NCA (1983) evaluated the carcinogenicity of ingested methylene chloride in mice from drinking water for 2 years. The incidence of liver tumors was higher in treated males than in male control groups (but not in females); however, the increase was reported not to be dose-related or statistically significant when compared with concurrent control rates.

C.7.2.4 **Mutagenic Effects** Methylene chloride produced dose-related increases in chromosomal aberrations in human peripheral lymphocytes, in Chinese hamster ovary cells, and in mouse lymphoma cells (Thilagar and Kumaroo, 1983). No

evidence of chromosome abnormalities were seen in bone marrow cells of rats exposed by inhalation to methylene chloride for 6 months (Burek et al., 1980). Methylene chloride was not mutagenic in three studies utilizing mammalian cell systems (Andrae and Wolff, 1983; Thilagar et al., 1984; Schumann et al., 1984).

C.7.2.5 **Reproductive and Teratogenic Effects** Only one study was found in the available literature that evaluated reproductive end points (Nitschke et al., 1985). The results of this study were negative.

C.7.2.6 **Standards and Guidelines for the Protection of Human Health** USEPA has classified methylene chloride as a B2 carcinogen. The most recent cancer slope factor derived for methylene chloride is 7.5×10^{-3} $(mg/kg/day)^{-1}$. A verified reference dose RfD also is available. The most current RfD is 0.06 mg/kg/day (IRIS, 1991). The OSHA PEL is 500 ppm with a ceiling level of 1000 ppm and a peak of 2000 ppm. The ACGIH TLV is 100 ppm.

C.7.3 Ecological Effects

C.7.3.1 **Bioconcentration** Bioconcentration factors are not available for methylene chloride.

C.7.3.2 **Aquatic Toxicity** Acute toxicity values (LC_{50}s) for freshwater fish exposed to methylene chloride include 193,000 $\mu g/\ell$ for the fathead minnow (Alexander et al., 1978) and 224,000 $\mu g/\ell$ for the bluegill (EPA, 1978). Cladocerans are equally sensitive with a 48 hr EC50 (Immobilization) of 224,000 $\mu g/\ell$ (EPA, 1978). Amphibian embryos exposed to methylene are more sensitive with a 4 day LC_{50} value of 17,780 $\mu g/\ell$ for the frog (*Rana catesbeiana*)(Birge et al., 1980).

C.7.3.3 **Standards and Guidelines for the Protection of Aquatic Life** AWQC for methylene chloride for the protection of aquatic life are not available as there is not enough toxicity data to derive the criteria.

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C.8 TOLUENE.

C.8.1 Introduction Toluene is an aromatic hydrocarbon that is flammable, practically insoluble in water, and fully miscible with many organic liquids. Toluene is produced primarily from petroleum sources. The major use of toluene is as a component of gasoline. It is also used in chemical extractions and chemical synthesis and as a solvent in paints, inks, adhesives, and cleaning agents.

The largest source of toluene release to the environment is production, transport and use of gasoline which contains about 5-7 percent toluene by weight. Toluene is degraded in the atmosphere is degraded by reaction with hydroxyl radicals, with a typical half life of 13 hours. Toluene in soil or water tends to volatilize to the air, and that which remains is subject to microbial degradation (ATSDR, 1988).

C.8.2 Human Toxic Effects Acute toluene exposure can cause subjective CNS symptoms (e.g., nausea, headache, and fatigue) as well as eye irritation, at levels equal to or exceeding 200 ppm.

Chronic exposure to toluene was also reported to cause CNS disturbances. In 100 workers exposed to toluene for one to three weeks, and who sought medical attention, 30 percent were exposed to 200 to 500 ppm and complained of headache, nausea, anorexia, lassitude, impairment of coordination, and loss of memory (Wilson, 1943). The workers exposed to 500 to 1,500 ppm complained of nausea, headache, dizziness, anorexia, extreme weakness, and pronounced impairment of coordination and reaction time. It was unclear whether toluene levels below 200 ppm caused adverse effects.

There is no conclusive evidence that toluene causes genotoxic or reproductive effects in humans.

C.8.2.1 Acute Animal Toxicity The acute oral LD_{50} for rats ranges from 6 to 7.5 g/kg. Inhalation LD_{50} values range from 500 to 700 ppm for mice and 4,000 ppm for rats (USEPA, 1983). The most noted effect of toluene in animals is CNS depression. Vapor levels at or below 1,000 ppm appear to have little effect on gross parameters, although more sensitive indicators (e.g., electroencephalogram [EEG] changes) were noted in rats.

C.8.2.2 Chronic Animal Toxicity In rats exposed to vapor levels of 100 or 300 ppm, 5 days per week, 6 hours per day for 2 years, no renal, hepatic, respiratory or cardiovascular effects were noted. In females, toluene significantly reduced hematocrit levels and increased mean corpuscular hemoglobin concentration (CIIT, 1980).

C.8.2.3 Carcinogenic Effects No treatment-related neoplastic lesions were noted in a 2-year study in F344 rats exposed to vapor levels of up to 300 ppm (CIIT, 1980). This study was limited by the fact that the maximum tolerated dose was not tested. The National Toxicology Program (NTP) is currently conducting an inhalation carcinogenicity bioassay in rats and mice.

C.8.2.4 Mutagenic Effects *In vitro* assays indicate that toluene is not mutagenic or genotoxic (ATSDR, 1988).

C.8.2.5 Reproductive and Teratogenic Effects Toluene has been shown to induce adverse developmental effects in laboratory animals. Acute inhalation exposures to 267 ppm caused skeletal anomalies, signs of retarded skeletal development and low fetal weights in mice, rats, and rabbits (Ungvary, 1985; Ungvary and Tatrai, 1985).

C.8.2.6 Standards and Guidelines for the Protection of Human Health USEPA has proposed a drinking water MCL and MCLG of 2.0 mg/ℓ and an SMCL of 0.04 mg/ℓ for toluene. OSHA has a time-weighted-average Permissible Exposure Limit (PEL) of 100 ppm and a Short-term Exposure Limit (STEL) of 150 ppm. ACGIH has a Threshold Limit Value (TLV) of 100 ppm and a STEL of 150 ppm. The verified reference dose (RfD) for toluene is 0.3 mg/kg/day (IRIS, 1991).

C.8.3 Ecological Effects

C.8.3.1 Bioavailability A bioconcentration factor of 380 for toluene by the alga genera Chlorella is reported by Geyer et al., (1984).

C.8.3.2 Aquatic Toxicity The lowest reported acute toxicity level (LC_{50}) for freshwater fish in available literature is 12,700 μg/ℓ for the bluegill. The results of toxicity testing of toluene with freshwater invertebrates is limited to the cladoceran Daphnia magna with the lowest 48 hour EC50 concentration reported at 11,513 μg/ℓ (Abernathy et al., 1986).

C.8.3.3 Standards and Guidelines for the Protection of Aquatic Life AWQC for toluene for the protection of aquatic life are not available as there is not enough toxicity data to derive the criteria.

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C.9 XYLENE(s).

C.9.1 Introduction Xylene is a volatile aromatic compound used as a solvent for prints, ink, and adhesives. Xylenes are components of detergents and other household and industrial products.

Xylene readily volatilizes from surface water and surface soil. Volatilization and subsequent photo-oxidation by reaction with hydroxyl radicals in the atmosphere are probably important transport and fate processes for xylene in the upper layer of soil and in aquatic environments. Xylene binds to sediment in water and to organics in soils and undergoes microbial degradation. Biodegradation is probably the most important fate process in both soils and the aquatic environment. Xylenes have been shown to persist for up to six months in soil. Because of their low water solubility and rapid biodegradation, xylenes are unlikely to leach into groundwater in high concentrations.

C.9.2 Human Toxic Effects Short-term exposure can cause eye, nose, and throat irritation at 200 ppm. There is some evidence that chronic exposures to less than 50 ppm can cause headaches and other CNS effects. The lowest oral lethal dose for humans has been reported as 50 mg/kg (USEPA, 1987).

Occupational exposure to xylene has been reported to cause headache, fatigue, lassitude, irritability, and GI disturbances (e.g., nausea, anorexia, and flatulence). Other researchers have also reported neurological disturbances such as changes in numerative ability, short-term memory and electroencephalographic patterns.

Short-term exposures to xylene vapors have not been demonstrated to cause noticeable subjective effects at levels less than 200 ppm. When 10 volunteers were exposed for 3 to 5 minutes to xylene at 200 ppm, the majority reported eye, nose, and throat irritation (Nelson et al., 1943). At 100 ppm, the majority reported no symptoms and indicated than an 8-hour daily exposure at this level would be satisfactory. In another study, one of six people exposed for 15 minutes to 233 ppm experienced eye irritation, and four of six reported eye irritation at 460 ppm (Carpenter et al., 1975). Activities reported to cause eye and upper respiratory tract irritation from uncharacterized xylene levels include furniture polishing and demolition of epoxy resin concrete. Unconsciousness and death have been reported to result from xylene exposure in excess of 10,000 ppm (Morley et al., 1970). The workers who died had evidence of pulmonary edema and brain hemorrhage. The survivors suffered from amnesia, renal impairment, and hepatic dysfunction.

Long-term exposure to xylene may result in subjective symptoms at levels lower than 200 ppm. One-third of 45 xylene production workers exposed daily to 10 to 45 ppm reported headaches, irritability, insomnia, rapid heartbeat, and indigestion (Sukhanova et al., 1969). Intermittent exposure over 2 months to 270- to 350-ppm xylene caused acute vomiting, giddiness, and loss of appetite in one worker (Glass, 1961).

C.9.2.1 Acute Animal Toxicity In rats, oral LD_{50} values range from 4300 to 5000 mg/kg. Four hour LC_{50} values are 4700 to 6600 ppm (USEPA, 1987).

C.9.2.2 Chronic Animal Toxicity Carpenter et al. (1975) exposed rats to mixed xylenes at vapor levels of 180, 460 or 810 ppm for 6 hours per day, 5 days per week for 13 weeks. Transitory changes in blood cell counts and slight changes in renal tubules were observed at the highest dose level. No effect on weight gain or hematological factors were seen in rats, guinea pigs, dogs or monkeys exposed to continuous vapor concentrations of 78 ppm for 90 days (Jenkins et al., 1970).

C.9.2.3 Carcinogenic Effects Xylene has not been shown to be carcinogenic when administered orally to rats or mice. The National Toxicology Program (NTP) conducted a study in which F344/N rats and B6C3F1 mice were administered mixed xylenes in corn oil by gavage in doses of 0, 250 or 500 mg/kg/day, 5 days per week for 103 weeks. Interstitial cell tumors of the testes in male rats could not be attributed to xylene administration (NTP, 1986).

C.9.2.4 Mutagenic Effects Studies indicate that xylene isomers, technical grade xylene or mixed xylenes are not mutagenic in bacterial tests. In in vitro studies with human lymphocytes, xylene caused no increase in the number of sister chromatid exchanges. Chromosome aberrations were not increased in bone marrow cells of rats exposed to xylenes by inhalation (USEPA, 1990).

C.9.2.5 Teratogenic and Reproductive Effects Xylene is not teratogenic but has caused embryotoxicity in rats and mice. Hudak and Ungvary (1978) exposed rats to 230 ppm of mixed xylenes 24 hours/day during days 9 to 14 of pregnancy. There were increased incidences of fused sternebrae and extra ribs in the offspring which the authors interpreted as signs of embryotoxicity. In another study, no signs of teratogenicity were reported in the offspring of rats exposed to vapor levels of 0, 100 or 400 ppm of xylenes during days 6 to 15 of pregnancy (Litton Bionetics, 1978).

C.9.2.6 Standards and Guidelines for the Protection of Human Health ACGIH believes irritant effects are minimal at 100 ppm with no significant degree of narcosis or chronic injury from exposures at that level; consequently, they recommended a TLV of 100 ppm (435 mg/m^3). A short-term exposure limit of 150 ppm has been recommended by ACGIH for exposures of less than 15 minutes in an 8-hour work day. The OSHA PEL is 100 ppm TWA and the STEL is 150 ppm. USEPA has proposed a drinking water MCL and MCLG of 10 mg/ℓ and an SMCL of 0.02 mg/ℓ. The most recent verified reference dose (RfD) for xylenes is 2.0 mg/kg/day (IRIS, 1991).

C.9.3.1 Bioavailability There are no readily available laboratory data on the bioconcentration of xylenes by aquatic organisms.

C.9.3.2 Aquatic Toxicity The lowest reported acute toxicity level (LC_{50}) for freshwater fish in available literature is 8,200 μg/ℓ for rainbow trout (Johnson & Finley, 1980). The results of toxicity testing of toluene with freshwater invertebrates is limited to the cladoceran Daphnia magna with the lowest 96 hour LC_{50} concentration reported at 3,185 μg/ℓ for ortho substituted xylene (Abernathy et al., 1986). Information on the chronic toxicity of xylenes to freshwater aquatic organisms is not available

C.9.3.3 Standards and Guidelines for the Protection of Aquatic Life AWQC for xylenes for the protection of aquatic life are not available as there is not enough toxicity data to derive the criteria.

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Table 5-11
Summary of Chemical and Toxicological Properties of Hazardous Chemicals from Outlying Landing Field (OLF) Barin

Site Inspection Report
OLF Barin, Foley, Alabama

Chemical	Chemical/Physical Properties				Human Health Toxicological Properties/Factors						Ecological Toxicity Factors				CAS Registry No.
											AWQC				
	Water Solubility	Log_{10} K_{ow}	Vapor Pressure	Henry's Law Constant	Federal MCL	Federal MCLG	Alabama MCL	RfD	Cancer Slope Factor	CAG (Wt. of Evidence)	Acute	Chronic	Lowest Acute LC_{50}	Bioconcentr-ations Factors	
Units	mg/ℓ at 25 °C (unless otherwise specified)		Torr 25 °C (unless otherwise specified)	Atm-m^3/mole	mg/ℓ	mg/ℓ	mg/ℓ	(mg/kg/day)	$(mg/kg/day)^{-1}$		µg/ℓ	µg/ℓ	As shown	No units	
Toluene	535	2.73 (A)	28.4 (A)	5.94×10^{-3} (A)	N/A	N/A	N/A	0.3	N/A	(D)	1,400 (6)	40 (6)	5,000 mg/kg (rat)	1.0 est. (4)	108-88-3
Ethyl benzene	161	3.15	9.53 (B)	8.44×10^{-3} (B)	N/A	0.68	N/A	0.1	N/A	(D)	32,000 (5)	N/A	3,800 mg/kg (rat)	1.19 (fish) (B)	100-41-4
Xylenes	175	3.20	6.6 (A)	7.68×10^{-3} (A)	N/A	0.44	N/A	2.0	N/A	(D)	N/A	N/A	4,300 mg/kg (rat)	1.33 (eel) (A)	1330-20-7
Methylene chloride	1.3×10^{4} (A)	1.25	435 (A)	2.68×10^{-3} (A)	N/A	N/A	N/A	0.06	0.0075 (oral)	(B2)	N/A	N/A	1,600 mg/kg (rat)	5 est. (5)	75-09-2
1,2-dichlorethylene	6.300 (A)	2.06	340 (A)	6.72×10^{-3} (A)	N/A	0.070	N/A	0.02	N/A	(noncar-cinogen)	11,600	N/A	7,902 mg/kg (rat)	22 est. (5)	156-60-5
Trichloroethylene	1,100 (A)	2.42	69 (A)	1.03×10^{-2} (A)	0.005	0	0.005	N/A	1.1×10^{-2} (oral)	(B2)	41,000	29,000		17-29 (A)	79-01-6
Tetrachloroethylene	1,503 (A)	3.40	18.5 (A)	1.49×10^{-2} (A)	0.005 (propo-sed)	0	N/A	0.01	5.1×10^{-2}	(B2)	5,280	840	2,629 mg/kg (rat)	39-49 (A)	127-18-4
4,4-DDD	0.16 D	5.99	10.2×10^{-7} (D)	2.14×10^{-4}	N/A	N/A	N/A	N/A	0.24	(B2)	N/A	N/A	113 mg/kg (rat)	9,120-82,3-00 (D)	72-54-8
4,4'-DDE	0.12 (D)	5.69	6.5×10^{-6} (D)	not available	N/A	N/A	N/A	N/A	0.34	(B2)	N/A	N/A	700 mg/kg (mouse)	27,000-180,-000 (D)	72-55-9
4,4'-DDT	0.0034 (D)	3.98	1.5×10^{-3} (20 °) (D)	3.8×10^{-3} (D)	N/A	N/A	N/A	5×10^{-4}	0.34	(B2)	1.1	0.001	7.6 mg/kg (frog)	600-690,000 (D)	50-29-3

Table 5-11 (Continued)
Summary of Chemical and Toxicological Properties of Hazardous Chemicals from Outlying Landing Field (OLF) Barin

Site Inspection Report
OLF Barin, Foley, Alabama

Chemical	Chemical/Physical Properties				Human Health Toxicological Properties/Factors						Ecological Toxicity Factors				CAS Registry No.
											AWQC		Lowest Acute LC_{50}	Bioconcentr-ations Factors	
	Water Solubility	Log_{10} K_{ow}	Vapor Pressure	Henry's Law Constant	Federal MCL	Federal MCLG	Alabama MCL	RfD	Cancer Slope Factor	CAG (Wt. of Evidence)	Acute	Chronic			
Dieldrin	0.195 (D)	3.87	7.8×10^{-7} (D)	N/A	N/A	N/A	N/A	5×10^{-5}	16	(B2)	1.0	0.0019	3 mg/kg (monkey)	3-6,000 (fish) (D)	60-59-1
Cyanide	4.8×10^{5} KCN^{C}	N/A	N/A	N/A	N/A	N/A	N/A	0.02	Not applicable	(D)	22	5.2	3 mg/kg (mouse)	0.3 est. (5)	57-12-5
Lead	(1)	N/A	N/A	N/A	0.05	0.020	0.020	N/A	N/A	(B2)	5.7 (3)	0.22 (3)	* (4)	17-2,512 (D)	7,439-92-1
Mercury	(2)	N/A	N/A	N/A	0.002	0.002	0.002	3×10^{-4} (methyl mercury)	Not applicable	(D)	2.4	0.012	* (4)	1,400-2,800 (D)	7,439-97-6

Notes:
(1) lead sulfide 120 mg/ℓ (E)
lead oxide 23 mg/ℓ (E)
lead nitrate 5.6×10^{5} mg/ℓ (E)

(2) mercury sulfide 0.01 mg/ℓ (D)
mercury oxide 50 mg/ℓ (D)
mercuric acetate 2.5×10^{5} mg/ℓ (10^{-}) (D)

(3) Depends on water hardness concentration given for total hardness of 12.4 mg/ℓ as $CaCO_3$. Based on calculations of hardness in Sandy Creek from Ca and Mg concentrations
(4) Wide range of toxicity, highly dependent on exact chemicals and route of exposure. Organic compounds many times more toxic than inorganic.
(5) Estimated from solubility and K_{ow}
(6) No AWQC available, value represents lowest observed effects level.

Log_{10} =
K_{ow} = octanol-water partition coefficient
MCL = maximum contaminant limit
MCLG = maximum contaminant limit goal
RfD = verified reference dose
CAG = Cancer Assessment Group
AWQC = ambient water quality criteria
LC_{50} = concentration at which 50 percent of organisms die

CAS = Chemcial Abstract Service
mg/ℓ = milligram per liter
°C = degrees centigrade
ug/ℓ = micrograms per liter
N/A = Not available
4,4-DDD = dichlorophenyl dichloroethane
4,4-DDE = dichlorophenyl dichloroethylene
4,4-DDT = dichlorophenyl trichloroethane

References:
(A) Howard, P.H., Fate and Exposure Data for Organic Chemicals, Vol. II, Solvents, 1990, Lewis Publishers, Inc.
(B) Howard, P.H., Fate and Exposure Data for Organic Chemicals, Vol. I, Large Production and Priority Pollutants, 1989, Lewis Publishers, Inc.
(C) Weast, R.C., Ph.D., CRC Handbook of Chemistry and Physics, 67th Edition, 1989, CRC Press, Inc.
(D) Hazardous Substance Data Based from TOMES, Vol. 8, expires 4/30/91.
(E) Dean, J.A., Lange's Handbook of Chemistry and Physics, Thirteenth Edition, 1985, McGraw-Hill Book Company.

Table 6-2
Summary of Sampling and Analysis Schedule Recommended For Outlying Landing Field Barin
Phase I Remedial Investigation

Site Inspection Report
OLF Barin, Foley, Alabama

Site	Type of Sample	Chemical Analysis: VOC by GC (Including Xylenes and MTBE)	VOC by GC/MS	SVOCs by GC/MS	Pesti-cides/PCBs	PAHs by HPLC	Petroleum Hydrocarbons	Metals: TAL	Metals: Lead only	Metals: Copper only	Total Cyanide	TCLP: Lead only	TCLP: Complete List
Site Wide Background	GW	–	–	–	–	–	–	–	–	–	–	–	–
(Groundwater background included with upgradient	SW	–	–	–	–	–	–	–	–	–	–	–	–
wells for Sites 19B/20B, and 21B; Surface Water and	SD	–	–	–	–	–	–	–	–	–	–	–	–
Sediment with Sandy Creek)	SO	–	–	–	8	8	–	8	–	–	–	–	–
Former Hangar Maintenance Area and Abandoned	GW	39	8	12	12	–	–	28	–	–	12	–	–
UST and Fuel Pits Area Sites 19B/20B	SW	–	–	–	–	–	–	–	–	–	–	–	–
(includes production well; pumping test; newly	SD	–	–	–	–	–	–	–	–	–	–	–	–
installed wells, 2 deep, 10 shallow; plus 8 existing wells)	SO	–	20	10	10	10	10	10	10	–	10	–	4
Rubble Landfill Site 21B	GW	–	3	3	3	–	–	3	–	–	3	–	–
	SW	–	–	–	–	–	–	–	–	–	–	–	–
	SD	–	–	–	–	–	–	–	–	–	–	–	–
	SO	–	6	6	6	–	–	6	–	–	6	–	–
Old Firefighting Demonstration Area, Site 22B, and	GW	–	–	–	–	–	–	–	–	–	–	–	–
Machine Gun Butt	SW	–	–	–	–	–	–	–	–	–	–	–	–
	SD	–	–	–	–	–	–	–	–	–	–	–	–
	SO	–	–	–	–	4	–	–	44	44	–	3	–
Drainage Ditch Leading to Sandy Creek, Site 23B	GW	–	–	–	–	–	–	–	–	–	–	–	–
Upper Ditch, soil boring 3 samples; Ditch Outfall, and	SW	–	–	–	–	–	–	–	–	–	–	–	–
North Area Ditch Outfall surface soils one sample	SD	–	–	–	–	–	–	–	–	–	–	–	–
each)	SO	–	5	5	5	–	–	5	–	–	5	–	–
Sandy Creek	GW	–	–	–	–	–	–	–	–	–	–	–	–
	SW	–	8	8	8	–	–	8	–	–	8	–	–
	SD	–	8	8	8	–	–	8	–	–	8	–	–
	SO	–	–	–	–	–	–	–	–	–	–	–	–

Table 6-2 (Continued)
Summary of Sampling and Analysis Schedule Recommended For Outlying Landing Field Barin
Phase I Remedial Investigation

Site Inspection Report
OLF Barin, Foley, Alabama

Site	Type of Sample	Chemical Analysis											
		VOC by GC (Including Xylenes and MTBE)	VOC by GC/MS	SVOCs by GC/MS	Pesti-cides/PCBs	PAHs by HPLC	Petroleum Hydrocarbons	Metals			Total Cyanide	TCLP	
								TAL	Lead only	Copper only		Lead only	Complete List
Uncontrolled Dumpsite	GW	–	–	–	–	–	–	–	–	–	–	–	–
	SW	–	–	–	–	–	–	–	–	–	–	–	–
	SD	–	–	–	–	–	–	–	–	–	–	–	–
	SO	–	5	5	5	–	5	5	–	–	5	–	3
Abandoned Wastewater Treatment Plant	GW	–	–	–	–	–	–	–	–	–	–	–	–
	SW	–	–	–	–	–	–	–	–	–	–	–	–
	SD	–	–	–	–	–	–	–	–	–	–	–	–
	SO	–	–	3	3	–	–	3	–	–	–	–	–
Total Installation	GW	39	11	15	15	–	–	31	–	–	15	–	–
	SW	0	8	8	8	–	–	8	–	–	8	–	–
	SD	0	8	8	8	–	–	8	–	–	8	–	–
	SO	0	36	29	37	25	10	37	54	44	26	3	7

Notes:
VOC = Volatile organic chemicals
GC = gas chromatography
MTBE = Methyl tert-butyl ether
GC/MS = Gas chromatography/mass spectrography
PCBs = polychlorinated biphenyls
PAHs = polynuclear aromatic hydrocarbons
HPLC = high performance liquid chromatography
TAL = target analyte list
TCLP = toxicity characteristicsleaching procedure
GW = groundwater
SD = sediments
SO = soil

18 GC samples for VOCs will be analyzed by field GC during the pumping test of the production well

DRAFT

APPENDIX A

Boring Logs

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GRAPH SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS	GTGS CODE
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS		GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURE, LITTLE OR NO FINES	25
		(LITTLE OR NO FINES)		GP	POORLY -GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	26
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES		GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES	28
		(APPRECIABLE AMOUNT OF FINES)		GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES	28=43
	SAND AND SANDY SOILS	CLEAN SAND		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	1
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE		(LITTLE OR NO FINES)		SP	POORLY-GRADED SANDS, GRAVELLY SANDS LITTLE OR NO FINES	22
	MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	SANDS WITH FINES		SM	SILTY SANDS, SAND-SILT MIXTURES	37
		(APPRECIABLE AMOUNT OF FINES)		SC	CLAYEY SANDS, SAND-CLAY MIXTURES	36
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY	39
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS,SANDY CLAYS, SILTY CLAYS, LEAN CLAYS	33
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	22=14
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS	19
				CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	34
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS	40
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENT	20

SOIL CLASSIFICATION CHART

NOTE:
WHEN SHOWN ON THE BORING LOGS, THE FOLLOWING TERMS ARE USED TO DESCRIBE THE CONSISTENCY OF COHESIVE SOILS AND THE RELATIVE COMPACTNESS OF COHESIONLESS SOILS.

COHESIVE SOILS
(APPROXIMATE SHEARING STRENGTH IN KSF)

VERY SOFT	LESS THAN .25
SOFT	0.25 TO 0.5
MEDIUM STIFF	0.5 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	GREATER THAN 4.0

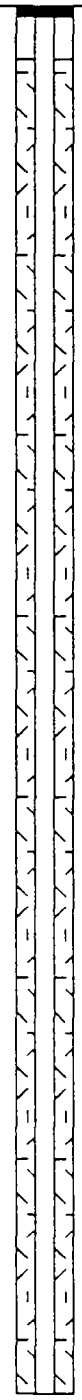
COHESIONLESS SOILS

VERY LOOSE	THESE ARE USUALLY BASED ON AN EXAMINATION OF SOIL SAMPLES, PENETRATION RESISTANCE AND SOIL DENSITY DATA
LOOSE	
MEDIUM DENSE	
DENSE	
VERY DENSE	

TITLE: OLF BARIN SI		LOG of WELL: 19B-2D	BORING NO.
CLIENT: SOUTHDIV NAVY			PROJECT NO: 5898-05
CONTRACTOR: LAYNE		DATE STARTED: 05/22/90	COMPLTD: 06/02/90
METHOD: MUD ROTARY	CASE SIZE: 4.0 IN	BORE DIA.: 10 IN	PROTECTION LEVEL: D
TOC ELEV.: 43.78 FT.	MONITOR INST.: OVA	TOT DPTH: 102FT.	DPTH TO ▽: 13.15 FT.
LOGGED BY: C. DOUSE	WELL DEVELOPMENT DATE:		SITE: BARIN FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN
0								
5		1	1.2/2	14	5.0-5.6 SAND-pale yellow very fine to fine sand 5.6-6.2 SAND-tan very fine sand w/ trace silt 6.2-7.0 no recovery		SP SP	8, 7, 7, 10
10		2	1.8/2	5.0	10.0-11.8 SAND-pink to light brown to tan fine sand, moist 11.8-12.0 no recovery		SP	12, 12, 15, 15
15		3	1.7/2	3.0	15.0-15.4 SAND-tan very fine to fine sand 15.4-16.7 SAND-pale yellow to rose fine sand, saturated 16.7-17.0 no recovery		SP SP	7, 6, 5, 10
20		4	0.6/2	4.4	20.0-20.6 SAND-orange red to pale yellow fine sand w/ some gravel 20.6-22.0 no recovery		SP	7, 4, 5, 7
25		5	0.7/2	1.8	25.0-25.7 SAND-red orange fine to medium sand w/ little gravel 25.7-27.0 no recovery		SP	6, 6, 5, 6

WELL DATA



E.C. JORDAN CO.

TITLE: OLF BARIN SI	LOG of WELL: 198-2D	BORING NO.
CLIENT: SOUTHDIV NAVY		PROJECT NO: 5898-05
CONTRACTOR: LAYNE	DATE STARTED: 05/22/90	COMPLTD: 06/02/90
METHOD: MUD ROTARY	CASE SIZE: 4.0 IN	BORE DIA.: 10 IN	PROTECTION LEVEL: D
TOC ELEV.: 43.78 FT.	MONITOR INST.: OVA	TOT DPTH: 102FT.	DPTH TO ▽: 13.15 FT.
LOGGED BY: C. DOUSE	WELL DEVELOPMENT DATE:	SITE: BARIN FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					Continued from PAGE 1				
26			0.7/2						
		6	1.2/2	2.0	30.0-31.2 CLAY-red orange clay w/ some fine to medium sand 31.2-32.0 no recovery		SP	1, 3, 4, 4	
31									
		7	1.8/2	4.2	35.0-35.4 CLAY-tan clay w/ some fine sand little gravel 35.4-36.8 CLAY-red orange clay w/ some fine to medium sand 36.8-37.0 no recovery		CL CL	4, 7, 7, 5	
36									
		8	1.4/2	4.5	40.0-40.6 CLAY-brown to tan clay w/ some sand little clay 40.6-41.4 CLAY-red orange clay w/ some fine sand little gravel 41.4-42.0 no recovery		CL CL	5, 5, 6, 6	
41									
		9	1.7/2	1.2	45.0-45.4 SAND-tan fin sand w/ some gravel 45.4-46.7 red orange fine sand w/ some gravel 46.7-47.0 no recovery		SP SP	2, 2, 4, 4	
46									
		10	2.0/2	1.8	50.0-51.3 SAND-tan to red fine sand w/ some gravel 51.3-52.0 red orange fine sand w/ some gravel		SP SP	2, 4, 5, 5	
51									

E.C. JORDAN CO.

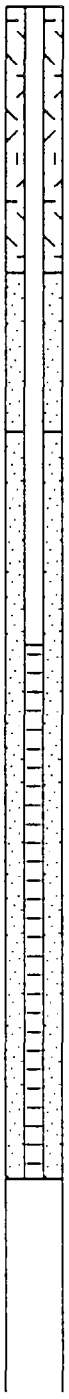
TITLE: OLF BARIN SI		LOG of WELL: 19B-2D	BORING NO.
CLIENT: SOUTHDIV NAVY			PROJECT NO: 5898-05
CONTRACTOR: LAYNE		DATE STARTED: 05/22/90	COMPLTD: 06/02/90
METHOD: MUD ROTARY	CASE SIZE: 4.0 IN	BORE DIA.: 10 IN	PROTECTION LEVEL: D
TOC ELEV.: 43.78 FT.	MONITOR INST.: OVA	TOT DPTH: 102FT.	DPTH TO ▽: 13.15 FT.
LOGGED BY: C. DOUSE	WELL DEVELOPMENT DATE:		SITE: BARIN FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					Continued from PAGE 2				
52									
		11	1.2/2	1.0	55.0-56.0 GRAVEL-light brown to pink 56.0-56.2 HARDPAN brown			18, 18, 15, 15	
57					58.0-78.0 no soil samples collected				
62									
67									
72									
77									

E.C. JORDAN CO.

TITLE: OLF BARIN SI	LOG of WELL: 19B-2D	BORING NO.
CLIENT: SOUTHDIV NAVY		PROJECT NO: 5898-05
CONTRACTOR: LAYNE	DATE STARTED: 05/22/90	COMPLTD: 06/02/90
METHOD: MUD ROTARY	CASE SIZE: 4.0 IN	BORE DIA.: 10 IN	PROTECTION LEVEL: D
TOC ELEV.: 43.78 FT.	MONITOR INST.: OVA	TOT DPTH: 102FT.	DPTH TO ▽: 13.15 FT.
LOGGED BY: C. DOUSE	WELL DEVELOPMENT DATE:	SITE: BARIN FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					Continued from PAGE 3				
78					78.0-100.0 no soil samples recovered				
83									
88									
93									
98									
103									



E.C. JORDAN CO.

TITLE: OLF BARIN SI		LOG of WELL: 19B-1D	BORING NO.
CLIENT: SOUTHDIV NAVY			PROJECT NO: 5898-05
CONTRACTOR: LAYNE		DATE STARTED: 05/19/90	COMPLTD: 06/02/90
METHOD: MUD ROTARY	CASE SIZE: 4.0 IN	BORE DIA.: 10 IN	PROTECTION LEVEL: D
TOC ELEV.: 48.65 FT.	MONITOR INST.: OVA	TOT DPTH: 102FT.	DPTH TO ▽: 10.10 FT.
LOGGED BY: A. DESANDRO	WELL DEVELOPMENT DATE:		SITE: BARIN FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
0					0.0-2.0 SAND-brown fine sand w/ some silt		SW		
5		1	1.8/2	0.8	5.0-5.6 SAND-brow fine to very fine sand w/ little silt 5.6-6.8 SAND-orange brown fine sand w/ little clay 6.8-7.0 no recovery		SW SP	3, 5, 5, 4	
10		2	1.5/2	5.8	10.0-11.5 SAND-orange brown to red fine to medium sand w/ trace clay 11.5-12.0 no recovery		SP	6, 8, 15, 17	▽
15		3	0.8/2	3.8	15.0-15.2 SAND-orange brown coarse to fine sand 15.2-15.6 SAND-pale yellow very coarse to fine sand 15.6-15.8 SAND-red to pale yellow coarse to fine sand 15.8-17.0 no recovery		SC SP SP	7, 5, 7, 9	
20		4	1.1/2	5.6	20.0-20.3 SAND-light brown fine to coarse sand 20.3-21.1 SAND-orange red fine to coarse sand 21.1-22.0 no recovery		SW SW	4, 6, 11, 7	
25		5	1.2/2	3.0	25.0-25.2 SAND-orange red medium to fine sand w/ trace gravel 25.2-25.6 SAND-tan medium to fine grained sand 25.6-26.2 SAND-[illegible]		SC SW SW	3, 5, 5, 9	

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E.C. JORDAN CO.

TITLE: OLF BARIN SI	LOG of WELL: 198-1D	BORING NO.
CLIENT: SOUTHDIV NAVY		PROJECT NO: 5898-05
CONTRACTOR: LAYNE	DATE STARTED: 05/19/90	COMPLTD: 06/02/90
METHOD: MUD ROTARY	CASE SIZE: 4.0 IN / BORE DIA.: 10 IN	PROTECTION LEVEL: D
TOC ELEV.: 48.65 FT.	MONITOR INST.: OVA / TOT DPTH: 102FT.	DPTH TO ▽: 10.10 FT.
LOGGED BY: A. DESANDRO	WELL DEVELOPMENT DATE:	SITE: BARIN FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					Continued from PAGE 1				
26			1.2/2				SM		
		6		5.4	30.0-31.0 SAND-light brown coarse sand w/ some gravel, poorly sorted		SP	9, 10, 11, 11	
31			1.3/2		31.0-31.3 SAND-tan medium to fine sand 31.3-32.0 no recovery		SP		
		7		9.6	35.0-36.2 SAND-tan to light brown coarse to very coarse sand		SP	9, 14, 14, 15	
36			2.0/2		36.2-36.4 GRAVEL-tan to white gravel w/ trace fine sand 36.4-37.0 SAND-orange medium sand w/ trace gravel		GP SP		
		8		4.6	40.0-40.3 SAND-tan coarse to medium sand 40.3-40.5 GRAVEL-tan to white gravel		SP GP	7, 11, 10, 10	
41			1.1/2		40.5-41.1 SAND-light brown to tan medium to fine sand w/ trace gravel 41.1-42.0 no recovery		SP		
		9		3.8	45.0-45.6 GRAVEL-light brown to tan gravel, angular to subangular		GP	8, 12, 13, 18	
46			1.0/2		45.6-46.0 SAND-light brown to yellow fine to very fine sand 46.0-47.0 no recovery		SP		
		10		3.0	50.0-50.7 same as soil above		SP	5, 6, 12, 18	
51			1.7/2		50.7-51.7 SAND-pale yellow fine to very fine sand 51.7-52.0 no recovery		SP		

E.C. JORDAN CO.

TITLE: OLF BARIN SI	LOG of WELL: 198-1D	BORING NO.
CLIENT: SOUTHDIV NAVY		PROJECT NO: 5898-05
CONTRACTOR: LAYNE	DATE STARTED: 05/19/90	COMPLTD: 06/02/90
METHOD: MUD ROTARY	CASE SIZE: 4.0 IN	BORE DIA.: 10 IN	PROTECTION LEVEL: D
TOC ELEV.: 48.65 FT.	MONITOR INST.: OVA	TOT DPTH: 102FT.	DPTH TO ▽: 10.10 FT.
LOGGED BY: A. DESANDRO	WELL DEVELOPMENT DATE:	SITE: BARIN FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					Continued from PAGE 2				
52									
		11	0.8/2	4.0	55.0-55.2 SAND-light brown to yellow fine to very fine sand 55.2-55.8 SAND-light brown to tan sand 55.8-57.0 no recovery		SP SP	12, 21, 26, 27	
57									
		12	1.6/2	2.0	60.0-60.8 same as soil above 60.8-60.9 GRAVEL-tan gravel, subrounded 60.9-61.6 SAND-light brown to orange fine medium to fine sand 61.6-62.0 no recovery		SP GP SP	19, 30, 31	
62									
		13	1.8/2	1.0	65.0-65.8 SAND-light brown to tan coarse to fine sand w/ some gravel 65.8-66.0 SAND-red to dark red fine to very fine sand w/ some silt trace clay 66.0-66.8 brown to light brown fine sand 66.8-67.0 no recovery		SP SM SP SP	15, 23, 28, 29	
67									
		14							
72									
		15	2.0/2	1.2	75.0-77.0 SAND-light gray to light brown to dark red very fine sand w/ some silt, mottled		SM	10, 10, 20, 30	
77									

E.C. JORDAN CO.

TITLE: OLF BARIN SI		LOG of WELL: 19B-1D	BORING NO.
CLIENT: SOUTHDIV NAVY			PROJECT NO: 5898-05
CONTRACTOR: LAYNE		DATE STARTED: 05/19/90	COMPLTD: 06/02/90
METHOD: MUD ROTARY	CASE SIZE: 4.0 IN	BORE DIA.: 10 IN	PROTECTION LEVEL: D
TOC ELEV.: 48.65 FT.	MONITOR INST.: OVA	TOT DPTH: 102FT.	DPTH TO ▽: 10.10 FT.
LOGGED BY: A. DESANDRO	WELL DEVELOPMENT DATE:		SITE: BARIN FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					Continued from PAGE 3				
78					77.0-100.0 no soil samples collected				
83									
88									
93									
98									
103									

E.C. JORDAN CO.

TITLE: OLF BARIN SI		LOG of WELL: 198-3D	BORING NO.
CLIENT: SOUTHDIV NAVY			PROJECT NO: 5898-05
CONTRACTOR: LAYNE		DATE STARTED: 05/16/90	COMPLTD: 05/16/90
METHOD: HSA	CASE SIZE: 4.0 IN	BORE DIA.: 10 IN	PROTECTION LEVEL: D
TOC ELEV.: 50.28 FT.	MONITOR INST.: OVA	TOT DPTH: 102FT.	DPTH TO ∇: 22.30 FT.
LOGGED BY: E. BLOMBERG	WELL DEVELOPMENT DATE:		SITE: BARIN FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
0					0.0-3.0 SAND-brown to orange brown fine sand w/ some silt and clay		SC		
		1	2.0/2	3.6	4.0-4.3 SAND-dark brown very fine sand w/ some silt 4.3-5.0 SAND-light brown fine to medium sand w/ little silt, saturated 5.0-6.0 SAND-orange to red orange fine sand w/ some clay, dry		SM SP SC	9, 12, 24, 30	
5									
10		2	2.0/2	5.8	10.0-10.3 SAND-dark brown to light brown fine sand w/ some silt 10.3-11.1 SAND-orange to red orange fine sand w/ some clay, very moist, few sandy clay lenses 11.1-12.0 SAND-orange very coarse sand to gravel w/ trace silt and clay, saturated		SM SC SP	5, 5, 4, 4	
15		3	2.0/2	7.6	15.0-15.2 SAND-brown fine sand w/ some silt, saturated 15.2-15.6 SAND-dark red to orange fine sand w/ some silt and clay 15.6-16.2 SAND-orange yellow fine to coarse sand w/ trace clay, poorly sorted 16.2-17.0 SAND-orange to pink fine to very coarse sand to gravel, well sorted		SM SC SP SM	1, 2, 3, 4	
20		4	2.0/2	4.4	20.0-21.2 SAND-orange fine to very coarse sand, subangular, poorly sorted 21.2-21.5 SAND-brown to red brown fine sand w/ some clay, few sandy clay lenses 21.5-22.0 SAND-dark red to tan to pink very coarse sand to gravel w/ trace clay		SP SC SP	1, 4, 8, 10	∇
25		5	2.0/2	8.0	25.0-27.0 SAND-pink to tan fine to medium sand w/ little silt		SP	7, 11, 13, 11	

E.C. JORDAN CO.

TITLE: OLF BARIN SI	LOG of WELL: 19B-3D	BORING NO.
CLIENT: SOUTHDIV NAVY		PROJECT NO: 5898-05
CONTRACTOR: LAYNE	DATE STARTED: 05/16/90	COMPLTD: 05/16/90
METHOD: HSA	CASE SIZE: 4.0 IN / BORE DIA.: 10 IN	PROTECTION LEVEL: D
TOC ELEV.: 50.28 FT.	MONITOR INST.: OVA / TOT DPTH: 102FT.	DPTH TO ▽: 22.30 FT.
LOGGED BY: E. BLOMBERG	WELL DEVELOPMENT DATE:	SITE: BARIN FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					Continued from PAGE 1				
26			2.0/2				SP		
		6		3.4	30.0-31.2 SAND-tan fine to very coarse sand to gravel, well graded, subangular to subrounded		SW	2, 3, 5, 11	
31			2.0/2		31.2-32.0 SAND-white fine to coarse sand well sorted		SW		
		7		3.8	35.0-36.7 SAND-tan fine to very coarse sand, subrounded		SP	5, 7, 23, 46	
36			2.0/2		36.7-37.0 SAND-dark brown fine sand w/ some silt and clay		SM		
		8		4.6	40.0-41.2 SAND-tan fine to coarse sand poorly sorted		SP	4, 7, 9, 45	
41			2.0/2		41.2-42.0 SAND-tan to yellow fine sand		SP		
		9		6.4	45.0-46.5 SAND-orange to tan fine to coarse sand, subangular		SP	7, 7, 8, 14	
46			2.0/2		46.5-47.0 SAND-orange fine sand w/ some silt trace clay		SM		
		10		1.4	50.0-51.0 SAND-tan fine to coarse sand, well sorted		SW	8, 5, 5, 9	
51			2.0/2		51.0-52.0 SAND-orange to purple to gray very fine sand w/ some silt little clay, mottled		SM		

E.C. JORDAN CO.

TITLE: OLF BARIN SI	LOG of WELL: 198-3D	BORING NO.
CLIENT: SOUTHDIV NAVY		PROJECT NO: 5898-05
CONTRACTOR: LAYNE	DATE STARTED: 05/16/90	COMPLTD: 05/16/90
METHOD: HSA	CASE SIZE: 4.0 IN	BORE DIA.: 10 IN	PROTECTION LEVEL: D
TOC ELEV.: 50.28 FT.	MONITOR INST.: OVA	TOT DPTH: 102FT.	DPTH TO ▽: 22.30 FT.
LOGGED BY: E. BLOMBERG	WELL DEVELOPMENT DATE:	SITE: BARIN FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					Continued from PAGE 2				
52									
		11	2.0/2	0.4	55.0-55.3 SAND-tan fine to medium sand 55.3-57.0 SILT-gray silt w/ some very fine sand and clay		SP SC	1, 5, 5, 7	
57									
		12	2.0/2	0.6	60.0-62.0 SAND&CLAY-gray fine sand and clay, moderate plasticity, wood fragments		SC	7, 6, 4, 8	
62									
		13	2.0/2	0.2	65.0-67.0 SAND-gray very fine sand w/ some silt, trace clay		SM	-------	
67									
		14	2.0/2	0.6	70.0-71.2 SILT-gray silt w/ some clay, trace very fine sand, moderate plasticity, wood fragments 71.2-72.0 SAND-gray to dark gray very fine sand w/ some silt, trace clay		MH SM	6, 5, 6, 9	
72									
		15	2.0/2	0.2	75.0-77.0 SAND-gray fine sand w/ some clay		SC	4, 4, 4, 6	
77									

E.C. JORDAN CO.

TITLE: OLF BARIN SI	LOG of WELL: 198-30	BORING NO.
CLIENT: SOUTHDIV NAVY		PROJECT NO: 5898-05
CONTRACTOR: LAYNE	DATE STARTED: 05/16/90	COMPLTD: 05/16/90
METHOD: HSA	CASE SIZE: 4.0 IN	BORE DIA.: 10 IN	PROTECTION LEVEL: D
TOC ELEV.: 50.28 FT.	MONITOR INST.: OVA	TOT DPTH: 102FT.	DPTH TO ▽: 22.30 FT.
LOGGED BY: E. BLOMBERG	WELL DEVELOPMENT DATE:	SITE: BARIN FIELD

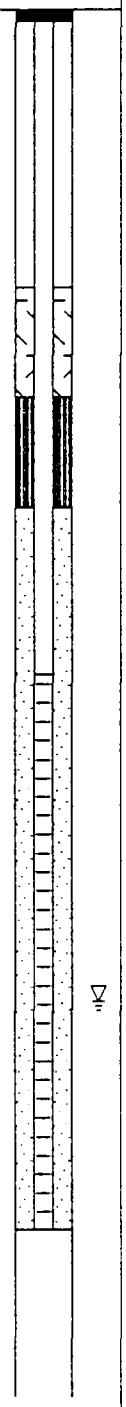
DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
					Continued from PAGE 3				
78									
		16	2.0/2	1.0	80.0-80.3 SILT-black silt w/ organics 80.3-80.5 SAND-gray fine sand w/ some silt 80.5-82.0 SAND-red to orangefine sand w/ some silt		ML SM SM	-------	
83									
		17	2.0/2	0.2	85.0-85.2 SAND-brown fine sand 85.2-85.6 SILT-black silt w/ organics 85.6-85.8 SAND-orange fine sand 85.8-86.1 CLAY-pink to gray to orange clay w/ some silt, mottled, high plasticity 86.1-87.0 SAND-orange to tan fine to medium sand		SP ML SM CH SP	3, 3, 4, 6	
88									
		18	2.0/2	0.6	90.0-91.8 SAND-light brown fine sand 91.8-92.0 SILT-black silt w/ organics		SP ML	5, 5, 4, 10	
93									
		19	2.0/2	0.5	95.0-97.0 SAND-light brown fine sand		SP	15, 24, 17, 31	
98									
		20	2.0/2	1.2	100.0-100.8 same as soil above 100.8-102 SAND-orange fine sand w/ some silt		SP SM	9, 6, 6, 13	
103									

E.C. JORDAN CO.

TITLE: OLF BARTIN SI	LOG of WELL: 20B-1		BORING NO.
CLIENT: SOUTHDIV NAVY			PROJECT NO: 5898-05
CONTRACTOR: LAYNE		DATE STARTED: 05/12/90	COMPLTD: 05/12/90
METHOD: HSA	CASE SIZE: 4.0 IN	BORE DIA.: 10 IN	PROTECTION LEVEL: D
TOC ELEV.: 57.60 FT.	MONITOR INST.: OVA	TOT DPTH: 25FT.	DPTH TO ▽: 17.88 FT.
LOGGED BY: E. BLOMBERG	WELL DEVELOPMENT DATE:		SITE: BARIN FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN
0					0.0-3.0 SAND-red orange fine sand w/ some clay (30%)		SC	
		1	2.0/2	0.0	3.0-5.0 same as soil above w/ little clay		SC	3, 3, 3, 4
5		2	0.8/2	0.0	5.0-5.8 same as soil above 5.8-7.0 no recovery		SC	5, 5, 9, 9
		3	1.5/2	0.0	7.0-8.5 same as soil above w/ some silt trace clay 8.5-9.0 no recovery		SC	9, 9, 9, 9
10		4	1.6/2	0.0	9.0-10.6 SAND-dark red to red orange fine sand w/ little silt, trace clay 10.6-11.0 no recovery		SP	9, 16, 13, 15
		5	1.8/2	0.1	11.0-12.8 SAND-red orange to tan fine sand w/ trace silt 12.8-13.0 no recovery		SP	12, 19, 25, 28
		6	2.0/2	0.2	13.0-15.0 SAND-pink to tan fine to medium fine sand, saturated		SP	21, 33, 34, 31
15								
		7	2.0/2	0.1	18.0-19.3 SAND-tan to light brown to red to pink to yellow very fine sand w/ some silt, saturated		SP	4, 5, 5, 10
20					19.3-20.0 SAND-pink to yellow very coarse gravel w/ little clay, saturated		SP	
25								

WELL DATA

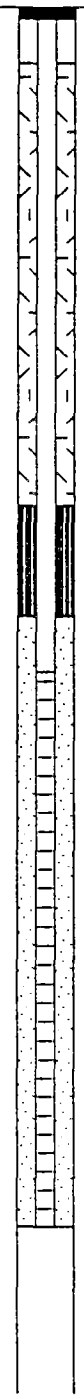


E.C. JORDAN CO.

TITLE: OLF BARTIN SI	LOG of WELL: 20B-2		BORING NO.
CLIENT: SOUTHDIV NAVY			PROJECT NO: 5898-05
CONTRACTOR: LAYNE		DATE STARTED: 05/12/90	COMPLTD: 05/12/90
METHOD: HSA	CASE SIZE: 4.0 IN	BORE DIA.: 10 IN	PROTECTION LEVEL: D
TOC ELEV.: 56.99 FT.	MONITOR INST.: OVA	TOT DPTH: 25FT.	DPTH TO ▽: 17.37 FT.
LOGGED BY: E. BLOMBERG	WELL DEVELOPMENT DATE:		SITE: BARIN FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN
0					0.0-3.0 SAND-red orange fine sand w/ some clay (30%)		SC	
		1	1.3/2	0.0	3.0-4.3 same as soil above 4.3-5.0 no recovery		SC	2, 4, 4, 4
5		2	1.8/2	0.0	5.0-6.8 same as soil above 6.8-7.0 no recovery		SC	3, 3, 3, 13
		3	1.7/2	0.0	7.0-8.7 SAND-red orange to yellow brown fine sand w/ little silt trace clay 8.7-9.0 no rcovery		SP	7, 8, 10, 11
10		4	2.0/2	0.0	9.0-11.0 SAND-yellow brown to dark red to yellow fine sand w/ little silt, trace clay, moist		SP	9, 10, 13, 16
		5	1.5/2	0.1	11.0-12.5 SAND-dark red to orange fine sand w/ trace silt 12.5-13.0 no recovery		SP	15, 16, 17, 19
		6	1.2/2	0.2	13.0-14.2 SAND-orange fine sand w/ trace silt, saturated 14.2-15.0 no recovery		SP	15, 26, 25, 28
15								
		7	2.0/2	0.2	18.0-20.0 SAND-dark red to orange to tan fine to medium sand w/ little silt, saturated		SP	1, 1, 1, 1
20								
25								

WELL DATA



E.C. JORDAN CO.

TITLE: OLF BARTIN SI	LOG of WELL: 208-3	BORING NO.
CLIENT: SOUTHDIV NAVY		PROJECT NO: 5898-05
CONTRACTOR: LAYNE	DATE STARTED: 05/11/90	COMPLTD: 05/11/90
METHOD: HSA	CASE SIZE: 4.0 IN	BORE DIA.: 10 IN	PROTECTION LEVEL: D
TOC ELEV.: 49.00 FT.	MONITOR INST.: OVA	TOT DPTH: 20FT.	DPTH TO ▽: 9.7 FT.
LOGGED BY: E. BLOMBERG	WELL DEVELOPMENT DATE:	SITE: BARIN FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN
0					0.0-0.7 SAND-brown fine sand w/ some silt, roots		SM	
					0.7-3.0 SAND-orange brown fine sand w/ some silt little clay		SM	
		1	1.9/2	0.2	3.0-4.9 SAND-orange brown fine sand w/ some silt and clay 4.9-5.0 no recovery		SM	4, 4, 4, 4
5		2	2.0/2	0.1	5.0-7.0 SAND-orange brown fine sand w/ little silt trace clay, moist		SP	4, 6, 7, 7
		3	1.5/2	1.0	7.0-8.5 SAND-orange brown fine to medium sand w/ trace silt and clay 8.5-9.0 no recovery		SP	6, 12, 12, 16
		4	2.0/2	2.4	9.0-9.5 SAND-orange fine to medium sand w/ trace silt, saturated 9.5-11.0 SAND-orange to tan coarse sand w/ little fine to medium sand, saturated		SP SP	6, 12, 17, 24
10		5	2.0/2	0.0	11.0-12.8 SAND-tan to red orange fine to very coarse sand, poorly sorted saturated 12.8-13.0 SAND&CLAY-dark red very coarse sand and clay, dense		SP SC	7, 10, 13, 23
15		6	2.0/2	4.8	16.0-17.2 SAND-light red brown very coarse sand, poorly sorted, saturated 17.2-18.0 SAND-dark red coarse to very coarse sand w/ little clay, saturated		SP SP	
20								

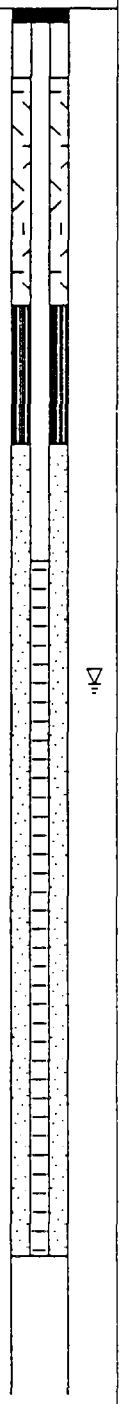
WELL DATA

E.C. JORDAN CO.

TITLE: OLF BARIN SI	LOG of WELL: 20B-4	BORING NO.
CLIENT: SOUTHDIV NAVY		PROJECT NO: 5898-05
CONTRACTOR: LAYNE	DATE STARTED: 05/11/90	COMPLTD: 05/11/90
METHOD: HSA	CASE SIZE: 4.0 IN	BORE DIA.: 10 IN	PROTECTION LEVEL: D
TOC ELEV.: 49.31 FT.	MONITOR INST.: OVA	TOT DPTH: 20FT.	DPTH TO ▽: 9.77 FT.
LOGGED BY: E. BLOMBERG	WELL DEVELOPMENT DATE:	SITE: BARIN FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN
0					0.0-2.0 SAND-red brown fine sand w/ some clay		SC	
		1	2.0/2	0.0	2.0-4.0 SAND-red fine sand w/ some clay		SC	2, 2, 2, 3
5		2	1.8/2	0.0	4.0-6.0 SAND-red brown to orange fine sand w/ some silt little clay, moist		SM	3, 5, 6, 8
		3	1.7/2	0.0	6.0-7.7 same as soil above, very moist 7.7-8.0 no recovery		SM	6, 11, 12, 13
		4	2.0/2	2.5	8.0-10.0 SAND-red orange fine to coarse sand w/ little silt and clay, poorly sorted, very moist		SP	14, 16, 17, 17
10		5	2.0/2	2.2	10.0-11.2 SAND-brown red fine to coarse sand w/ little silt, poorly sorted, saturated 11.2-12.0 SAND-yellow to tan coarse sand w/ trace fine to medium sand, poorly sorted, saturated, coarse sand, poorly sorted		SP SP	7, 14, 14, 15
15								
		6	2.0/2	2.0	17.0-18.0 SAND-orange tan fine to coarse sand, moderately sorted, saturated 18.0-19.0 SAND-orange tan fine sand, poorly sorted, saturated		SM SP	
20								

WELL DATA



E.C. JORDAN CO.

TITLE: OLF BARTIN SI	LOG of WELL: 208-5	BORING NO.
CLIENT: SOUTHDIV NAVY		PROJECT NO: 5898-05
CONTRACTOR: LAYNE	DATE STARTED: 05/11/90	COMPLTD: 05/11/90
METHOD: HSA	CASE SIZE: 4.0 IN	BORE DIA.: 10 IN	PROTECTION LEVEL: D
TOC ELEV.: 51.29 FT.	MONITOR INST.: OVA	TOT DPTH: 21FT.	DPTH TO ▽: 11.90 FT.
LOGGED BY: E. BLOMBERG	WELL DEVELOPMENT DATE:	SITE: BARIN FIELD

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN
0					0.0-0.5 SAND-brown fine sand		SP	
					0.5-3.0 SAND&CLAY-orange brown fine sand and clay		SC	
		1	1.7/2	0.0	3.0-3.5 SAND-orange brown to red brown sand w/ some clay		SC	11, 16, 10, 10
					3.5-4.0 SAND-red brown fine sand w/ some clay		SC, SM	
5		2	1.8/2	0.0	4.0-4.7 SAND-red fine sand w/ some silt		SC	4, 8, 9, 9
					4.7-5.0 no recovery		SM	
					5.0-5.4 SAND-brown fine sand w/ some clay			
					5.4-6.8 SAND-orange red fine sand w/ some silt trace clay, dry			
		3	0.7/2	0.0	6.8-7.0 no recovery		SC	5, 6, 7, 7
					7.0-7.7 SAND-orange red sand w/ some clay			
					7.7-9.0 no recovery			
		4	1.6/2	0.0	9.0-9.5 SAND-orange brown to red brown fine sand w/ some clay (40%)		SC	2, 4, 4, 6
10					9.5-10.6 SAND-orange to tan fine to coarse sand, poorly sorted		SP	
		5	2.0/2	0.4	10.6-11.0 no recovery		SC	4, 6, 6, 7
					11.0-11.5 SAND-orange brown to red fine sand w/ some clay (40%), rock fragments		SP	
					11.5-13.0 SAND-tan to pink fine to coarse sand, poorly sorted, saturated			
15								
		6	2.0/2	3.2	16.0-17.7 same as soil above		SP	4, 5, 6, 11
					17.7-17.9 SAND-red to yellow medium to coarse sand w/ few thin (4 mm) white clay lenses		SP	
					17.9-18.0 SAND-white fine sand, saturated		SP	
20								
25								

WELL DATA

E.C. JORDAN CO.

APPENDIX B

LABORATORY DATA REPORTS

Pioneer LABORATORY, INC. a division of Analytical Technologies, Inc.
11 EAST OLIVE ROAD • PENSACOLA, FLORIDA 32514 • (904) 474-1001

ABB ENVIRONMENTAL, INC
2571 EXECUTIVE CENTER CIR
SUITE 100
TALLAHASSEE FL 32301-5001

Lab I.D.#:	90-2309
Order Number:	P29574
Order Date:	05/01/90
Client:	10001
Sampled By:	E.B./A.D.
Sample Date:	04/30/90
Sample Time:	1500

Project Number: 5898-05
Project Name: OLF BARIN
Sample Site: FOLEY, AL
Sample Type: GROUNDWATER

N/S = Not Submitted

R E S U L T S

reported on the following page(s)

Comments: PPM = Parts Per Million, mg/l. PPB = Parts Per Billion, ug/l.
Method Reference: SW-846, 3rd Edition, November 1986.
BDL = Below Detection Limits.

Approved By : John V Hawkins

Pioneer LABORATORY, INC. a division of Analytical Technologies, Inc.
11 EAST OLIVE ROAD • PENSACOLA, FLORIDA 32514 • (904) 474-1001

Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2309-1
Order Date: 05/01/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: GROUNDWATER

Sample ID.: SUPPLY WELL Sample Date: 04/30/90 Time: 1500

TCL/INORGANICS TARGET COMPOUND LIST - INORGANICS

Parameter	Units	Result	Detection Limit
SILVER	PPM	BDL	0.0002
ALUMINUM	PPM	BDL	0.5
ARSENIC	PPM	BDL	0.001
BARIUM	PPM	BDL	0.1
BERYLLIUM	PPM	BDL	0.01
CALCIUM	PPM	1.4	1
CADMIUM	PPM	BDL	0.0002
COBALT	PPM	BDL	0.05
CHROMIUM	PPM	BDL	0.01
COPPER	PPM	BDL	0.03
CYANIDE, TOTAL	PPM	BDL	0.005
IRON	PPM	BDL	0.03
MERCURY	PPM	BDL	0.0005
POTASSIUM	PPM	0.68	0.6
MAGNESIUM	PPM	0.74	0.01
MANGANESE	PPM	BDL	0.01
SODIUM	PPM	3.5	0.2
NICKEL	PPM	BDL	0.05
LEAD	PPM	0.004	0.004
ANTIMONY	PPM	BDL	0.1
SELENIUM	PPM	BDL	0.003
THALLIUM	PPM	BDL	0.4
VANADIUM	PPM	BDL	0.2
ZINC	PPM	BDL	0.01

Pioneer LABORATORY, INC. a division of Analytical Technologies, Inc.
11 EAST OLIVE ROAD • PENSACOLA, FLORIDA 32514 • (904) 474-1001

Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2309-1
Order Date: 05/01/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: GROUNDWATER

Sample ID.: SUPPLY WELL Sample Date: 04/30/90 Time: 1500

TCL/ACID TARGET COMPOUND LIST - ACID EXTRACT

Parameter	Units	Result	Detection Limit
BENZOIC ACID	PPB	BDL	50
4-CHLORO-3-METHYLPHENOL	PPB	BDL	10
2-CHLOROPHENOL	PPB	BDL	10
2,4-DICHLOROPHENOL	PPB	BDL	10
2,4-DIMETHYLPHENOL	PPB	BDL	10
4,6-DINITRO-2-METHYLPHENOL	PPB	BDL	50
2,4-DINITROPHENOL	PPB	BDL	50
2-METHYLPHENOL	PPB	BDL	10
4-METHYLPHENOL	PPB	BDL	10
2-NITROPHENOL	PPB	BDL	10
4-NITROPHENOL	PPB	BDL	50
PENTACHLOROPHENOL	PPB	BDL	50
PHENOL	PPB	BDL	10
2,4,5-TRICHLOROPHENOL	PPB	BDL	50
2,4,6-TRICHLOROPHENOL	PPB	BDL	10

Pioneer LABORATORY, INC. a division of Analytical Technologies, Inc.
11 EAST OLIVE ROAD • PENSACOLA, FLORIDA 32514 • (904) 474-1001

Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2309-1
Order Date: 05/01/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: GROUNDWATER

Sample ID.: SUPPLY WELL Sample Date: 04/30/90 Time: 1500

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL

Parameter	Units	Result	Detection Limit
ACENAPHTHENE	PPB	BDL	10
ACENAPHTHYLENE	PPB	BDL	10
ANTHRACENE	PPB	BDL	10
BENZO(A)ANTHRACENE	PPB	BDL	10
BENZO(A)PYRENE	PPB	BDL	10
BENZO(B)FLUORANTHENE	PPB	BDL	10
BENZO(G,H,I)PERYLENE	PPB	BDL	10
BENZO(K)FLUORANTHENE	PPB	BDL	10
BENZYL ALCOHOL	PPB	BDL	10
BIS(2-CHLOROETHOXY)METHANE	PPB	BDL	10
BIS(2-CHLOROETHYL)ETHER	PPB	BDL	10
BIS(2-CHLOROISOPROPYL)ETHER	PPB	BDL	10
BIS(2-ETHYLHEXYL)PHTHALATE	PPB	BDL	10
4-BROMOPHENYL PHENYL ETHER	PPB	BDL	10
BUTYL BENZYL PHTHALATE	PPB	BDL	10
4-CHLOROANILINE	PPB	BDL	10
2-CHLORONAPHTHALENE	PPB	BDL	10
4-CHLOROPHENYL PHENYL ETHER	PPB	BDL	10
CHRYSENE	PPB	BDL	10
DIBENZ(A,H)ANTHRACENE	PPB	BDL	10
DIBENZOFURAN	PPB	BDL	10
1,2-DICHLOROBENZENE	PPB	BDL	10
1,3-DICHLOROBENZENE	PPB	BDL	10
1,4-DICHLOROBENZENE	PPB	BDL	10
3,3'-DICHLOROBENZIDINE	PPB	BDL	50
DIETHYLPHTHALATE	PPB	BDL	10
DIMETHYLPHTHALATE	PPB	BDL	10
DI-N-BUTYLPHTHALATE	PPB	BDL	10
2,4-DINITROTOLUENE	PPB	BDL	10
2,6-DINITROTOLUENE	PPB	BDL	10
DI-N-OCTYLPHTHALATE	PPB	BDL	10
FLUORANTHENE	PPB	BDL	10
FLUORENE	PPB	BDL	10
HEXACHLOROBENZENE	PPB	BDL	10
HEXACHLOROBUTADIENE	PPB	BDL	10

Sample ID.: SUPPLY WELL Test Parameters continued on next page

Pioneer LABORATORY, INC. a division of Analytical Technologies, Inc.
11 EAST OLIVE ROAD • PENSACOLA, FLORIDA 32514 • (904) 474-1001

Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2309-1
Order Date: 05/01/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: GROUNDWATER

Sample ID.: SUPPLY WELL Sample Date: 04/30/90 Time: 1500

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL continued

Parameter	Units	Result	Detection Limit
HEXACHLOROCYCLOPENTADIENE	PPB	BDL	10
HEXACHLOROETHANE	PPB	BDL	10
INDENO(1,2,3-CD)PYRENE	PPB	BDL	10
ISOPHORONE	PPB	BDL	10
2-METHYLNAPHTHALENE	PPB	BDL	10
NAPHTHALENE	PPB	BDL	10
2-NITROANILINE	PPB	BDL	10
3-NITROANILINE	PPB	BDL	10
4-NITROANILINE	PPB	BDL	10
NITROBENZENE	PPB	BDL	10
N-NITROSODIPHENYLAMINE	PPB	BDL	10
N-NITROSO-DI-N-DIPROPYLAMINE	PPB	BDL	10
PHENANTHRENE	PPB	BDL	10
PYRENE	PPB	BDL	10
1,2,4-TRICHLOROBENZENE	PPB	BDL	10

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11 EAST OLIVE ROAD • PENSACOLA, FLORIDA 32514 • (904) 474-1001

Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2309-1
Order Date: 05/01/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: GROUNDWATER

Sample ID.: SUPPLY WELL Sample Date: 04/30/90 Time: 1500

TCL/PEST TARGET COMPOUND LIST-PESTICIDES

Parameter	Units	Result	Detection Limit
ALDRIN	PPB	BDL	0.02
ALPHA CHLORDANE	PPB	BDL	0.5
ALPHA-BHC	PPB	BDL	0.04
BETA-BHC	PPB	BDL	0.04
DELTA-BHC	PPB	BDL	0.01
GAMMA-BHC (LINDANE)	PPB	BDL	0.02
4,4'-DDD	PPB	BDL	0.01
4,4'-DDE	PPB	BDL	0.01
4,4'-DDT	PPB	BDL	0.03
DIELDRIN	PPB	BDL	0.01
ENDOSULFAN I	PPB	BDL	0.02
ENDOSULFAN II	PPB	BDL	0.02
ENDOSULFAN SULFATE	PPB	BDL	0.04
ENDRIN	PPB	BDL	0.02
ENDRIN KETONE	PPB	BDL	0.1
GAMMA CHLORDANE	PPB	BDL	0.5
HEPTACHLOR	PPB	BDL	0.02
HEPTACHLOR EPOXIDE	PPB	BDL	0.01
METHOXYCHLOR	PPB	BDL	0.5
AROCLOR-1016	PPB	BDL	0.5
AROCLOR-1221	PPB	BDL	0.5
AROCLOR-1232	PPB	BDL	0.5
AROCLOR-1242	PPB	BDL	0.5
AROCLOR-1248	PPB	BDL	0.5
AROCLOR-1254	PPB	BDL	0.5
AROCLOR-1260	PPB	BDL	0.5
TOXAPHENE	PPB	BDL	0.5

Pioneer LABORATORY, INC. a division of AnalyticalTechnologies, Inc.
11 EAST OLIVE ROAD • PENSACOLA, FLORIDA 32514 • (904) 474-1001

Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2309-1
Order Date: 05/01/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: GROUNDWATER

Sample ID.: SUPPLY WELL Sample Date: 04/30/90 Time: 1500

TCL/VOL TARGET COMPOUND LIST - VOLATILES

Parameter	Units	Result	Detection Limit
ACETONE	PPB	BDL	10
BENZENE	PPB	BDL	1
BROMODICHLOROMETHANE	PPB	BDL	1
BROMOFORM	PPB	BDL	2
BROMOMETHANE	PPB	BDL	1
2-BUTANONE (MEK)	PPB	BDL	3
CARBON DISULFIDE	PPB	BDL	1
CARBON TETRACHLORIDE	PPB	BDL	2
CHLOROBENZENE	PPB	BDL	1
CHLOROETHANE	PPB	BDL	1
CHLOROFORM	PPB	BDL	2
CHLOROMETHANE	PPB	BDL	2
DIBROMOCHLOROMETHANE	PPB	BDL	5
1,1-DICHLOROETHANE	PPB	BDL	1
1,2-DICHLOROETHANE	PPB	BDL	2
1,1-DICHLOROETHENE	PPB	BDL	1
1,2-DICHLOROETHENE	PPB	BDL	5
1,2-DICHLOROPROPANE	PPB	BDL	2
CIS-1,3-DICHLOROPROPENE	PPB	BDL	1
TRANS-1,3-DICHLOROPROPENE	PPB	BDL	1
ETHYLBENZENE	PPB	BDL	1
2-HEXANONE	PPB	BDL	3
METHYLENE CHLORIDE	PPB	BDL	3
4-METHYL-2-PENTANONE	PPB	BDL	3
STYRENE	PPB	BDL	2
1,1,2,2-TETRACHLOROETHANE	PPB	BDL	2
TETRACHLOROETHENE	PPB	BDL	1
TOLUENE	PPB	BDL	1
1,1,1-TRICHLOROETHANE	PPB	BDL	5
1,1,2-TRICHLOROETHANE	PPB	BDL	2
TRICHLOROETHENE	PPB	BDL	1
VINYL ACETATE	PPB	BDL	2
VINYL CHLORIDE	PPB	BDL	1
TOTAL XYLENES	PPB	BDL	4

end of report

QC "C"

CHAIN OF CUSTODY

Pioneer LABORATORY, INC.
11 EAST OLIVE ROAD PENSACOLA, FLORIDA 32514
PHONE (904) 474-1001 • FAX 478-2671

Client: ABB ENVIRONMENTAL
Address:
City/State/Zip:
Phone No. (904) 656-1293
Contact: MIKE NUGENT
P.O. #:

Laboratory I.D.: 90-2309 Date: 4/30/90
Method of Shipment: hand
Sampler: E. BLOMBERG/A. DESANDRO
Project #: 5898-05
Project Name: OLF BARIN
Project Location: FOLEY AL

SAMPLE TYPE: DW DRINKING WATER, WW WASTE WATER, GW GROUND WATER, SW SURFACE WATER, SO SOIL, OL OIL, AR AIR, SL SLUDGE, HZ HAZARDOUS, OT OTHER

SAMPLE SITE	FIELD I.D.		Date	Time	# Btls.	CLP VOLATILES 40ml VOA	CLP SEMI-VOA 1 l AMBER	CLP PEST 1 l AMBER	TAL METALS 16 oz P	TAL CN 32 oz P			Lab Use Only
SUPPLY WELL			4-30	1500	8	2	2	2	1	1			

	Date	Time		Date	Time
RELINQUISHED BY Eric Blomberg	4-30	1700	RECEIVED BY Laura Albert	4/30	5:20
RELINQUISHED BY			RECEIVED BY		
RELINQUISHED BY			RECEIVED BY		
RELINQUISHED BY			RECEIVED BY		

Comments:

Pioneer LABORATORY, INC. a division of Analytical Technologies, Inc.
11 EAST OLIVE ROAD • PENSACOLA, FLORIDA 32514 • (904) 474-1001

ABB ENVIRONMENTAL, INC
2571 EXECUTIVE CENTER CIR
SUITE 100
TALLAHASSEE FL 32301-5001

Lab I.D.#: 90-2499
Order Number: P29854
Order Date: 05/08/90
Client: 10001
Sampled By: E.B./A.D.
Sample Date: 05/07-08
Sample Time: VARIOUS

Project Number: 5898-05
Project Name: OLF BARIN
Sample Site: FOLEY, AL
Sample Type: SOIL

N/S = Not Submitted

Lab ID	Sample ID	Parameter	Units	Results	Detection Limit
2499-1	WHF-SS-22B-L1	LEAD	PPM	BDL	6.8
2499-2	WHF-SS-22B-L2	LEAD	PPM	BDL	6.9
2499-3	WHF-SS-22B-L3	LEAD	PPM	BDL	7.0
2499-4	WHF-SS-22B-L4	LEAD	PPM	BDL	6.7
2499-5	WHF-SS-22B-L5	LEAD	PPM	BDL	7.4
2499-6	WHF-SS-22B-K1	LEAD	PPM	BDL	6.6
2499-7	WHF-SS-22B-K2	LEAD	PPM	BDL	6.9
2499-8	WHF-SS-22B-K3	LEAD	PPM	BDL	7.0
2499-9	WHF-SS-22B-K4	LEAD	PPM	BDL	6.7
2499-10	WHF-SS-22B-K5	LEAD	PPM	BDL	7.1
2499-11	WHF-SS-22B-J1	LEAD	PPM	BDL	7.0
2499-12	WHF-SS-22B-J2	LEAD	PPM	BDL	7.1
2499-13	WHF-SS-22B-J3	LEAD	PPM	BDL	7.1
2499-14	WHF-SS-22B-J4	LEAD	PPM	BDL	7.1
2499-15	WHF-SS-22B-J5	LEAD	PPM	BDL	7.2
2499-16	WHF-SS-22B-J1D1	LEAD	PPM	BDL	6.9
2499-17	WHF-SS-22B-J6	LEAD	PPM	BDL	7.1
2499-18	WHF-SS-22B-I1	LEAD	PPM	BDL	6.9
2499-19	WHF-SS-22B-I2	LEAD	PPM	BDL	6.8
2499-20	WHF-SS-22B-I3	LEAD	PPM	BDL	6.8
2499-21	WHF-SS-22B-I4	LEAD	PPM	BDL	6.9
2499-22	WHF-SS-22B-I5	LEAD	PPM	BDL	7.0
2499-23	WHF-SS-22B-I6	LEAD	PPM	72	7.5
2499-24	WHF-SS-22B-I5D1	LEAD	PPM	BDL	6.8
2499-25	WHF-SS-22B-H4	LEAD	PPM	73	7.0
2499-26	WHF-SS-22B-H5	LEAD	PPM	146	7.1
2499-27	WHF-SS-22B-H6	LEAD	PPM	BDL	7.2
2499-28	WHF-SS-22B-H7	LEAD	PPM	338	7.5
2499-29	WHF-SS-22B-G4	LEAD	PPM	BDL	6.8
2499-30	WHF-SS-22B-G5	LEAD	PPM	BDL	7.1
2499-31	WHF-SS-22B-G6	LEAD	PPM	BDL	7.1

Comments: PPM = Parts Per Million, mg/kg on a dry basis. BDL = Below Detection Limits. Method Ref: SW-846, 3rd Edition, November 1986.

Approved By : Jon V Hawkins

Pioneer LABORATORY, INC. a division of Analytical Technologies, Inc.
11 EAST OLIVE ROAD • PENSACOLA, FLORIDA 32514 • (904) 474-1001

Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2499
Order Date: 05/08/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: SOIL

Single Tests continued Sample Date: 05/07-08 Time: VARIOUS

Lab ID	Sample ID	Parameter	Units	Results	Detection Limit
2499-32	WHF-SS-22B-G6D1	LEAD	PPM	BDL	7.1
2499-33	WHF-SS-22B-G7	LEAD	PPM	31	7.3
2499-34	WHF-SS-22B-F5	LEAD	PPM	BDL	7.0
2499-35	WHF-SS-22B-F4	LEAD	PPM	BDL	6.9
2499-36	WHF-SS-22B-F6	LEAD	PPM	149	7.2
2499-37	WHF-SS-22B-F7	LEAD	PPM	364	8.3
2499-38	WHF-SS-22B-E4	LEAD	PPM	BDL	6.9
2499-39	WHF-SS-22B-E4D1	LEAD	PPM	19	6.9
2499-40	WHF-SS-22B-E5	LEAD	PPM	30	6.9
2499-41	WHF-SS-22B-E6	LEAD	PPM	BDL	7.0
2499-42	WHF-SS-22B-E7	LEAD	PPM	BDL	6.9
2499-43	WHF-SS-22B-D4	LEAD	PPM	BDL	6.9
2499-44	WHF-SS-22B-D5	LEAD	PPM	BDL	6.9
2499-45	WHF-SS-22B-D6	LEAD	PPM	BDL	6.9
2499-46	WHF-SS-22B-D7	LEAD	PPM	BDL	6.9
2499-47	WHF-SS-22B-C4	LEAD	PPM	BDL	6.9
2499-48	WHF-SS-22B-C5	LEAD	PPM	BDL	6.8
2499-49	WHF-SS-22B-C6	LEAD	PPM	BDL	6.8
2499-50	WHF-SS-22B-C7	LEAD	PPM	BDL	6.9
2499-51	WHF-SS-22B-B4	LEAD	PPM	BDL	7.0
2499-52	WHF-SS-22B-B5	LEAD	PPM	BDL	6.9
2499-53	WHF-SS-22B-B6	LEAD	PPM	BDL	7.0
2499-54	WHF-SS-22B-B7	LEAD	PPM	BDL	7.0
2499-55	WHF-SS-22B-B7D1	LEAD	PPM	BDL	7.0
2499-56	WHF-SS-22B-A5	LEAD	PPM	BDL	7.1
2499-57	WHF-SS-22B-A6	LEAD	PPM	BDL	7.1
2499-58	WHF-SS-22B-A4	LEAD	PPM	BDL	7.0
2499-59	WHF-SS-22B-A7	LEAD	PPM	15	6.8
2499-60	WHF-FB-22B-1	LEAD	PPM	BDL	0.13
2499-61	WHF-EB-22B-1	LEAD	PPM	BDL	0.13
2499-62	WHF-EB-22B-2	LEAD	PPM	BDL	0.13
2499-63	WHF-EB-22B-3	LEAD	PPM	BDL	0.13
2499-64	WHF-EB-22B-4	LEAD	PPM	BDL	0.13
2499-65	WHF-EB-22B-5	LEAD	PPM	BDL	0.13

end of report

Pioneer LABORATORY, INC.
AST OLIVE ROAD PENSACOLA, FLORIDA 32514
PHONE (904) 474-1001 • FAX 478-2671

CHAIN OF CUSTODY

Client: ABB ENVIRONMENTAL
Address:
City/State/Zip: TALL. FL
Phone No. (904) 656-1293
Contact: MIKE NUGENT
P.O. #:

Laboratory I.D.: 90-2499 Date: 5/8/90
Method of Shipment: hand
Sampler: BLOMBERG / DESANDRO
Project #: 5898-05
Project Name: OLF BARIN
Project Location: FOLEY ALABAMA

SAMPLE TYPE

DW DRINKING WATER
WW WASTE WATER
GW GROUND WATER
SW SURFACE WATER
SO SOIL
OL OIL
AR AIR
SL SLUDGE
HZ HAZARDOUS
OT OTHER

SAMPLE SITE	FIELD I.D.	Date	Time	# Btls.	PARAMETERS: Pb 6010							Lab Use Only
OLF BARIN 22B	WHF-SS-22B-L1(1-2)-1	5/7	1257	1	1							1
"	" L2 "		1312	1	1							2
"	" L3 "		1320	1	1							3
"	" L4 "		1330	1	1							4
"	" L5 "		1340	1	1							5
"	" K1 "		1357	1	1							6
"	" K2 "		1403	1	1							7
"	" K3 "		1410	1	1							8
"	" K4 "		1420	1	1							9
"	" K5 "		1425	1	1							10
"	" J1 "		1455	1	1							11
"	" J2 "		1510	1	1							12

	Date	Time		Date	Time
RELINQUISHED BY [signature]	5/8	1530	RECEIVED BY S. Blackstock / ATI	5/8	16:3
RELINQUISHED BY			RECEIVED BY		
RELINQUISHED BY			RECEIVED BY		
RELINQUISHED BY			RECEIVED BY		

Comments:

CERTIFICATION NUMBERS

CHAIN OF CUSTODY

Pioneer LABORATORY, INC.
11 EAST OLIVE ROAD PENSACOLA, FLORIDA 32514
PHONE (904) 474-1001 • FAX 478-2671

Client: ABB ENVIRONMENTAL
Address:
City/State/Zip:
Phone No. (904) 656-1293
Contact: MIKE NUGENT
P.O. #:

Laboratory I.D.: 90-2499 Date: 5/8/90
Method of Shipment: hand
Sampler: BLOMBERG / DESANDRO
Project #: 5898-05
Project Name: OLF BARIN
Project Location: FOLEY, ALAB.

SAMPLE TYPE

DW DRINKING WATER
WW WASTE WATER
GW GROUND WATER
SW SURFACE WATER
SO SOIL
OL OIL
AR AIR
SL SLUDGE
HZ HAZARDOUS
OT OTHER

SAMPLE SITE	FIELD I.D.	Date	Time	# Btls.	PB 6010							Lab Use Only
OLF BARIN 22B	WHF-SS-22B-J3(1-2)-1	5/7	1516	1	1							13
"	" J4 "	"	1537	1	1							14
"	" J5 "	"	1547	1	1							15
"	" J1(1-2)-D-1	"	1455	1	1							16
"	" J6(1-2)-1	"	1553	1	1							17
"	" I1 "	"	1600	1	1							18
"	" I2 "	"	1604	1	1							19
"	" I3 "	"	1607	1	1							20
"	" I4 "	"	1613	1	1							21
"	" I5 "	"	1620	1	1							22
"	" I6 "	"	1625	1	1							23
"	" I5(1-2)-D-1	"	1620	1	1							24

	Date	Time		Date	Time
RELINQUISHED BY [signature]	5/8	1630	RECEIVED BY S. Braddock / ATI	5/8	16[illegible]
RELINQUISHED BY			RECEIVED BY		
RELINQUISHED BY			RECEIVED BY		
RELINQUISHED BY			RECEIVED BY		

Comments:

CHAIN OF CUSTODY

Pioneer LABORATORY, INC.
AST OLIVE ROAD PENSACOLA, FLORIDA 32514
PHONE (904) 474-1001 • FAX 478-2671

Client: ABB ENVIRONMENTAL
Address:
City/State/Zip:
Phone No. ( ) 656-1293
Contact: M. NUGENT
P.O. #:

Laboratory I.D.: 90-2499 Date: 5/8/90
Method of Shipment: hand
Sampler: BLOMBERG/DESANDRO
Project #: 5898-05
Project Name: OLF BARIN
Project Location: FOLEY, ALAB

SAMPLE TYPE

DW DRINKING WATER
WW WASTE WATER
GW GROUND WATER
SW SURFACE WATER
SO SOIL
OL OIL
AR AIR
SL SLUDGE
HZ HAZARDOUS
OT OTHER

SAMPLE SITE	FIELD I.D.		Date	Time	# Btls.	PARAMETERS: Pb 6010							Lab Use Only
OLF BARIN 22B	WHF-SS-22B-H4(1-2)-1		5/8	0910	1	1							25
"	" H5 "		"	0915	1	1							26
"	" H6 "		"	0920	1	1							27
"	" H7 "		"	0930	1	1							28
"	" G4 "		"	0935	1	1							29
"	" G5 "		"	0942	1	1							30
"	" G6 "		"	0949	1	1							31
"	" G6(1-2)-D-1		"	0949	1	1							32
"	" G7 (1-2)-1		"	0953	1	1							33
"	" F5 "		"	1050	1	1							34
"	" F4 "		"	1057	1	1							35
"	" F6 "		"	1101	1	1							36

	Date	Time		Date	Time
RELINQUISHED BY [signature]	5/8	1630	RECEIVED BY S. Brackbock / ATI	5/8	16:30
RELINQUISHED BY			RECEIVED BY		
RELINQUISHED BY			RECEIVED BY		
NQUISHED BY			RECEIVED BY		

Comments:

Pioneer LABORATORY, INC.
11 EAST OLIVE ROAD PENSACOLA, FLORIDA 32514
PHONE (904) 474-1001 • FAX 478-2671

CHAIN OF CUSTODY

Client: ABB ENVIRONMENTAL
Address:
City/State/Zip:
Phone No. (904) 656-1293
Contact: M. NUGENT
P.O. #:

Laboratory I.D.: 90-2499 Date: 5/8/90
Method of Shipment: hand
Sampler: BLOMBERG / DESANDRO
Project #: 5898-05
Project Name: OLF BARIN
Project Location: FOLEY, ALAB

SAMPLE TYPE: DW DRINKING WATER, WW WASTE WATER, GW GROUND WATER, SW SURFACE WATER, SO SOIL, OL OIL, AR AIR, SL SLUDGE, HZ HAZARDOUS, OT OTHER

SAMPLE SITE	FIELD I.D.	Date	Time	# Btls.	Pb GOLD							Lab Use Only
OLF BARIN 22B	WHF-SS-22B-F7(1-2)-1	5/8	1107	1	1							37
"	" E4 "	"	1117	1	1							38
"	" E4(1-2)-D-1	"	1117	1	1							39
"	" E5(1-2)-1	"	1122	1	1							40
"	" E6 "	"	1138	1	1							41
"	" E7 "	"	1140	1	1							42
"	" D4 "	"	1307	1	1							43
"	" D5 "	"	1312	1	1							44
"	" D6 "	"	1315	1	1							45
"	" D7 "	"	1322	1	1							46
"	" C4 "	"	1328	1	1							47
"	" C5 "	"	1337	1	1							48

	Date	Time		Date	Time
RELINQUISHED BY [signature]	5/8	1630	RECEIVED BY S. Bradlock / ATI	5/8	1630
RELINQUISHED BY			RECEIVED BY		
RELINQUISHED BY			RECEIVED BY		
RELINQUISHED BY			RECEIVED BY		

Comments:

Pioneer LABORATORY, INC.
AST OLIVE ROAD PENSACOLA, FLORIDA 32514
PHONE (904) 474-1001 • FAX 478-2671

CHAIN OF CUSTODY

Client: ABB ENVIRONMENTAL
Address:
City/State/Zip:
Phone No.: (904) 656-1293
Contact: M. NUGENT
P.O. #:

Laboratory I.D.: 90-2499 Date: 5/8/90
Method of Shipment: hand
Sampler: BLOMBERG / DESANDRO
Project #: 5898-05
Project Name: OLF BARIN
Project Location: FOLEY, ALAB

SAMPLE TYPE: DW DRINKING WATER; WW WASTE WATER; GW GROUND WATER; SW SURFACE WATER; SO SOIL; OL OIL; AR AIR; SL SLUDGE; HZ HAZARDOUS; OT OTHER

SAMPLE SITE	FIELD I.D.	Date	Time	# Btls.	Pb 6010							Lab Use Only
OLF BARIN 22B	WHF-SS-22B-C6(1-2)-1	5/8	1341	1	1							49
"	" C7 "		1346	1	1							50
	" B4 "		1403	1	1							51
	" B5 "		1408	1	1							52
	" B6 "		1412	1	1							53
	" B7 "		1418	1	1							54
	" B7(1-2)-D-1		1418	1	1							55
	" A5(1-2)-1		1436	1	1							56
	" A6 "		1438	1	1							57
	" A4 "		1444	1	1							58
	" A7 "		1448	1	1							59
	"											~~60~~

	Date	Time		Date	Time
RELINQUISHED BY [signature]	1630		RECEIVED BY S. Braddock / ATI	5/8	1630
RELINQUISHED BY			RECEIVED BY		
RELINQUISHED BY			RECEIVED BY		
RELINQUISHED BY			RECEIVED BY		

Comments:

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PL LABORATORY, INC.
11 EAST OLIVE ROAD PENSACOLA, FLORIDA 32514
PHONE (904) 474-1001 • FAX 478-2671

CHAIN OF CUSTOD

Client: ~~MEB~~ ENVIRONMENTAL
Address:
City/State/Zip:
Phone No.: (904) 656-1293
Contact: M. NUGENT
P.O. #:

Laboratory I.D.: 90-2499 Date: 5/8/90
Method of Shipment: hand
Sampler: BLOMBERG/DESANDRO
Project #: 5898-05
Project Name: OLF BARIN
Project Location: FOLEY, ALAB.

SAMPLE TYPE

DW DRINKING WATER
WW WASTE WATER
GW GROUND WATER
SW SURFACE WATER
SO SOIL
OL OIL
AR AIR
SL SLUDGE
HZ HAZARDOUS
(OT) OTHER DI WATER

SAMPLE SITE	FIELD I.D.	Date	Time	# Btls.	Pb 6010							Lab Use Only
OLF BARIN 22B	WHF-FB-22B-1	5/7	1634	1	1							60
"	WHF-EB-22B-1	5/7	1636	1	1							61
"	WHF-EB-22B-2	5/8	1040	1	1							62
"	WHF-EB-22B-3	"	1128	1	1							63
"	WHF-EB-22B-4	"	1333	1	1							64
"	WHF-EB-22B-5	"	1500	1	1							65

	Date	Time		Date	Time
RELINQUISHED BY [signature]	5/8	1630	RECEIVED BY S. Braddock LATI	5/8	1630
RELINQUISHED BY			RECEIVED BY		
RELINQUISHED BY			RECEIVED BY		
RELINQUISHED BY			RECEIVED BY		

Comments:

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ABB ENVIRONMENTAL, INC
2571 EXECUTIVE CENTER CIR
SUITE 100
TALLAHASSEE FL 32301-5001

Lab I.D.#: 90-2546W
Order Number: P29930
Order Date: 05/10/90
Client: 10001
Sampled By: E.B./A.D.
Sample Date: 05/09/90
Sample Time: VARIOUS

Project Number: 5898-05
Project Name: OLF BARIN
Sample Site: FOLEY, AL
Sample Type: GROUNDWATER

N/S = Not Submitted

Lab ID	Sample ID	Parameter	Units	Results	Detection Limit
2546W-1	WHF-SW-23B-2-1	PHENOLS,TOTAL	PPM	BDL	0.005
2546W-2	WHF-SW-23B-2-D1	PHENOLS,TOTAL	PPM	BDL	0.005

Comments: PPM = Parts Per Million, mg/l. PPB = Parts Per Billion, ug/l.
Method Reference: SW-846, 3rd Edition, November 1986.
BDL = Below Detection Limits.

Approved By : John V Hawkins

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2546W-1
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: GROUNDWATER

Sample ID.: WHF-SW-23B-2-1 Sample Date: 05/09/90 Time: VARIOUS

TCL/INORGANICS TARGET COMPOUND LIST - INORGANICS

Parameter	Units	Result	Detection Limit
SILVER	PPM	BDL	0.0002
ALUMINUM	PPM	BDL	0.5
ARSENIC	PPM	BDL	0.001
BARIUM	PPM	BDL	0.1
BERYLLIUM	PPM	BDL	0.01
CALCIUM	PPM	2.0	1
CADMIUM	PPM	BDL	0.0002
COBALT	PPM	BDL	0.05
CHROMIUM	PPM	BDL	0.01
COPPER	PPM	BDL	0.03
CYANIDE, TOTAL	PPM	BDL	0.005
IRON	PPM	0.32	0.03
MERCURY	PPM	BDL	0.0005
POTASSIUM	PPM	0.8	0.6
MAGNESIUM	PPM	1.7	0.01
MANGANESE	PPM	BDL	0.01
SODIUM	PPM	3.1	0.2
NICKEL	PPM	BDL	0.05
LEAD	PPM	BDL	0.004
ANTIMONY	PPM	BDL	0.1
SELENIUM	PPM	BDL	0.003
THALLIUM	PPM	BDL	0.4
VANADIUM	PPM	BDL	0.2
ZINC	PPM	BDL	0.01

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2546W-2
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: GROUNDWATER

Sample ID.: WHF-SW-23B-2-D1 Sample Date: 05/09/90 Time: VARIOUS

TCL/INORGANICS TARGET COMPOUND LIST - INORGANICS

Parameter	Units	Result	Detection Limit
SILVER	PPM	BDL	0.0002
ALUMINUM	PPM	BDL	0.5
ARSENIC	PPM	BDL	0.001
BARIUM	PPM	BDL	0.1
BERYLLIUM	PPM	BDL	0.01
CALCIUM	PPM	1.7	1
CADMIUM	PPM	BDL	0.0002
COBALT	PPM	BDL	0.05
CHROMIUM	PPM	BDL	0.01
COPPER	PPM	BDL	0.03
CYANIDE, TOTAL	PPM	BDL	0.005
IRON	PPM	0.30	0.03
MERCURY	PPM	BDL	0.0005
POTASSIUM	PPM	0.7	0.6
MAGNESIUM	PPM	1.7	0.01
MANGANESE	PPM	BDL	0.01
SODIUM	PPM	3.0	0.2
NICKEL	PPM	BDL	0.05
LEAD	PPM	BDL	0.004
ANTIMONY	PPM	BDL	0.1
SELENIUM	PPM	BDL	0.003
THALLIUM	PPM	BDL	0.4
VANADIUM	PPM	BDL	0.2
ZINC	PPM	BDL	0.01

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2546W-1
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: GROUNDWATER

Sample ID.: WHF-SW-23B-2-1 Sample Date: 05/09/90 Time: VARIOUS

TCL/ACID TARGET COMPOUND LIST - ACID EXTRACT

Parameter	Units	Result	Detection Limit
BENZOIC ACID	PPB	BDL	50
4-CHLORO-3-METHYLPHENOL	PPB	BDL	10
2-CHLOROPHENOL	PPB	BDL	10
2,4-DICHLOROPHENOL	PPB	BDL	10
2,4-DIMETHYLPHENOL	PPB	BDL	10
4,6-DINITRO-2-METHYLPHENOL	PPB	BDL	50
2,4-DINITROPHENOL	PPB	BDL	50
2-METHYLPHENOL	PPB	BDL	10
4-METHYLPHENOL	PPB	BDL	10
2-NITROPHENOL	PPB	BDL	10
4-NITROPHENOL	PPB	BDL	50
PENTACHLOROPHENOL	PPB	BDL	50
PHENOL	PPB	BDL	10
2,4,5-TRICHLOROPHENOL	PPB	BDL	50
2,4,6-TRICHLOROPHENOL	PPB	BDL	10

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2546W-2
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: GROUNDWATER

Sample ID.: WHF-SW-23B-2-D1 Sample Date: 05/09/90 Time: VARIOUS

TCL/ACID TARGET COMPOUND LIST - ACID EXTRACT

Parameter	Units	Result	Detection Limit
BENZOIC ACID	PPB	BDL	50
4-CHLORO-3-METHYLPHENOL	PPB	BDL	10
2-CHLOROPHENOL	PPB	BDL	10
2,4-DICHLOROPHENOL	PPB	BDL	10
2,4-DIMETHYLPHENOL	PPB	BDL	10
4,6-DINITRO-2-METHYLPHENOL	PPB	BDL	50
2,4-DINITROPHENOL	PPB	BDL	50
2-METHYLPHENOL	PPB	BDL	10
4-METHYLPHENOL	PPB	BDL	10
2-NITROPHENOL	PPB	BDL	10
4-NITROPHENOL	PPB	BDL	50
PENTACHLOROPHENOL	PPB	BDL	50
PHENOL	PPB	BDL	10
2,4,5-TRICHLOROPHENOL	PPB	BDL	50
2,4,6-TRICHLOROPHENOL	PPB	BDL	10

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2546W-1
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: GROUNDWATER

Sample ID.: WHF-SW-23B-2-1 Sample Date: 05/09/90 Time: VARIOUS

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL

Parameter	Units	Result	Detection Limit
ACENAPHTHENE	PPB	BDL	10
ACENAPHTHYLENE	PPB	BDL	10
ANTHRACENE	PPB	BDL	10
BENZO(A)ANTHRACENE	PPB	BDL	10
BENZO(A)PYRENE	PPB	BDL	10
BENZO(B)FLUORANTHENE	PPB	BDL	10
BENZO(G,H,I)PERYLENE	PPB	BDL	10
BENZO(K)FLUORANTHENE	PPB	BDL	10
BENZYL ALCOHOL	PPB	BDL	10
BIS(2-CHLOROETHOXY)METHANE	PPB	BDL	10
BIS(2-CHLOROETHYL)ETHER	PPB	BDL	10
BIS(2-CHLOROISOPROPYL)ETHER	PPB	BDL	10
BIS(2-ETHYLHEXYL)PHTHALATE	PPB	BDL	10
4-BROMOPHENYL PHENYL ETHER	PPB	BDL	10
BUTYL BENZYL PHTHALATE	PPB	BDL	10
4-CHLOROANILINE	PPB	BDL	10
2-CHLORONAPHTHALENE	PPB	BDL	10
4-CHLOROPHENYL PHENYL ETHER	PPB	BDL	10
CHRYSENE	PPB	BDL	10
DIBENZ(A,H)ANTHRACENE	PPB	BDL	10
DIBENZOFURAN	PPB	BDL	10
1,2-DICHLOROBENZENE	PPB	BDL	10
1,3-DICHLOROBENZENE	PPB	BDL	10
1,4-DICHLOROBENZENE	PPB	BDL	10
3,3'-DICHLOROBENZIDINE	PPB	BDL	50
DIETHYLPHTHALATE	PPB	BDL	10
DIMETHYLPHTHALATE	PPB	BDL	10
DI-N-BUTYLPHTHALATE	PPB	BDL	10
2,4-DINITROTOLUENE	PPB	BDL	10
2,6-DINITROTOLUENE	PPB	BDL	10
DI-N-OCTYLPHTHALATE	PPB	BDL	10
FLUORANTHENE	PPB	BDL	10
FLUORENE	PPB	BDL	10
HEXACHLOROBENZENE	PPB	BDL	10
HEXACHLOROBUTADIENE	PPB	BDL	10

Sample ID.: WHF-SW-23B-2-1 Test Parameters continued on next page

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2546W-1
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: GROUNDWATER

Sample ID.: WHF-SW-23B-2-1 Sample Date: 05/09/90 Time: VARIOUS

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL continued

Parameter	Units	Result	Detection Limit
HEXACHLOROCYCLOPENTADIENE	PPB	BDL	10
HEXACHLOROETHANE	PPB	BDL	10
INDENO(1,2,3-CD)PYRENE	PPB	BDL	10
ISOPHORONE	PPB	BDL	10
2-METHYLNAPHTHALENE	PPB	BDL	10
NAPHTHALENE	PPB	BDL	10
2-NITROANILINE	PPB	BDL	10
3-NITROANILINE	PPB	BDL	10
4-NITROANILINE	PPB	BDL	10
NITROBENZENE	PPB	BDL	10
N-NITROSODIPHENYLAMINE	PPB	BDL	10
N-NITROSO-DI-N-DIPROPYLAMINE	PPB	BDL	10
PHENANTHRENE	PPB	BDL	10
PYRENE	PPB	BDL	10
1,2,4-TRICHLOROBENZENE	PPB	BDL	10

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2546W-2
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: GROUNDWATER

Sample ID.: WHF-SW-23B-2-D1 Sample Date: 05/09/90 Time: VARIOUS

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL

Parameter	Units	Result	Detection Limit
ACENAPHTHENE	PPB	BDL	10
ACENAPHTHYLENE	PPB	BDL	10
ANTHRACENE	PPB	BDL	10
BENZO(A)ANTHRACENE	PPB	BDL	10
BENZO(A)PYRENE	PPB	BDL	10
BENZO(B)FLUORANTHENE	PPB	BDL	10
BENZO(G,H,I)PERYLENE	PPB	BDL	10
BENZO(K)FLUORANTHENE	PPB	BDL	10
BENZYL ALCOHOL	PPB	BDL	10
BIS(2-CHLOROETHOXY)METHANE	PPB	BDL	10
BIS(2-CHLOROETHYL)ETHER	PPB	BDL	10
BIS(2-CHLOROISOPROPYL)ETHER	PPB	BDL	10
BIS(2-ETHYLHEXYL)PHTHALATE	PPB	BDL	10
4-BROMOPHENYL PHENYL ETHER	PPB	BDL	10
BUTYL BENZYL PHTHALATE	PPB	BDL	10
4-CHLOROANILINE	PPB	BDL	10
2-CHLORONAPHTHALENE	PPB	BDL	10
4-CHLOROPHENYL PHENYL ETHER	PPB	BDL	10
CHRYSENE	PPB	BDL	10
DIBENZ(A,H)ANTHRACENE	PPB	BDL	10
DIBENZOFURAN	PPB	BDL	10
1,2-DICHLOROBENZENE	PPB	BDL	10
1,3-DICHLOROBENZENE	PPB	BDL	10
1,4-DICHLOROBENZENE	PPB	BDL	10
3,3'-DICHLOROBENZIDINE	PPB	BDL	50
DIETHYLPHTHALATE	PPB	BDL	10
DIMETHYLPHTHALATE	PPB	BDL	10
DI-N-BUTYLPHTHALATE	PPB	BDL	10
2,4-DINITROTOLUENE	PPB	BDL	10
2,6-DINITROTOLUENE	PPB	BDL	10
DI-N-OCTYLPHTHALATE	PPB	BDL	10
FLUORANTHENE	PPB	BDL	10
FLUORENE	PPB	BDL	10
HEXACHLOROBENZENE	PPB	BDL	10
HEXACHLOROBUTADIENE	PPB	BDL	10

Sample ID.: WHF-SW-23B-2-D1 Test Parameters continued on next page

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2546W-2
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: GROUNDWATER

Sample ID.: WHF-SW-23B-2-D1 Sample Date: 05/09/90 Time: VARIOUS

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL continued

Parameter	Units	Result	Detection Limit
HEXACHLOROCYCLOPENTADIENE	PPB	BDL	10
HEXACHLOROETHANE	PPB	BDL	10
INDENO(1,2,3-CD)PYRENE	PPB	BDL	10
ISOPHORONE	PPB	BDL	10
2-METHYLNAPHTHALENE	PPB	BDL	10
NAPHTHALENE	PPB	BDL	10
2-NITROANILINE	PPB	BDL	10
3-NITROANILINE	PPB	BDL	10
4-NITROANILINE	PPB	BDL	10
NITROBENZENE	PPB	BDL	10
N-NITROSODIPHENYLAMINE	PPB	BDL	10
N-NITROSO-DI-N-DIPROPYLAMINE	PPB	BDL	10
PHENANTHRENE	PPB	BDL	10
PYRENE	PPB	BDL	10
1,2,4-TRICHLOROBENZENE	PPB	BDL	10

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2546W-1
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: GROUNDWATER

Sample ID.: WHF-SW-23B-2-1 Sample Date: 05/09/90 Time: VARIOUS

TCL/PEST TARGET COMPOUND LIST-PESTICIDES

Parameter	Units	Result	Detection Limit
ALDRIN	PPB	BDL	0.02
ALPHA CHLORDANE	PPB	BDL	0.5
ALPHA-BHC	PPB	BDL	0.04
BETA-BHC	PPB	BDL	0.04
DELTA-BHC	PPB	BDL	0.01
GAMMA-BHC (LINDANE)	PPB	BDL	0.02
4,4'-DDD	PPB	BDL	0.01
4,4'-DDE	PPB	BDL	0.01
4,4'-DDT	PPB	BDL	0.03
DIELDRIN	PPB	BDL	0.01
ENDOSULFAN I	PPB	BDL	0.02
ENDOSULFAN II	PPB	BDL	0.02
ENDOSULFAN SULFATE	PPB	BDL	0.04
ENDRIN	PPB	BDL	0.02
ENDRIN KETONE	PPB	BDL	0.1
GAMMA CHLORDANE	PPB	BDL	0.5
HEPTACHLOR	PPB	BDL	0.02
HEPTACHLOR EPOXIDE	PPB	BDL	0.01
METHOXYCHLOR	PPB	BDL	0.5
AROCLOR-1016	PPB	BDL	0.5
AROCLOR-1221	PPB	BDL	0.5
AROCLOR-1232	PPB	BDL	0.5
AROCLOR-1242	PPB	BDL	0.5
AROCLOR-1248	PPB	BDL	0.5
AROCLOR-1254	PPB	BDL	0.5
AROCLOR-1260	PPB	BDL	0.5
TOXAPHENE	PPB	BDL	0.5

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2546W-2
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: GROUNDWATER

Sample ID.: WHF-SW-23B-2-D1 Sample Date: 05/09/90 Time: VARIOUS

TCL/PEST TARGET COMPOUND LIST-PESTICIDES

Parameter	Units	Result	Detection Limit
ALDRIN	PPB	BDL	0.02
ALPHA CHLORDANE	PPB	BDL	0.5
ALPHA-BHC	PPB	BDL	0.04
BETA-BHC	PPB	BDL	0.04
DELTA-BHC	PPB	BDL	0.01
GAMMA-BHC (LINDANE)	PPB	BDL	0.02
4,4'-DDD	PPB	BDL	0.01
4,4'-DDE	PPB	BDL	0.01
4,4'-DDT	PPB	BDL	0.03
DIELDRIN	PPB	BDL	0.01
ENDOSULFAN I	PPB	BDL	0.02
ENDOSULFAN II	PPB	BDL	0.02
ENDOSULFAN SULFATE	PPB	BDL	0.04
ENDRIN	PPB	BDL	0.02
ENDRIN KETONE	PPB	BDL	0.1
GAMMA CHLORDANE	PPB	BDL	0.5
HEPTACHLOR	PPB	BDL	0.02
HEPTACHLOR EPOXIDE	PPB	BDL	0.01
METHOXYCHLOR	PPB	BDL	0.5
AROCLOR-1016	PPB	BDL	0.5
AROCLOR-1221	PPB	BDL	0.5
AROCLOR-1232	PPB	BDL	0.5
AROCLOR-1242	PPB	BDL	0.5
AROCLOR-1248	PPB	BDL	0.5
AROCLOR-1254	PPB	BDL	0.5
AROCLOR-1260	PPB	BDL	0.5
TOXAPHENE	PPB	BDL	0.5

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2546W-1
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: GROUNDWATER

Sample ID.: WHF-SW-23B-2-1 Sample Date: 05/09/90 Time: VARIOUS

TCL/VOL TARGET COMPOUND LIST - VOLATILES

Parameter	Units	Result	Detection Limit
ACETONE	PPB	BDL	10
BENZENE	PPB	BDL	1
BROMODICHLOROMETHANE	PPB	BDL	1
BROMOFORM	PPB	BDL	2
BROMOMETHANE	PPB	BDL	1
2-BUTANONE (MEK)	PPB	BDL	3
CARBON DISULFIDE	PPB	BDL	1
CARBON TETRACHLORIDE	PPB	BDL	2
CHLOROBENZENE	PPB	BDL	1
CHLOROETHANE	PPB	BDL	1
CHLOROFORM	PPB	BDL	2
CHLOROMETHANE	PPB	BDL	2
DIBROMOCHLOROMETHANE	PPB	BDL	5
1,1-DICHLOROETHANE	PPB	BDL	1
1,2-DICHLOROETHANE	PPB	BDL	2
1,1-DICHLOROETHENE	PPB	BDL	1
1,2-DICHLOROETHENE	PPB	BDL	5
1,2-DICHLOROPROPANE	PPB	BDL	2
CIS-1,3-DICHLOROPROPENE	PPB	BDL	1
TRANS-1,3-DICHLOROPROPENE	PPB	BDL	1
ETHYLBENZENE	PPB	BDL	1
2-HEXANONE	PPB	BDL	3
METHYLENE CHLORIDE	PPB	BDL	3
4-METHYL-2-PENTANONE	PPB	BDL	3
STYRENE	PPB	BDL	2
1,1,2,2-TETRACHLOROETHANE	PPB	BDL	2
TETRACHLOROETHENE	PPB	BDL	1
TOLUENE	PPB	BDL	1
1,1,1-TRICHLOROETHANE	PPB	BDL	5
1,1,2-TRICHLOROETHANE	PPB	BDL	2
TRICHLOROETHENE	PPB	BDL	1
VINYL ACETATE	PPB	BDL	2
VINYL CHLORIDE	PPB	BDL	1
TOTAL XYLENES	PPB	BDL	4

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11 EAST OLIVE ROAD • PENSACOLA, FLORIDA 32514 • (904) 474-1001

Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2546W-2
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: GROUNDWATER

Sample ID.: WHF-SW-23B-2-D1 Sample Date: 05/09/90 Time: VARIOUS

TCL/VOL TARGET COMPOUND LIST - VOLATILES

Parameter	Units	Result	Detection Limit
ACETONE	PPB	BDL	10
BENZENE	PPB	BDL	1
BROMODICHLOROMETHANE	PPB	BDL	1
BROMOFORM	PPB	BDL	2
BROMOMETHANE	PPB	BDL	1
2-BUTANONE (MEK)	PPB	BDL	3
CARBON DISULFIDE	PPB	BDL	1
CARBON TETRACHLORIDE	PPB	BDL	2
CHLOROBENZENE	PPB	BDL	1
CHLOROETHANE	PPB	BDL	1
CHLOROFORM	PPB	BDL	2
CHLOROMETHANE	PPB	BDL	2
DIBROMOCHLOROMETHANE	PPB	BDL	5
1,1-DICHLOROETHANE	PPB	BDL	1
1,2-DICHLOROETHANE	PPB	BDL	2
1,1-DICHLOROETHENE	PPB	BDL	1
1,2-DICHLOROETHENE	PPB	BDL	5
1,2-DICHLOROPROPANE	PPB	BDL	2
CIS-1,3-DICHLOROPROPENE	PPB	BDL	1
TRANS-1,3-DICHLOROPROPENE	PPB	BDL	1
ETHYLBENZENE	PPB	BDL	1
2-HEXANONE	PPB	BDL	3
METHYLENE CHLORIDE	PPB	BDL	3
4-METHYL-2-PENTANONE	PPB	BDL	3
STYRENE	PPB	BDL	2
1,1,2,2-TETRACHLOROETHANE	PPB	BDL	2
TETRACHLOROETHENE	PPB	BDL	1
TOLUENE	PPB	BDL	1
1,1,1-TRICHLOROETHANE	PPB	BDL	5
1,1,2-TRICHLOROETHANE	PPB	BDL	2
TRICHLOROETHENE	PPB	BDL	1
VINYL ACETATE	PPB	BDL	2
VINYL CHLORIDE	PPB	BDL	1
TOTAL XYLENES	PPB	BDL	4

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2546W-3
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: GROUNDWATER

Sample ID.: WHF-TB-23B-2 Sample Date: 05/09/90 Time: VARIOUS

TCL/VOL TARGET COMPOUND LIST - VOLATILES

Parameter	Units	Result	Detection Limit
ACETONE	PPB	BDL	10
BENZENE	PPB	BDL	1
BROMODICHLOROMETHANE	PPB	BDL	1
BROMOFORM	PPB	BDL	2
BROMOMETHANE	PPB	BDL	1
2-BUTANONE (MEK)	PPB	BDL	3
CARBON DISULFIDE	PPB	BDL	1
CARBON TETRACHLORIDE	PPB	BDL	2
CHLOROBENZENE	PPB	BDL	1
CHLOROETHANE	PPB	BDL	1
CHLOROFORM	PPB	BDL	2
CHLOROMETHANE	PPB	BDL	2
DIBROMOCHLOROMETHANE	PPB	BDL	5
1,1-DICHLOROETHANE	PPB	BDL	1
1,2-DICHLOROETHANE	PPB	BDL	2
1,1-DICHLOROETHENE	PPB	BDL	1
1,2-DICHLOROETHENE	PPB	BDL	5
1,2-DICHLOROPROPANE	PPB	BDL	2
CIS-1,3-DICHLOROPROPENE	PPB	BDL	1
TRANS-1,3-DICHLOROPROPENE	PPB	BDL	1
ETHYLBENZENE	PPB	BDL	1
2-HEXANONE	PPB	BDL	3
METHYLENE CHLORIDE	PPB	BDL	3
4-METHYL-2-PENTANONE	PPB	BDL	3
STYRENE	PPB	BDL	2
1,1,2,2-TETRACHLOROETHANE	PPB	BDL	2
TETRACHLOROETHENE	PPB	BDL	1
TOLUENE	PPB	BDL	1
1,1,1-TRICHLOROETHANE	PPB	BDL	5
1,1,2-TRICHLOROETHANE	PPB	BDL	2
TRICHLOROETHENE	PPB	BDL	1
VINYL ACETATE	PPB	BDL	2
VINYL CHLORIDE	PPB	BDL	1
TOTAL XYLENES	PPB	BDL	4

end of report

NEESA LEVEL "C"

CHAIN OF CUSTODY

Pioneer LABORATORY, INC.
EAST OLIVE ROAD PENSACOLA, FLORIDA 32514
PHONE (904) 474-1001 • FAX 478-2671

S/W

Client: ABB ENVIRONMENTAL
Address:
City/State/Zip:
Phone No. (904) 656-1293
Contact: M. NUGENT
P.O. #:

Laboratory I.D. 90-2546 Date 5/10/90
Method of Shipment:
Sampler: BLOMBERG / DESANDRO
Project # 5898-05
Project Name: OLF BARIN
Project Location: FOLEY, ALAB

SAMPLE TYPE: DW DRINKING WATER, WW WASTE WATER, GW GROUND WATER, SW SURFACE WATER, SO SOIL, OL OIL, AR AIR, SL SLUDGE, HZ HAZARDOUS, OT OTHER

SAMPLE SITE	FIELD I.D.		Date	Time	# Btls.	CLP VOA TCL	SEMI VOA TCL	PEST/PCB TCL	TCL METALS	CYANIDE	TOTAL PHENOLS		Lab Use Only
OLF BARIN 23B	WHF-SW-23B-2-1 *	SURFACE WTR	5/9	1745	15	2	3	3	1	3	3		W-1
"	WHF-SW-23B-2-D-1	"	"	1745	7	2	1	1	1	1	1		W-2
"	WHF-SD-23B-2-1	SEDIMENT SOIL	"	1755	4	1	1	1	X	X	X		S-1
"	WHF-SD-23B-2-D-1	SEDIMENT SOIL	"	1755	4	1	1	1	X	X	X		S-2
"	WHF-TB-23B-2	WTR	"	-	1	1							W-3

	Date	Time		Date	Time
RELINQUISHED BY Andrew J. DeSandro	5/10	1100	RECEIVED BY Laura Tolbert	5/10	11:0
RELINQUISHED BY			RECEIVED BY		
RELINQUISHED BY			RECEIVED BY		
RELINQUISHED BY			RECEIVED BY		

Comments: * INCLUDES ADDITIONAL BOTTLES FOR LEVEL "C" QC

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ABB ENVIRONMENTAL, INC
2571 EXECUTIVE CENTER CIR
SUITE 100
TALLAHASSEE FL 32301-5001

Lab I.D.#: 90-2546S
Order Number: P29932
Order Date: 05/10/90
Client: 10001
Sampled By: E.B./A.D.
Sample Date: 05/09/90
Sample Time: VARIOUS

Project Number: 5898-05
Project Name: OLF BARIN
Sample Site: FOLEY, AL
Sample Type: SOIL

N/S = Not Submitted

Lab ID	Sample ID	Parameter	Units	Results	Detection Limit
2546S-1	WHF-SD-23B-2-1	PHENOLS,TOTAL	PPM	3.8	0.35
2546S-2	WHF-SD-23B-2-D1	PHENOLS,TOTAL	PPM	0.35	0.35

Comments: PPM = Parts Per Million, mg/kg on a dry basis; PPB = Parts Per Billion, ug/kg on a dry basis. BDL = Below Detection Limits.
Method Reference: SW-846, 3rd Edition, November 1986.

Approved By : John V Hawkins

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2546S-1
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: SOIL

Sample ID.: WHF-SD-23B-2-1 Sample Date: 05/09/90 Time: VARIOUS

TCL/INORGANICS TARGET COMPOUND LIST - INORGANICS

Parameter	Units	Result	Detection Limit
SILVER	PPM	0.021	0.014
ALUMINUM	PPM	5417	35
ARSENIC	PPM	0.69	0.07
BARIUM	PPM	9.0	6.9
BERYLLIUM	PPM	BDL	0.7
CALCIUM	PPM	136	69
CADMIUM	PPM	BDL	0.7
COBALT	PPM	BDL	3.5
CHROMIUM	PPM	4.9	0.69
COPPER	PPM	2.8	2.1
CYANIDE, TOTAL	PPM	BDL	0.35
IRON	PPM	2639	2.1
MERCURY	PPM	BDL	0.35
POTASSIUM	PPM	69	42
MAGNESIUM	PPM	76	0.69
MANGANESE	PPM	0.71	0.71
SODIUM	PPM	BDL	14
NICKEL	PPM	BDL	3.5
LEAD	PPM	BDL	9.0
ANTIMONY	PPM	BDL	6.9
SELENIUM	PPM	0.28	0.21
THALLIUM	PPM	BDL	28
VANADIUM	PPM	BDL	14
ZINC	PPM	1.4	1.4

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2546S-2
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: SOIL

Sample ID.: WHF-SD-23B-2-D1 Sample Date: 05/09/90 Time: VARIOUS

TCL/INORGANICS TARGET COMPOUND LIST - INORGANICS

Parameter	Units	Result	Detection Limit
SILVER	PPM	0.014	0.014
ALUMINUM	PPM	3056	35
ARSENIC	PPM	0.42	0.07
BARIUM	PPM	BDL	6.9
BERYLLIUM	PPM	BDL	0.7
CALCIUM	PPM	132	69
CADMIUM	PPM	BDL	0.7
COBALT	PPM	BDL	3.5
CHROMIUM	PPM	2.8	0.69
COPPER	PPM	BDL	2.1
CYANIDE, TOTAL	PPM	BDL	0.35
IRON	PPM	1215	2.1
MERCURY	PPM	BDL	0.35
POTASSIUM	PPM	65	42
MAGNESIUM	PPM	47	0.69
MANGANESE	PPM	BDL	0.70
SODIUM	PPM	14	14
NICKEL	PPM	BDL	3.5
LEAD	PPM	BDL	9.0
ANTIMONY	PPM	BDL	6.9
SELENIUM	PPM	0.21	0.21
THALLIUM	PPM	BDL	28
VANADIUM	PPM	BDL	14
ZINC	PPM	2.1	1.4

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2546S-1
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: SOIL

Sample ID.: WHF-SD-23B-2-1 Sample Date: 05/09/90 Time: VARIOUS

TCL/ACID TARGET COMPOUND LIST - ACID EXTRACT

Parameter	Units	Result	Detection Limit
BENZOIC ACID	PPB	BDL	3430
4-CHLORO-3-METHYLPHENOL	PPB	BDL	686
2-CHLOROPHENOL	PPB	BDL	686
2,4-DICHLOROPHENOL	PPB	BDL	686
2,4-DIMETHYLPHENOL	PPB	BDL	686
4,6-DINITRO-2-METHYLPHENOL	PPB	BDL	3430
2,4-DINITROPHENOL	PPB	BDL	3430
2-METHYLPHENOL	PPB	BDL	686
4-METHYLPHENOL	PPB	BDL	686
2-NITROPHENOL	PPB	BDL	686
4-NITROPHENOL	PPB	BDL	3430
PENTACHLOROPHENOL	PPB	BDL	3430
PHENOL	PPB	BDL	686
2,4,5-TRICHLOROPHENOL	PPB	BDL	3430
2,4,6-TRICHLOROPHENOL	PPB	BDL	686

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2546S-2
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: SOIL

Sample ID.: WHF-SD-23B-2-D1 Sample Date: 05/09/90 Time: VARIOUS

TCL/ACID TARGET COMPOUND LIST - ACID EXTRACT

Parameter	Units	Result	Detection Limit
BENZOIC ACID	PPB	BDL	2345
4-CHLORO-3-METHYLPHENOL	PPB	BDL	469
2-CHLOROPHENOL	PPB	BDL	469
2,4-DICHLOROPHENOL	PPB	BDL	469
2,4-DIMETHYLPHENOL	PPB	BDL	469
4,6-DINITRO-2-METHYLPHENOL	PPB	BDL	2345
2,4-DINITROPHENOL	PPB	BDL	2345
2-METHYLPHENOL	PPB	BDL	469
4-METHYLPHENOL	PPB	BDL	469
2-NITROPHENOL	PPB	BDL	469
4-NITROPHENOL	PPB	BDL	2345
PENTACHLOROPHENOL	PPB	BDL	2345
PHENOL	PPB	BDL	469
2,4,5-TRICHLOROPHENOL	PPB	BDL	2345
2,4,6-TRICHLOROPHENOL	PPB	BDL	469

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2546S-1
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: SOIL

Sample ID.: WHF-SD-23B-2-1 Sample Date: 05/09/90 Time: VARIOUS

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL

Parameter	Units	Result	Detection Limit
ACENAPHTHENE	PPB	BDL	686
ACENAPHTHYLENE	PPB	BDL	686
ANTHRACENE	PPB	BDL	686
BENZO(A)ANTHRACENE	PPB	BDL	686
BENZO(A)PYRENE	PPB	BDL	686
BENZO(B)FLUORANTHENE	PPB	BDL	686
BENZO(G,H,I)PERYLENE	PPB	BDL	686
BENZO(K)FLUORANTHENE	PPB	BDL	686
BENZYL ALCOHOL	PPB	BDL	686
BIS(2-CHLOROETHOXY)METHANE	PPB	BDL	686
BIS(2-CHLOROETHYL)ETHER	PPB	BDL	686
BIS(2-CHLOROISOPROPYL)ETHER	PPB	BDL	686
BIS(2-ETHYLHEXYL)PHTHALATE	PPB	BDL	686
4-BROMOPHENYL PHENYL ETHER	PPB	BDL	686
BUTYL BENZYL PHTHALATE	PPB	BDL	686
4-CHLOROANILINE	PPB	BDL	686
2-CHLORONAPHTHALENE	PPB	BDL	686
4-CHLOROPHENYL PHENYL ETHER	PPB	BDL	686
CHRYSENE	PPB	BDL	686
DIBENZ(A,H)ANTHRACENE	PPB	BDL	686
DIBENZOFURAN	PPB	BDL	686
1,2-DICHLOROBENZENE	PPB	BDL	686
1,3-DICHLOROBENZENE	PPB	BDL	686
1,4-DICHLOROBENZENE	PPB	BDL	686
3,3'-DICHLOROBENZIDINE	PPB	BDL	3430
DIETHYLPHTHALATE	PPB	BDL	686
DIMETHYLPHTHALATE	PPB	BDL	686
DI-N-BUTYLPHTHALATE	PPB	BDL	686
2,4-DINITROTOLUENE	PPB	BDL	686
2,6-DINITROTOLUENE	PPB	BDL	686
DI-N-OCTYLPHTHALATE	PPB	BDL	686
FLUORANTHENE	PPB	BDL	686
FLUORENE	PPB	BDL	686
HEXACHLOROBENZENE	PPB	BDL	686
HEXACHLOROBUTADIENE	PPB	BDL	686

Sample ID.: WHF-SD-23B-2-1 Test Parameters continued on next page

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2546S-1
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: SOIL

Sample ID.: WHF-SD-23B-2-1 Sample Date: 05/09/90 Time: VARIOUS

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL continued

Parameter	Units	Result	Detection Limit
HEXACHLOROCYCLOPENTADIENE	PPB	BDL	686
HEXACHLOROETHANE	PPB	BDL	686
INDENO(1,2,3-CD)PYRENE	PPB	BDL	686
ISOPHORONE	PPB	BDL	686
2-METHYLNAPHTHALENE	PPB	BDL	686
NAPHTHALENE	PPB	BDL	686
2-NITROANILINE	PPB	BDL	686
3-NITROANILINE	PPB	BDL	686
4-NITROANILINE	PPB	BDL	686
NITROBENZENE	PPB	BDL	686
N-NITROSODIPHENYLAMINE	PPB	BDL	686
N-NITROSO-DI-N-DIPROPYLAMINE	PPB	BDL	686
PHENANTHRENE	PPB	BDL	686
PYRENE	PPB	BDL	686
1,2,4-TRICHLOROBENZENE	PPB	BDL	866

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2546S-2
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: SOIL

Sample ID.: WHF-SD-23B-2-D1 Sample Date: 05/09/90 Time: VARIOUS

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL

Parameter	Units	Result	Detection Limit
ACENAPHTHENE	PPB	BDL	469
ACENAPHTHYLENE	PPB	BDL	469
ANTHRACENE	PPB	BDL	469
BENZO(A)ANTHRACENE	PPB	BDL	469
BENZO(A)PYRENE	PPB	BDL	469
BENZO(B)FLUORANTHENE	PPB	BDL	469
BENZO(G,H,I)PERYLENE	PPB	BDL	469
BENZO(K)FLUORANTHENE	PPB	BDL	469
BENZYL ALCOHOL	PPB	BDL	469
BIS(2-CHLOROETHOXY)METHANE	PPB	BDL	469
BIS(2-CHLOROETHYL)ETHER	PPB	BDL	469
BIS(2-CHLOROISOPROPYL)ETHER	PPB	BDL	469
BIS(2-ETHYLHEXYL)PHTHALATE	PPB	BDL	469
4-BROMOPHENYL PHENYL ETHER	PPB	BDL	469
BUTYL BENZYL PHTHALATE	PPB	BDL	469
4-CHLOROANILINE	PPB	BDL	469
2-CHLORONAPHTHALENE	PPB	BDL	469
4-CHLOROPHENYL PHENYL ETHER	PPB	BDL	469
CHRYSENE	PPB	BDL	469
DIBENZ(A,H)ANTHRACENE	PPB	BDL	469
DIBENZOFURAN	PPB	BDL	469
1,2-DICHLOROBENZENE	PPB	BDL	469
1,3-DICHLOROBENZENE	PPB	BDL	469
1,4-DICHLOROBENZENE	PPB	BDL	469
3,3'-DICHLOROBENZIDINE	PPB	BDL	2345
DIETHYLPHTHALATE	PPB	BDL	469
DIMETHYLPHTHALATE	PPB	BDL	469
DI-N-BUTYLPHTHALATE	PPB	BDL	469
2,4-DINITROTOLUENE	PPB	BDL	469
2,6-DINITROTOLUENE	PPB	BDL	469
DI-N-OCTYLPHTHALATE	PPB	BDL	469
FLUORANTHENE	PPB	BDL	469
FLUORENE	PPB	BDL	469
HEXACHLOROBENZENE	PPB	BDL	469
HEXACHLOROBUTADIENE	PPB	BDL	469

Sample ID.: WHF-SD-23B-2-D1 Test Parameters continued on next page

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2546S-2
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: SOIL

Sample ID.: WHF-SD-23B-2-D1 Sample Date: 05/09/90 Time: VARIOUS

'CL/BASE TARGET COMPOUND LIST - BASE NEUTRAL continued

Parameter	Units	Result	Detection Limit
HEXACHLOROCYCLOPENTADIENE	PPB	BDL	469
HEXACHLOROETHANE	PPB	BDL	469
INDENO(1,2,3-CD)PYRENE	PPB	BDL	469
ISOPHORONE	PPB	BDL	469
2-METHYLNAPHTHALENE	PPB	BDL	469
NAPHTHALENE	PPB	BDL	469
2-NITROANILINE	PPB	BDL	469
3-NITROANILINE	PPB	BDL	469
4-NITROANILINE	PPB	BDL	469
NITROBENZENE	PPB	BDL	469
N-NITROSODIPHENYLAMINE	PPB	BDL	469
N-NITROSO-DI-N-DIPROPYLAMINE	PPB	BDL	469
PHENANTHRENE	PPB	BDL	469
PYRENE	PPB	BDL	469
1,2,4-TRICHLOROBENZENE	PPB	BDL	469

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11 EAST OLIVE ROAD • PENSACOLA, FLORIDA 32514 • (904) 474-1001

Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2546S-1
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: SOIL

Sample ID.: WHF-SD-23B-2-1 Sample Date: 05/09/90 Time: VARIOUS

TCL/PEST TARGET COMPOUND LIST-PESTICIDES

Parameter	Units	Result	Detection Limit
ALDRIN	PPB	BDL	1
ALPHA CHLORDANE	PPB	BDL	5
ALPHA-BHC	PPB	BDL	1
BETA-BHC	PPB	BDL	1
DELTA-BHC	PPB	BDL	1
GAMMA-BHC (LINDANE)	PPB	BDL	1
4,4'-DDD	PPB	2	1
4,4'-DDE	PPB	5	1
4,4'-DDT	PPB	14	1
DIELDRIN	PPB	10	1
ENDOSULFAN I	PPB	BDL	1
ENDOSULFAN II	PPB	BDL	1
ENDOSULFAN SULFATE	PPB	BDL	1
ENDRIN	PPB	BDL	1
ENDRIN KETONE	PPB	BDL	1
GAMMA CHLORDANE	PPB	BDL	5
HEPTACHLOR	PPB	BDL	1
HEPTACHLOR EPOXIDE	PPB	BDL	1
METHOXYCHLOR	PPB	BDL	5
AROCLOR-1016	PPB	BDL	5
AROCLOR-1221	PPB	BDL	5
AROCLOR-1232	PPB	BDL	5
AROCLOR-1242	PPB	BDL	5
AROCLOR-1248	PPB	BDL	5
AROCLOR-1254	PPB	BDL	5
AROCLOR-1260	PPB	BDL	5
TOXAPHENE	PPB	BDL	5

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2546S-2
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: SOIL

Sample ID.: WHF-SD-23B-2-D1 Sample Date: 05/09/90 Time: VARIOUS

TCL/PEST TARGET COMPOUND LIST-PESTICIDES

Parameter	Units	Result	Detection Limit
ALDRIN	PPB	BDL	1
ALPHA CHLORDANE	PPB	BDL	5
ALPHA-BHC	PPB	BDL	1
BETA-BHC	PPB	BDL	1
DELTA-BHC	PPB	BDL	1
GAMMA-BHC (LINDANE)	PPB	BDL	1
4,4'-DDD	PPB	2	1
4,4'-DDE	PPB	4	1
4,4'-DDT	PPB	10	1
DIELDRIN	PPB	8	1
ENDOSULFAN I	PPB	BDL	1
ENDOSULFAN II	PPB	BDL	1
ENDOSULFAN SULFATE	PPB	BDL	1
ENDRIN	PPB	BDL	1
ENDRIN KETONE	PPB	BDL	1
GAMMA CHLORDANE	PPB	BDL	5
HEPTACHLOR	PPB	BDL	1
HEPTACHLOR EPOXIDE	PPB	BDL	1
METHOXYCHLOR	PPB	BDL	5
AROCLOR-1016	PPB	BDL	5
AROCLOR-1221	PPB	BDL	5
AROCLOR-1232	PPB	BDL	5
AROCLOR-1242	PPB	BDL	5
AROCLOR-1248	PPB	BDL	5
AROCLOR-1254	PPB	BDL	5
AROCLOR-1260	PPB	BDL	5
TOXAPHENE	PPB	BDL	5

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11 EAST OLIVE ROAD • PENSACOLA, FLORIDA 32514 • (904) 474-1001

Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2546S-1
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: SOIL

Sample ID.: WHF-SD-23B-2-1 Sample Date: 05/09/90 Time: VARIOUS

TCL/VOL TARGET COMPOUND LIST - VOLATILES

Parameter	Units	Result	Detection Limit
ACETONE	PPB	BDL	128
BENZENE	PPB	BDL	13
BROMODICHLOROMETHANE	PPB	BDL	13
BROMOFORM	PPB	BDL	26
BROMOMETHANE	PPB	BDL	13
2-BUTANONE (MEK)	PPB	BDL	38
CARBON DISULFIDE	PPB	BDL	13
CARBON TETRACHLORIDE	PPB	BDL	26
CHLOROBENZENE	PPB	BDL	13
CHLOROETHANE	PPB	BDL	13
CHLOROFORM	PPB	BDL	26
CHLOROMETHANE	PPB	BDL	26
DIBROMOCHLOROMETHANE	PPB	BDL	64
1,1-DICHLOROETHANE	PPB	BDL	13
1,2-DICHLOROETHANE	PPB	BDL	26
1,1-DICHLOROETHENE	PPB	BDL	13
1,2-DICHLOROETHENE	PPB	BDL	64
1,2-DICHLOROPROPANE	PPB	BDL	26
CIS-1,3-DICHLOROPROPENE	PPB	BDL	13
TRANS-1,3-DICHLOROPROPENE	PPB	BDL	13
ETHYLBENZENE	PPB	26	13
2-HEXANONE	PPB	BDL	38
METHYLENE CHLORIDE	PPB	BDL	38
4-METHYL-2-PENTANONE	PPB	BDL	38
STYRENE	PPB	BDL	26
1,1,2,2-TETRACHLOROETHANE	PPB	BDL	26
TETRACHLOROETHENE	PPB	BDL	13
TOLUENE	PPB	115	13
1,1,1-TRICHLOROETHANE	PPB	BDL	64
1,1,2-TRICHLOROETHANE	PPB	BDL	26
TRICHLOROETHENE	PPB	BDL	13
VINYL ACETATE	PPB	BDL	26
VINYL CHLORIDE	PPB	BDL	13
TOTAL XYLENES	PPB	128	51

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2546S-2
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: SOIL

Sample ID.: WHF-SD-23B-2-D1 Sample Date: 05/09/90 Time: VARIOUS

TCL/VOL TARGET COMPOUND LIST - VOLATILES

Parameter	Units	Result	Detection Limit
ACETONE	PPB	BDL	141
BENZENE	PPB	BDL	14
BROMODICHLOROMETHANE	PPB	BDL	14
BROMOFORM	PPB	BDL	28
BROMOMETHANE	PPB	BDL	14
2-BUTANONE (MEK)	PPB	56	42
CARBON DISULFIDE	PPB	BDL	14
CARBON TETRACHLORIDE	PPB	BDL	28
CHLOROBENZENE	PPB	BDL	14
CHLOROETHANE	PPB	BDL	14
CHLOROFORM	PPB	BDL	28
CHLOROMETHANE	PPB	BDL	28
DIBROMOCHLOROMETHANE	PPB	BDL	70
1,1-DICHLOROETHANE	PPB	BDL	14
1,2-DICHLOROETHANE	PPB	BDL	28
1,1-DICHLOROETHENE	PPB	BDL	14
1,2-DICHLOROETHENE	PPB	BDL	70
1,2-DICHLOROPROPANE	PPB	BDL	28
CIS-1,3-DICHLOROPROPENE	PPB	BDL	14
TRANS-1,3-DICHLOROPROPENE	PPB	BDL	14
ETHYLBENZENE	PPB	42	14
2-HEXANONE	PPB	BDL	42
METHYLENE CHLORIDE	PPB	113	42
4-METHYL-2-PENTANONE	PPB	BDL	42
STYRENE	PPB	BDL	28
1,1,2,2-TETRACHLOROETHANE	PPB	BDL	28
TETRACHLOROETHENE	PPB	BDL	14
TOLUENE	PPB	155	14
1,1,1-TRICHLOROETHANE	PPB	BDL	70
1,1,2-TRICHLOROETHANE	PPB	BDL	28
TRICHLOROETHENE	PPB	BDL	14
VINYL ACETATE	PPB	BDL	28
VINYL CHLORIDE	PPB	BDL	14
TOTAL XYLENES	PPB	226	56

end of report

NEESA
LEVEL "C"

CHAIN OF CUSTODY

Pioneer LABORATORY, INC.
EAST OLIVE ROAD PENSACOLA, FLORIDA 32514
PHONE (904) 474-1001 • FAX 478-2671

S/W

Client: ABB ENVIRONMENTAL
Laboratory I.D.: 90-3546 Date: 5/10/90
Address:
Method of Shipment:
City/State/Zip:
Sampler: BLOMBERG / DESANDRO
Phone No. (904) 656-1293
Project #: 5898-05
Contact: M. NUGENT
Project Name: OLF BARIN
P.O. #:
Project Location: FOLEY, ALAB

SAMPLE TYPE

DW DRINKING WATER
WW WASTE WATER
GW GROUND WATER
SW SURFACE WATER
SO SOIL
OL OIL
AR AIR
SL SLUDGE
HZ HAZARDOUS
OT OTHER

SAMPLE SITE	FIELD I.D.		Date	Time	# Btls.	CLP VOA TCL	SEMI VOA TCL	TEST/PCB TCL	TCL METALS	CYANIDE	TOTAL PHENOLS		Lab Use Only
OLF BARIN 23B	WHF-SW-23B-2-1 *	SURFACE WTR	5/9	1745	15	2	3	3	1	3	3		W-1
"	WHF-SW-23B-2-D-1	"	"	1745	7	2	1	1	1	1	1		W-2
"	WHF-SD-23B-2-1	SEDIMENT SOIL	"	1755	4	1	1	1	X	X	X		S-1
"	WHF-SD-23B-2-D-1	SEDIMENT SOIL	"	1755	4	1	1	1	X	X	X		S-2
"	WHF-TB-23B-2	WTR	"	-	1	1							W-3

	Date	Time		Date	Time
RELINQUISHED BY Andrew J. DeSandro	5/10	1700	RECEIVED BY Laura Gilbert	5/10	11:
RELINQUISHED BY			RECEIVED BY		
RELINQUISHED BY			RECEIVED BY		
RELINQUISHED BY			RECEIVED BY		

Comments: * INCLUDES ADDITIONAL BOTTLES FOR LEVEL "C" QC

CERTIFICATION NUMBERS

Pioneer LABORATORY, INC. a division of Analytical Technologies, Inc.
11 EAST OLIVE ROAD • PENSACOLA, FLORIDA 32514 • (904) 474-1001

ABB ENVIRONMENTAL, INC
2571 EXECUTIVE CENTER CIR
SUITE 100
TALLAHASSEE FL 32301-5001

Lab I.D.#: 90-2547A
Order Number: P29927
Order Date: 05/10/90
Client: 10001
Sampled By: E.B./A.D.
Sample Date: 05/09/90
Sample Time: VARIOUS

Project Number: 5898-05
Project Name: OLF BARIN
Sample Site: FOLEY, AL
Sample Type: SOIL

N/S = Not Submitted

Lab ID	Sample ID	Parameter	Units	Results	Detection Limit
2547A-1	WHF-SS-23B-1	LEAD	PPM	BDL	7.2
2547A-2	WHF-SS-23B-2	LEAD	PPM	BDL	7.1
2547A-3	WHF-SS-23B-2-D	LEAD	PPM	BDL	7.1
2547A-4	WHF-SS-23B-3	LEAD	PPM	BDL	7.5
2547A-5	WHF-EB-23B-1	LEAD	PPM	BDL	0.05

Comments: PPM = Parts Per Million, mg/kg on a dry basis; PPB = Parts Per Billion, ug/kg on a dry basis. BDL = Below Detection Limits.
Method Reference: SW-846, 3rd Edition, November 1986.

Approved By : John V Hawkins

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2547A-1
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: SOIL

Sample ID.: WHF-SS-23B-1 Sample Date: 05/09/90 Time: VARIOUS

PAH/8310 PAH/8310

Parameter	Units	Result	Detection Limit
ACENAPHTHENE	PPB	BDL	200
ACENAPHTHYLENE	PPB	BDL	200
ANTHRACENE	PPB	BDL	200
BENZO(A)ANTHRACENE	PPB	BDL	200
BENZO(A)PYRENE	PPB	BDL	200
BENZO(B)FLUORANTHENE	PPB	BDL	200
BENZO(GHI)PERYLENE	PPB	BDL	200
BENZO(K)FLUORANTHENE	PPB	BDL	200
CHRYSENE	PPB	BDL	200
DIBENZO(A,H)ANTHRACENE	PPB	BDL	200
FLUORANTHENE	PPB	BDL	200
FLUORENE	PPB	BDL	200
INDENO(1,2,3-CD)PYRENE	PPB	BDL	200
NAPHTHALENE	PPB	BDL	200
PHENANTHRENE	PPB	BDL	200
PYRENE	PPB	BDL	200
1,METHYLNAPHTHALENE	PPB	BDL	200
2,METHYLNAPHTHALENE	PPB	BDL	200

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2547A-2
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: SOIL

Sample ID.: WHF-SS-23B-2 Sample Date: 05/09/90 Time: VARIOUS

PAH/8310 PAH/8310

Parameter	Units	Result	Detection Limit
ACENAPHTHENE	PPB	BDL	10
ACENAPHTHYLENE	PPB	BDL	10
ANTHRACENE	PPB	BDL	10
BENZO(A)ANTHRACENE	PPB	BDL	10
BENZO(A)PYRENE	PPB	BDL	10
BENZO(B)FLUORANTHENE	PPB	BDL	10
BENZO(GHI)PERYLENE	PPB	BDL	10
BENZO(K)FLUORANTHENE	PPB	BDL	10
CHRYSENE	PPB	BDL	10
DIBENZO(A,H)ANTHRACENE	PPB	BDL	10
FLUORANTHENE	PPB	BDL	10
FLUORENE	PPB	BDL	10
INDENO(1,2,3-CD)PYRENE	PPB	BDL	10
NAPHTHALENE	PPB	BDL	10
PHENANTHRENE	PPB	BDL	10
PYRENE	PPB	BDL	10
1,METHYLNAPHTHALENE	PPB	BDL	10
2,METHYLNAPHTHALENE	PPB	BDL	10

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2547A-3
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: SOIL

Sample ID.: WHF-SS-23B-2-D Sample Date: 05/09/90 Time: VARIOUS

PAH/8310 PAH/8310

Parameter	Units	Result	Detection Limit
ACENAPHTHENE	PPB	BDL	10
ACENAPHTHYLENE	PPB	BDL	10
ANTHRACENE	PPB	BDL	10
BENZO(A)ANTHRACENE	PPB	BDL	10
BENZO(A)PYRENE	PPB	BDL	10
BENZO(B)FLUORANTHENE	PPB	BDL	10
BENZO(GHI)PERYLENE	PPB	BDL	10
BENZO(K)FLUORANTHENE	PPB	BDL	10
CHRYSENE	PPB	BDL	10
DIBENZO(A,H)ANTHRACENE	PPB	BDL	10
FLUORANTHENE	PPB	BDL	10
FLUORENE	PPB	BDL	10
INDENO(1,2,3-CD)PYRENE	PPB	BDL	10
NAPHTHALENE	PPB	BDL	10
PHENANTHRENE	PPB	BDL	10
PYRENE	PPB	BDL	10
1,METHYLNAPHTHALENE	PPB	BDL	10
2,METHYLNAPHTHALENE	PPB	BDL	10

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2547A-4
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: SOIL

Sample ID.: WHF-SS-23B-3 Sample Date: 05/09/90 Time: VARIOUS

PAH/8310 PAH/8310

Parameter	Units	Result	Detection Limit
ACENAPHTHENE	PPB	BDL	10
ACENAPHTHYLENE	PPB	BDL	10
ANTHRACENE	PPB	BDL	10
BENZO(A)ANTHRACENE	PPB	BDL	10
BENZO(A)PYRENE	PPB	BDL	10
BENZO(B)FLUORANTHENE	PPB	BDL	10
BENZO(GHI)PERYLENE	PPB	BDL	10
BENZO(K)FLUORANTHENE	PPB	BDL	10
CHRYSENE	PPB	BDL	10
DIBENZO(A,H)ANTHRACENE	PPB	BDL	10
FLUORANTHENE	PPB	BDL	10
FLUORENE	PPB	BDL	10
INDENO(1,2,3-CD)PYRENE	PPB	BDL	10
NAPHTHALENE	PPB	BDL	10
PHENANTHRENE	PPB	BDL	10
PYRENE	PPB	BDL	10
1,METHYLNAPHTHALENE	PPB	BDL	10
2,METHYLNAPHTHALENE	PPB	BDL	10

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2547A-5
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: SOIL

Sample ID.: WHF-EB-23B-1 Sample Date: 05/09/90 Time: VARIOUS

PAH/8310 PAH/8310

Parameter	Units	Result	Detection Limit
ACENAPHTHENE	PPB	BDL	10
ACENAPHTHYLENE	PPB	BDL	10
ANTHRACENE	PPB	BDL	10
BENZO(A)ANTHRACENE	PPB	BDL	10
BENZO(A)PYRENE	PPB	BDL	10
BENZO(B)FLUORANTHENE	PPB	BDL	10
BENZO(GHI)PERYLENE	PPB	BDL	10
BENZO(K)FLUORANTHENE	PPB	BDL	10
CHRYSENE	PPB	BDL	10
DIBENZO(A,H)ANTHRACENE	PPB	BDL	10
FLUORANTHENE	PPB	BDL	10
FLUORENE	PPB	BDL	10
INDENO(1,2,3-CD)PYRENE	PPB	BDL	10
NAPHTHALENE	PPB	BDL	10
PHENANTHRENE	PPB	BDL	10
PYRENE	PPB	BDL	10
1,METHYLNAPHTHALENE	PPB	BDL	10
2,METHYLNAPHTHALENE	PPB	BDL	10

end of report

Pioneer LABORATORY, INC.

NEESA LEVEL "C"

CHAIN OF CUSTODY

11 EAST OLIVE ROAD PENSACOLA, FLORIDA 32514
PHONE (904) 474-1001 • FAX 478-2671

Client: ABB ENVIRONMENTAL
Address:
City/State/Zip:
Phone No. (904) 656-1293
Contact: M. NUGENT
P.O. #:

Laboratory I.D.: 90-2547ABC Date: 5/10/90
Method of Shipment: hand
Sampler: BLOMBERG/DESANDRO
Project #: 5898-05
Project Name: OLF BARIN
Project Location: FOLEY, ALAB

SAMPLE TYPE

DW DRINKING WATER, WW WASTE WATER, GW GROUND WATER, SW SURFACE WATER, SO SOIL, OL OIL, AR AIR, SL SLUDGE, HZ HAZARDOUS, OT OTHER

SAMPLE SITE	FIELD I.D.		Date	Time	# Btls.	PB 6010	PAH SW846-8310	VOA CLP TCL	SEMI VOA CLP TCL	TCL METALS	CYANIDE	T PHENOL	PEST/PCB	Lab Use Only
OLF BARN 23B	WHF-SS-23B-1(1-2)-1	SOIL	5/9	1335	2	1	1							1A
"	" -2(1-2)-1	"	"	1347	2	1	1							2A
"	" -2(1-2)-D-1	"	"	1347	2	1	1							3A
"	" -3(1-2)-1	"	"	1400	2	1	1							4A
"	WHF-EB-23B-1	WATER	"	1408	2	1	1							5A
OLF BARIN 21B	WHF-SS-21B-1(1-2)-1	SOIL	"	1515	4			1	1	X	X	X	1	1B
"	" -2(1-2)-1	"	"	1545	4			1	1	X	X	X	1	2B
"	" -3(1-2)-1	"	"	1615	4			1	1	X	X	X	1	3B
"	" -3(1-2)-D-1	"	"	1615	4			1	1	X	X	X	1	4B

	Date	Time		Date	Time
RELINQUISHED BY Andrew J. DeSandro	5/10	100	RECEIVED BY James Tolbert	5/10	1100
RELINQUISHED BY			RECEIVED BY		
RELINQUISHED BY			RECEIVED BY		
RELINQUISHED BY			RECEIVED BY		

Comments:

Pioneer LABORATORY, INC. a division of Analytical Technologies, Inc.
11 EAST OLIVE ROAD • PENSACOLA, FLORIDA 32514 • (904) 474-1001

ABB ENVIRONMENTAL, INC
2571 EXECUTIVE CENTER CIR
SUITE 100
TALLAHASSEE FL 32301-5001

Lab I.D.#: 90-2547B
Order Number: P29929
Order Date: 05/10/90
Client: 10001
Sampled By: E.B./A.D.
Sample Date: 05/09/90
Sample Time: VARIOUS

Project Number: 5898-05
Project Name: OLF BARIN
Sample Site: FOLEY, AL
Sample Type: SOIL

N/S = Not Submitted

Lab ID	Sample ID	Parameter	Units	Results	Detection Limit
2547B-1	WHF-SS-21B-1	PHENOLS,TOTAL	PPM	BDL	0.26
2547B-2	WHF-SS-21B-2	PHENOLS,TOTAL	PPM	BDL	0.26
2547B-3	WHF-SS-21B-3	PHENOLS,TOTAL	PPM	BDL	0.28
2547B-4	WHF-SS-21B-3-D	PHENOLS,TOTAL	PPM	BDL	0.27

Comments: PPM = Parts Per Million, mg/kg on a dry basis; PPB = Parts Per Billion, ug/kg on a dry basis. BDL = Below Detection Limits.
Method Reference: SW-846, 3rd Edition, November 1986.

Approved By : John U Hawkins

Pioneer LABORATORY, INC. a division of Analytical Technologies, Inc.
11 EAST OLIVE ROAD • PENSACOLA, FLORIDA 32514 • (904) 474-1001

Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2547B-1
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: SOIL

Sample ID.: WHF-SS-21B-1 Sample Date: 05/09/90 Time: VARIOUS

TCL/INORGANICS TARGET COMPOUND LIST - INORGANICS

Parameter	Units	Result	Detection Limit
SILVER	PPM	BDL	0.011
ALUMINUM	PPM	1711	26
ARSENIC	PPM	0.63	0.05
BARIUM	PPM	7.4	5.3
BERYLLIUM	PPM	BDL	0.5
CALCIUM	PPM	63	53
CADMIUM	PPM	BDL	0.53
COBALT	PPM	BDL	2.6
CHROMIUM	PPM	1.1	0.53
COPPER	PPM	BDL	1.6
CYANIDE, TOTAL	PPM	BDL	0.26
IRON	PPM	2526	1.6
MERCURY	PPM	BDL	0.26
POTASSIUM	PPM	49	32
MAGNESIUM	PPM	79	0.53
MANGANESE	PPM	7.4	0.53
SODIUM	PPM	BDL	11
NICKEL	PPM	BDL	2.6
LEAD	PPM	BDL	6.8
ANTIMONY	PPM	BDL	5.3
SELENIUM	PPM	BDL	0.16
THALLIUM	PPM	BDL	21
VANADIUM	PPM	BDL	11
ZINC	PPM	1.1	0.02

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11 EAST OLIVE ROAD • PENSACOLA, FLORIDA 32514 • (904) 474-1001

Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2547B-2
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: SOIL

Sample ID.: WHF-SS-21B-2 Sample Date: 05/09/90 Time: VARIOUS

TCL/INORGANICS TARGET COMPOUND LIST - INORGANICS

Parameter	Units	Result	Detection Limit
SILVER	PPM	BDL	0.011
ALUMINUM	PPM	4842	26
ARSENIC	PPM	0.68	0.05
BARIUM	PPM	8.4	5.3
BERYLLIUM	PPM	BDL	0.5
CALCIUM	PPM	89	53
CADMIUM	PPM	BDL	0.5
COBALT	PPM	BDL	2.6
CHROMIUM	PPM	1.1	0.53
COPPER	PPM	3.2	1.6
CYANIDE, TOTAL	PPM	BDL	0.26
IRON	PPM	2737	1.6
MERCURY	PPM	BDL	0.26
POTASSIUM	PPM	36	32
MAGNESIUM	PPM	95	0.53
MANGANESE	PPM	44	0.53
SODIUM	PPM	BDL	11
NICKEL	PPM	BDL	2.6
LEAD	PPM	BDL	6.8
ANTIMONY	PPM	BDL	5.3
SELENIUM	PPM	BDL	0.16
THALLIUM	PPM	BDL	21
VANADIUM	PPM	BDL	11
ZINC	PPM	2.6	1.1

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2547B-3
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: SOIL

Sample ID.: WHF-SS-21B-3 Sample Date: 05/09/90 Time: VARIOUS

TCL/INORGANICS TARGET COMPOUND LIST - INORGANICS

Parameter	Units	Result	Detection Limit
SILVER	PPM	BDL	0.011
ALUMINUM	PPM	24167	28
ARSENIC	PPM	2.20	0.06
BARIUM	PPM	24	5.6
BERYLLIUM	PPM	BDL	0.6
CALCIUM	PPM	167	56
CADMIUM	PPM	BDL	0.56
COBALT	PPM	BDL	2.8
CHROMIUM	PPM	24	0.56
COPPER	PPM	11	1.7
CYANIDE, TOTAL	PPM	BDL	0.28
IRON	PPM	11611	1.7
MERCURY	PPM	BDL	0.28
POTASSIUM	PPM	117	33
MAGNESIUM	PPM	167	0.56
MANGANESE	PPM	BDL	0.56
SODIUM	PPM	BDL	11
NICKEL	PPM	BDL	2.8
LEAD	PPM	BDL	7.2
ANTIMONY	PPM	BDL	5.6
SELENIUM	PPM	BDL	0.15
THALLIUM	PPM	BDL	22
VANADIUM	PPM	40	11
ZINC	PPM	6.1	1.1

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2547B-4
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: SOIL

Sample ID.: WHF-SS-21B-3-D Sample Date: 05/09/90 Time: VARIOUS

TCL/INORGANICS TARGET COMPOUND LIST - INORGANICS

Parameter	Units	Result	Detection Limit
SILVER	PPM	BDL	0.011
ALUMINUM	PPM	13187	27
ARSENIC	PPM	1.65	0.05
BARIUM	PPM	18	5.5
BERYLLIUM	PPM	BDL	0.5
CALCIUM	PPM	130	55
CADMIUM	PPM	BDL	0.55
COBALT	PPM	BDL	2.7
CHROMIUM	PPM	12	0.55
COPPER	PPM	4.4	1.6
CYANIDE, TOTAL	PPM	BDL	0.27
IRON	PPM	6923	1.6
MERCURY	PPM	BDL	0.27
POTASSIUM	PPM	60	33
MAGNESIUM	PPM	66	0.55
MANGANESE	PPM	BDL	0.55
SODIUM	PPM	BDL	11
NICKEL	PPM	BDL	2.7
LEAD	PPM	BDL	7.1
ANTIMONY	PPM	BDL	5.5
SELENIUM	PPM	BDL	0.16
THALLIUM	PPM	BDL	22
VANADIUM	PPM	24	11
ZINC	PPM	BDL	1.1

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Client: ABB ENVIRONMENTAL, INC
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Lab I.D.#: 90-2547B-1
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: SOIL

Sample ID.: WHF-SS-21B-1 Sample Date: 05/09/90 Time: VARIOUS

TCL/ACID TARGET COMPOUND LIST - ACID EXTRACT

Parameter	Units	Result	Detection Limit
BENZOIC ACID	PPB	BDL	1730
4-CHLORO-3-METHYLPHENOL	PPB	BDL	346
2-CHLOROPHENOL	PPB	BDL	346
2,4-DICHLOROPHENOL	PPB	BDL	346
2,4-DIMETHYLPHENOL	PPB	BDL	346
4,6-DINITRO-2-METHYLPHENOL	PPB	BDL	1730
2,4-DINITROPHENOL	PPB	BDL	1730
2-METHYLPHENOL	PPB	BDL	346
4-METHYLPHENOL	PPB	BDL	346
2-NITROPHENOL	PPB	BDL	346
4-NITROPHENOL	PPB	BDL	1730
PENTACHLOROPHENOL	PPB	BDL	1730
PHENOL	PPB	BDL	346
2,4,5-TRICHLOROPHENOL	PPB	BDL	1730
2,4,6-TRICHLOROPHENOL	PPB	BDL	346

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Client: ABB ENVIRONMENTAL, INC
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Lab I.D.#: 90-2547B-2
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: SOIL

Sample ID.: WHF-SS-21B-2 Sample Date: 05/09/90 Time: VARIOUS

TCL/ACID TARGET COMPOUND LIST - ACID EXTRACT

Parameter	Units	Result	Detection Limit
BENZOIC ACID	PPB	BDL	1750
4-CHLORO-3-METHYLPHENOL	PPB	BDL	350
2-CHLOROPHENOL	PPB	BDL	350
2,4-DICHLOROPHENOL	PPB	BDL	350
2,4-DIMETHYLPHENOL	PPB	BDL	350
4,6-DINITRO-2-METHYLPHENOL	PPB	BDL	1750
2,4-DINITROPHENOL	PPB	BDL	1750
2-METHYLPHENOL	PPB	BDL	350
4-METHYLPHENOL	PPB	BDL	350
2-NITROPHENOL	PPB	BDL	350
4-NITROPHENOL	PPB	BDL	1750
PENTACHLOROPHENOL	PPB	BDL	1750
PHENOL	PPB	BDL	350
2,4,5-TRICHLOROPHENOL	PPB	BDL	1750
2,4,6-TRICHLOROPHENOL	PPB	BDL	350

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Lab I.D.#: 90-2547B-3
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: SOIL

Sample ID.: WHF-SS-21B-3 Sample Date: 05/09/90 Time: VARIOUS

TCL/ACID TARGET COMPOUND LIST - ACID EXTRACT

Parameter	Units	Result	Detection Limit
BENZOIC ACID	PPB	BDL	1870
4-CHLORO-3-METHYLPHENOL	PPB	BDL	374
2-CHLOROPHENOL	PPB	BDL	374
2,4-DICHLOROPHENOL	PPB	BDL	374
2,4-DIMETHYLPHENOL	PPB	BDL	374
4,6-DINITRO-2-METHYLPHENOL	PPB	BDL	1870
2,4-DINITROPHENOL	PPB	BDL	1870
2-METHYLPHENOL	PPB	BDL	374
4-METHYLPHENOL	PPB	BDL	374
2-NITROPHENOL	PPB	BDL	374
4-NITROPHENOL	PPB	BDL	1870
PENTACHLOROPHENOL	PPB	BDL	1870
PHENOL	PPB	BDL	374
2,4,5-TRICHLOROPHENOL	PPB	BDL	1870
2,4,6-TRICHLOROPHENOL	PPB	BDL	374

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Client: ABB ENVIRONMENTAL, INC
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Lab I.D.#: 90-2547B-4
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: SOIL

Sample ID.: WHF-SS-21B-3-D Sample Date: 05/09/90 Time: VARIOUS

TCL/ACID TARGET COMPOUND LIST - ACID EXTRACT

Parameter	Units	Result	Detection Limit
BENZOIC ACID	PPB	BDL	1825
4-CHLORO-3-METHYLPHENOL	PPB	BDL	365
2-CHLOROPHENOL	PPB	BDL	365
2,4-DICHLOROPHENOL	PPB	BDL	365
2,4-DIMETHYLPHENOL	PPB	BDL	365
4,6-DINITRO-2-METHYLPHENOL	PPB	BDL	1825
2,4-DINITROPHENOL	PPB	BDL	1825
2-METHYLPHENOL	PPB	BDL	365
4-METHYLPHENOL	PPB	BDL	365
2-NITROPHENOL	PPB	BDL	365
4-NITROPHENOL	PPB	BDL	1825
PENTACHLOROPHENOL	PPB	BDL	1825
PHENOL	PPB	BDL	365
2,4,5-TRICHLOROPHENOL	PPB	BDL	1825
2,4,6-TRICHLOROPHENOL	PPB	BDL	365

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Client: ABB ENVIRONMENTAL, INC
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Lab I.D.#: 90-2547B-1
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: SOIL

Sample ID.: WHF-SS-21B-1 Sample Date: 05/09/90 Time: VARIOUS

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL

Parameter	Units	Result	Detection Limit
ACENAPHTHENE	PPB	BDL	346
ACENAPHTHYLENE	PPB	BDL	346
ANTHRACENE	PPB	BDL	346
BENZO(A)ANTHRACENE	PPB	BDL	346
BENZO(A)PYRENE	PPB	BDL	346
BENZO(B)FLUORANTHENE	PPB	BDL	346
BENZO(G,H,I)PERYLENE	PPB	BDL	346
BENZO(K)FLUORANTHENE	PPB	BDL	346
BENZYL ALCOHOL	PPB	BDL	346
BIS(2-CHLOROETHOXY)METHANE	PPB	BDL	346
BIS(2-CHLOROETHYL)ETHER	PPB	BDL	346
BIS(2-CHLOROISOPROPYL)ETHER	PPB	BDL	346
BIS(2-ETHYLHEXYL)PHTHALATE	PPB	BDL	346
4-BROMOPHENYL PHENYL ETHER	PPB	BDL	346
BUTYL BENZYL PHTHALATE	PPB	BDL	346
4-CHLOROANILINE	PPB	BDL	346
2-CHLORONAPHTHALENE	PPB	BDL	346
4-CHLOROPHENYL PHENYL ETHER	PPB	BDL	346
CHRYSENE	PPB	BDL	346
DIBENZ(A,H)ANTHRACENE	PPB	BDL	346
DIBENZOFURAN	PPB	BDL	346
1,2-DICHLOROBENZENE	PPB	BDL	346
1,3-DICHLOROBENZENE	PPB	BDL	346
1,4-DICHLOROBENZENE	PPB	BDL	346
3,3'-DICHLOROBENZIDINE	PPB	BDL	1730
DIETHYLPHTHALATE	PPB	BDL	346
DIMETHYLPHTHALATE	PPB	BDL	346
DI-N-BUTYLPHTHALATE	PPB	BDL	346
2,4-DINITROTOLUENE	PPB	BDL	346
2,6-DINITROTOLUENE	PPB	BDL	346
DI-N-OCTYLPHTHALATE	PPB	BDL	346
FLUORANTHENE	PPB	BDL	346
FLUORENE	PPB	BDL	346
HEXACHLOROBENZENE	PPB	BDL	346
HEXACHLOROBUTADIENE	PPB	BDL	346

Sample ID.: WHF-SS-21B-1 Test Parameters continued on next page

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Client: ABB ENVIRONMENTAL, INC
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Lab I.D.#: 90-2547B-1
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: SOIL

Sample ID.: WHF-SS-21B-1 Sample Date: 05/09/90 Time: VARIOUS

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL continued

Parameter	Units	Result	Detection Limit
HEXACHLOROCYCLOPENTADIENE	PPB	BDL	346
HEXACHLOROETHANE	PPB	BDL	346
INDENO(1,2,3-CD)PYRENE	PPB	BDL	346
ISOPHORONE	PPB	BDL	346
2-METHYLNAPHTHALENE	PPB	BDL	346
NAPHTHALENE	PPB	BDL	346
2-NITROANILINE	PPB	BDL	346
3-NITROANILINE	PPB	BDL	346
4-NITROANILINE	PPB	BDL	346
NITROBENZENE	PPB	BDL	346
N-NITROSODIPHENYLAMINE	PPB	BDL	346
N-NITROSO-DI-N-DIPROPYLAMINE	PPB	BDL	346
PHENANTHRENE	PPB	BDL	346
PYRENE	PPB	BDL	346
1,2,4-TRICHLOROBENZENE	PPB	BDL	346

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Client: ABB ENVIRONMENTAL, INC
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Lab I.D.#: 90-2547B-2
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: SOIL

Sample ID.: WHF-SS-21B-2 Sample Date: 05/09/90 Time: VARIOUS

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL

Parameter	Units	Result	Detection Limit
ACENAPHTHENE	PPB	BDL	350
ACENAPHTHYLENE	PPB	BDL	350
ANTHRACENE	PPB	BDL	350
BENZO(A)ANTHRACENE	PPB	BDL	350
BENZO(A)PYRENE	PPB	BDL	350
BENZO(B)FLUORANTHENE	PPB	BDL	350
BENZO(G,H,I)PERYLENE	PPB	BDL	350
BENZO(K)FLUORANTHENE	PPB	BDL	350
BENZYL ALCOHOL	PPB	BDL	350
BIS(2-CHLOROETHOXY)METHANE	PPB	BDL	350
BIS(2-CHLOROETHYL)ETHER	PPB	BDL	350
BIS(2-CHLOROISOPROPYL)ETHER	PPB	BDL	350
BIS(2-ETHYLHEXYL)PHTHALATE	PPB	BDL	350
4-BROMOPHENYL PHENYL ETHER	PPB	BDL	350
BUTYL BENZYL PHTHALATE	PPB	BDL	350
4-CHLOROANILINE	PPB	BDL	350
2-CHLORONAPHTHALENE	PPB	BDL	350
4-CHLOROPHENYL PHENYL ETHER	PPB	BDL	350
CHRYSENE	PPB	BDL	350
DIBENZ(A,H)ANTHRACENE	PPB	BDL	350
DIBENZOFURAN	PPB	BDL	350
1,2-DICHLOROBENZENE	PPB	BDL	350
1,3-DICHLOROBENZENE	PPB	BDL	350
1,4-DICHLOROBENZENE	PPB	BDL	350
3,3'-DICHLOROBENZIDINE	PPB	BDL	1750
DIETHYLPHTHALATE	PPB	BDL	350
DIMETHYLPHTHALATE	PPB	BDL	350
DI-N-BUTYLPHTHALATE	PPB	BDL	350
2,4-DINITROTOLUENE	PPB	BDL	350
2,6-DINITROTOLUENE	PPB	BDL	350
DI-N-OCTYLPHTHALATE	PPB	BDL	350
FLUORANTHENE	PPB	BDL	350
FLUORENE	PPB	BDL	350
HEXACHLOROBENZENE	PPB	BDL	350
HEXACHLOROBUTADIENE	PPB	BDL	350

Sample ID.: WHF-SS-21B-2 Test Parameters continued on next page

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2547B-2
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: SOIL

Sample ID.: WHF-SS-21B-2 Sample Date: 05/09/90 Time: VARIOUS

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL continued

Parameter	Units	Result	Detection Limit
HEXACHLOROCYCLOPENTADIENE	PPB	BDL	350
HEXACHLOROETHANE	PPB	BDL	350
INDENO(1,2,3-CD)PYRENE	PPB	BDL	350
ISOPHORONE	PPB	BDL	350
2-METHYLNAPHTHALENE	PPB	BDL	350
NAPHTHALENE	PPB	BDL	350
2-NITROANILINE	PPB	BDL	350
3-NITROANILINE	PPB	BDL	350
4-NITROANILINE	PPB	BDL	350
NITROBENZENE	PPB	BDL	350
N-NITROSODIPHENYLAMINE	PPB	BDL	350
N-NITROSO-DI-N-DIPROPYLAMINE	PPB	BDL	350
PHENANTHRENE	PPB	BDL	350
PYRENE	PPB	BDL	350
1,2,4-TRICHLOROBENZENE	PPB	BDL	350

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Client: ABB ENVIRONMENTAL, INC
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Lab I.D.#: 90-2547B-3
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: SOIL

Sample ID.: WHF-SS-21B-3 Sample Date: 05/09/90 Time: VARIOUS

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL

Parameter	Units	Result	Detection Limit
ACENAPHTHENE	PPB	BDL	374
ACENAPHTHYLENE	PPB	BDL	374
ANTHRACENE	PPB	BDL	374
BENZO(A)ANTHRACENE	PPB	BDL	374
BENZO(A)PYRENE	PPB	BDL	374
BENZO(B)FLUORANTHENE	PPB	BDL	374
BENZO(G,H,I)PERYLENE	PPB	BDL	374
BENZO(K)FLUORANTHENE	PPB	BDL	374
BENZYL ALCOHOL	PPB	BDL	374
BIS(2-CHLOROETHOXY)METHANE	PPB	BDL	374
BIS(2-CHLOROETHYL)ETHER	PPB	BDL	374
BIS(2-CHLOROISOPROPYL)ETHER	PPB	BDL	374
BIS(2-ETHYLHEXYL)PHTHALATE	PPB	BDL	374
4-BROMOPHENYL PHENYL ETHER	PPB	BDL	374
BUTYL BENZYL PHTHALATE	PPB	BDL	374
4-CHLOROANILINE	PPB	BDL	374
2-CHLORONAPHTHALENE	PPB	BDL	374
4-CHLOROPHENYL PHENYL ETHER	PPB	BDL	374
CHRYSENE	PPB	BDL	374
DIBENZ(A,H)ANTHRACENE	PPB	BDL	374
DIBENZOFURAN	PPB	BDL	374
1,2-DICHLOROBENZENE	PPB	BDL	374
1,3-DICHLOROBENZENE	PPB	BDL	374
1,4-DICHLOROBENZENE	PPB	BDL	374
3,3'-DICHLOROBENZIDINE	PPB	BDL	1870
DIETHYLPHTHALATE	PPB	BDL	374
DIMETHYLPHTHALATE	PPB	BDL	374
DI-N-BUTYLPHTHALATE	PPB	BDL	374
2,4-DINITROTOLUENE	PPB	BDL	374
2,6-DINITROTOLUENE	PPB	BDL	374
DI-N-OCTYLPHTHALATE	PPB	BDL	374
FLUORANTHENE	PPB	BDL	374
FLUORENE	PPB	BDL	374
HEXACHLOROBENZENE	PPB	BDL	374
HEXACHLOROBUTADIENE	PPB	BDL	374

Sample ID.: WHF-SS-21B-3 Test Parameters continued on next page

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2547B-3
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: SOIL

Sample ID.: WHF-SS-21B-3 Sample Date: 05/09/90 Time: VARIOUS

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL continued

Parameter	Units	Result	Detection Limit
HEXACHLOROCYCLOPENTADIENE	PPB	BDL	374
HEXACHLOROETHANE	PPB	BDL	374
INDENO(1,2,3-CD)PYRENE	PPB	BDL	374
ISOPHORONE	PPB	BDL	374
2-METHYLNAPHTHALENE	PPB	BDL	374
NAPHTHALENE	PPB	BDL	374
2-NITROANILINE	PPB	BDL	374
3-NITROANILINE	PPB	BDL	374
4-NITROANILINE	PPB	BDL	374
NITROBENZENE	PPB	BDL	374
N-NITROSODIPHENYLAMINE	PPB	BDL	374
N-NITROSO-DI-N-DIPROPYLAMINE	PPB	BDL	374
PHENANTHRENE	PPB	BDL	374
PYRENE	PPB	BDL	374
1,2,4-TRICHLOROBENZENE	PPB	BDL	374

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2547B-4
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: SOIL

Sample ID.: WHF-SS-21B-3-D Sample Date: 05/09/90 Time: VARIOUS

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL

Parameter	Units	Result	Detection Limit
ACENAPHTHENE	PPB	BDL	365
ACENAPHTHYLENE	PPB	BDL	365
ANTHRACENE	PPB	BDL	365
BENZO(A)ANTHRACENE	PPB	BDL	365
BENZO(A)PYRENE	PPB	BDL	365
BENZO(B)FLUORANTHENE	PPB	BDL	365
BENZO(G,H,I)PERYLENE	PPB	BDL	365
BENZO(K)FLUORANTHENE	PPB	BDL	365
BENZYL ALCOHOL	PPB	BDL	365
BIS(2-CHLOROETHOXY)METHANE	PPB	BDL	365
BIS(2-CHLOROETHYL)ETHER	PPB	BDL	365
BIS(2-CHLOROISOPROPYL)ETHER	PPB	BDL	365
BIS(2-ETHYLHEXYL)PHTHALATE	PPB	BDL	365
4-BROMOPHENYL PHENYL ETHER	PPB	BDL	365
BUTYL BENZYL PHTHALATE	PPB	BDL	365
4-CHLOROANILINE	PPB	BDL	365
2-CHLORONAPHTHALENE	PPB	BDL	365
3-CHLOROPHENYL PHENYL ETHER	PPB	BDL	365
CHRYSENE	PPB	BDL	365
DIBENZ(A,H)ANTHRACENE	PPB	BDL	365
DIBENZOFURAN	PPB	BDL	365
1,2-DICHLOROBENZENE	PPB	BDL	365
1,3-DICHLOROBENZENE	PPB	BDL	365
1,4-DICHLOROBENZENE	PPB	BDL	365
3,3'-DICHLOROBENZIDINE	PPB	BDL	1825
DIETHYLPHTHALATE	PPB	BDL	365
DIMETHYLPHTHALATE	PPB	BDL	365
DI-N-BUTYLPHTHALATE	PPB	BDL	365
2,4-DINITROTOLUENE	PPB	BDL	365
2,6-DINITROTOLUENE	PPB	BDL	365
DI-N-OCTYLPHTHALATE	PPB	BDL	365
FLUORANTHENE	PPB	BDL	365
FLUORENE	PPB	BDL	365
HEXACHLOROBENZENE	PPB	BDL	365
HEXACHLOROBUTADIENE	PPB	BDL	365

Sample ID.: WHF-SS-21B-3-D Test Parameters continued on next page

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2547B-4
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: SOIL

Sample ID.: WHF-SS-21B-3-D Sample Date: 05/09/90 Time: VARIOUS

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL continued

Parameter	Units	Result	Detection Limit
HEXACHLOROCYCLOPENTADIENE	PPB	BDL	365
HEXACHLOROETHANE	PPB	BDL	365
INDENO(1,2,3-CD)PYRENE	PPB	BDL	365
ISOPHORONE	PPB	BDL	365
2-METHYLNAPHTHALENE	PPB	BDL	365
NAPHTHALENE	PPB	BDL	365
2-NITROANILINE	PPB	BDL	365
3-NITROANILINE	PPB	BDL	365
4-NITROANILINE	PPB	BDL	365
NITROBENZENE	PPB	BDL	365
N-NITROSODIPHENYLAMINE	PPB	BDL	365
N-NITROSO-DI-N-DIPROPYLAMINE	PPB	BDL	365
PHENANTHRENE	PPB	BDL	365
PYRENE	PPB	BDL	365
1,2,4-TRICHLOROBENZENE	PPB	BDL	365

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11 EAST OLIVE ROAD • PENSACOLA, FLORIDA 32514 • (904) 474-1001

Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2547B-1
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: SOIL

Sample ID.: WHF-SS-21B-1 Sample Date: 05/09/90 Time: VARIOUS

TCL/PEST TARGET COMPOUND LIST-PESTICIDES

Parameter	Units	Result	Detection Limit
ALDRIN	PPB	BDL	1
ALPHA CHLORDANE	PPB	BDL	5
ALPHA-BHC	PPB	BDL	1
BETA-BHC	PPB	BDL	1
DELTA-BHC	PPB	BDL	1
GAMMA-BHC (LINDANE)	PPB	BDL	1
4,4'-DDD	PPB	BDL	1
4,4'-DDE	PPB	BDL	1
4,4'-DDT	PPB	BDL	1
DIELDRIN	PPB	BDL	1
ENDOSULFAN I	PPB	BDL	1
ENDOSULFAN II	PPB	BDL	1
ENDOSULFAN SULFATE	PPB	BDL	1
ENDRIN	PPB	BDL	1
ENDRIN KETONE	PPB	BDL	1
GAMMA CHLORDANE	PPB	BDL	5
HEPTACHLOR	PPB	BDL	1
HEPTACHLOR EPOXIDE	PPB	BDL	1
METHOXYCHLOR	PPB	BDL	5
AROCLOR-1016	PPB	BDL	5
AROCLOR-1221	PPB	BDL	5
AROCLOR-1232	PPB	BDL	5
AROCLOR-1242	PPB	BDL	5
AROCLOR-1248	PPB	BDL	5
AROCLOR-1254	PPB	BDL	5
AROCLOR-1260	PPB	BDL	5
TOXAPHENE	PPB	BDL	5

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2547B-2
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: SOIL

Sample ID.: WHF-SS-21B-2 Sample Date: 05/09/90 Time: VARIOUS

TCL/PEST/608 TARGET COMPOUND LIST-PESTICIDES

Parameter	Units	Result	Detection Limit
ALDRIN	PPB	BDL	1
ALPHA CHLORDANE	PPB	BDL	5
ALPHA-BHC	PPB	BDL	1
BETA-BHC	PPB	BDL	1
DELTA-BHC	PPB	BDL	1
GAMMA-BHC (LINDANE)	PPB	BDL	1
4,4'-DDD	PPB	BDL	1
4,4'-DDE	PPB	BDL	1
4,4'-DDT	PPB	BDL	1
DIELDRIN	PPB	BDL	1
ENDOSULFAN I	PPB	BDL	1
ENDOSULFAN II	PPB	BDL	1
ENDOSULFAN SULFATE	PPB	BDL	1
ENDRIN	PPB	BDL	1
ENDRIN KETONE	PPB	BDL	1
GAMMA CHLORDANE	PPB	BDL	5
HEPTACHLOR	PPB	BDL	1
HEPTACHLOR EPOXIDE	PPB	BDL	1
METHOXYCHLOR	PPB	BDL	5
AROCLOR-1016	PPB	BDL	5
AROCLOR-1221	PPB	BDL	5
AROCLOR-1232	PPB	BDL	5
AROCLOR-1242	PPB	BDL	5
AROCLOR-1248	PPB	BDL	5
AROCLOR-1254	PPB	BDL	5
AROCLOR-1260	PPB	BDL	5
TOXAPHENE	PPB	BDL	5

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2547B-3
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: SOIL

Sample ID.: WHF-SS-21B-3 Sample Date: 05/09/90 Time: VARIOUS

TCL/PEST TARGET COMPOUND LIST-PESTICIDES

Parameter	Units	Result	Detection Limit
ALDRIN	PPB	BDL	1
ALPHA CHLORDANE	PPB	BDL	5
ALPHA-BHC	PPB	BDL	1
BETA-BHC	PPB	BDL	1
DELTA-BHC	PPB	BDL	1
GAMMA-BHC (LINDANE)	PPB	BDL	1
4,4'-DDD	PPB	BDL	1
4,4'-DDE	PPB	BDL	1
4,4'-DDT	PPB	BDL	1
DIELDRIN	PPB	BDL	1
ENDOSULFAN I	PPB	BDL	1
ENDOSULFAN II	PPB	BDL	1
ENDOSULFAN SULFATE	PPB	BDL	1
ENDRIN	PPB	BDL	1
ENDRIN KETONE	PPB	BDL	1
GAMMA CHLORDANE	PPB	BDL	5
HEPTACHLOR	PPB	BDL	1
HEPTACHLOR EPOXIDE	PPB	BDL	1
METHOXYCHLOR	PPB	BDL	5
AROCLOR-1016	PPB	BDL	5
AROCLOR-1221	PPB	BDL	5
AROCLOR-1232	PPB	BDL	5
AROCLOR-1242	PPB	BDL	5
AROCLOR-1248	PPB	BDL	5
AROCLOR-1254	PPB	BDL	5
AROCLOR-1260	PPB	BDL	5
TOXAPHENE	PPB	BDL	5

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2547B-4
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: SOIL

Sample ID.: WHF-SS-21B-3-D Sample Date: 05/09/90 Time: VARIOUS

TCL/PEST TARGET COMPOUND LIST-PESTICIDES

Parameter	Units	Result	Detection Limit
ALDRIN	PPB	BDL	1
ALPHA CHLORDANE	PPB	BDL	5
ALPHA-BHC	PPB	BDL	1
BETA-BHC	PPB	BDL	1
DELTA-BHC	PPB	BDL	1
GAMMA-BHC (LINDANE)	PPB	BDL	1
4,4'-DDD	PPB	BDL	1
4,4'-DDE	PPB	BDL	1
4,4'-DDT	PPB	BDL	1
DIELDRIN	PPB	BDL	1
ENDOSULFAN I	PPB	BDL	1
ENDOSULFAN II	PPB	BDL	1
ENDOSULFAN SULFATE	PPB	BDL	1
ENDRIN	PPB	BDL	1
ENDRIN KETONE	PPB	BDL	1
GAMMA CHLORDANE	PPB	BDL	5
HEPTACHLOR	PPB	BDL	1
HEPTACHLOR EPOXIDE	PPB	BDL	1
METHOXYCHLOR	PPB	BDL	5
AROCLOR-1016	PPB	BDL	5
AROCLOR-1221	PPB	BDL	5
AROCLOR-1232	PPB	BDL	5
AROCLOR-1242	PPB	BDL	5
AROCLOR-1248	PPB	BDL	5
AROCLOR-1254	PPB	BDL	5
AROCLOR-1260	PPB	BDL	5
TOXAPHENE	PPB	BDL	5

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2547B-1
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: SOIL

Sample ID.: WHF-SS-21B-1 Sample Date: 05/09/90 Time: VARIOUS

TCL/VOL TARGET COMPOUND LIST - VOLATILES

Parameter	Units	Result	Detection Limit
ACETONE	PPB	BDL	106
BENZENE	PPB	BDL	11
BROMODICHLOROMETHANE	PPB	BDL	11
BROMOFORM	PPB	BDL	21
BROMOMETHANE	PPB	BDL	11
2-BUTANONE (MEK)	PPB	BDL	32
CARBON DISULFIDE	PPB	BDL	11
CARBON TETRACHLORIDE	PPB	BDL	21
CHLOROBENZENE	PPB	BDL	11
CHLOROETHANE	PPB	BDL	11
CHLOROFORM	PPB	BDL	21
CHLOROMETHANE	PPB	BDL	21
DIBROMOCHLOROMETHANE	PPB	BDL	53
1,1-DICHLOROETHANE	PPB	BDL	11
1,2-DICHLOROETHANE	PPB	BDL	22
1,1-DICHLOROETHENE	PPB	BDL	11
1,2-DICHLOROETHENE	PPB	BDL	53
1,2-DICHLOROPROPANE	PPB	BDL	21
CIS-1,3-DICHLOROPROPENE	PPB	BDL	11
TRANS-1,3-DICHLOROPROPENE	PPB	BDL	11
ETHYLBENZENE	PPB	BDL	11
2-HEXANONE	PPB	BDL	32
METHYLENE CHLORIDE	PPB	BDL	32
4-METHYL-2-PENTANONE	PPB	BDL	32
STYRENE	PPB	BDL	21
1,1,2,2-TETRACHLOROETHANE	PPB	BDL	21
TETRACHLOROETHENE	PPB	BDL	11
TOLUENE	PPB	BDL	11
1,1,1-TRICHLOROETHANE	PPB	BDL	53
1,1,2-TRICHLOROETHANE	PPB	BDL	21
TRICHLOROETHENE	PPB	BDL	11
VINYL ACETATE	PPB	BDL	21
VINYL CHLORIDE	PPB	BDL	11
TOTAL XYLENES	PPB	BDL	43

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2547B-2
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: SOIL

Sample ID.: WHF-SS-21B-2 Sample Date: 05/09/90 Time: VARIOUS

TCL/VOL TARGET COMPOUND LIST - VOLATILES

Parameter	Units	Result	Detection Limit
ACETONE	PPB	BDL	106
BENZENE	PPB	BDL	11
BROMODICHLOROMETHANE	PPB	BDL	11
BROMOFORM	PPB	BDL	21
BROMOMETHANE	PPB	BDL	11
2-BUTANONE (MEK)	PPB	BDL	32
CARBON DISULFIDE	PPB	BDL	11
CARBON TETRACHLORIDE	PPB	BDL	21
CHLOROBENZENE	PPB	BDL	11
CHLOROETHANE	PPB	BDL	11
CHLOROFORM	PPB	BDL	21
CHLOROMETHANE	PPB	BDL	21
DIBROMOCHLOROMETHANE	PPB	BDL	53
1,1-DICHLOROETHANE	PPB	BDL	11
1,2-DICHLOROETHANE	PPB	BDL	21
1,1-DICHLOROETHENE	PPB	BDL	11
1,2-DICHLOROETHENE	PPB	BDL	53
1,2-DICHLOROPROPANE	PPB	BDL	21
CIS-1,3-DICHLOROPROPENE	PPB	BDL	11
TRANS-1,3-DICHLOROPROPENE	PPB	BDL	11
ETHYLBENZENE	PPB	BDL	11
2-HEXANONE	PPB	BDL	32
METHYLENE CHLORIDE	PPB	BDL	32
4-METHYL-2-PENTANONE	PPB	BDL	32
STYRENE	PPB	BDL	21
1,1,2,2-TETRACHLOROETHANE	PPB	BDL	21
TETRACHLOROETHENE	PPB	BDL	11
TOLUENE	PPB	BDL	11
1,1,1-TRICHLOROETHANE	PPB	BDL	53
1,1,2-TRICHLOROETHANE	PPB	BDL	21
TRICHLOROETHENE	PPB	BDL	11
VINYL ACETATE	PPB	BDL	21
VINYL CHLORIDE	PPB	BDL	11
TOTAL XYLENES	PPB	BDL	43

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2547B-3
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: SOIL

Sample ID.: WHF-SS-21B-3 Sample Date: 05/09/90 Time: VARIOUS

TCL/VOL TARGET COMPOUND LIST - VOLATILES

Parameter	Units	Result	Detection Limit
ACETONE	PPB	BDL	115
BENZENE	PPB	BDL	11
BROMODICHLOROMETHANE	PPB	BDL	11
BROMOFORM	PPB	BDL	23
BROMOMETHANE	PPB	BDL	11
2-BUTANONE (MEK)	PPB	BDL	34
CARBON DISULFIDE	PPB	BDL	11
CARBON TETRACHLORIDE	PPB	BDL	21
CHLOROBENZENE	PPB	BDL	11
CHLOROETHANE	PPB	BDL	11
CHLOROFORM	PPB	BDL	23
CHLOROMETHANE	PPB	BDL	23
DIBROMOCHLOROMETHANE	PPB	BDL	57
1,1-DICHLOROETHANE	PPB	BDL	11
1,2-DICHLOROETHANE	PPB	BDL	23
1,1-DICHLOROETHENE	PPB	BDL	11
1,2-DICHLOROETHENE	PPB	BDL	57
1,2-DICHLOROPROPANE	PPB	BDL	23
CIS-1,3-DICHLOROPROPENE	PPB	BDL	11
TRANS-1,3-DICHLOROPROPENE	PPB	BDL	11
ETHYLBENZENE	PPB	BDL	11
2-HEXANONE	PPB	BDL	34
METHYLENE CHLORIDE	PPB	448	34
4-METHYL-2-PENTANONE	PPB	BDL	34
STYRENE	PPB	BDL	23
1,1,2,2-TETRACHLOROETHANE	PPB	BDL	23
TETRACHLOROETHENE	PPB	BDL	11
TOLUENE	PPB	BDL	11
1,1,1-TRICHLOROETHANE	PPB	BDL	57
1,1,2-TRICHLOROETHANE	PPB	BDL	23
TRICHLOROETHENE	PPB	BDL	11
VINYL ACETATE	PPB	BDL	23
VINYL CHLORIDE	PPB	BDL	11
TOTAL XYLENES	PPB	BDL	46

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2547B-4
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: SOIL

Sample ID.: WHF-SS-21B-3-D Sample Date: 05/09/90 Time: VARIOUS

TCL/VOL TARGET COMPOUND LIST - VOLATILES

Parameter	Units	Result	Detection Limit
ACETONE	PPB	BDL	109
BENZENE	PPB	BDL	11
BROMODICHLOROMETHANE	PPB	BDL	11
BROMOFORM	PPB	BDL	22
BROMOMETHANE	PPB	BDL	11
2-BUTANONE (MEK)	PPB	BDL	33
CARBON DISULFIDE	PPB	BDL	11
CARBON TETRACHLORIDE	PPB	BDL	22
CHLOROBENZENE	PPB	BDL	11
CHLOROETHANE	PPB	BDL	11
CHLOROFORM	PPB	BDL	22
CHLOROMETHANE	PPB	BDL	22
DIBROMOCHLOROMETHANE	PPB	BDL	54
1,1-DICHLOROETHANE	PPB	BDL	11
1,2-DICHLOROETHANE	PPB	BDL	22
1,1-DICHLOROETHENE	PPB	BDL	11
1,2-DICHLOROETHENE	PPB	BDL	54
1,2-DICHLOROPROPANE	PPB	BDL	22
CIS-1,3-DICHLOROPROPENE	PPB	BDL	11
TRANS-1,3-DICHLOROPROPENE	PPB	BDL	11
ETHYLBENZENE	PPB	BDL	11
2-HEXANONE	PPB	BDL	33
METHYLENE CHLORIDE	PPB	BDL	33
4-METHYL-2-PENTANONE	PPB	BDL	33
STYRENE	PPB	BDL	22
1,1,2,2-TETRACHLOROETHANE	PPB	BDL	22
TETRACHLOROETHENE	PPB	BDL	11
TOLUENE	PPB	21	11
1,1,1-TRICHLOROETHANE	PPB	BDL	54
1,1,2-TRICHLOROETHANE	PPB	BDL	22
TRICHLOROETHENE	PPB	BDL	11
VINYL ACETATE	PPB	BDL	22
VINYL CHLORIDE	PPB	BDL	11
TOTAL XYLENES	PPB	BDL	43

end of report

Pioneer LABORATORY, INC.

NEESA LEVEL "C"

CHAIN OF CUSTOD

T OLIVE ROAD PENSACOLA, FLORIDA 32514
PHONE (904) 474-1001 • FAX 478-2671

Client ABB ENVIRONMENTAL
Address
City/State/Zip
Phone No. (904) 656-1293
Contact M. NUGENT
P.O. #

Laboratory I.D. 90-35-47ABN Date 5/10/90
Method of Shipment hand
Sampler BLOMBERG/DESANDRO
Project # 5898-05
Project Name OLF BARIN
Project Location FOLEY, ALAB

SAMPLE SITE	FIELD I.D.	SAMPLE TYPE (DW, WW, GW, SW, SO, OL, AR, SL, HZ, OT)	Date	Time	# Btls.	PB 6010	PAH SW846-8310	VOA CLP TCL	SEMI VOA CLP TCL	TCL METALS	CYANIDE	T PHENOL	PEST/PCB	Lab Use Only
OLF BARN 23B	WHF-SS-23B-1(1-2)-1	SOIL	5/9	1335	2	1	1							1A
"	" -2(1-2)-1	"	"	1347	2	1	1							
"	" -2(1-2)-D-1	"	"	1347	2	1	1							3A
"	" -3(1-2)-1	"	"	1400	2	1	1							4A
"	WHF-EB-23B-1	WATER	"	1408	2	1	1							5A
OLF BARN 21B	WHF-SS-21B-1(1-2)-1	SOIL	"	1515	4			1	1	X	X	X	1	1B
"	" -2(1-2)-1	"	"	1545	4			1	1	X	X	X	1	2B
"	" -3(1-2)-1	"	"	1615	4			1	1	X	X	X	1	3B
"	" -3(1-2)-D-1	"	"	1615	4			1	1	X	X	X	1	4B

	Date	Time		Date
RELINQUISHED BY Andrew F. DeSandro	5/10	100	RECEIVED BY Laura Tolbert	5/10
RELINQUISHED BY			RECEIVED BY	
RELINQUISHED BY			RECEIVED BY	
RELINQUISHED BY			RECEIVED BY	

Comments:

CERTIFICATION NUMBERS

Pioneer LABORATORY, INC. a division of Analytical Technologies, Inc.
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ABB ENVIRONMENTAL, INC
2571 EXECUTIVE CENTER CIR
SUITE 100
TALLAHASSEE FL 32301-5001

Lab I.D.#: 90-2545S
Order Number: P29926
Order Date: 05/10/90
Client: 10001
Sampled By: E.B./A.D.
Sample Date: 05/09/90
Sample Time: 1815

Project Number: 5898-05
Project Name: OLF BARIN
Sample Site: FOLEY, AL
Sample Type: SOIL

N/S = Not Submitted

Lab ID	Sample ID	Parameter	Units	Results	Detection Limit
2545S-1	WHF-SP-23B-1-1	PHENOLS,TOTAL	PPM	3.6	0.36

Comments: PPM = Parts Per Million, mg/kg on a dry basis; PPB = Parts Per Billion, ug/kg on a dry basis. BDL = Below Detection Limits.
Method Reference: SW-846, 3rd Edition, November 1986.

Approved By : John J Hawkins

Pioneer LABORATORY, INC.
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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2545S-1
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: SOIL

Sample ID.: WHF-SP-23B-1-1 Sample Date: 05/09/90 Time: 1815

TCL/INORGANICS TARGET COMPOUND LIST - INORGANICS

Parameter	Units	Result	Detection Limit
SILVER	PPM	BDL	0.014
ALUMINUM	PPM	979	36
ARSENIC	PPM	0.21	0.07
BARIUM	PPM	BDL	7.1
BERYLLIUM	PPM	BDL	0.7
CALCIUM	PPM	BDL	71
CADMIUM	PPM	BDL	0.7
COBALT	PPM	BDL	3.6
CHROMIUM	PPM	BDL	0.71
COPPER	PPM	BDL	2.1
CYANIDE, TOTAL	PPM	BDL	0.36
IRON	PPM	407	2.1
MERCURY	PPM	BDL	0.36
POTASSIUM	PPM	BDL	43
MAGNESIUM	PPM	17	0.71
MANGANESE	PPM	BDL	0.71
SODIUM	PPM	20	14
NICKEL	PPM	BDL	3.6
LEAD	PPM	BDL	9.3
ANTIMONY	PPM	BDL	7.1
SELENIUM	PPM	BDL	0.21
THALLIUM	PPM	BDL	29
VANADIUM	PPM	BDL	14
ZINC	PPM	BDL	1.4

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2545S-1
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: SOIL

Sample ID.: WHF-SP-23B-1-1 Sample Date: 05/09/90 Time: 1815

TCL/ACID TARGET COMPOUND LIST - ACID EXTRACT

Parameter	Units	Result	Detection Limit
BENZOIC ACID	PPB	BDL	3575
4-CHLORO-3-METHYLPHENOL	PPB	BDL	715
2-CHLOROPHENOL	PPB	BDL	715
2,4-DICHLOROPHENOL	PPB	BDL	715
2,4-DIMETHYLPHENOL	PPB	BDL	715
4,6-DINITRO-2-METHYLPHENOL	PPB	BDL	3575
2,4-DINITROPHENOL	PPB	BDL	3575
2-METHYLPHENOL	PPB	BDL	715
4-METHYLPHENOL	PPB	BDL	715
2-NITROPHENOL	PPB	BDL	715
4-NITROPHENOL	PPB	BDL	3575
PENTACHLOROPHENOL	PPB	BDL	3575
PHENOL	PPB	BDL	715
2,4,5-TRICHLOROPHENOL	PPB	BDL	3575
2,4,6-TRICHLOROPHENOL	PPB	BDL	715

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11 EAST OLIVE ROAD • PENSACOLA, FLORIDA 32514 • (904) 474-1001

Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2545S-1
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: SOIL

Sample ID.: WHF-SP-23B-1-1 Sample Date: 05/09/90 Time: 1815

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL

Parameter	Units	Result	Detection Limit
ACENAPHTHENE	PPB	BDL	715
ACENAPHTHYLENE	PPB	BDL	715
ANTHRACENE	PPB	BDL	715
BENZO(A)ANTHRACENE	PPB	BDL	715
BENZO(A)PYRENE	PPB	BDL	715
BENZO(B)FLUORANTHENE	PPB	BDL	715
BENZO(G,H,I)PERYLENE	PPB	BDL	715
BENZO(K)FLUORANTHENE	PPB	BDL	715
BENZYL ALCOHOL	PPB	BDL	715
BIS(2-CHLOROETHOXY)METHANE	PPB	BDL	715
BIS(2-CHLOROETHYL)ETHER	PPB	BDL	715
BIS(2-CHLOROISOPROPYL)ETHER	PPB	BDL	715
BIS(2-ETHYLHEXYL)PHTHALATE	PPB	BDL	715
4-BROMOPHENYL PHENYL ETHER	PPB	BDL	715
BUTYL BENZYL PHTHALATE	PPB	BDL	715
4-CHLOROANILINE	PPB	BDL	715
2-CHLORONAPHTHALENE	PPB	BDL	715
4-CHLOROPHENYL PHENYL ETHER	PPB	BDL	715
CHRYSENE	PPB	BDL	715
DIBENZ(A,H)ANTHRACENE	PPB	BDL	715
DIBENZOFURAN	PPB	BDL	715
1,2-DICHLOROBENZENE	PPB	BDL	715
1,3-DICHLOROBENZENE	PPB	BDL	715
1,4-DICHLOROBENZENE	PPB	BDL	715
3,3'-DICHLOROBENZIDINE	PPB	BDL	3575
DIETHYLPHTHALATE	PPB	BDL	715
DIMETHYLPHTHALATE	PPB	BDL	715
DI-N-BUTYLPHTHALATE	PPB	BDL	715
2,4-DINITROTOLUENE	PPB	BDL	715
2,6-DINITROTOLUENE	PPB	BDL	715
DI-N-OCTYLPHTHALATE	PPB	BDL	715
FLUORANTHENE	PPB	BDL	715
FLUORENE	PPB	BDL	715
HEXACHLOROBENZENE	PPB	BDL	715
HEXACHLOROBUTADIENE	PPB	BDL	715

Sample ID.: WHF-SP-23B-1-1 Test Parameters continued on next page

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2545S-1
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: SOIL

Sample ID.: WHF-SP-23B-1-1 Sample Date: 05/09/90 Time: 1815

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL continued

Parameter	Units	Result	Detection Limit
HEXACHLOROCYCLOPENTADIENE	PPB	BDL	715
HEXACHLOROETHANE	PPB	BDL	715
INDENO(1,2,3-CD)PYRENE	PPB	BDL	715
ISOPHORONE	PPB	BDL	715
2-METHYLNAPHTHALENE	PPB	BDL	715
NAPHTHALENE	PPB	BDL	715
2-NITROANILINE	PPB	BDL	715
3-NITROANILINE	PPB	BDL	715
4-NITROANILINE	PPB	BDL	715
NITROBENZENE	PPB	BDL	715
N-NITROSODIPHENYLAMINE	PPB	BDL	715
N-NITROSO-DI-N-DIPROPYLAMINE	PPB	BDL	715
PHENANTHRENE	PPB	BDL	715
PYRENE	PPB	BDL	715
1,2,4-TRICHLOROBENZENE	PPB	BDL	715

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2545S-1
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: SOIL

Sample ID.: WHF-SP-23B-1-1 Sample Date: 05/09/90 Time: 1815

TCL/PEST TARGET COMPOUND LIST-PESTICIDES

Parameter	Units	Result	Detection Limit
ALDRIN	PPB	BDL	1
ALPHA CHLORDANE	PPB	BDL	5
ALPHA-BHC	PPB	BDL	1
BETA-BHC	PPB	BDL	1
DELTA-BHC	PPB	BDL	1
GAMMA-BHC (LINDANE)	PPB	BDL	1
4,4'-DDD	PPB	BDL	1
4,4'-DDE	PPB	BDL	1
4,4'-DDT	PPB	BDL	1
DIELDRIN	PPB	BDL	1
ENDOSULFAN I	PPB	BDL	1
ENDOSULFAN II	PPB	BDL	1
ENDOSULFAN SULFATE	PPB	BDL	1
ENDRIN	PPB	BDL	1
ENDRIN KETONE	PPB	BDL	1
GAMMA CHLORDANE	PPB	BDL	5
HEPTACHLOR	PPB	BDL	1
HEPTACHLOR EPOXIDE	PPB	BDL	1
METHOXYCHLOR	PPB	BDL	5
AROCLOR-1016	PPB	BDL	5
AROCLOR-1221	PPB	BDL	5
AROCLOR-1232	PPB	BDL	5
AROCLOR-1242	PPB	BDL	5
AROCLOR-1248	PPB	BDL	5
AROCLOR-1254	PPB	BDL	5
AROCLOR-1260	PPB	BDL	5
TOXAPHENE	PPB	BDL	5

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2545S-1
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: SOIL

Sample ID.: WHF-SP-23B-1-1 Sample Date: 05/09/90 Time: 1815

TCL/VOL TARGET COMPOUND LIST - VOLATILES

Parameter	Units	Result	Detection Limit
ACETONE	PPB	BDL	143
BENZENE	PPB	BDL	14
BROMODICHLOROMETHANE	PPB	BDL	14
BROMOFORM	PPB	BDL	29
BROMOMETHANE	PPB	BDL	14
2-BUTANONE (MEK)	PPB	BDL	43
CARBON DISULFIDE	PPB	BDL	14
CARBON TETRACHLORIDE	PPB	BDL	29
CHLOROBENZENE	PPB	BDL	14
CHLOROETHANE	PPB	BDL	14
CHLOROFORM	PPB	BDL	29
CHLOROMETHANE	PPB	BDL	29
DIBROMOCHLOROMETHANE	PPB	BDL	71
1,1-DICHLOROETHANE	PPB	BDL	14
1,2-DICHLOROETHANE	PPB	BDL	29
1,1-DICHLOROETHENE	PPB	BDL	14
1,2-DICHLOROETHENE	PPB	BDL	71
1,2-DICHLOROPROPANE	PPB	BDL	29
CIS-1,3-DICHLOROPROPENE	PPB	BDL	14
TRANS-1,3-DICHLOROPROPENE	PPB	BDL	14
ETHYLBENZENE	PPB	57	14
2-HEXANONE	PPB	BDL	43
METHYLENE CHLORIDE	PPB	100	43
4-METHYL-2-PENTANONE	PPB	BDL	43
STYRENE	PPB	BDL	29
1,1,2,2-TETRACHLOROETHANE	PPB	BDL	29
TETRACHLOROETHENE	PPB	BDL	14
TOLUENE	PPB	229	14
1,1,1-TRICHLOROETHANE	PPB	BDL	71
1,1,2-TRICHLOROETHANE	PPB	BDL	29
TRICHLOROETHENE	PPB	BDL	14
VINYL ACETATE	PPB	BDL	29
VINYL CHLORIDE	PPB	BDL	14
TOTAL XYLENES	PPB	286	57

end of report

Pioneer LABORATORY, INC.

11 EAST OLIVE ROAD PENSACOLA, FLORIDA 32514
PHONE (904) 474-1001 • FAX 478-2671

Page "C"

CHAIN OF CUSTODY

S/W

Client ABB Environmental
Address
City/State/Zip
Phone No. (904) 656-1293
Contact M. Nugent
P.O. #

Laboratory I.D. 90-2545 Date 5/10/90
Method of Shipment hand
Sampler Blomberg / DeSandro
Project # 5898-05
Project Name OLF Barrin
Project Location Foley, Fla.

SAMPLE TYPE

DW DRINKING WATER, WW WASTE WATER, GW GROUND WATER, SW SURFACE WATER, SO SOIL, OL OIL, AR AIR, SL SLUDGE, HZ HAZARDOUS, OT OTHER

SAMPLE SITE	FIELD I.D.		Date	Time	# Btls.	TCL-VOA	TCL Semi-VOA	Pest/PCB	TCL metal	CYANIDE	T-Phenol		Lab Use Only
OLF Barrin 23B	VVHF-SP-23B-1-1	Sediment SO	5/9	1835	4	1	1	1	X	X	X		S-1
OLF Barrin 23B	VVHF-SW-23B-1-1	SW	5/9	1810		2	1	1	1	1	1		1
OLF Barrin 21B	VVHF-FB-21B-1	DI water	5/9	1848	6	1	1	1	1	1	1		2
OLF Barrin 21B	VVHF-EB-21B-1	DI water	5/9	1852	6	1	1	1	1	1	1		3
OLF Barrin 23B	VVHF-TB-23B-1	water	5/9	-	1	1					-		4

	Date	Time		Date	Time
RELINQUISHED BY Anthony DeSandro	5/10	1102	RECEIVED BY Laura Gilbert	5/10	11:02
RELINQUISHED BY			RECEIVED BY		
RELINQUISHED BY			RECEIVED BY		
RELINQUISHED BY			RECEIVED BY		

Comments:

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ABB ENVIRONMENTAL, INC
2571 EXECUTIVE CENTER CIR
SUITE 100
TALLAHASSEE FL 32301-5001

Lab I.D.#: 90-2545W
Order Number: P29928
Order Date: 05/10/90
Client: 10001
Sampled By: E.B./A.D.
Sample Date: 05/09/90
Sample Time: VARIOUS

Project Number: 5898-05
Project Name: OLF BARIN
Sample Site: FOLEY, AL
Sample Type: GROUNDWATER

N/S = Not Submitted

Lab ID	Sample ID	Parameter	Units	Results	Detection Limit
2545W-1	WHF-SW-23B-1-1	PHENOLS,TOTAL	PPM	BDL	0.005
2545W-2	WHF-FB-21B-1	PHENOLS,TOTAL	PPM	BDL	0.005
2545W-3	WHF-EB-21B-1	PHENOLS,TOTAL	PPM	BDL	0.005

Comments: PPM = Parts Per Million, mg/l. PPB = Parts Per Billion, ug/l.
Method Reference: SW-846, 3rd Edition, November 1986.
BDL = Below Detection Limits.

Approved By : John V Hawkins

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2545W-1
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: GROUNDWATER

Sample ID.: WHF-SW-23B-1-1 Sample Date: 05/09/90 Time: VARIOUS

TCL/INORGANICS TARGET COMPOUND LIST - INORGANICS

Parameter	Units	Result	Detection Limit
SILVER	PPM	BDL	0.0002
ALUMINUM	PPM	0.5	0.5
ARSENIC	PPM	BDL	0.001
BARIUM	PPM	BDL	0.1
BERYLLIUM	PPM	BDL	0.01
CALCIUM	PPM	2.8	1
CADMIUM	PPM	BDL	0.0002
COBALT	PPM	BDL	0.05
CHROMIUM	PPM	BDL	0.01
COPPER	PPM	BDL	0.03
CYANIDE, TOTAL	PPM	0.006	0.005
IRON	PPM	0.36	0.03
MERCURY	PPM	BDL	0.0005
POTASSIUM	PPM	0.8	0.6
MAGNESIUM	PPM	1.7	0.01
MANGANESE	PPM	0.03	0.01
SODIUM	PPM	3.5	0.2
NICKEL	PPM	BDL	0.05
LEAD	PPM	BDL	0.004
ANTIMONY	PPM	BDL	0.1
SELENIUM	PPM	BDL	0.003
THALLIUM	PPM	BDL	0.4
VANADIUM	PPM	BDL	0.2
ZINC	PPM	0.05	0.01

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2545W-2
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: GROUNDWATER

Sample ID.: WHF-FB-21B-1 Sample Date: 05/09/90 Time: VARIOUS

TCL/INORGANICS TARGET COMPOUND LIST - INORGANICS

Parameter	Units	Result	Detection Limit
SILVER	PPM	BDL	0.0002
ALUMINUM	PPM	BDL	0.5
ARSENIC	PPM	BDL	0.001
BARIUM	PPM	BDL	0.1
BERYLLIUM	PPM	BDL	0.01
CALCIUM	PPM	BDL	1
CADMIUM	PPM	BDL	0.0002
COBALT	PPM	BDL	0.05
CHROMIUM	PPM	BDL	0.01
COPPER	PPM	BDL	0.03
CYANIDE, TOTAL	PPM	BDL	0.005
IRON	PPM	BDL	0.03
MERCURY	PPM	BDL	0.0005
POTASSIUM	PPM	BDL	0.6
MAGNESIUM	PPM	BDL	0.01
MANGANESE	PPM	BDL	0.01
SODIUM	PPM	BDL	0.2
NICKEL	PPM	BDL	0.05
LEAD	PPM	BDL	0.004
ANTIMONY	PPM	BDL	0.1
SELENIUM	PPM	BDL	0.003
THALLIUM	PPM	BDL	0.4
VANADIUM	PPM	BDL	0.2
ZINC	PPM	BDL	0.01

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2545W-3
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: GROUNDWATER

Sample ID.: WHF-EB-21B-1 Sample Date: 05/09/90 Time: VARIOUS

TCL/INORGANICS TARGET COMPOUND LIST - INORGANICS

Parameter	Units	Result	Detection Limit
SILVER	PPM	BDL	0.0002
ALUMINUM	PPM	BDL	0.5
ARSENIC	PPM	BDL	0.001
BARIUM	PPM	BDL	0.1
BERYLLIUM	PPM	BDL	0.01
CALCIUM	PPM	BDL	1
CADMIUM	PPM	BDL	0.0002
COBALT	PPM	BDL	0.05
CHROMIUM	PPM	BDL	0.01
COPPER	PPM	BDL	0.03
CYANIDE, TOTAL	PPM	BDL	0.005
IRON	PPM	BDL	0.03
MERCURY	PPM	BDL	0.0005
POTASSIUM	PPM	BDL	0.6
MAGNESIUM	PPM	BDL	0.01
MANGANESE	PPM	BDL	0.01
SODIUM	PPM	0.2	0.2
NICKEL	PPM	BDL	0.05
LEAD	PPM	BDL	0.004
ANTIMONY	PPM	BDL	0.1
SELENIUM	PPM	BDL	0.003
THALLIUM	PPM	BDL	0.4
VANADIUM	PPM	BDL	0.2
ZINC	PPM	BDL	0.01

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2545W-1
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: GROUNDWATER

Sample ID.: WHF-SW-23B-1-1 Sample Date: 05/09/90 Time: VARIOUS

TCL/ACID TARGET COMPOUND LIST - ACID EXTRACT

Parameter	Units	Result	Detection Limit
BENZOIC ACID	PPB	BDL	50
4-CHLORO-3-METHYLPHENOL	PPB	BDL	10
2-CHLOROPHENOL	PPB	BDL	10
2,4-DICHLOROPHENOL	PPB	BDL	10
2,4-DIMETHYLPHENOL	PPB	BDL	10
4,6-DINITRO-2-METHYLPHENOL	PPB	BDL	50
2,4-DINITROPHENOL	PPB	BDL	50
2-METHYLPHENOL	PPB	BDL	10
4-METHYLPHENOL	PPB	BDL	10
2-NITROPHENOL	PPB	BDL	10
4-NITROPHENOL	PPB	BDL	50
PENTACHLOROPHENOL	PPB	BDL	50
PHENOL	PPB	BDL	10
2,4,5-TRICHLOROPHENOL	PPB	BDL	50
2,4,6-TRICHLOROPHENOL	PPB	BDL	10

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2545W-2
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: GROUNDWATER

Sample ID.: WHF-FB-21B-1 Sample Date: 05/09/90 Time: VARIOUS

TCL/ACID TARGET COMPOUND LIST - ACID EXTRACT

Parameter	Units	Result	Detection Limit
BENZOIC ACID	PPB	BDL	50
4-CHLORO-3-METHYLPHENOL	PPB	BDL	10
2-CHLOROPHENOL	PPB	BDL	10
2,4-DICHLOROPHENOL	PPB	BDL	10
2,4-DIMETHYLPHENOL	PPB	BDL	10
4,6-DINITRO-2-METHYLPHENOL	PPB	BDL	50
2,4-DINITROPHENOL	PPB	BDL	50
2-METHYLPHENOL	PPB	BDL	10
4-METHYLPHENOL	PPB	BDL	10
2-NITROPHENOL	PPB	BDL	10
4-NITROPHENOL	PPB	BDL	50
PENTACHLOROPHENOL	PPB	BDL	50
PHENOL	PPB	BDL	10
2,4,5-TRICHLOROPHENOL	PPB	BDL	50
2,4,6-TRICHLOROPHENOL	PPB	BDL	10

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Client: ABB ENVIRONMENTAL, INC
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Lab I.D.#: 90-2545W-3
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: GROUNDWATER

Sample ID.: WHF-EB-21B-1 Sample Date: 05/09/90 Time: VARIOUS

TCL/ACID TARGET COMPOUND LIST - ACID EXTRACT

Parameter	Units	Result	Detection Limit
BENZOIC ACID	PPB	BDL	50
4-CHLORO-3-METHYLPHENOL	PPB	BDL	10
2-CHLOROPHENOL	PPB	BDL	10
2,4-DICHLOROPHENOL	PPB	BDL	10
2,4-DIMETHYLPHENOL	PPB	BDL	10
4,6-DINITRO-2-METHYLPHENOL	PPB	BDL	50
2,4-DINITROPHENOL	PPB	BDL	50
2-METHYLPHENOL	PPB	BDL	10
4-METHYLPHENOL	PPB	BDL	10
2-NITROPHENOL	PPB	BDL	10
4-NITROPHENOL	PPB	BDL	50
PENTACHLOROPHENOL	PPB	BDL	50
PHENOL	PPB	BDL	10
2,4,5-TRICHLOROPHENOL	PPB	BDL	50
2,4,6-TRICHLOROPHENOL	PPB	BDL	10

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2545W-1
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: GROUNDWATER

Sample ID.: WHF-SW-23B-1-1 Sample Date: 05/09/90 Time: VARIOUS

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL

Parameter	Units	Result	Detection Limit
ACENAPHTHENE	PPB	BDL	10
ACENAPHTHYLENE	PPB	BDL	10
ANTHRACENE	PPB	BDL	10
BENZO(A)ANTHRACENE	PPB	BDL	10
BENZO(A)PYRENE	PPB	BDL	10
BENZO(B)FLUORANTHENE	PPB	BDL	10
BENZO(G,H,I)PERYLENE	PPB	BDL	10
BENZO(K)FLUORANTHENE	PPB	BDL	10
BENZYL ALCOHOL	PPB	BDL	10
BIS(2-CHLOROETHOXY)METHANE	PPB	BDL	10
BIS(2-CHLOROETHYL)ETHER	PPB	BDL	10
BIS(2-CHLOROISOPROPYL)ETHER	PPB	BDL	10
BIS(2-ETHYLHEXYL)PHTHALATE	PPB	BDL	10
4-BROMOPHENYL PHENYL ETHER	PPB	BDL	10
BUTYL BENZYL PHTHALATE	PPB	BDL	10
4-CHLOROANILINE	PPB	BDL	10
2-CHLORONAPHTHALENE	PPB	BDL	10
4-CHLOROPHENYL PHENYL ETHER	PPB	BDL	10
CHRYSENE	PPB	BDL	10
DIBENZ(A,H)ANTHRACENE	PPB	BDL	10
DIBENZOFURAN	PPB	BDL	10
1,2-DICHLOROBENZENE	PPB	BDL	10
1,3-DICHLOROBENZENE	PPB	BDL	10
1,4-DICHLOROBENZENE	PPB	BDL	10
3,3'-DICHLOROBENZIDINE	PPB	BDL	50
DIETHYLPHTHALATE	PPB	BDL	10
DIMETHYLPHTHALATE	PPB	BDL	10
DI-N-BUTYLPHTHALATE	PPB	BDL	10
2,4-DINITROTOLUENE	PPB	BDL	10
2,6-DINITROTOLUENE	PPB	BDL	10
DI-N-OCTYLPHTHALATE	PPB	BDL	10
FLUORANTHENE	PPB	BDL	10
FLUORENE	PPB	BDL	10
HEXACHLOROBENZENE	PPB	BDL	10
HEXACHLOROBUTADIENE	PPB	BDL	10

Sample ID.: WHF-SW-23B-1-1 Test Parameters continued on next page

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11 EAST OLIVE ROAD • PENSACOLA, FLORIDA 32514 • (904) 474-1001

Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2545W-1
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: GROUNDWATER

Sample ID.: WHF-SW-23B-1-1 Sample Date: 05/09/90 Time: VARIOUS

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL continued

Parameter	Units	Result	Detection Limit
HEXACHLOROCYCLOPENTADIENE	PPB	BDL	10
HEXACHLOROETHANE	PPB	BDL	10
INDENO(1,2,3-CD)PYRENE	PPB	BDL	10
ISOPHORONE	PPB	BDL	10
2-METHYLNAPHTHALENE	PPB	BDL	10
NAPHTHALENE	PPB	BDL	10
2-NITROANILINE	PPB	BDL	10
3-NITROANILINE	PPB	BDL	10
4-NITROANILINE	PPB	BDL	10
NITROBENZENE	PPB	BDL	10
N-NITROSODIPHENYLAMINE	PPB	BDL	10
N-NITROSO-DI-N-DIPROPYLAMINE	PPB	BDL	10
PHENANTHRENE	PPB	BDL	10
PYRENE	PPB	BDL	10
1,2,4-TRICHLOROBENZENE	PPB	BDL	10

Pioneer LABORATORY, INC. a division of Analytical Technologies, Inc.
11 EAST OLIVE ROAD • PENSACOLA, FLORIDA 32514 • (904) 474-1001

Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2545W-2
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: GROUNDWATER

Sample ID.: WHF-FB-21B-1 Sample Date: 05/09/90 Time: VARIOUS

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL

Parameter	Units	Result	Detection Limit
ACENAPHTHENE	PPB	BDL	10
ACENAPHTHYLENE	PPB	BDL	10
ANTHRACENE	PPB	BDL	10
BENZO(A)ANTHRACENE	PPB	BDL	10
BENZO(A)PYRENE	PPB	BDL	10
BENZO(B)FLUORANTHENE	PPB	BDL	10
BENZO(G,H,I)PERYLENE	PPB	BDL	10
BENZO(K)FLUORANTHENE	PPB	BDL	10
BENZYL ALCOHOL	PPB	BDL	10
BIS(2-CHLOROETHOXY)METHANE	PPB	BDL	10
BIS(2-CHLOROETHYL)ETHER	PPB	BDL	10
BIS(2-CHLOROISOPROPYL)ETHER	PPB	BDL	10
BIS(2-ETHYLHEXYL)PHTHALATE	PPB	BDL	10
4-BROMOPHENYL PHENYL ETHER	PPB	BDL	10
BUTYL BENZYL PHTHALATE	PPB	BDL	10
4-CHLOROANILINE	PPB	BDL	10
2-CHLORONAPHTHALENE	PPB	BDL	10
4-CHLOROPHENYL PHENYL ETHER	PPB	BDL	10
CHRYSENE	PPB	BDL	10
DIBENZ(A,H)ANTHRACENE	PPB	BDL	10
DIBENZOFURAN	PPB	BDL	10
1,2-DICHLOROBENZENE	PPB	BDL	10
1,3-DICHLOROBENZENE	PPB	BDL	10
1,4-DICHLOROBENZENE	PPB	BDL	10
3,3'-DICHLOROBENZIDINE	PPB	BDL	50
DIETHYLPHTHALATE	PPB	BDL	10
DIMETHYLPHTHALATE	PPB	BDL	10
DI-N-BUTYLPHTHALATE	PPB	BDL	10
2,4-DINITROTOLUENE	PPB	BDL	10
2,6-DINITROTOLUENE	PPB	BDL	10
DI-N-OCTYLPHTHALATE	PPB	BDL	10
FLUORANTHENE	PPB	BDL	10
FLUORENE	PPB	BDL	10
HEXACHLOROBENZENE	PPB	BDL	10
HEXACHLOROBUTADIENE	PPB	BDL	10

Sample ID.: WHF-FB-21B-1 Test Parameters continued on next page

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2545W-2
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: GROUNDWATER

Sample ID.: WHF-FB-21B-1 Sample Date: 05/09/90 Time: VARIOUS

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL continued

Parameter	Units	Result	Detection Limit
HEXACHLOROCYCLOPENTADIENE	PPB	BDL	10
HEXACHLOROETHANE	PPB	BDL	10
INDENO(1,2,3-CD)PYRENE	PPB	BDL	10
ISOPHORONE	PPB	BDL	10
2-METHYLNAPHTHALENE	PPB	BDL	10
NAPHTHALENE	PPB	BDL	10
2-NITROANILINE	PPB	BDL	10
3-NITROANILINE	PPB	BDL	10
4-NITROANILINE	PPB	BDL	10
NITROBENZENE	PPB	BDL	10
N-NITROSODIPHENYLAMINE	PPB	BDL	10
N-NITROSO-DI-N-DIPROPYLAMINE	PPB	BDL	10
PHENANTHRENE	PPB	BDL	10
PYRENE	PPB	BDL	10
1,2,4-TRICHLOROBENZENE	PPB	BDL	10

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2545W-3
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: GROUNDWATER

Sample ID.: WHF-EB-21B-1 Sample Date: 05/09/90 Time: VARIOUS

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL

Parameter	Units	Result	Detection Limit
ACENAPHTHENE	PPB	BDL	10
ACENAPHTHYLENE	PPB	BDL	10
ANTHRACENE	PPB	BDL	10
BENZO(A)ANTHRACENE	PPB	BDL	10
BENZO(A)PYRENE	PPB	BDL	10
BENZO(B)FLUORANTHENE	PPB	BDL	10
BENZO(G,H,I)PERYLENE	PPB	BDL	10
BENZO(K)FLUORANTHENE	PPB	BDL	10
BENZYL ALCOHOL	PPB	BDL	10
BIS(2-CHLOROETHOXY)METHANE	PPB	BDL	10
BIS(2-CHLOROETHYL)ETHER	PPB	BDL	10
BIS(2-CHLOROISOPROPYL)ETHER	PPB	BDL	10
BIS(2-ETHYLHEXYL)PHTHALATE	PPB	BDL	10
4-BROMOPHENYL PHENYL ETHER	PPB	BDL	10
BUTYL BENZYL PHTHALATE	PPB	BDL	10
4-CHLOROANILINE	PPB	BDL	10
2-CHLORONAPHTHALENE	PPB	BDL	10
4-CHLOROPHENYL PHENYL ETHER	PPB	BDL	10
CHRYSENE	PPB	BDL	10
DIBENZ(A,H)ANTHRACENE	PPB	BDL	10
DIBENZOFURAN	PPB	BDL	10
1,2-DICHLOROBENZENE	PPB	BDL	10
1,3-DICHLOROBENZENE	PPB	BDL	10
1,4-DICHLOROBENZENE	PPB	BDL	10
3,3'-DICHLOROBENZIDINE	PPB	BDL	50
DIETHYLPHTHALATE	PPB	BDL	10
DIMETHYLPHTHALATE	PPB	BDL	10
DI-N-BUTYLPHTHALATE	PPB	BDL	10
2,4-DINITROTOLUENE	PPB	BDL	10
2,6-DINITROTOLUENE	PPB	BDL	10
DI-N-OCTYLPHTHALATE	PPB	BDL	10
FLUORANTHENE	PPB	BDL	10
FLUORENE	PPB	BDL	10
HEXACHLOROBENZENE	PPB	BDL	10
HEXACHLOROBUTADIENE	PPB	BDL	10

Sample ID.: WHF-EB-21B-1 Test Parameters continued on next page

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2545W-3
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: GROUNDWATER

Sample ID.: WHF-EB-21B-1 Sample Date: 05/09/90 Time: VARIOUS

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL continued

Parameter	Units	Result	Detection Limit
HEXACHLOROCYCLOPENTADIENE	PPB	BDL	10
HEXACHLOROETHANE	PPB	BDL	10
INDENO(1,2,3-CD)PYRENE	PPB	BDL	10
ISOPHORONE	PPB	BDL	10
2-METHYLNAPHTHALENE	PPB	BDL	10
NAPHTHALENE	PPB	BDL	10
2-NITROANILINE	PPB	BDL	10
3-NITROANILINE	PPB	BDL	10
4-NITROANILINE	PPB	BDL	10
NITROBENZENE	PPB	BDL	10
N-NITROSODIPHENYLAMINE	PPB	BDL	10
N-NITROSO-DI-N-DIPROPYLAMINE	PPB	BDL	10
PHENANTHRENE	PPB	BDL	10
PYRENE	PPB	BDL	10
1,2,4-TRICHLOROBENZENE	PPB	BDL	10

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2545W-1
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: GROUNDWATER

Sample ID.: WHF-SW-23B-1-1 Sample Date: 05/09/90 Time: VARIOUS

TCL/PEST TARGET COMPOUND LIST-PESTICIDES

Parameter	Units	Result	Detection Limit
ALDRIN	PPB	BDL	0.02
ALPHA CHLORDANE	PPB	BDL	0.5
ALPHA-BHC	PPB	BDL	0.04
BETA-BHC	PPB	BDL	0.04
DELTA-BHC	PPB	BDL	0.01
GAMMA-BHC (LINDANE)	PPB	BDL	0.02
4,4'-DDD	PPB	BDL	0.01
4,4'-DDE	PPB	BDL	0.01
4,4'-DDT	PPB	BDL	0.03
DIELDRIN	PPB	BDL	0.01
ENDOSULFAN I	PPB	BDL	0.02
ENDOSULFAN II	PPB	BDL	0.02
ENDOSULFAN SULFATE	PPB	BDL	0.04
ENDRIN	PPB	BDL	0.02
ENDRIN KETONE	PPB	BDL	0.1
GAMMA CHLORDANE	PPB	BDL	0.5
HEPTACHLOR	PPB	BDL	0.02
HEPTACHLOR EPOXIDE	PPB	BDL	0.01
METHOXYCHLOR	PPB	BDL	0.5
AROCLOR-1016	PPB	BDL	0.5
AROCLOR-1221	PPB	BDL	0.5
AROCLOR-1232	PPB	BDL	0.5
AROCLOR-1242	PPB	BDL	0.5
AROCLOR-1248	PPB	BDL	0.5
AROCLOR-1254	PPB	BDL	0.5
AROCLOR-1260	PPB	BDL	0.5
TOXAPHENE	PPB	BDL	0.5

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2545W-2
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: GROUNDWATER

Sample ID.: WHF-FB-21B-1 Sample Date: 05/09/90 Time: VARIOUS

TCL/PEST TARGET COMPOUND LIST-PESTICIDES

Parameter	Units	Result	Detection Limit
ALDRIN	PPB	BDL	0.02
ALPHA CHLORDANE	PPB	BDL	0.5
ALPHA-BHC	PPB	BDL	0.04
BETA-BHC	PPB	BDL	0.04
DELTA-BHC	PPB	BDL	0.01
GAMMA-BHC (LINDANE)	PPB	BDL	0.02
4,4'-DDD	PPB	BDL	0.01
4,4'-DDE	PPB	BDL	0.01
4,4'-DDT	PPB	BDL	0.03
DIELDRIN	PPB	BDL	0.01
ENDOSULFAN I	PPB	BDL	0.02
ENDOSULFAN II	PPB	BDL	0.02
ENDOSULFAN SULFATE	PPB	BDL	0.04
ENDRIN	PPB	BDL	0.02
ENDRIN KETONE	PPB	BDL	0.1
GAMMA CHLORDANE	PPB	BDL	0.5
HEPTACHLOR	PPB	BDL	0.02
HEPTACHLOR EPOXIDE	PPB	BDL	0.01
METHOXYCHLOR	PPB	BDL	0.5
AROCLOR-1016	PPB	BDL	0.5
AROCLOR-1221	PPB	BDL	0.5
AROCLOR-1232	PPB	BDL	0.5
AROCLOR-1242	PPB	BDL	0.5
AROCLOR-1248	PPB	BDL	0.5
AROCLOR-1254	PPB	BDL	0.5
AROCLOR-1260	PPB	BDL	0.5
TOXAPHENE	PPB	BDL	0.5

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2545W-3
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: GROUNDWATER

Sample ID.: WHF-EB-21B-1 Sample Date: 05/09/90 Time: VARIOUS

TCL/PEST TARGET COMPOUND LIST-PESTICIDES

Parameter	Units	Result	Detection Limit
ALDRIN	PPB	BDL	0.02
ALPHA CHLORDANE	PPB	BDL	0.5
ALPHA-BHC	PPB	BDL	0.04
BETA-BHC	PPB	BDL	0.04
DELTA-BHC	PPB	BDL	0.01
GAMMA-BHC (LINDANE)	PPB	BDL	0.02
4,4'-DDD	PPB	BDL	0.01
4,4'-DDE	PPB	BDL	0.01
4,4'-DDT	PPB	BDL	0.03
DIELDRIN	PPB	BDL	0.01
ENDOSULFAN I	PPB	BDL	0.02
ENDOSULFAN II	PPB	BDL	0.02
ENDOSULFAN SULFATE	PPB	BDL	0.04
ENDRIN	PPB	BDL	0.02
ENDRIN KETONE	PPB	BDL	0.1
GAMMA CHLORDANE	PPB	BDL	0.5
HEPTACHLOR	PPB	BDL	0.02
HEPTACHLOR EPOXIDE	PPB	BDL	0.01
METHOXYCHLOR	PPB	BDL	0.5
AROCLOR-1016	PPB	BDL	0.5
AROCLOR-1221	PPB	BDL	0.5
AROCLOR-1232	PPB	BDL	0.5
AROCLOR-1242	PPB	BDL	0.5
AROCLOR-1248	PPB	BDL	0.5
AROCLOR-1254	PPB	BDL	0.5
AROCLOR-1260	PPB	BDL	0.5
TOXAPHENE	PPB	BDL	0.5

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2545W-1
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: GROUNDWATER

Sample ID.: WHF-SW-23B-1-1 Sample Date: 05/09/90 Time: VARIOUS

TCL/VOL TARGET COMPOUND LIST - VOLATILES

Parameter	Units	Result	Detection Limit
ACETONE	PPB	BDL	10
BENZENE	PPB	BDL	1
BROMODICHLOROMETHANE	PPB	BDL	1
BROMOFORM	PPB	BDL	2
BROMOMETHANE	PPB	BDL	1
2-BUTANONE (MEK)	PPB	BDL	3
CARBON DISULFIDE	PPB	BDL	1
CARBON TETRACHLORIDE	PPB	BDL	2
CHLOROBENZENE	PPB	BDL	1
CHLOROETHANE	PPB	BDL	1
CHLOROFORM	PPB	BDL	2
CHLOROMETHANE	PPB	BDL	2
DIBROMOCHLOROMETHANE	PPB	BDL	5
1,1-DICHLOROETHANE	PPB	BDL	1
1,2-DICHLOROETHANE	PPB	BDL	2
1,1-DICHLOROETHENE	PPB	BDL	1
1,2-DICHLOROETHENE	PPB	BDL	5
1,2-DICHLOROPROPANE	PPB	BDL	2
CIS-1,3-DICHLOROPROPENE	PPB	BDL	1
TRANS-1,3-DICHLOROPROPENE	PPB	BDL	1
ETHYLBENZENE	PPB	BDL	1
2-HEXANONE	PPB	BDL	3
METHYLENE CHLORIDE	PPB	BDL	3
4-METHYL-2-PENTANONE	PPB	BDL	3
STYRENE	PPB	BDL	2
1,1,2,2-TETRACHLOROETHANE	PPB	BDL	2
TETRACHLOROETHENE	PPB	BDL	1
TOLUENE	PPB	BDL	1
1,1,1-TRICHLOROETHANE	PPB	BDL	5
1,1,2-TRICHLOROETHANE	PPB	BDL	2
TRICHLOROETHENE	PPB	BDL	1
VINYL ACETATE	PPB	BDL	2
VINYL CHLORIDE	PPB	BDL	1
TOTAL XYLENES	PPB	BDL	4

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2545W-2
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: GROUNDWATER

Sample ID.: WHF-FB-21B-1 Sample Date: 05/09/90 Time: VARIOUS

TCL/VOL TARGET COMPOUND LIST - VOLATILES

Parameter	Units	Result	Detection Limit
ACETONE	PPB	BDL	10
BENZENE	PPB	BDL	1
BROMODICHLOROMETHANE	PPB	BDL	1
BROMOFORM	PPB	BDL	2
BROMOMETHANE	PPB	BDL	1
2-BUTANONE (MEK)	PPB	BDL	3
CARBON DISULFIDE	PPB	BDL	1
CARBON TETRACHLORIDE	PPB	BDL	2
CHLOROBENZENE	PPB	BDL	1
CHLOROETHANE	PPB	BDL	1
CHLOROFORM	PPB	BDL	2
CHLOROMETHANE	PPB	BDL	2
DIBROMOCHLOROMETHANE	PPB	BDL	5
1,1-DICHLOROETHANE	PPB	BDL	1
1,2-DICHLOROETHANE	PPB	BDL	2
1,1-DICHLOROETHENE	PPB	BDL	1
1,2-DICHLOROETHENE	PPB	BDL	5
1,2-DICHLOROPROPANE	PPB	BDL	2
CIS-1,3-DICHLOROPROPENE	PPB	BDL	1
TRANS-1,3-DICHLOROPROPENE	PPB	BDL	1
ETHYLBENZENE	PPB	BDL	1
2-HEXANONE	PPB	BDL	3
METHYLENE CHLORIDE	PPB	BDL	3
4-METHYL-2-PENTANONE	PPB	BDL	3
STYRENE	PPB	BDL	2
1,1,2,2-TETRACHLOROETHANE	PPB	BDL	2
TETRACHLOROETHENE	PPB	BDL	1
TOLUENE	PPB	BDL	1
1,1,1-TRICHLOROETHANE	PPB	BDL	5
1,1,2-TRICHLOROETHANE	PPB	BDL	2
TRICHLOROETHENE	PPB	BDL	1
VINYL ACETATE	PPB	BDL	2
VINYL CHLORIDE	PPB	BDL	1
TOTAL XYLENES	PPB	BDL	4

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2545W-3
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: GROUNDWATER

Sample ID.: WHF-EB-21B-1 Sample Date: 05/09/90 Time: VARIOUS

TCL/VOL TARGET COMPOUND LIST - VOLATILES

Parameter	Units	Result	Detection Limit
ACETONE	PPB	BDL	10
BENZENE	PPB	BDL	1
BROMODICHLOROMETHANE	PPB	BDL	1
BROMOFORM	PPB	BDL	2
BROMOMETHANE	PPB	BDL	1
2-BUTANONE (MEK)	PPB	BDL	3
CARBON DISULFIDE	PPB	BDL	1
CARBON TETRACHLORIDE	PPB	BDL	2
CHLOROBENZENE	PPB	BDL	1
CHLOROETHANE	PPB	BDL	1
CHLOROFORM	PPB	BDL	2
CHLOROMETHANE	PPB	BDL	2
DIBROMOCHLOROMETHANE	PPB	BDL	5
1,1-DICHLOROETHANE	PPB	BDL	1
1,2-DICHLOROETHANE	PPB	BDL	2
1,1-DICHLOROETHENE	PPB	BDL	1
1,2-DICHLOROETHENE	PPB	BDL	5
1,2-DICHLOROPROPANE	PPB	BDL	2
CIS-1,3-DICHLOROPROPENE	PPB	BDL	1
TRANS-1,3-DICHLOROPROPENE	PPB	BDL	1
ETHYLBENZENE	PPB	BDL	1
2-HEXANONE	PPB	BDL	3
METHYLENE CHLORIDE	PPB	BDL	3
4-METHYL-2-PENTANONE	PPB	BDL	3
STYRENE	PPB	BDL	2
1,1,2,2-TETRACHLOROETHANE	PPB	BDL	2
TETRACHLOROETHENE	PPB	BDL	1
TOLUENE	PPB	BDL	1
1,1,1-TRICHLOROETHANE	PPB	BDL	5
1,1,2-TRICHLOROETHANE	PPB	BDL	2
TRICHLOROETHENE	PPB	BDL	1
VINYL ACETATE	PPB	BDL	2
VINYL CHLORIDE	PPB	BDL	1
TOTAL XYLENES	PPB	BDL	4

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-2545W-4
Order Date: 05/10/90
Sampled By: E.B./A.D.

Sample Site: FOLEY, AL
Sample Type: GROUNDWATER

Sample ID.: WHF-TB-23B-1 Sample Date: 05/09/90 Time: VARIOUS

TCL/VOL TARGET COMPOUND LIST - VOLATILES

Parameter	Units	Result	Detection Limit
ACETONE	PPB	BDL	10
BENZENE	PPB	BDL	1
BROMODICHLOROMETHANE	PPB	BDL	1
BROMOFORM	PPB	BDL	2
BROMOMETHANE	PPB	BDL	1
2-BUTANONE (MEK)	PPB	BDL	3
CARBON DISULFIDE	PPB	BDL	1
CARBON TETRACHLORIDE	PPB	BDL	2
CHLOROBENZENE	PPB	BDL	1
CHLOROETHANE	PPB	BDL	1
CHLOROFORM	PPB	BDL	2
CHLOROMETHANE	PPB	BDL	2
DIBROMOCHLOROMETHANE	PPB	BDL	5
1,1-DICHLOROETHANE	PPB	BDL	1
1,2-DICHLOROETHANE	PPB	BDL	2
1,1-DICHLOROETHENE	PPB	BDL	1
1,2-DICHLOROETHENE	PPB	BDL	5
1,2-DICHLOROPROPANE	PPB	BDL	2
CIS-1,3-DICHLOROPROPENE	PPB	BDL	1
TRANS-1,3-DICHLOROPROPENE	PPB	BDL	1
ETHYLBENZENE	PPB	BDL	1
2-HEXANONE	PPB	BDL	3
METHYLENE CHLORIDE	PPB	BDL	3
4-METHYL-2-PENTANONE	PPB	BDL	3
STYRENE	PPB	BDL	2
1,1,2,2-TETRACHLOROETHANE	PPB	BDL	2
TETRACHLOROETHENE	PPB	BDL	1
TOLUENE	PPB	BDL	1
1,1,1-TRICHLOROETHANE	PPB	BDL	5
1,1,2-TRICHLOROETHANE	PPB	BDL	2
TRICHLOROETHENE	PPB	BDL	1
VINYL ACETATE	PPB	BDL	2
VINYL CHLORIDE	PPB	BDL	1
TOTAL XYLENES	PPB	BDL	4

end of report

Level "C"

Pioneer LABORATORY, INC.

CHAIN OF CUSTOD

11 EAST OLIVE ROAD PENSACOLA, FLORIDA 32514
PHONE (904) 474-1001 • FAX 478-2671

S/W

Client ABB Environmental
Address
City/State/Zip
Phone No. (904) 656-1293
Contact M. Nugent
P.O. #

Laboratory I.D. 905345 Date 5/10/90
Method of Shipment hand
Sampler Blomberg / DeSandro
Project # 5898-05
Project Name OLF Barrin
Project Location Foley, Fl.

SAMPLE TYPE

DW DRINKING WATER
WW WASTE WATER
GW GROUND WATER
SW SURFACE WATER
SO SOIL
OL OIL
AR AIR
SL SLUDGE
HZ HAZARDOUS
OT OTHER

SAMPLE SITE	FIELD I.D.		Date	Time	# Btls.	TCL-VOA	TCL Semi-VOA	Pest/PCB	TCL metal	CYANIDE	T-Phenol		Lab Use Only
OLF Barrin 23B	WHF-SD-23B-1-1	Sediment SO	5/9	1835	4	1	1	1	X	X	X		S-1
OLF Barrin 23B	WHF-SW-23B-1-1	SW	5/9	1810		2	1	1	1	1	1		W-1
LF Barrin 21B	WHF-FB-21B-1	DI water	5/9	1848	6	1	1	1	1	1	1		
OLF Barrin 21B	WHF-EB-21B-1	DI water	5/9	1852	6	1	1	1	1	1	1		
OLF Barrin 23B	WHF-TB-23B-1	water	5/9	-	1	1							

	Date	Time		Date	Time
RELINQUISHED BY Anthony DeSandro	5/10	1102	RECEIVED BY Laura Gilbert	5/10	11:0
RELINQUISHED BY			RECEIVED BY		
RELINQUISHED BY			RECEIVED BY		
RELINQUISHED BY			RECEIVED BY		

Comments:

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ABB ENVIRONMENTAL, INC
2571 EXECUTIVE CENTER CIR
SUITE 100
TALLAHASSEE FL 32301-5001

Lab I.D.#: 90-3345
Order Number: P31110
Order Date: 06/15/90
Client: 10001
Sampled By: M.H. / A.D.
Sample Date: 06/13-14
Sample Time: VARIOUS

Project Number: 5898-05
Project Name: NAVY - SOUTHERN DIVISION
Sample Site: OLF BARIN
Sample Type: GROUNDWATER

N/S = Not Submitted

Lab ID	Sample ID	Parameter	Units	Results	Detection Limit
3345-1	WHF-20B-1-1	PHENOLS,TOTAL	PPM	BDL	0.005
3345-2	WHF-20B-2-1	PHENOLS,TOTAL	PPM	BDL	0.005
3345-3	WHF-19B-1D-1	PHENOLS,TOTAL	PPM	0.011	0.005
3345-4	WHF-19B-2D-1	PHENOLS,TOTAL	PPM	BDL	0.005
3345-5	WHF-EB1-1	PHENOLS,TOTAL	PPM	BDL	0.005
3345-6	WHF-FB1-1	PHENOLS,TOTAL	PPM	BDL	0.005
3345-7	WHF-20B-3-1	PHENOLS,TOTAL	PPM	BDL	0.005
3345-8	WHF-19B-3D-1	PHENOLS,TOTAL	PPM	BDL	0.005
3345-9	WHF-19B-3D-D-1	PHENOLS,TOTAL	PPM	BDL	0.005
3345-10	WHF-20B-4-1	PHENOLS,TOTAL	PPM	0.006	0.005
3345-11	WHF-20B-5-1	PHENOLS,TOTAL	PPM	BDL	0.005
3345-12	WHF-EB2-1	PHENOLS,TOTAL	PPM	BDL	0.005

Comments: PPM = Parts Per Million, mg/l. PPB = Parts Per Billion, ug/l.
Method References: EPA 600/4-79-020, Revised March 1983 and Federal Register 40 CFR Part 136, July 1, 1988. BDL = Below Detection Limits.

Approved By : W. F. Bowen

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-1
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-20B-1-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/INORGANICS TARGET COMPOUND LIST - INORGANICS

Parameter	Units	Result	Detection Limit
SILVER	PPM	BDL	0.0002
ALUMINUM	PPM	1.1	0.5
ARSENIC	PPM	BDL	0.001
BARIUM	PPM	BDL	0.1
BERYLLIUM	PPM	BDL	0.01
CALCIUM	PPM	4.0	1
CADMIUM	PPM	BDL	0.0002
COBALT	PPM	BDL	0.05
CHROMIUM	PPM	BDL	0.01
COPPER	PPM	BDL	0.03
CYANIDE, TOTAL	PPM	BDL	0.005
IRON	PPM	0.31	0.03
MERCURY	PPM	0.0058	0.0005
POTASSIUM	PPM	0.8	0.6
MAGNESIUM	PPM	0.45	0.01
MANGANESE	PPM	BDL	0.01
SODIUM	PPM	1.6	0.2
NICKEL	PPM	BDL	0.05
LEAD	PPM	BDL	0.004
ANTIMONY	PPM	0.1	0.1
SELENIUM	PPM	BDL	0.003
THALLIUM	PPM	BDL	0.4
VANADIUM	PPM	BDL	0.2
ZINC	PPM	BDL	0.02

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-2
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-20B-2-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/INORGANICS TARGET COMPOUND LIST - INORGANICS

Parameter	Units	Result	Detection Limit
SILVER	PPM	BDL	0.0002
ALUMINUM	PPM	3.3	0.5
ARSENIC	PPM	BDL	0.001
BARIUM	PPM	BDL	0.1
BERYLLIUM	PPM	BDL	0.01
CALCIUM	PPM	7.4	1
CADMIUM	PPM	BDL	0.0002
COBALT	PPM	BDL	0.05
CHROMIUM	PPM	BDL	0.01
COPPER	PPM	BDL	0.03
CYANIDE, TOTAL	PPM	BDL	0.005
IRON	PPM	0.65	0.03
MERCURY	PPM	0.0059	0.0005
POTASSIUM	PPM	0.7	0.6
MAGNESIUM	PPM	0.77	0.01
MANGANESE	PPM	BDL	0.01
SODIUM	PPM	1.3	0.2
NICKEL	PPM	BDL	0.05
LEAD	PPM	0.007	0.004
ANTIMONY	PPM	BDL	0.1
SELENIUM	PPM	BDL	0.003
THALLIUM	PPM	BDL	0.4
VANADIUM	PPM	BDL	0.2
ZINC	PPM	BDL	0.02

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-3
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-19B-1D-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/INORGANICS TARGET COMPOUND LIST - INORGANICS

Parameter	Units	Result	Detection Limit
SILVER	PPM	BDL	0.0002
ALUMINUM	PPM	BDL	0.5
ARSENIC	PPM	0.001	0.001
BARIUM	PPM	BDL	0.1
BERYLLIUM	PPM	BDL	0.01
CALCIUM	PPM	14	1
CADMIUM	PPM	BDL	0.0002
COBALT	PPM	BDL	0.05
CHROMIUM	PPM	BDL	0.01
COPPER	PPM	BDL	0.03
CYANIDE, TOTAL	PPM	BDL	0.005
IRON	PPM	0.19	0.03
MERCURY	PPM	0.0007	0.0005
POTASSIUM	PPM	7.1	0.6
MAGNESIUM	PPM	0.38	0.01
MANGANESE	PPM	BDL	0.01
SODIUM	PPM	12	0.2
NICKEL	PPM	BDL	0.05
LEAD	PPM	0.005	0.004
ANTIMONY	PPM	0.1	0.1
SELENIUM	PPM	BDL	0.003
THALLIUM	PPM	BDL	0.4
VANADIUM	PPM	BDL	0.2
ZINC	PPM	BDL	0.02

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-4
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-19B-2D-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/INORGANICS TARGET COMPOUND LIST - INORGANICS

Parameter	Units	Result	Detection Limit
SILVER	PPM	BDL	0.0002
ALUMINUM	PPM	BDL	0.5
ARSENIC	PPM	BDL	0.001
BARIUM	PPM	BDL	0.1
BERYLLIUM	PPM	BDL	0.01
CALCIUM	PPM	2.8	1
CADMIUM	PPM	0.0003	0.0002
COBALT	PPM	BDL	0.05
CHROMIUM	PPM	BDL	0.01
COPPER	PPM	BDL	0.03
CYANIDE, TOTAL	PPM	BDL	0.005
IRON	PPM	0.36	0.03
MERCURY	PPM	BDL	0.0005
POTASSIUM	PPM	4.1	0.6
MAGNESIUM	PPM	0.18	0.01
MANGANESE	PPM	BDL	0.01
SODIUM	PPM	9.0	0.2
NICKEL	PPM	BDL	0.05
LEAD	PPM	0.007	0.004
ANTIMONY	PPM	BDL	0.1
SELENIUM	PPM	BDL	0.003
THALLIUM	PPM	BDL	0.4
VANADIUM	PPM	BDL	0.2
ZINC	PPM	BDL	0.02

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-5
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-EB1-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/INORGANICS TARGET COMPOUND LIST - INORGANICS

Parameter	Units	Result	Detection Limit
SILVER	PPM	BDL	0.0002
ALUMINUM	PPM	BDL	0.5
ARSENIC	PPM	BDL	0.001
BARIUM	PPM	BDL	0.1
BERYLLIUM	PPM	BDL	0.01
CALCIUM	PPM	BDL	1
CADMIUM	PPM	BDL	0.0002
COBALT	PPM	BDL	0.05
CHROMIUM	PPM	BDL	0.01
COPPER	PPM	BDL	0.03
CYANIDE, TOTAL	PPM	BDL	0.005
IRON	PPM	BDL	0.03
MERCURY	PPM	BDL	0.0005
POTASSIUM	PPM	BDL	0.6
MAGNESIUM	PPM	BDL	0.01
MANGANESE	PPM	BDL	0.01
SODIUM	PPM	BDL	0.2
NICKEL	PPM	BDL	0.05
LEAD	PPM	BDL	0.004
ANTIMONY	PPM	BDL	0.1
SELENIUM	PPM	BDL	0.003
THALLIUM	PPM	BDL	0.4
VANADIUM	PPM	BDL	0.2
ZINC	PPM	BDL	0.02

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-6
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-FB1-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/INORGANICS TARGET COMPOUND LIST - INORGANICS

Parameter	Units	Result	Detection Limit
SILVER	PPM	BDL	0.0002
ALUMINUM	PPM	BDL	0.5
ARSENIC	PPM	BDL	0.001
BARIUM	PPM	BDL	0.1
BERYLLIUM	PPM	BDL	0.01
CALCIUM	PPM	BDL	1
CADMIUM	PPM	BDL	0.0002
COBALT	PPM	BDL	0.05
CHROMIUM	PPM	BDL	0.01
COPPER	PPM	BDL	0.03
CYANIDE, TOTAL	PPM	BDL	0.005
IRON	PPM	BDL	0.03
MERCURY	PPM	BDL	0.0005
POTASSIUM	PPM	BDL	0.6
MAGNESIUM	PPM	BDL	0.01
MANGANESE	PPM	BDL	0.01
SODIUM	PPM	BDL	0.2
NICKEL	PPM	BDL	0.05
LEAD	PPM	BDL	0.004
ANTIMONY	PPM	BDL	0.1
SELENIUM	PPM	BDL	0.003
THALLIUM	PPM	BDL	0.4
VANADIUM	PPM	BDL	0.2
ZINC	PPM	BDL	0.02

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-7
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-20B-3-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/INORGANICS TARGET COMPOUND LIST - INORGANICS

Parameter	Units	Result	Detection Limit
SILVER	PPM	BDL	0.0002
ALUMINUM	PPM	1.0	0.5
ARSENIC	PPM	BDL	0.001
BARIUM	PPM	BDL	0.1
BERYLLIUM	PPM	BDL	0.01
CALCIUM	PPM	2.4	1
CADMIUM	PPM	BDL	0.0002
COBALT	PPM	BDL	0.05
CHROMIUM	PPM	BDL	0.01
COPPER	PPM	BDL	0.03
CYANIDE, TOTAL	PPM	BDL	0.005
IRON	PPM	0.35	0.03
MERCURY	PPM	BDL	0.0005
POTASSIUM	PPM	1.5	0.6
MAGNESIUM	PPM	0.49	0.01
MANGANESE	PPM	BDL	0.01
SODIUM	PPM	0.9	0.2
NICKEL	PPM	BDL	0.05
LEAD	PPM	BDL	0.004
ANTIMONY	PPM	BDL	0.1
SELENIUM	PPM	BDL	0.003
THALLIUM	PPM	BDL	0.4
VANADIUM	PPM	BDL	0.2
ZINC	PPM	BDL	0.02

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-8
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-19B-3D-1 Sample Date: 06/13-14 Time: VARIOUS

CL/INORGANICS TARGET COMPOUND LIST - INORGANICS

Parameter	Units	Result	Detection Limit
SILVER	PPM	BDL	0.0002
ALUMINUM	PPM	0.8	0.5
ARSENIC	PPM	BDL	0.001
BARIUM	PPM	BDL	0.1
BERYLLIUM	PPM	BDL	0.01
CALCIUM	PPM	7.1	1
CADMIUM	PPM	BDL	0.0002
COBALT	PPM	BDL	0.05
CHROMIUM	PPM	BDL	0.01
COPPER	PPM	BDL	0.03
CYANIDE, TOTAL	PPM	BDL	0.005
IRON	PPM	0.20	0.03
MERCURY	PPM	BDL	0.0005
POTASSIUM	PPM	17	0.6
MAGNESIUM	PPM	0.22	0.01
MANGANESE	PPM	BDL	0.01
SODIUM	PPM	7.3	0.2
NICKEL	PPM	BDL	0.05
LEAD	PPM	BDL	0.004
ANTIMONY	PPM	BDL	0.1
SELENIUM	PPM	BDL	0.003
THALLIUM	PPM	BDL	0.4
VANADIUM	PPM	BDL	0.2
ZINC	PPM	BDL	0.02

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-9
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-19B-3D-D-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/INORGANICS TARGET COMPOUND LIST - INORGANICS

Parameter	Units	Result	Detection Limit
SILVER	PPM	BDL	0.0002
ALUMINUM	PPM	0.8	0.5
ARSENIC	PPM	BDL	0.001
BARIUM	PPM	BDL	0.1
BERYLLIUM	PPM	BDL	0.01
CALCIUM	PPM	7.2	1
CADMIUM	PPM	0.0002	0.0002
COBALT	PPM	BDL	0.05
CHROMIUM	PPM	BDL	0.01
COPPER	PPM	BDL	0.03
CYANIDE, TOTAL	PPM	BDL	0.005
IRON	PPM	0.19	0.03
MERCURY	PPM	BDL	0.0005
POTASSIUM	PPM	18	0.6
MAGNESIUM	PPM	0.23	0.01
MANGANESE	PPM	BDL	0.01
SODIUM	PPM	8.1	0.2
NICKEL	PPM	BDL	0.05
LEAD	PPM	BDL	0.004
ANTIMONY	PPM	0.1	0.1
SELENIUM	PPM	BDL	0.003
THALLIUM	PPM	BDL	0.4
VANADIUM	PPM	BDL	0.2
ZINC	PPM	BDL	0.02

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-10
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-20B-4-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/INORGANICS TARGET COMPOUND LIST - INORGANICS

Parameter	Units	Result	Detection Limit
SILVER	PPM	BDL	0.0002
ALUMINUM	PPM	1.8	0.5
ARSENIC	PPM	BDL	0.001
BARIUM	PPM	BDL	0.1
BERYLLIUM	PPM	BDL	0.01
CALCIUM	PPM	6.2	1
CADMIUM	PPM	0.0010	0.0002
COBALT	PPM	BDL	0.05
CHROMIUM	PPM	BDL	0.01
COPPER	PPM	BDL	0.03
CYANIDE, TOTAL	PPM	BDL	0.005
IRON	PPM	2.0	0.03
MERCURY	PPM	BDL	0.0005
POTASSIUM	PPM	BDL	0.6
MAGNESIUM	PPM	0.91	0.01
MANGANESE	PPM	0.02	0.01
SODIUM	PPM	0.9	0.2
NICKEL	PPM	BDL	0.05
LEAD	PPM	0.030	0.004
ANTIMONY	PPM	BDL	0.1
SELENIUM	PPM	BDL	0.003
THALLIUM	PPM	BDL	0.4
VANADIUM	PPM	BDL	0.2
ZINC	PPM	0.02	0.02

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-11
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-20B-5-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/INORGANICS TARGET COMPOUND LIST - INORGANICS

Parameter	Units	Result	Detection Limit
SILVER	PPM	BDL	0.0002
ALUMINUM	PPM	BDL	0.5
ARSENIC	PPM	BDL	0.001
BARIUM	PPM	BDL	0.1
BERYLLIUM	PPM	BDL	0.01
CALCIUM	PPM	1.8	1
CADMIUM	PPM	BDL	0.0002
COBALT	PPM	BDL	0.05
CHROMIUM	PPM	BDL	0.01
COPPER	PPM	BDL	0.03
CYANIDE, TOTAL	PPM	BDL	0.005
IRON	PPM	0.22	0.03
MERCURY	PPM	BDL	0.0005
POTASSIUM	PPM	BDL	0.6
MAGNESIUM	PPM	0.50	0.01
MANGANESE	PPM	BDL	0.01
SODIUM	PPM	2.5	0.2
NICKEL	PPM	BDL	0.05
LEAD	PPM	BDL	0.004
ANTIMONY	PPM	BDL	0.1
SELENIUM	PPM	BDL	0.003
THALLIUM	PPM	BDL	0.4
VANADIUM	PPM	BDL	0.2
ZINC	PPM	BDL	0.02

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-12
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-EB2-1 Sample Date: 06/13-14 Time: VARIOUS

CL/INORGANICS TARGET COMPOUND LIST - INORGANICS

Parameter	Units	Result	Detection Limit
SILVER	PPM	BDL	0.0002
ALUMINUM	PPM	BDL	0.5
ARSENIC	PPM	BDL	0.001
BARIUM	PPM	BDL	0.1
BERYLLIUM	PPM	BDL	0.01
CALCIUM	PPM	BDL	1
CADMIUM	PPM	BDL	0.0002
COBALT	PPM	BDL	0.05
CHROMIUM	PPM	BDL	0.01
COPPER	PPM	BDL	0.03
CYANIDE, TOTAL	PPM	BDL	0.005
IRON	PPM	BDL	0.03
MERCURY	PPM	BDL	0.0005
POTASSIUM	PPM	BDL	0.6
MAGNESIUM	PPM	BDL	0.01
MANGANESE	PPM	BDL	0.01
SODIUM	PPM	BDL	0.2
NICKEL	PPM	BDL	0.05
LEAD	PPM	BDL	0.004
ANTIMONY	PPM	BDL	0.1
SELENIUM	PPM	BDL	0.003
THALLIUM	PPM	BDL	0.4
VANADIUM	PPM	BDL	0.2
ZINC	PPM	BDL	0.02

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-1
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-20B-1-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/ACID TARGET COMPOUND LIST - ACID EXTRACT

Parameter	Units	Result	Detection Limit
BENZOIC ACID	PPB	BDL	50
4-CHLORO-3-METHYLPHENOL	PPB	BDL	10
2-CHLOROPHENOL	PPB	BDL	10
2,4-DICHLOROPHENOL	PPB	BDL	10
2,4-DIMETHYLPHENOL	PPB	BDL	10
4,6-DINITRO-2-METHYLPHENOL	PPB	BDL	50
2,4-DINITROPHENOL	PPB	BDL	50
2-METHYLPHENOL	PPB	BDL	10
4-METHYLPHENOL	PPB	BDL	10
2-NITROPHENOL	PPB	BDL	10
4-NITROPHENOL	PPB	BDL	50
PENTACHLOROPHENOL	PPB	BDL	50
PHENOL	PPB	BDL	10
2,4,5-TRICHLOROPHENOL	PPB	BDL	50
2,4,6-TRICHLOROPHENOL	PPB	BDL	10

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-2
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-20B-2-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/ACID TARGET COMPOUND LIST - ACID EXTRACT

Parameter	Units	Result	Detection Limit
BENZOIC ACID	PPB	BDL	50
4-CHLORO-3-METHYLPHENOL	PPB	BDL	10
2-CHLOROPHENOL	PPB	BDL	10
2,4-DICHLOROPHENOL	PPB	BDL	10
2,4-DIMETHYLPHENOL	PPB	BDL	10
4,6-DINITRO-2-METHYLPHENOL	PPB	BDL	50
2,4-DINITROPHENOL	PPB	BDL	50
2-METHYLPHENOL	PPB	BDL	10
4-METHYLPHENOL	PPB	BDL	10
2-NITROPHENOL	PPB	BDL	10
4-NITROPHENOL	PPB	BDL	50
PENTACHLOROPHENOL	PPB	BDL	50
PHENOL	PPB	BDL	10
2,4,5-TRICHLOROPHENOL	PPB	BDL	50
2,4,6-TRICHLOROPHENOL	PPB	BDL	10

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-3
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-19B-1D-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/ACID TARGET COMPOUND LIST - ACID EXTRACT

Parameter	Units	Result	Detection Limit
BENZOIC ACID	PPB	BDL	50
4-CHLORO-3-METHYLPHENOL	PPB	BDL	10
2-CHLOROPHENOL	PPB	BDL	10
2,4-DICHLOROPHENOL	PPB	BDL	10
2,4-DIMETHYLPHENOL	PPB	BDL	10
4,6-DINITRO-2-METHYLPHENOL	PPB	BDL	50
2,4-DINITROPHENOL	PPB	BDL	50
-METHYLPHENOL	PPB	BDL	10
-METHYLPHENOL	PPB	BDL	10
2-NITROPHENOL	PPB	BDL	10
4-NITROPHENOL	PPB	BDL	50
PENTACHLOROPHENOL	PPB	BDL	50
PHENOL	PPB	BDL	10
2,4,5-TRICHLOROPHENOL	PPB	BDL	50
2,4,6-TRICHLOROPHENOL	PPB	BDL	10

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-4
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-19B-2D-1 Sample Date: 06/13-14 Time: VARIOUS

CL/ACID TARGET COMPOUND LIST - ACID EXTRACT

Parameter	Units	Result	Detection Limit
BENZOIC ACID	PPB	BDL	50
4-CHLORO-3-METHYLPHENOL	PPB	BDL	10
2-CHLOROPHENOL	PPB	BDL	10
2,4-DICHLOROPHENOL	PPB	BDL	10
2,4-DIMETHYLPHENOL	PPB	BDL	10
4,6-DINITRO-2-METHYLPHENOL	PPB	BDL	50
2,4-DINITROPHENOL	PPB	BDL	50
2-METHYLPHENOL	PPB	BDL	10
4-METHYLPHENOL	PPB	BDL	10
2-NITROPHENOL	PPB	BDL	10
4-NITROPHENOL	PPB	BDL	50
PENTACHLOROPHENOL	PPB	BDL	50
PHENOL	PPB	BDL	10
2,4,5-TRICHLOROPHENOL	PPB	BDL	50
2,4,6-TRICHLOROPHENOL	PPB	BDL	10

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-5
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-EB1-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/ACID TARGET COMPOUND LIST - ACID EXTRACT

Parameter	Units	Result	Detection Limit
BENZOIC ACID	PPB	BDL	50
4-CHLORO-3-METHYLPHENOL	PPB	BDL	10
2-CHLOROPHENOL	PPB	BDL	10
2,4-DICHLOROPHENOL	PPB	BDL	10
2,4-DIMETHYLPHENOL	PPB	BDL	10
4,6-DINITRO-2-METHYLPHENOL	PPB	BDL	50
2,4-DINITROPHENOL	PPB	BDL	50
2-METHYLPHENOL	PPB	BDL	10
4-METHYLPHENOL	PPB	BDL	10
2-NITROPHENOL	PPB	BDL	10
4-NITROPHENOL	PPB	BDL	50
PENTACHLOROPHENOL	PPB	BDL	50
PHENOL	PPB	BDL	10
2,4,5-TRICHLOROPHENOL	PPB	BDL	50
2,4,6-TRICHLOROPHENOL	PPB	BDL	10

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-6
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-FB1-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/ACID TARGET COMPOUND LIST - ACID EXTRACT

Parameter	Units	Result	Detection Limit
BENZOIC ACID	PPB	BDL	50
4-CHLORO-3-METHYLPHENOL	PPB	BDL	10
2-CHLOROPHENOL	PPB	BDL	10
2,4-DICHLOROPHENOL	PPB	BDL	10
2,4-DIMETHYLPHENOL	PPB	BDL	10
4,6-DINITRO-2-METHYLPHENOL	PPB	BDL	50
2,4-DINITROPHENOL	PPB	BDL	50
2-METHYLPHENOL	PPB	BDL	10
4-METHYLPHENOL	PPB	BDL	10
2-NITROPHENOL	PPB	BDL	10
4-NITROPHENOL	PPB	BDL	50
PENTACHLOROPHENOL	PPB	BDL	50
PHENOL	PPB	BDL	10
2,4,5-TRICHLOROPHENOL	PPB	BDL	50
2,4,6-TRICHLOROPHENOL	PPB	BDL	10

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-7
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-20B-3-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/ACID TARGET COMPOUND LIST - ACID EXTRACT

Parameter	Units	Result	Detection Limit
BENZOIC ACID	PPB	BDL	50
4-CHLORO-3-METHYLPHENOL	PPB	BDL	10
2-CHLOROPHENOL	PPB	BDL	10
2,4-DICHLOROPHENOL	PPB	BDL	10
2,4-DIMETHYLPHENOL	PPB	BDL	10
4,6-DINITRO-2-METHYLPHENOL	PPB	BDL	50
2,4-DINITROPHENOL	PPB	BDL	50
2-METHYLPHENOL	PPB	BDL	10
4-METHYLPHENOL	PPB	BDL	10
2-NITROPHENOL	PPB	BDL	10
4-NITROPHENOL	PPB	BDL	50
PENTACHLOROPHENOL	PPB	BDL	50
PHENOL	PPB	BDL	10
2,4,5-TRICHLOROPHENOL	PPB	BDL	50
2,4,6-TRICHLOROPHENOL	PPB	BDL	10

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Client: ABB ENVIRONMENTAL, INC
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Lab I.D.#: 90-3345-8
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-19B-3D-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/ACID TARGET COMPOUND LIST - ACID EXTRACT

Parameter	Units	Result	Detection Limit
BENZOIC ACID	PPB	BDL	50
4-CHLORO-3-METHYLPHENOL	PPB	BDL	10
2-CHLOROPHENOL	PPB	BDL	10
2,4-DICHLOROPHENOL	PPB	BDL	10
2,4-DIMETHYLPHENOL	PPB	BDL	10
4,6-DINITRO-2-METHYLPHENOL	PPB	BDL	50
2,4-DINITROPHENOL	PPB	BDL	50
2-METHYLPHENOL	PPB	BDL	10
4-METHYLPHENOL	PPB	BDL	10
2-NITROPHENOL	PPB	BDL	10
4-NITROPHENOL	PPB	BDL	50
PENTACHLOROPHENOL	PPB	BDL	50
PHENOL	PPB	BDL	10
2,4,5-TRICHLOROPHENOL	PPB	BDL	50
2,4,6-TRICHLOROPHENOL	PPB	BDL	10

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Client: ABB ENVIRONMENTAL, INC
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Lab I.D.#: 90-3345-9
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-19B-3D-D-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/ACID TARGET COMPOUND LIST - ACID EXTRACT

Parameter	Units	Result	Detection Limit
BENZOIC ACID	PPB	BDL	50
4-CHLORO-3-METHYLPHENOL	PPB	BDL	10
2-CHLOROPHENOL	PPB	BDL	10
2,4-DICHLOROPHENOL	PPB	BDL	10
2,4-DIMETHYLPHENOL	PPB	BDL	10
4,6-DINITRO-2-METHYLPHENOL	PPB	BDL	50
2,4-DINITROPHENOL	PPB	BDL	50
2-METHYLPHENOL	PPB	BDL	10
4-METHYLPHENOL	PPB	BDL	10
2-NITROPHENOL	PPB	BDL	10
4-NITROPHENOL	PPB	BDL	50
PENTACHLOROPHENOL	PPB	BDL	50
PHENOL	PPB	BDL	10
2,4,5-TRICHLOROPHENOL	PPB	BDL	50
2,4,6-TRICHLOROPHENOL	PPB	BDL	10

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Client: ABB ENVIRONMENTAL, INC
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Lab I.D.#: 90-3345-10
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-20B-4-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/ACID TARGET COMPOUND LIST - ACID EXTRACT

Parameter	Units	Result	Detection Limit
BENZOIC ACID	PPB	BDL	50
4-CHLORO-3-METHYLPHENOL	PPB	BDL	10
2-CHLOROPHENOL	PPB	BDL	10
2,4-DICHLOROPHENOL	PPB	BDL	10
2,4-DIMETHYLPHENOL	PPB	BDL	10
4,6-DINITRO-2-METHYLPHENOL	PPB	BDL	50
2,4-DINITROPHENOL	PPB	BDL	50
2-METHYLPHENOL	PPB	BDL	10
4-METHYLPHENOL	PPB	BDL	10
2-NITROPHENOL	PPB	BDL	10
4-NITROPHENOL	PPB	BDL	50
PENTACHLOROPHENOL	PPB	BDL	50
PHENOL	PPB	BDL	10
2,4,5-TRICHLOROPHENOL	PPB	BDL	50
2,4,6-TRICHLOROPHENOL	PPB	BDL	10

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-11
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-20B-5-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/ACID TARGET COMPOUND LIST - ACID EXTRACT

Parameter	Units	Result	Detection Limit
BENZOIC ACID	PPB	BDL	50
4-CHLORO-3-METHYLPHENOL	PPB	BDL	10
2-CHLOROPHENOL	PPB	BDL	10
2,4-DICHLOROPHENOL	PPB	BDL	10
2,4-DIMETHYLPHENOL	PPB	BDL	10
4,6-DINITRO-2-METHYLPHENOL	PPB	BDL	50
2,4-DINITROPHENOL	PPB	BDL	50
`-METHYLPHENOL	PPB	BDL	10
4-METHYLPHENOL	PPB	BDL	10
2-NITROPHENOL	PPB	BDL	10
4-NITROPHENOL	PPB	BDL	50
PENTACHLOROPHENOL	PPB	BDL	50
PHENOL	PPB	BDL	10
2,4,5-TRICHLOROPHENOL	PPB	BDL	50
2,4,6-TRICHLOROPHENOL	PPB	BDL	10

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-12
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-EB2-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/ACID TARGET COMPOUND LIST - ACID EXTRACT

Parameter	Units	Result	Detection Limit
BENZOIC ACID	PPB	BDL	50
4-CHLORO-3-METHYLPHENOL	PPB	BDL	10
2-CHLOROPHENOL	PPB	BDL	10
2,4-DICHLOROPHENOL	PPB	BDL	10
2,4-DIMETHYLPHENOL	PPB	BDL	10
4,6-DINITRO-2-METHYLPHENOL	PPB	BDL	50
2,4-DINITROPHENOL	PPB	BDL	50
2-METHYLPHENOL	PPB	BDL	10
4-METHYLPHENOL	PPB	BDL	10
2-NITROPHENOL	PPB	BDL	10
4-NITROPHENOL	PPB	BDL	50
PENTACHLOROPHENOL	PPB	BDL	50
PHENOL	PPB	BDL	10
2,4,5-TRICHLOROPHENOL	PPB	BDL	50
2,4,6-TRICHLOROPHENOL	PPB	BDL	10

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-1
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-20B-1-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL

Parameter	Units	Result	Detection Limit
ACENAPHTHENE	PPB	BDL	10
ACENAPHTHYLENE	PPB	BDL	10
ANTHRACENE	PPB	BDL	10
BENZO(A)ANTHRACENE	PPB	BDL	10
BENZO(A)PYRENE	PPB	BDL	10
BENZO(B)FLUORANTHENE	PPB	BDL	10
BENZO(G,H,I)PERYLENE	PPB	BDL	10
BENZO(K)FLUORANTHENE	PPB	BDL	10
BENZYL ALCOHOL	PPB	BDL	10
BIS(2-CHLOROETHOXY)METHANE	PPB	BDL	10
BIS(2-CHLOROETHYL)ETHER	PPB	BDL	10
BIS(2-CHLOROISOPROPYL)ETHER	PPB	BDL	10
BIS(2-ETHYLHEXYL)PHTHALATE	PPB	BDL	10
4-BROMOPHENYL PHENYL ETHER	PPB	BDL	10
BUTYL BENZYL PHTHALATE	PPB	BDL	10
4-CHLOROANILINE	PPB	BDL	10
2-CHLORONAPHTHALENE	PPB	BDL	10
4-CHLOROPHENYL PHENYL ETHER	PPB	BDL	10
CHRYSENE	PPB	BDL	10
DIBENZ(A,H)ANTHRACENE	PPB	BDL	10
DIBENZOFURAN	PPB	BDL	10
1,2-DICHLOROBENZENE	PPB	BDL	10
1,3-DICHLOROBENZENE	PPB	BDL	10
1,4-DICHLOROBENZENE	PPB	BDL	10
3,3'-DICHLOROBENZIDINE	PPB	BDL	50
DIETHYLPHTHALATE	PPB	BDL	10
DIMETHYLPHTHALATE	PPB	BDL	10
DI-N-BUTYLPHTHALATE	PPB	BDL	10
2,4-DINITROTOLUENE	PPB	BDL	10
2,6-DINITROTOLUENE	PPB	BDL	10
DI-N-OCTYLPHTHALATE	PPB	BDL	10
FLUORANTHENE	PPB	BDL	10
FLUORENE	PPB	BDL	10
HEXACHLOROBENZENE	PPB	BDL	10
HEXACHLOROBUTADIENE	PPB	BDL	10

Sample ID.: WHF-20B-1-1 Test Parameters continued on next page

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-1
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-20B-1-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL continued

Parameter	Units	Result	Detection Limit
HEXACHLOROCYCLOPENTADIENE	PPB	BDL	10
HEXACHLOROETHANE	PPB	BDL	10
INDENO(1,2,3-CD)PYRENE	PPB	BDL	10
ISOPHORONE	PPB	BDL	10
2-METHYLNAPHTHALENE	PPB	BDL	10
NAPHTHALENE	PPB	BDL	10
2-NITROANILINE	PPB	BDL	10
3-NITROANILINE	PPB	BDL	10
4-NITROANILINE	PPB	BDL	10
NITROBENZENE	PPB	BDL	10
N-NITROSODIPHENYLAMINE	PPB	BDL	10
N-NITROSO-DI-N-DIPROPYLAMINE	PPB	BDL	10
PHENANTHRENE	PPB	BDL	10
PYRENE	PPB	BDL	10
1,2,4-TRICHLOROBENZENE	PPB	BDL	10

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-2
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-20B-2-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL

Parameter	Units	Result	Detection Limit
ACENAPHTHENE	PPB	BDL	10
ACENAPHTHYLENE	PPB	BDL	10
ANTHRACENE	PPB	BDL	10
BENZO(A)ANTHRACENE	PPB	BDL	10
BENZO(A)PYRENE	PPB	BDL	10
BENZO(B)FLUORANTHENE	PPB	BDL	10
BENZO(G,H,I)PERYLENE	PPB	BDL	10
BENZO(K)FLUORANTHENE	PPB	BDL	10
BENZYL ALCOHOL	PPB	BDL	10
BIS(2-CHLOROETHOXY)METHANE	PPB	BDL	10
BIS(2-CHLOROETHYL)ETHER	PPB	BDL	10
BIS(2-CHLOROISOPROPYL)ETHER	PPB	BDL	10
BIS(2-ETHYLHEXYL)PHTHALATE	PPB	BDL	10
4-BROMOPHENYL PHENYL ETHER	PPB	BDL	10
BUTYL BENZYL PHTHALATE	PPB	BDL	10
4-CHLOROANILINE	PPB	BDL	10
2-CHLORONAPHTHALENE	PPB	BDL	10
4-CHLOROPHENYL PHENYL ETHER	PPB	BDL	10
CHRYSENE	PPB	BDL	10
DIBENZ(A,H)ANTHRACENE	PPB	BDL	10
DIBENZOFURAN	PPB	BDL	10
1,2-DICHLOROBENZENE	PPB	BDL	10
1,3-DICHLOROBENZENE	PPB	BDL	10
1,4-DICHLOROBENZENE	PPB	BDL	10
3,3'-DICHLOROBENZIDINE	PPB	BDL	50
DIETHYLPHTHALATE	PPB	BDL	10
DIMETHYLPHTHALATE	PPB	BDL	10
DI-N-BUTYLPHTHALATE	PPB	BDL	10
2,4-DINITROTOLUENE	PPB	BDL	10
2,6-DINITROTOLUENE	PPB	BDL	10
DI-N-OCTYLPHTHALATE	PPB	BDL	10
FLUORANTHENE	PPB	BDL	10
FLUORENE	PPB	BDL	10
HEXACHLOROBENZENE	PPB	BDL	10
HEXACHLOROBUTADIENE	PPB	BDL	10

Sample ID.: WHF-20B-2-1 Test Parameters continued on next page

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11 EAST OLIVE ROAD • PENSACOLA, FLORIDA 32514 • (904) 474-1001

Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-2
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-20B-2-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL continued

Parameter	Units	Result	Detection Limit
HEXACHLOROCYCLOPENTADIENE	PPB	BDL	10
HEXACHLOROETHANE	PPB	BDL	10
INDENO(1,2,3-CD)PYRENE	PPB	BDL	10
ISOPHORONE	PPB	BDL	10
2-METHYLNAPHTHALENE	PPB	BDL	10
NAPHTHALENE	PPB	BDL	10
2-NITROANILINE	PPB	BDL	10
3-NITROANILINE	PPB	BDL	10
4-NITROANILINE	PPB	BDL	10
NITROBENZENE	PPB	BDL	10
N-NITROSODIPHENYLAMINE	PPB	BDL	10
N-NITROSO-DI-N-DIPROPYLAMINE	PPB	BDL	10
PHENANTHRENE	PPB	BDL	10
PYRENE	PPB	BDL	10
1,2,4-TRICHLOROBENZENE	PPB	BDL	10

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-3
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-19B-1D-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL

Parameter	Units	Result	Detection Limit
ACENAPHTHENE	PPB	BDL	10
ACENAPHTHYLENE	PPB	BDL	10
ANTHRACENE	PPB	BDL	10
BENZO(A)ANTHRACENE	PPB	BDL	10
BENZO(A)PYRENE	PPB	BDL	10
BENZO(B)FLUORANTHENE	PPB	BDL	10
BENZO(G,H,I)PERYLENE	PPB	BDL	10
BENZO(K)FLUORANTHENE	PPB	BDL	10
BENZYL ALCOHOL	PPB	BDL	10
BIS(2-CHLOROETHOXY)METHANE	PPB	BDL	10
BIS(2-CHLOROETHYL)ETHER	PPB	BDL	10
BIS(2-CHLOROISOPROPYL)ETHER	PPB	BDL	10
BIS(2-ETHYLHEXYL)PHTHALATE	PPB	BDL	10
4-BROMOPHENYL PHENYL ETHER	PPB	BDL	10
BUTYL BENZYL PHTHALATE	PPB	BDL	10
4-CHLOROANILINE	PPB	BDL	10
2-CHLORONAPHTHALENE	PPB	BDL	10
4-CHLOROPHENYL PHENYL ETHER	PPB	BDL	10
CHRYSENE	PPB	BDL	10
DIBENZ(A,H)ANTHRACENE	PPB	BDL	10
DIBENZOFURAN	PPB	BDL	10
1,2-DICHLOROBENZENE	PPB	BDL	10
1,3-DICHLOROBENZENE	PPB	BDL	10
1,4-DICHLOROBENZENE	PPB	BDL	10
3,3'-DICHLOROBENZIDINE	PPB	BDL	50
DIETHYLPHTHALATE	PPB	BDL	10
DIMETHYLPHTHALATE	PPB	BDL	10
DI-N-BUTYLPHTHALATE	PPB	BDL	10
2,4-DINITROTOLUENE	PPB	BDL	10
2,6-DINITROTOLUENE	PPB	BDL	10
DI-N-OCTYLPHTHALATE	PPB	BDL	10
FLUORANTHENE	PPB	BDL	10
FLUORENE	PPB	BDL	10
HEXACHLOROBENZENE	PPB	BDL	10
HEXACHLOROBUTADIENE	PPB	BDL	10

Sample ID.: WHF-19B-1D-1 Test Parameters continued on next page

Pioneer LABORATORY, INC. a division of Analytical Technologies, Inc.
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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-3
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-19B-1D-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL continued

Parameter	Units	Result	Detection Limit
HEXACHLOROCYCLOPENTADIENE	PPB	BDL	10
HEXACHLOROETHANE	PPB	BDL	10
INDENO(1,2,3-CD)PYRENE	PPB	BDL	10
ISOPHORONE	PPB	BDL	10
2-METHYLNAPHTHALENE	PPB	BDL	10
NAPHTHALENE	PPB	BDL	10
2-NITROANILINE	PPB	BDL	10
3-NITROANILINE	PPB	BDL	10
4-NITROANILINE	PPB	BDL	10
NITROBENZENE	PPB	BDL	10
N-NITROSODIPHENYLAMINE	PPB	BDL	10
N-NITROSO-DI-N-DIPROPYLAMINE	PPB	BDL	10
PHENANTHRENE	PPB	BDL	10
PYRENE	PPB	BDL	10
1,2,4-TRICHLOROBENZENE	PPB	BDL	10

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-4
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-19B-2D-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL

Parameter	Units	Result	Detection Limit
ACENAPHTHENE	PPB	BDL	10
ACENAPHTHYLENE	PPB	BDL	10
ANTHRACENE	PPB	BDL	10
BENZO(A)ANTHRACENE	PPB	BDL	10
BENZO(A)PYRENE	PPB	BDL	10
BENZO(B)FLUORANTHENE	PPB	BDL	10
BENZO(G,H,I)PERYLENE	PPB	BDL	10
BENZO(K)FLUORANTHENE	PPB	BDL	10
BENZYL ALCOHOL	PPB	BDL	10
BIS(2-CHLOROETHOXY)METHANE	PPB	BDL	10
BIS(2-CHLOROETHYL)ETHER	PPB	BDL	10
BIS(2-CHLOROISOPROPYL)ETHER	PPB	BDL	10
BIS(2-ETHYLHEXYL)PHTHALATE	PPB	BDL	10
4-BROMOPHENYL PHENYL ETHER	PPB	BDL	10
BUTYL BENZYL PHTHALATE	PPB	BDL	10
4-CHLOROANILINE	PPB	BDL	10
2-CHLORONAPHTHALENE	PPB	BDL	10
4-CHLOROPHENYL PHENYL ETHER	PPB	BDL	10
CHRYSENE	PPB	BDL	10
DIBENZ(A,H)ANTHRACENE	PPB	BDL	10
DIBENZOFURAN	PPB	BDL	10
1,2-DICHLOROBENZENE	PPB	BDL	10
1,3-DICHLOROBENZENE	PPB	BDL	10
1,4-DICHLOROBENZENE	PPB	BDL	10
3,3'-DICHLOROBENZIDINE	PPB	BDL	50
DIETHYLPHTHALATE	PPB	BDL	10
DIMETHYLPHTHALATE	PPB	BDL	10
DI-N-BUTYLPHTHALATE	PPB	BDL	10
2,4-DINITROTOLUENE	PPB	BDL	10
2,6-DINITROTOLUENE	PPB	BDL	10
DI-N-OCTYLPHTHALATE	PPB	BDL	10
FLUORANTHENE	PPB	BDL	10
FLUORENE	PPB	BDL	10
HEXACHLOROBENZENE	PPB	BDL	10
HEXACHLOROBUTADIENE	PPB	BDL	10

Sample ID.: WHF-19B-2D-1 Test Parameters continued on next page

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-4
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-19B-2D-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL continued

Parameter	Units	Result	Detection Limit
HEXACHLOROCYCLOPENTADIENE	PPB	BDL	10
HEXACHLOROETHANE	PPB	BDL	10
INDENO(1,2,3-CD)PYRENE	PPB	BDL	10
ISOPHORONE	PPB	BDL	10
2-METHYLNAPHTHALENE	PPB	BDL	10
NAPHTHALENE	PPB	BDL	10
2-NITROANILINE	PPB	BDL	10
3-NITROANILINE	PPB	BDL	10
4-NITROANILINE	PPB	BDL	10
NITROBENZENE	PPB	BDL	10
N-NITROSODIPHENYLAMINE	PPB	BDL	10
N-NITROSO-DI-N-DIPROPYLAMINE	PPB	BDL	10
PHENANTHRENE	PPB	BDL	10
PYRENE	PPB	BDL	10
1,2,4-TRICHLOROBENZENE	PPB	BDL	10

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-5
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-EB1-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL

Parameter	Units	Result	Detection Limit
ACENAPHTHENE	PPB	BDL	10
ACENAPHTHYLENE	PPB	BDL	10
ANTHRACENE	PPB	BDL	10
BENZO(A)ANTHRACENE	PPB	BDL	10
BENZO(A)PYRENE	PPB	BDL	10
BENZO(B)FLUORANTHENE	PPB	BDL	10
BENZO(G,H,I)PERYLENE	PPB	BDL	10
BENZO(K)FLUORANTHENE	PPB	BDL	10
BENZYL ALCOHOL	PPB	BDL	10
BIS(2-CHLOROETHOXY)METHANE	PPB	BDL	10
BIS(2-CHLOROETHYL)ETHER	PPB	BDL	10
BIS(2-CHLOROISOPROPYL)ETHER	PPB	BDL	10
BIS(2-ETHYLHEXYL)PHTHALATE	PPB	BDL	10
4-BROMOPHENYL PHENYL ETHER	PPB	BDL	10
BUTYL BENZYL PHTHALATE	PPB	BDL	10
4-CHLOROANILINE	PPB	BDL	10
2-CHLORONAPHTHALENE	PPB	BDL	10
4-CHLOROPHENYL PHENYL ETHER	PPB	BDL	10
CHRYSENE	PPB	BDL	10
DIBENZ(A,H)ANTHRACENE	PPB	BDL	10
DIBENZOFURAN	PPB	BDL	10
1,2-DICHLOROBENZENE	PPB	BDL	10
1,3-DICHLOROBENZENE	PPB	BDL	10
1,4-DICHLOROBENZENE	PPB	BDL	10
3,3'-DICHLOROBENZIDINE	PPB	BDL	50
DIETHYLPHTHALATE	PPB	BDL	10
DIMETHYLPHTHALATE	PPB	BDL	10
DI-N-BUTYLPHTHALATE	PPB	BDL	10
2,4-DINITROTOLUENE	PPB	BDL	10
2,6-DINITROTOLUENE	PPB	BDL	10
DI-N-OCTYLPHTHALATE	PPB	BDL	10
FLUORANTHENE	PPB	BDL	10
FLUORENE	PPB	BDL	10
HEXACHLOROBENZENE	PPB	BDL	10
HEXACHLOROBUTADIENE	PPB	BDL	10

Sample ID.: WHF-EB1-1 Test Parameters continued on next page

Pioneer LABORATORY, INC. a division of Analytical Technologies, Inc.
11 EAST OLIVE ROAD • PENSACOLA, FLORIDA 32514 • (904) 474-1001

Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-5
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-EB1-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL continued

Parameter	Units	Result	Detection Limit
HEXACHLOROCYCLOPENTADIENE	PPB	BDL	10
HEXACHLOROETHANE	PPB	BDL	10
INDENO(1,2,3-CD)PYRENE	PPB	BDL	10
ISOPHORONE	PPB	BDL	10
2-METHYLNAPHTHALENE	PPB	BDL	10
NAPHTHALENE	PPB	BDL	10
2-NITROANILINE	PPB	BDL	10
3-NITROANILINE	PPB	BDL	10
4-NITROANILINE	PPB	BDL	10
NITROBENZENE	PPB	BDL	10
N-NITROSODIPHENYLAMINE	PPB	BDL	10
N-NITROSO-DI-N-DIPROPYLAMINE	PPB	BDL	10
PHENANTHRENE	PPB	BDL	10
PYRENE	PPB	BDL	10
1,2,4-TRICHLOROBENZENE	PPB	BDL	10

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-6
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-FB1-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL

Parameter	Units	Result	Detection Limit
ACENAPHTHENE	PPB	BDL	10
ACENAPHTHYLENE	PPB	BDL	10
ANTHRACENE	PPB	BDL	10
BENZO(A)ANTHRACENE	PPB	BDL	10
BENZO(A)PYRENE	PPB	BDL	10
BENZO(B)FLUORANTHENE	PPB	BDL	10
BENZO(G,H,I)PERYLENE	PPB	BDL	10
BENZO(K)FLUORANTHENE	PPB	BDL	10
BENZYL ALCOHOL	PPB	BDL	10
BIS(2-CHLOROETHOXY)METHANE	PPB	BDL	10
BIS(2-CHLOROETHYL)ETHER	PPB	BDL	10
BIS(2-CHLOROISOPROPYL)ETHER	PPB	BDL	10
BIS(2-ETHYLHEXYL)PHTHALATE	PPB	BDL	10
4-BROMOPHENYL PHENYL ETHER	PPB	BDL	10
BUTYL BENZYL PHTHALATE	PPB	BDL	10
4-CHLOROANILINE	PPB	BDL	10
2-CHLORONAPHTHALENE	PPB	BDL	10
4-CHLOROPHENYL PHENYL ETHER	PPB	BDL	10
CHRYSENE	PPB	BDL	10
DIBENZ(A,H)ANTHRACENE	PPB	BDL	10
DIBENZOFURAN	PPB	BDL	10
1,2-DICHLOROBENZENE	PPB	BDL	10
1,3-DICHLOROBENZENE	PPB	BDL	10
1,4-DICHLOROBENZENE	PPB	BDL	10
3,3'-DICHLOROBENZIDINE	PPB	BDL	50
DIETHYLPHTHALATE	PPB	BDL	10
DIMETHYLPHTHALATE	PPB	BDL	10
DI-N-BUTYLPHTHALATE	PPB	BDL	10
2,4-DINITROTOLUENE	PPB	BDL	10
2,6-DINITROTOLUENE	PPB	BDL	10
DI-N-OCTYLPHTHALATE	PPB	BDL	10
FLUORANTHENE	PPB	BDL	10
FLUORENE	PPB	BDL	10
HEXACHLOROBENZENE	PPB	BDL	10
HEXACHLOROBUTADIENE	PPB	BDL	10

Sample ID.: WHF-FB1-1 Test Parameters continued on next page

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11 EAST OLIVE ROAD • PENSACOLA, FLORIDA 32514 • (904) 474-1001

Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-6
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-FB1-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL continued

Parameter	Units	Result	Detection Limit
HEXACHLOROCYCLOPENTADIENE	PPB	BDL	10
HEXACHLOROETHANE	PPB	BDL	10
INDENO(1,2,3-CD)PYRENE	PPB	BDL	10
ISOPHORONE	PPB	BDL	10
2-METHYLNAPHTHALENE	PPB	BDL	10
NAPHTHALENE	PPB	BDL	10
2-NITROANILINE	PPB	BDL	10
3-NITROANILINE	PPB	BDL	10
4-NITROANILINE	PPB	BDL	10
NITROBENZENE	PPB	BDL	10
N-NITROSODIPHENYLAMINE	PPB	BDL	10
N-NITROSO-DI-N-DIPROPYLAMINE	PPB	BDL	10
PHENANTHRENE	PPB	BDL	10
PYRENE	PPB	BDL	10
1,2,4-TRICHLOROBENZENE	PPB	BDL	10

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-7
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-20B-3-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL

Parameter	Units	Result	Detection Limit
ACENAPHTHENE	PPB	BDL	10
ACENAPHTHYLENE	PPB	BDL	10
ANTHRACENE	PPB	BDL	10
BENZO(A)ANTHRACENE	PPB	BDL	10
BENZO(A)PYRENE	PPB	BDL	10
BENZO(B)FLUORANTHENE	PPB	BDL	10
BENZO(G,H,I)PERYLENE	PPB	BDL	10
BENZO(K)FLUORANTHENE	PPB	BDL	10
BENZYL ALCOHOL	PPB	BDL	10
BIS(2-CHLOROETHOXY)METHANE	PPB	BDL	10
BIS(2-CHLOROETHYL)ETHER	PPB	BDL	10
BIS(2-CHLOROISOPROPYL)ETHER	PPB	BDL	10
BIS(2-ETHYLHEXYL)PHTHALATE	PPB	BDL	10
4-BROMOPHENYL PHENYL ETHER	PPB	BDL	10
BUTYL BENZYL PHTHALATE	PPB	BDL	10
4-CHLOROANILINE	PPB	BDL	10
2-CHLORONAPHTHALENE	PPB	BDL	10
4-CHLOROPHENYL PHENYL ETHER	PPB	BDL	10
CHRYSENE	PPB	BDL	10
DIBENZ(A,H)ANTHRACENE	PPB	BDL	10
DIBENZOFURAN	PPB	BDL	10
1,2-DICHLOROBENZENE	PPB	BDL	10
1,3-DICHLOROBENZENE	PPB	BDL	10
1,4-DICHLOROBENZENE	PPB	BDL	10
3,3'-DICHLOROBENZIDINE	PPB	BDL	50
DIETHYLPHTHALATE	PPB	BDL	10
DIMETHYLPHTHALATE	PPB	BDL	10
DI-N-BUTYLPHTHALATE	PPB	BDL	10
2,4-DINITROTOLUENE	PPB	BDL	10
2,6-DINITROTOLUENE	PPB	BDL	10
DI-N-OCTYLPHTHALATE	PPB	BDL	10
FLUORANTHENE	PPB	BDL	10
FLUORENE	PPB	BDL	10
HEXACHLOROBENZENE	PPB	BDL	10
HEXACHLOROBUTADIENE	PPB	BDL	10

Sample ID.: WHF-20B-3-1 Test Parameters continued on next page

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11 EAST OLIVE ROAD • PENSACOLA, FLORIDA 32514 • (904) 474-1001

Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-7
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-20B-3-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL continued

Parameter	Units	Result	Detection Limit
HEXACHLOROCYCLOPENTADIENE	PPB	BDL	10
HEXACHLOROETHANE	PPB	BDL	10
INDENO(1,2,3-CD)PYRENE	PPB	BDL	10
ISOPHORONE	PPB	BDL	10
2-METHYLNAPHTHALENE	PPB	BDL	10
NAPHTHALENE	PPB	BDL	10
2-NITROANILINE	PPB	BDL	10
3-NITROANILINE	PPB	BDL	10
4-NITROANILINE	PPB	BDL	10
NITROBENZENE	PPB	BDL	10
N-NITROSODIPHENYLAMINE	PPB	BDL	10
N-NITROSO-DI-N-DIPROPYLAMINE	PPB	BDL	10
PHENANTHRENE	PPB	BDL	10
PYRENE	PPB	BDL	10
1,2,4-TRICHLOROBENZENE	PPB	BDL	10

Pioneer LABORATORY, INC. a division of Analytical Technologies, Inc.
11 EAST OLIVE ROAD • PENSACOLA, FLORIDA 32514 • (904) 474-1001

Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-8
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-19B-3D-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL

Parameter	Units	Result	Detection Limit
ACENAPHTHENE	PPB	BDL	10
ACENAPHTHYLENE	PPB	BDL	10
ANTHRACENE	PPB	BDL	10
BENZO(A)ANTHRACENE	PPB	BDL	10
BENZO(A)PYRENE	PPB	BDL	10
BENZO(B)FLUORANTHENE	PPB	BDL	10
BENZO(G,H,I)PERYLENE	PPB	BDL	10
BENZO(K)FLUORANTHENE	PPB	BDL	10
BENZYL ALCOHOL	PPB	BDL	10
BIS(2-CHLOROETHOXY)METHANE	PPB	BDL	10
BIS(2-CHLOROETHYL)ETHER	PPB	BDL	10
BIS(2-CHLOROISOPROPYL)ETHER	PPB	BDL	10
BIS(2-ETHYLHEXYL)PHTHALATE	PPB	BDL	10
4-BROMOPHENYL PHENYL ETHER	PPB	BDL	10
BUTYL BENZYL PHTHALATE	PPB	BDL	10
4-CHLOROANILINE	PPB	BDL	10
2-CHLORONAPHTHALENE	PPB	BDL	10
4-CHLOROPHENYL PHENYL ETHER	PPB	BDL	10
CHRYSENE	PPB	BDL	10
DIBENZ(A,H)ANTHRACENE	PPB	BDL	10
DIBENZOFURAN	PPB	BDL	10
1,2-DICHLOROBENZENE	PPB	BDL	10
1,3-DICHLOROBENZENE	PPB	BDL	10
1,4-DICHLOROBENZENE	PPB	BDL	10
3,3'-DICHLOROBENZIDINE	PPB	BDL	50
DIETHYLPHTHALATE	PPB	BDL	10
DIMETHYLPHTHALATE	PPB	BDL	10
DI-N-BUTYLPHTHALATE	PPB	BDL	10
2,4-DINITROTOLUENE	PPB	BDL	10
2,6-DINITROTOLUENE	PPB	BDL	10
DI-N-OCTYLPHTHALATE	PPB	BDL	10
FLUORANTHENE	PPB	BDL	10
FLUORENE	PPB	BDL	10
HEXACHLOROBENZENE	PPB	BDL	10
HEXACHLOROBUTADIENE	PPB	BDL	10

Sample ID.: WHF-19B-3D-1 Test Parameters continued on next page

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-8
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-19B-3D-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL continued

Parameter	Units	Result	Detection Limit
HEXACHLOROCYCLOPENTADIENE	PPB	BDL	10
HEXACHLOROETHANE	PPB	BDL	10
INDENO(1,2,3-CD)PYRENE	PPB	BDL	10
ISOPHORONE	PPB	BDL	10
2-METHYLNAPHTHALENE	PPB	BDL	10
NAPHTHALENE	PPB	BDL	10
2-NITROANILINE	PPB	BDL	10
3-NITROANILINE	PPB	BDL	10
4-NITROANILINE	PPB	BDL	10
NITROBENZENE	PPB	BDL	10
N-NITROSODIPHENYLAMINE	PPB	BDL	10
N-NITROSO-DI-N-DIPROPYLAMINE	PPB	BDL	10
PHENANTHRENE	PPB	BDL	10
PYRENE	PPB	BDL	10
1,2,4-TRICHLOROBENZENE	PPB	BDL	10

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-9
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-19B-3D-D-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL

Parameter	Units	Result	Detection Limit
ACENAPHTHENE	PPB	BDL	10
ACENAPHTHYLENE	PPB	BDL	10
ANTHRACENE	PPB	BDL	10
BENZO(A)ANTHRACENE	PPB	BDL	10
BENZO(A)PYRENE	PPB	BDL	10
BENZO(B)FLUORANTHENE	PPB	BDL	10
BENZO(G,H,I)PERYLENE	PPB	BDL	10
BENZO(K)FLUORANTHENE	PPB	BDL	10
BENZYL ALCOHOL	PPB	BDL	10
BIS(2-CHLOROETHOXY)METHANE	PPB	BDL	10
BIS(2-CHLOROETHYL)ETHER	PPB	BDL	10
BIS(2-CHLOROISOPROPYL)ETHER	PPB	BDL	10
BIS(2-ETHYLHEXYL)PHTHALATE	PPB	BDL	10
4-BROMOPHENYL PHENYL ETHER	PPB	BDL	10
BUTYL BENZYL PHTHALATE	PPB	BDL	10
4-CHLOROANILINE	PPB	BDL	10
2-CHLORONAPHTHALENE	PPB	BDL	10
4-CHLOROPHENYL PHENYL ETHER	PPB	BDL	10
CHRYSENE	PPB	BDL	10
DIBENZ(A,H)ANTHRACENE	PPB	BDL	10
DIBENZOFURAN	PPB	BDL	10
1,2-DICHLOROBENZENE	PPB	BDL	10
1,3-DICHLOROBENZENE	PPB	BDL	10
1,4-DICHLOROBENZENE	PPB	BDL	10
3,3'-DICHLOROBENZIDINE	PPB	BDL	50
DIETHYLPHTHALATE	PPB	BDL	10
DIMETHYLPHTHALATE	PPB	BDL	10
DI-N-BUTYLPHTHALATE	PPB	BDL	10
2,4-DINITROTOLUENE	PPB	BDL	10
2,6-DINITROTOLUENE	PPB	BDL	10
DI-N-OCTYLPHTHALATE	PPB	BDL	10
FLUORANTHENE	PPB	BDL	10
FLUORENE	PPB	BDL	10
HEXACHLOROBENZENE	PPB	BDL	10
HEXACHLOROBUTADIENE	PPB	BDL	10

Sample ID.: WHF-19B-3D-D-1 Test Parameters continued on next page

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-9
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-19B-3D-D-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL continued

Parameter	Units	Result	Detection Limit
HEXACHLOROCYCLOPENTADIENE	PPB	BDL	10
HEXACHLOROETHANE	PPB	BDL	10
INDENO(1,2,3-CD)PYRENE	PPB	BDL	10
ISOPHORONE	PPB	BDL	10
2-METHYLNAPHTHALENE	PPB	BDL	10
NAPHTHALENE	PPB	BDL	10
2-NITROANILINE	PPB	BDL	10
3-NITROANILINE	PPB	BDL	10
4-NITROANILINE	PPB	BDL	10
NITROBENZENE	PPB	BDL	10
N-NITROSODIPHENYLAMINE	PPB	BDL	10
N-NITROSO-DI-N-DIPROPYLAMINE	PPB	BDL	10
PHENANTHRENE	PPB	BDL	10
PYRENE	PPB	BDL	10
1,2,4-TRICHLOROBENZENE	PPB	BDL	10

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-10
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-20B-4-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL

Parameter	Units	Result	Detection Limit
ACENAPHTHENE	PPB	BDL	10
ACENAPHTHYLENE	PPB	BDL	10
ANTHRACENE	PPB	BDL	10
BENZO(A)ANTHRACENE	PPB	BDL	10
BENZO(A)PYRENE	PPB	BDL	10
BENZO(B)FLUORANTHENE	PPB	BDL	10
BENZO(G,H,I)PERYLENE	PPB	BDL	10
BENZO(K)FLUORANTHENE	PPB	BDL	10
BENZYL ALCOHOL	PPB	BDL	10
BIS(2-CHLOROETHOXY)METHANE	PPB	BDL	10
BIS(2-CHLOROETHYL)ETHER	PPB	BDL	10
BIS(2-CHLOROISOPROPYL)ETHER	PPB	BDL	10
BIS(2-ETHYLHEXYL)PHTHALATE	PPB	BDL	10
4-BROMOPHENYL PHENYL ETHER	PPB	BDL	10
BUTYL BENZYL PHTHALATE	PPB	BDL	10
4-CHLOROANILINE	PPB	BDL	10
2-CHLORONAPHTHALENE	PPB	BDL	10
4-CHLOROPHENYL PHENYL ETHER	PPB	BDL	10
CHRYSENE	PPB	BDL	10
DIBENZ(A,H)ANTHRACENE	PPB	BDL	10
DIBENZOFURAN	PPB	BDL	10
1,2-DICHLOROBENZENE	PPB	BDL	10
1,3-DICHLOROBENZENE	PPB	BDL	10
1,4-DICHLOROBENZENE	PPB	BDL	10
3,3'-DICHLOROBENZIDINE	PPB	BDL	50
DIETHYLPHTHALATE	PPB	BDL	10
DIMETHYLPHTHALATE	PPB	BDL	10
DI-N-BUTYLPHTHALATE	PPB	BDL	10
2,4-DINITROTOLUENE	PPB	BDL	10
2,6-DINITROTOLUENE	PPB	BDL	10
DI-N-OCTYLPHTHALATE	PPB	BDL	10
FLUORANTHENE	PPB	BDL	10
FLUORENE	PPB	BDL	10
HEXACHLOROBENZENE	PPB	BDL	10
HEXACHLOROBUTADIENE	PPB	BDL	10

Sample ID.: WHF-20B-4-1 Test Parameters continued on next page

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-10
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-20B-4-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL continued

Parameter	Units	Result	Detection Limit
HEXACHLOROCYCLOPENTADIENE	PPB	BDL	10
HEXACHLOROETHANE	PPB	BDL	10
INDENO(1,2,3-CD)PYRENE	PPB	BDL	10
ISOPHORONE	PPB	BDL	10
2-METHYLNAPHTHALENE	PPB	BDL	10
NAPHTHALENE	PPB	BDL	10
2-NITROANILINE	PPB	BDL	10
3-NITROANILINE	PPB	BDL	10
4-NITROANILINE	PPB	BDL	10
NITROBENZENE	PPB	BDL	10
N-NITROSODIPHENYLAMINE	PPB	BDL	10
N-NITROSO-DI-N-DIPROPYLAMINE	PPB	BDL	10
PHENANTHRENE	PPB	BDL	10
PYRENE	PPB	BDL	10
1,2,4-TRICHLOROBENZENE	PPB	BDL	10

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-11
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-20B-5-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL

Parameter	Units	Result	Detection Limit
ACENAPHTHENE	PPB	BDL	10
ACENAPHTHYLENE	PPB	BDL	10
ANTHRACENE	PPB	BDL	10
BENZO(A)ANTHRACENE	PPB	BDL	10
BENZO(A)PYRENE	PPB	BDL	10
BENZO(B)FLUORANTHENE	PPB	BDL	10
BENZO(G,H,I)PERYLENE	PPB	BDL	10
BENZO(K)FLUORANTHENE	PPB	BDL	10
BENZYL ALCOHOL	PPB	BDL	10
BIS(2-CHLOROETHOXY)METHANE	PPB	BDL	10
BIS(2-CHLOROETHYL)ETHER	PPB	BDL	10
BIS(2-CHLOROISOPROPYL)ETHER	PPB	BDL	10
BIS(2-ETHYLHEXYL)PHTHALATE	PPB	BDL	10
4-BROMOPHENYL PHENYL ETHER	PPB	BDL	10
BUTYL BENZYL PHTHALATE	PPB	BDL	10
4-CHLOROANILINE	PPB	BDL	10
2-CHLORONAPHTHALENE	PPB	BDL	10
4-CHLOROPHENYL PHENYL ETHER	PPB	BDL	10
CHRYSENE	PPB	BDL	10
DIBENZ(A,H)ANTHRACENE	PPB	BDL	10
DIBENZOFURAN	PPB	BDL	10
1,2-DICHLOROBENZENE	PPB	BDL	10
1,3-DICHLOROBENZENE	PPB	BDL	10
1,4-DICHLOROBENZENE	PPB	BDL	10
3,3'-DICHLOROBENZIDINE	PPB	BDL	50
DIETHYLPHTHALATE	PPB	BDL	10
DIMETHYLPHTHALATE	PPB	BDL	10
DI-N-BUTYLPHTHALATE	PPB	BDL	10
2,4-DINITROTOLUENE	PPB	BDL	10
2,6-DINITROTOLUENE	PPB	BDL	10
DI-N-OCTYLPHTHALATE	PPB	BDL	10
FLUORANTHENE	PPB	BDL	10
FLUORENE	PPB	BDL	10
HEXACHLOROBENZENE	PPB	BDL	10
HEXACHLOROBUTADIENE	PPB	BDL	10

Sample ID.: WHF-20B-5-1 Test Parameters continued on next page

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-11
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-20B-5-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL continued

Parameter	Units	Result	Detection Limit
HEXACHLOROCYCLOPENTADIENE	PPB	BDL	10
HEXACHLOROETHANE	PPB	BDL	10
INDENO(1,2,3-CD)PYRENE	PPB	BDL	10
ISOPHORONE	PPB	BDL	10
2-METHYLNAPHTHALENE	PPB	BDL	10
NAPHTHALENE	PPB	BDL	10
2-NITROANILINE	PPB	BDL	10
3-NITROANILINE	PPB	BDL	10
4-NITROANILINE	PPB	BDL	10
NITROBENZENE	PPB	BDL	10
N-NITROSODIPHENYLAMINE	PPB	BDL	10
N-NITROSO-DI-N-DIPROPYLAMINE	PPB	BDL	10
PHENANTHRENE	PPB	BDL	10
PYRENE	PPB	BDL	10
1,2,4-TRICHLOROBENZENE	PPB	BDL	10

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-12
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-EB2-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL

Parameter	Units	Result	Detection Limit
ACENAPHTHENE	PPB	BDL	10
ACENAPHTHYLENE	PPB	BDL	10
ANTHRACENE	PPB	BDL	10
BENZO(A)ANTHRACENE	PPB	BDL	10
BENZO(A)PYRENE	PPB	BDL	10
BENZO(B)FLUORANTHENE	PPB	BDL	10
BENZO(G,H,I)PERYLENE	PPB	BDL	10
BENZO(K)FLUORANTHENE	PPB	BDL	10
BENZYL ALCOHOL	PPB	BDL	10
BIS(2-CHLOROETHOXY)METHANE	PPB	BDL	10
BIS(2-CHLOROETHYL)ETHER	PPB	BDL	10
BIS(2-CHLOROISOPROPYL)ETHER	PPB	BDL	10
BIS(2-ETHYLHEXYL)PHTHALATE	PPB	BDL	10
4-BROMOPHENYL PHENYL ETHER	PPB	BDL	10
BUTYL BENZYL PHTHALATE	PPB	BDL	10
4-CHLOROANILINE	PPB	BDL	10
2-CHLORONAPHTHALENE	PPB	BDL	10
4-CHLOROPHENYL PHENYL ETHER	PPB	BDL	10
CHRYSENE	PPB	BDL	10
DIBENZ(A,H)ANTHRACENE	PPB	BDL	10
DIBENZOFURAN	PPB	BDL	10
1,2-DICHLOROBENZENE	PPB	BDL	10
1,3-DICHLOROBENZENE	PPB	BDL	10
1,4-DICHLOROBENZENE	PPB	BDL	10
3,3'-DICHLOROBENZIDINE	PPB	BDL	50
DIETHYLPHTHALATE	PPB	BDL	10
DIMETHYLPHTHALATE	PPB	BDL	10
DI-N-BUTYLPHTHALATE	PPB	BDL	10
2,4-DINITROTOLUENE	PPB	BDL	10
2,6-DINITROTOLUENE	PPB	BDL	10
DI-N-OCTYLPHTHALATE	PPB	BDL	10
FLUORANTHENE	PPB	BDL	10
FLUORENE	PPB	BDL	10
HEXACHLOROBENZENE	PPB	BDL	10
HEXACHLOROBUTADIENE	PPB	BDL	10

Sample ID.: WHF-EB2-1 Test Parameters continued on next page

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11 EAST OLIVE ROAD • PENSACOLA, FLORIDA 32514 • (904) 474-1001

Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-12
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-EB2-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/BASE TARGET COMPOUND LIST - BASE NEUTRAL continued

Parameter	Units	Result	Detection Limit
HEXACHLOROCYCLOPENTADIENE	PPB	BDL	10
HEXACHLOROETHANE	PPB	BDL	10
INDENO(1,2,3-CD)PYRENE	PPB	BDL	10
ISOPHORONE	PPB	BDL	10
2-METHYLNAPHTHALENE	PPB	BDL	10
NAPHTHALENE	PPB	BDL	10
2-NITROANILINE	PPB	BDL	10
3-NITROANILINE	PPB	BDL	10
4-NITROANILINE	PPB	BDL	10
NITROBENZENE	PPB	BDL	10
N-NITROSODIPHENYLAMINE	PPB	BDL	10
N-NITROSO-DI-N-DIPROPYLAMINE	PPB	BDL	10
PHENANTHRENE	PPB	BDL	10
PYRENE	PPB	BDL	10
1,2,4-TRICHLOROBENZENE	PPB	BDL	10

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11 EAST OLIVE ROAD • PENSACOLA, FLORIDA 32514 • (904) 474-1001

Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-1
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-20B-1-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/PEST TARGET COMPOUND LIST-PESTICIDES

Parameter	Units	Result	Detection Limit
ALDRIN	PPB	BDL	0.02
ALPHA CHLORDANE	PPB	BDL	0.5
ALPHA-BHC	PPB	BDL	0.04
BETA-BHC	PPB	BDL	0.04
DELTA-BHC	PPB	BDL	0.01
GAMMA-BHC (LINDANE)	PPB	BDL	0.02
4,4'-DDD	PPB	BDL	0.01
4,4'-DDE	PPB	BDL	0.01
4,4'-DDT	PPB	BDL	0.03
DIELDRIN	PPB	BDL	0.01
ENDOSULFAN I	PPB	BDL	0.02
ENDOSULFAN II	PPB	BDL	0.02
ENDOSULFAN SULFATE	PPB	BDL	0.04
ENDRIN	PPB	BDL	0.02
ENDRIN KETONE	PPB	BDL	0.1
GAMMA CHLORDANE	PPB	BDL	0.5
HEPTACHLOR	PPB	BDL	0.02
HEPTACHLOR EPOXIDE	PPB	BDL	0.01
METHOXYCHLOR	PPB	BDL	0.5
AROCLOR-1016	PPB	BDL	0.5
AROCLOR-1221	PPB	BDL	0.5
AROCLOR-1232	PPB	BDL	0.5
AROCLOR-1242	PPB	BDL	0.5
AROCLOR-1248	PPB	BDL	0.5
AROCLOR-1254	PPB	BDL	0.5
AROCLOR-1260	PPB	BDL	0.5
TOXAPHENE	PPB	BDL	0.5

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-2
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-20B-2-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/PEST TARGET COMPOUND LIST-PESTICIDES

Parameter	Units	Result	Detection Limit
ALDRIN	PPB	BDL	0.02
ALPHA CHLORDANE	PPB	BDL	0.5
ALPHA-BHC	PPB	BDL	0.04
BETA-BHC	PPB	BDL	0.04
DELTA-BHC	PPB	BDL	0.01
GAMMA-BHC (LINDANE)	PPB	BDL	0.02
4,4'-DDD	PPB	BDL	0.01
4,4'-DDE	PPB	BDL	0.01
4,4'-DDT	PPB	BDL	0.03
DIELDRIN	PPB	BDL	0.01
ENDOSULFAN I	PPB	BDL	0.02
ENDOSULFAN II	PPB	BDL	0.02
ENDOSULFAN SULFATE	PPB	BDL	0.04
ENDRIN	PPB	BDL	0.02
ENDRIN KETONE	PPB	BDL	0.1
GAMMA CHLORDANE	PPB	BDL	0.5
HEPTACHLOR	PPB	BDL	0.02
HEPTACHLOR EPOXIDE	PPB	BDL	0.01
METHOXYCHLOR	PPB	BDL	0.5
AROCLOR-1016	PPB	BDL	0.5
AROCLOR-1221	PPB	BDL	0.5
AROCLOR-1232	PPB	BDL	0.5
AROCLOR-1242	PPB	BDL	0.5
AROCLOR-1248	PPB	BDL	0.5
AROCLOR-1254	PPB	BDL	0.5
AROCLOR-1260	PPB	BDL	0.5
TOXAPHENE	PPB	BDL	0.5

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11 EAST OLIVE ROAD • PENSACOLA, FLORIDA 32514 • (904) 474-1001

Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-3
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-19B-1D-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/PEST TARGET COMPOUND LIST-PESTICIDES

Parameter	Units	Result	Detection Limit
ALDRIN	PPB	BDL	0.02
ALPHA CHLORDANE	PPB	BDL	0.5
ALPHA-BHC	PPB	BDL	0.04
BETA-BHC	PPB	BDL	0.04
DELTA-BHC	PPB	BDL	0.01
GAMMA-BHC (LINDANE)	PPB	BDL	0.02
4,4'-DDD	PPB	BDL	0.01
4,4'-DDE	PPB	BDL	0.01
4,4'-DDT	PPB	BDL	0.03
DIELDRIN	PPB	BDL	0.01
ENDOSULFAN I	PPB	BDL	0.02
ENDOSULFAN II	PPB	BDL	0.02
ENDOSULFAN SULFATE	PPB	BDL	0.04
ENDRIN	PPB	BDL	0.02
ENDRIN KETONE	PPB	BDL	0.1
GAMMA CHLORDANE	PPB	BDL	0.5
HEPTACHLOR	PPB	BDL	0.02
HEPTACHLOR EPOXIDE	PPB	BDL	0.01
METHOXYCHLOR	PPB	BDL	0.5
AROCLOR-1016	PPB	BDL	0.5
AROCLOR-1221	PPB	BDL	0.5
AROCLOR-1232	PPB	BDL	0.5
AROCLOR-1242	PPB	BDL	0.5
AROCLOR-1248	PPB	BDL	0.5
AROCLOR-1254	PPB	BDL	0.5
AROCLOR-1260	PPB	BDL	0.5
TOXAPHENE	PPB	BDL	0.5

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-4
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-19B-2D-1 Sample Date: 06/13-14 Time: VARIOUS

CL/PEST TARGET COMPOUND LIST-PESTICIDES

Parameter	Units	Result	Detection Limit
ALDRIN	PPB	BDL	0.02
ALPHA CHLORDANE	PPB	BDL	0.5
ALPHA-BHC	PPB	BDL	0.04
BETA-BHC	PPB	BDL	0.04
DELTA-BHC	PPB	BDL	0.01
GAMMA-BHC (LINDANE)	PPB	BDL	0.02
4,4'-DDD	PPB	BDL	0.01
4,4'-DDE	PPB	BDL	0.01
4,4'-DDT	PPB	BDL	0.03
DIELDRIN	PPB	BDL	0.01
ENDOSULFAN I	PPB	BDL	0.02
ENDOSULFAN II	PPB	BDL	0.02
ENDOSULFAN SULFATE	PPB	BDL	0.04
ENDRIN	PPB	BDL	0.02
ENDRIN KETONE	PPB	BDL	0.1
GAMMA CHLORDANE	PPB	BDL	0.5
HEPTACHLOR	PPB	BDL	0.02
HEPTACHLOR EPOXIDE	PPB	BDL	0.01
METHOXYCHLOR	PPB	BDL	0.5
AROCLOR-1016	PPB	BDL	0.5
AROCLOR-1221	PPB	BDL	0.5
AROCLOR-1232	PPB	BDL	0.5
AROCLOR-1242	PPB	BDL	0.5
AROCLOR-1248	PPB	BDL	0.5
AROCLOR-1254	PPB	BDL	0.5
AROCLOR-1260	PPB	BDL	0.5
TOXAPHENE	PPB	BDL	0.5

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-5
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-EB1-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/PEST TARGET COMPOUND LIST-PESTICIDES

Parameter	Units	Result	Detection Limit
ALDRIN	PPB	BDL	0.02
ALPHA CHLORDANE	PPB	BDL	0.5
ALPHA-BHC	PPB	BDL	0.04
BETA-BHC	PPB	BDL	0.04
DELTA-BHC	PPB	BDL	0.01
GAMMA-BHC (LINDANE)	PPB	BDL	0.02
4,4'-DDD	PPB	BDL	0.01
4,4'-DDE	PPB	BDL	0.01
4,4'-DDT	PPB	BDL	0.03
DIELDRIN	PPB	BDL	0.01
ENDOSULFAN I	PPB	BDL	0.02
ENDOSULFAN II	PPB	BDL	0.02
ENDOSULFAN SULFATE	PPB	BDL	0.04
ENDRIN	PPB	BDL	0.02
ENDRIN KETONE	PPB	BDL	0.1
GAMMA CHLORDANE	PPB	BDL	0.5
HEPTACHLOR	PPB	BDL	0.02
HEPTACHLOR EPOXIDE	PPB	BDL	0.01
METHOXYCHLOR	PPB	BDL	0.5
AROCLOR-1016	PPB	BDL	0.5
AROCLOR-1221	PPB	BDL	0.5
AROCLOR-1232	PPB	BDL	0.5
AROCLOR-1242	PPB	BDL	0.5
AROCLOR-1248	PPB	BDL	0.5
AROCLOR-1254	PPB	BDL	0.5
AROCLOR-1260	PPB	BDL	0.5
TOXAPHENE	PPB	BDL	0.5

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-6
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-FB1-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/PEST TARGET COMPOUND LIST-PESTICIDES

Parameter	Units	Result	Detection Limit
ALDRIN	PPB	BDL	0.02
ALPHA CHLORDANE	PPB	BDL	0.5
ALPHA-BHC	PPB	BDL	0.04
BETA-BHC	PPB	BDL	0.04
DELTA-BHC	PPB	BDL	0.01
GAMMA-BHC (LINDANE)	PPB	BDL	0.02
4,4'-DDD	PPB	BDL	0.01
4,4'-DDE	PPB	BDL	0.01
4,4'-DDT	PPB	BDL	0.03
DIELDRIN	PPB	BDL	0.01
ENDOSULFAN I	PPB	BDL	0.02
ENDOSULFAN II	PPB	BDL	0.02
ENDOSULFAN SULFATE	PPB	BDL	0.04
ENDRIN	PPB	BDL	0.02
ENDRIN KETONE	PPB	BDL	0.1
GAMMA CHLORDANE	PPB	BDL	0.5
HEPTACHLOR	PPB	BDL	0.02
HEPTACHLOR EPOXIDE	PPB	BDL	0.01
METHOXYCHLOR	PPB	BDL	0.5
AROCLOR-1016	PPB	BDL	0.5
AROCLOR-1221	PPB	BDL	0.5
AROCLOR-1232	PPB	BDL	0.5
AROCLOR-1242	PPB	BDL	0.5
AROCLOR-1248	PPB	BDL	0.5
AROCLOR-1254	PPB	BDL	0.5
AROCLOR-1260	PPB	BDL	0.5
TOXAPHENE	PPB	BDL	0.5

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-7
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-20B-3-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/PEST TARGET COMPOUND LIST-PESTICIDES

Parameter	Units	Result	Detection Limit
ALDRIN	PPB	BDL	0.02
ALPHA CHLORDANE	PPB	BDL	0.5
ALPHA-BHC	PPB	BDL	0.04
BETA-BHC	PPB	BDL	0.04
DELTA-BHC	PPB	BDL	0.01
GAMMA-BHC (LINDANE)	PPB	BDL	0.02
4,4'-DDD	PPB	BDL	0.01
4,4'-DDE	PPB	BDL	0.01
4,4'-DDT	PPB	BDL	0.03
DIELDRIN	PPB	BDL	0.01
ENDOSULFAN I	PPB	BDL	0.02
ENDOSULFAN II	PPB	BDL	0.02
ENDOSULFAN SULFATE	PPB	BDL	0.04
ENDRIN	PPB	BDL	0.02
ENDRIN KETONE	PPB	BDL	0.1
GAMMA CHLORDANE	PPB	BDL	0.5
HEPTACHLOR	PPB	BDL	0.02
HEPTACHLOR EPOXIDE	PPB	BDL	0.01
METHOXYCHLOR	PPB	BDL	0.5
AROCLOR-1016	PPB	BDL	0.5
AROCLOR-1221	PPB	BDL	0.5
AROCLOR-1232	PPB	BDL	0.5
AROCLOR-1242	PPB	BDL	0.5
AROCLOR-1248	PPB	BDL	0.5
AROCLOR-1254	PPB	BDL	0.5
AROCLOR-1260	PPB	BDL	0.5
TOXAPHENE	PPB	BDL	0.5

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-8
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-19B-3D-1 Sample Date: 06/13-14 Time: VARIOUS

CL/PEST TARGET COMPOUND LIST-PESTICIDES

Parameter	Units	Result	Detection Limit
ALDRIN	PPB	BDL	0.02
ALPHA CHLORDANE	PPB	BDL	0.5
ALPHA-BHC	PPB	BDL	0.04
BETA-BHC	PPB	BDL	0.04
DELTA-BHC	PPB	BDL	0.01
GAMMA-BHC (LINDANE)	PPB	BDL	0.02
4,4'-DDD	PPB	BDL	0.01
4,4'-DDE	PPB	BDL	0.01
4,4'-DDT	PPB	BDL	0.03
DIELDRIN	PPB	BDL	0.01
ENDOSULFAN I	PPB	BDL	0.02
ENDOSULFAN II	PPB	BDL	0.02
ENDOSULFAN SULFATE	PPB	BDL	0.04
ENDRIN	PPB	BDL	0.02
ENDRIN KETONE	PPB	BDL	0.1
GAMMA CHLORDANE	PPB	BDL	0.5
HEPTACHLOR	PPB	BDL	0.02
HEPTACHLOR EPOXIDE	PPB	BDL	0.01
METHOXYCHLOR	PPB	BDL	0.5
AROCLOR-1016	PPB	BDL	0.5
AROCLOR-1221	PPB	BDL	0.5
AROCLOR-1232	PPB	BDL	0.5
AROCLOR-1242	PPB	BDL	0.5
AROCLOR-1248	PPB	BDL	0.5
AROCLOR-1254	PPB	BDL	0.5
AROCLOR-1260	PPB	BDL	0.5
TOXAPHENE	PPB	BDL	0.5

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-9
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-19B-3D-D-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/PEST TARGET COMPOUND LIST-PESTICIDES

Parameter	Units	Result	Detection Limit
ALDRIN	PPB	BDL	0.02
ALPHA CHLORDANE	PPB	BDL	0.5
ALPHA-BHC	PPB	BDL	0.04
BETA-BHC	PPB	BDL	0.04
DELTA-BHC	PPB	BDL	0.01
GAMMA-BHC (LINDANE)	PPB	BDL	0.02
4,4'-DDD	PPB	BDL	0.01
4,4'-DDE	PPB	BDL	0.01
4,4'-DDT	PPB	BDL	0.03
DIELDRIN	PPB	BDL	0.01
ENDOSULFAN I	PPB	BDL	0.02
ENDOSULFAN II	PPB	BDL	0.02
ENDOSULFAN SULFATE	PPB	BDL	0.04
ENDRIN	PPB	BDL	0.02
ENDRIN KETONE	PPB	BDL	0.1
GAMMA CHLORDANE	PPB	BDL	0.5
HEPTACHLOR	PPB	BDL	0.02
HEPTACHLOR EPOXIDE	PPB	BDL	0.01
METHOXYCHLOR	PPB	BDL	0.5
AROCLOR-1016	PPB	BDL	0.5
AROCLOR-1221	PPB	BDL	0.5
AROCLOR-1232	PPB	BDL	0.5
AROCLOR-1242	PPB	BDL	0.5
AROCLOR-1248	PPB	BDL	0.5
AROCLOR-1254	PPB	BDL	0.5
AROCLOR-1260	PPB	BDL	0.5
TOXAPHENE	PPB	BDL	0.5

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-10
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-20B-4-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/PEST TARGET COMPOUND LIST-PESTICIDES

Parameter	Units	Result	Detection Limit
ALDRIN	PPB	BDL	0.02
ALPHA CHLORDANE	PPB	BDL	0.5
ALPHA-BHC	PPB	BDL	0.04
BETA-BHC	PPB	BDL	0.04
DELTA-BHC	PPB	BDL	0.01
GAMMA-BHC (LINDANE)	PPB	BDL	0.02
4,4'-DDD	PPB	BDL	0.01
4,4'-DDE	PPB	BDL	0.01
4,4'-DDT	PPB	BDL	0.03
DIELDRIN	PPB	BDL	0.01
ENDOSULFAN I	PPB	BDL	0.02
ENDOSULFAN II	PPB	BDL	0.02
ENDOSULFAN SULFATE	PPB	BDL	0.04
ENDRIN	PPB	BDL	0.02
ENDRIN KETONE	PPB	BDL	0.1
GAMMA CHLORDANE	PPB	BDL	0.5
HEPTACHLOR	PPB	BDL	0.02
HEPTACHLOR EPOXIDE	PPB	BDL	0.01
METHOXYCHLOR	PPB	BDL	0.5
AROCLOR-1016	PPB	BDL	0.5
AROCLOR-1221	PPB	BDL	0.5
AROCLOR-1232	PPB	BDL	0.5
AROCLOR-1242	PPB	BDL	0.5
AROCLOR-1248	PPB	BDL	0.5
AROCLOR-1254	PPB	BDL	0.5
AROCLOR-1260	PPB	BDL	0.5
TOXAPHENE	PPB	BDL	0.5

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-11
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-20B-5-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/PEST TARGET COMPOUND LIST-PESTICIDES

Parameter	Units	Result	Detection Limit
ALDRIN	PPB	BDL	0.02
ALPHA CHLORDANE	PPB	BDL	0.5
ALPHA-BHC	PPB	BDL	0.04
BETA-BHC	PPB	BDL	0.04
DELTA-BHC	PPB	BDL	0.01
GAMMA-BHC (LINDANE)	PPB	BDL	0.02
4,4'-DDD	PPB	BDL	0.01
4,4'-DDE	PPB	BDL	0.01
4,4'-DDT	PPB	BDL	0.03
DIELDRIN	PPB	BDL	0.01
ENDOSULFAN I	PPB	BDL	0.02
ENDOSULFAN II	PPB	BDL	0.02
ENDOSULFAN SULFATE	PPB	BDL	0.04
ENDRIN	PPB	BDL	0.02
ENDRIN KETONE	PPB	BDL	0.1
GAMMA CHLORDANE	PPB	BDL	0.5
HEPTACHLOR	PPB	BDL	0.02
HEPTACHLOR EPOXIDE	PPB	BDL	0.01
METHOXYCHLOR	PPB	BDL	0.5
AROCLOR-1016	PPB	BDL	0.5
AROCLOR-1221	PPB	BDL	0.5
AROCLOR-1232	PPB	BDL	0.5
AROCLOR-1242	PPB	BDL	0.5
AROCLOR-1248	PPB	BDL	0.5
AROCLOR-1254	PPB	BDL	0.5
AROCLOR-1260	PPB	BDL	0.5
TOXAPHENE	PPB	BDL	0.5

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-12
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-EB2-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/PEST TARGET COMPOUND LIST-PESTICIDES

Parameter	Units	Result	Detection Limit
ALDRIN	PPB	BDL	0.02
ALPHA CHLORDANE	PPB	BDL	0.5
ALPHA-BHC	PPB	BDL	0.04
BETA-BHC	PPB	BDL	0.04
DELTA-BHC	PPB	BDL	0.01
GAMMA-BHC (LINDANE)	PPB	BDL	0.02
4,4'-DDD	PPB	BDL	0.01
4,4'-DDE	PPB	BDL	0.01
4,4'-DDT	PPB	BDL	0.03
DIELDRIN	PPB	BDL	0.01
ENDOSULFAN I	PPB	BDL	0.02
ENDOSULFAN II	PPB	BDL	0.02
ENDOSULFAN SULFATE	PPB	BDL	0.04
ENDRIN	PPB	BDL	0.02
ENDRIN KETONE	PPB	BDL	0.1
GAMMA CHLORDANE	PPB	BDL	0.5
HEPTACHLOR	PPB	BDL	0.02
HEPTACHLOR EPOXIDE	PPB	BDL	0.01
METHOXYCHLOR	PPB	BDL	0.5
AROCLOR-1016	PPB	BDL	0.5
AROCLOR-1221	PPB	BDL	0.5
AROCLOR-1232	PPB	BDL	0.5
AROCLOR-1242	PPB	BDL	0.5
AROCLOR-1248	PPB	BDL	0.5
AROCLOR-1254	PPB	BDL	0.5
AROCLOR-1260	PPB	BDL	0.5
TOXAPHENE	PPB	BDL	0.5

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-1
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-20B-1-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/VOL TARGET COMPOUND LIST - VOLATILES

Parameter	Units	Result	Detection Limit
ACETONE	PPB	BDL	10
BENZENE	PPB	BDL	1
BROMODICHLOROMETHANE	PPB	BDL	1
BROMOFORM	PPB	BDL	2
BROMOMETHANE	PPB	BDL	1
2-BUTANONE (MEK)	PPB	BDL	3
CARBON DISULFIDE	PPB	BDL	1
CARBON TETRACHLORIDE	PPB	BDL	2
CHLOROBENZENE	PPB	BDL	1
CHLOROETHANE	PPB	BDL	1
CHLOROFORM	PPB	BDL	2
CHLOROMETHANE	PPB	BDL	2
DIBROMOCHLOROMETHANE	PPB	BDL	5
1,1-DICHLOROETHANE	PPB	BDL	1
1,2-DICHLOROETHANE	PPB	BDL	2
1,1-DICHLOROETHENE	PPB	BDL	1
1,2-DICHLOROETHENE	PPB	BDL	5
1,2-DICHLOROPROPANE	PPB	BDL	2
CIS-1,3-DICHLOROPROPENE	PPB	BDL	1
TRANS-1,3-DICHLOROPROPENE	PPB	BDL	1
ETHYLBENZENE	PPB	BDL	1
2-HEXANONE	PPB	BDL	3
METHYLENE CHLORIDE	PPB	BDL	3
4-METHYL-2-PENTANONE	PPB	BDL	3
STYRENE	PPB	BDL	2
1,1,2,2-TETRACHLOROETHANE	PPB	BDL	2
TETRACHLOROETHENE	PPB	BDL	1
TOLUENE	PPB	2	1
1,1,1-TRICHLOROETHANE	PPB	BDL	5
1,1,2-TRICHLOROETHANE	PPB	BDL	2
TRICHLOROETHENE	PPB	BDL	1
VINYL ACETATE	PPB	BDL	2
VINYL CHLORIDE	PPB	BDL	1
TOTAL XYLENES	PPB	BDL	4

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-2
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-20B-2-1 Sample Date: 06/13-14 Time: VARIOUS

CL/VOL TARGET COMPOUND LIST - VOLATILES

Parameter	Units	Result	Detection Limit
ACETONE	PPB	BDL	10
BENZENE	PPB	BDL	1
BROMODICHLOROMETHANE	PPB	BDL	1
BROMOFORM	PPB	BDL	2
BROMOMETHANE	PPB	BDL	1
2-BUTANONE (MEK)	PPB	BDL	3
CARBON DISULFIDE	PPB	BDL	1
CARBON TETRACHLORIDE	PPB	BDL	2
CHLOROBENZENE	PPB	BDL	1
CHLOROETHANE	PPB	BDL	1
CHLOROFORM	PPB	BDL	2
CHLOROMETHANE	PPB	BDL	2
DIBROMOCHLOROMETHANE	PPB	BDL	5
1,1-DICHLOROETHANE	PPB	BDL	1
1,2-DICHLOROETHANE	PPB	BDL	2
1,1-DICHLOROETHENE	PPB	BDL	1
1,2-DICHLOROETHENE	PPB	BDL	5
1,2-DICHLOROPROPANE	PPB	BDL	2
CIS-1,3-DICHLOROPROPENE	PPB	BDL	1
TRANS-1,3-DICHLOROPROPENE	PPB	BDL	1
ETHYLBENZENE	PPB	BDL	1
2-HEXANONE	PPB	BDL	3
METHYLENE CHLORIDE	PPB	BDL	3
4-METHYL-2-PENTANONE	PPB	BDL	3
STYRENE	PPB	BDL	2
1,1,2,2-TETRACHLOROETHANE	PPB	BDL	2
TETRACHLOROETHENE	PPB	BDL	1
TOLUENE	PPB	BDL	1
1,1,1-TRICHLOROETHANE	PPB	BDL	5
1,1,2-TRICHLOROETHANE	PPB	BDL	2
TRICHLOROETHENE	PPB	BDL	1
VINYL ACETATE	PPB	BDL	2
VINYL CHLORIDE	PPB	BDL	1
TOTAL XYLENES	PPB	BDL	4

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-3
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-19B-1D-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/VOL TARGET COMPOUND LIST - VOLATILES

Parameter	Units	Result	Detection Limit
ACETONE	PPB	30	10
BENZENE	PPB	BDL	1
BROMODICHLOROMETHANE	PPB	BDL	1
BROMOFORM	PPB	BDL	2
BROMOMETHANE	PPB	BDL	1
2-BUTANONE (MEK)	PPB	43	3
CARBON DISULFIDE	PPB	BDL	1
CARBON TETRACHLORIDE	PPB	BDL	2
CHLOROBENZENE	PPB	BDL	1
CHLOROETHANE	PPB	BDL	1
CHLOROFORM	PPB	BDL	2
CHLOROMETHANE	PPB	BDL	2
DIBROMOCHLOROMETHANE	PPB	BDL	5
1,1-DICHLOROETHANE	PPB	BDL	1
1,2-DICHLOROETHANE	PPB	BDL	2
1,1-DICHLOROETHENE	PPB	BDL	1
1,2-DICHLOROETHENE	PPB	BDL	5
1,2-DICHLOROPROPANE	PPB	BDL	2
CIS-1,3-DICHLOROPROPENE	PPB	BDL	1
TRANS-1,3-DICHLOROPROPENE	PPB	BDL	1
ETHYLBENZENE	PPB	BDL	1
2-HEXANONE	PPB	BDL	3
METHYLENE CHLORIDE	PPB	BDL	3
4-METHYL-2-PENTANONE	PPB	BDL	3
STYRENE	PPB	BDL	2
1,1,2,2-TETRACHLOROETHANE	PPB	BDL	2
TETRACHLOROETHENE	PPB	BDL	1
TOLUENE	PPB	BDL	1
1,1,1-TRICHLOROETHANE	PPB	BDL	5
1,1,2-TRICHLOROETHANE	PPB	BDL	2
TRICHLOROETHENE	PPB	BDL	1
VINYL ACETATE	PPB	BDL	2
VINYL CHLORIDE	PPB	BDL	1
TOTAL XYLENES	PPB	BDL	4

Pioneer LABORATORY, INC. a division of Analytical Technologies, Inc.
11 EAST OLIVE ROAD • PENSACOLA, FLORIDA 32514 • (904) 474-1001

Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-4
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-19B-2D-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/VOL TARGET COMPOUND LIST - VOLATILES

Parameter	Units	Result	Detection Limit
ACETONE	PPB	BDL	10
BENZENE	PPB	BDL	1
BROMODICHLOROMETHANE	PPB	BDL	1
BROMOFORM	PPB	BDL	2
BROMOMETHANE	PPB	BDL	1
2-BUTANONE (MEK)	PPB	113	3
CARBON DISULFIDE	PPB	BDL	1
CARBON TETRACHLORIDE	PPB	BDL	2
CHLOROBENZENE	PPB	BDL	1
CHLOROETHANE	PPB	BDL	1
CHLOROFORM	PPB	BDL	2
CHLOROMETHANE	PPB	BDL	2
DIBROMOCHLOROMETHANE	PPB	BDL	5
1,1-DICHLOROETHANE	PPB	BDL	1
1,2-DICHLOROETHANE	PPB	BDL	2
1,1-DICHLOROETHENE	PPB	BDL	1
1,2-DICHLOROETHENE	PPB	BDL	5
1,2-DICHLOROPROPANE	PPB	BDL	2
CIS-1,3-DICHLOROPROPENE	PPB	BDL	1
TRANS-1,3-DICHLOROPROPENE	PPB	BDL	1
ETHYLBENZENE	PPB	BDL	1
2-HEXANONE	PPB	BDL	3
METHYLENE CHLORIDE	PPB	BDL	3
4-METHYL-2-PENTANONE	PPB	BDL	3
STYRENE	PPB	BDL	2
1,1,2,2-TETRACHLOROETHANE	PPB	BDL	2
TETRACHLOROETHENE	PPB	BDL	1
TOLUENE	PPB	BDL	1
1,1,1-TRICHLOROETHANE	PPB	BDL	5
1,1,2-TRICHLOROETHANE	PPB	BDL	2
TRICHLOROETHENE	PPB	BDL	1
VINYL ACETATE	PPB	6	2
VINYL CHLORIDE	PPB	BDL	1
TOTAL XYLENES	PPB	BDL	4

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-5
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-EB1-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/VOL TARGET COMPOUND LIST - VOLATILES

Parameter	Units	Result	Detection Limit
ACETONE	PPB	BDL	10
BENZENE	PPB	BDL	1
BROMODICHLOROMETHANE	PPB	BDL	1
BROMOFORM	PPB	BDL	2
BROMOMETHANE	PPB	BDL	1
2-BUTANONE (MEK)	PPB	BDL	3
CARBON DISULFIDE	PPB	BDL	1
CARBON TETRACHLORIDE	PPB	BDL	2
CHLOROBENZENE	PPB	BDL	1
CHLOROETHANE	PPB	BDL	1
CHLOROFORM	PPB	BDL	2
CHLOROMETHANE	PPB	BDL	2
DIBROMOCHLOROMETHANE	PPB	BDL	5
1,1-DICHLOROETHANE	PPB	BDL	1
1,2-DICHLOROETHANE	PPB	BDL	2
1,1-DICHLOROETHENE	PPB	BDL	1
1,2-DICHLOROETHENE	PPB	BDL	5
1,2-DICHLOROPROPANE	PPB	BDL	2
CIS-1,3-DICHLOROPROPENE	PPB	BDL	1
TRANS-1,3-DICHLOROPROPENE	PPB	BDL	1
ETHYLBENZENE	PPB	BDL	1
2-HEXANONE	PPB	BDL	3
METHYLENE CHLORIDE	PPB	BDL	3
4-METHYL-2-PENTANONE	PPB	BDL	3
STYRENE	PPB	BDL	2
1,1,2,2-TETRACHLOROETHANE	PPB	BDL	2
TETRACHLOROETHENE	PPB	BDL	1
TOLUENE	PPB	6	1
1,1,1-TRICHLOROETHANE	PPB	BDL	5
1,1,2-TRICHLOROETHANE	PPB	BDL	2
TRICHLOROETHENE	PPB	BDL	1
VINYL ACETATE	PPB	BDL	2
VINYL CHLORIDE	PPB	BDL	1
TOTAL XYLENES	PPB	BDL	4

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-6
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-FB1-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/VOL TARGET COMPOUND LIST - VOLATILES

Parameter	Units	Result	Detection Limit
ACETONE	PPB	BDL	10
BENZENE	PPB	BDL	1
BROMODICHLOROMETHANE	PPB	BDL	1
BROMOFORM	PPB	BDL	2
BROMOMETHANE	PPB	BDL	1
2-BUTANONE (MEK)	PPB	BDL	3
CARBON DISULFIDE	PPB	BDL	1
CARBON TETRACHLORIDE	PPB	BDL	2
CHLOROBENZENE	PPB	BDL	1
CHLOROETHANE	PPB	BDL	1
CHLOROFORM	PPB	BDL	2
CHLOROMETHANE	PPB	BDL	2
DIBROMOCHLOROMETHANE	PPB	BDL	5
1,1-DICHLOROETHANE	PPB	BDL	1
1,2-DICHLOROETHANE	PPB	BDL	2
1,1-DICHLOROETHENE	PPB	BDL	1
1,2-DICHLOROETHENE	PPB	BDL	5
1,2-DICHLOROPROPANE	PPB	BDL	2
CIS-1,3-DICHLOROPROPENE	PPB	BDL	1
TRANS-1,3-DICHLOROPROPENE	PPB	BDL	1
ETHYLBENZENE	PPB	BDL	1
2-HEXANONE	PPB	BDL	3
METHYLENE CHLORIDE	PPB	BDL	3
4-METHYL-2-PENTANONE	PPB	BDL	3
STYRENE	PPB	BDL	2
1,1,2,2-TETRACHLOROETHANE	PPB	BDL	2
TETRACHLOROETHENE	PPB	BDL	1
TOLUENE	PPB	BDL	1
1,1,1-TRICHLOROETHANE	PPB	BDL	5
1,1,2-TRICHLOROETHANE	PPB	BDL	2
TRICHLOROETHENE	PPB	BDL	1
VINYL ACETATE	PPB	BDL	2
VINYL CHLORIDE	PPB	BDL	1
TOTAL XYLENES	PPB	BDL	4

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-7
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-20B-3-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/VOL TARGET COMPOUND LIST - VOLATILES

Parameter	Units	Result	Detection Limit
ACETONE	PPB	BDL	10
BENZENE	PPB	BDL	1
BROMODICHLOROMETHANE	PPB	BDL	1
BROMOFORM	PPB	BDL	2
BROMOMETHANE	PPB	BDL	1
2-BUTANONE (MEK)	PPB	BDL	3
CARBON DISULFIDE	PPB	BDL	1
CARBON TETRACHLORIDE	PPB	BDL	2
CHLOROBENZENE	PPB	BDL	1
CHLOROETHANE	PPB	BDL	1
CHLOROFORM	PPB	BDL	2
CHLOROMETHANE	PPB	BDL	2
DIBROMOCHLOROMETHANE	PPB	BDL	5
1,1-DICHLOROETHANE	PPB	BDL	1
1,2-DICHLOROETHANE	PPB	BDL	2
1,1-DICHLOROETHENE	PPB	BDL	1
1,2-DICHLOROETHENE	PPB	BDL	5
1,2-DICHLOROPROPANE	PPB	BDL	2
CIS-1,3-DICHLOROPROPENE	PPB	BDL	1
TRANS-1,3-DICHLOROPROPENE	PPB	BDL	1
ETHYLBENZENE	PPB	BDL	1
2-HEXANONE	PPB	BDL	3
METHYLENE CHLORIDE	PPB	BDL	3
4-METHYL-2-PENTANONE	PPB	BDL	3
STYRENE	PPB	BDL	2
1,1,2,2-TETRACHLOROETHANE	PPB	BDL	2
TETRACHLOROETHENE	PPB	BDL	1
TOLUENE	PPB	BDL	1
1,1,1-TRICHLOROETHANE	PPB	BDL	5
1,1,2-TRICHLOROETHANE	PPB	BDL	2
TRICHLOROETHENE	PPB	BDL	1
VINYL ACETATE	PPB	BDL	2
VINYL CHLORIDE	PPB	BDL	1
TOTAL XYLENES	PPB	BDL	4

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-8
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-19B-3D-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/VOL TARGET COMPOUND LIST - VOLATILES

Parameter	Units	Result	Detection Limit
ACETONE	PPB	BDL	10
BENZENE	PPB	BDL	1
BROMODICHLOROMETHANE	PPB	BDL	1
BROMOFORM	PPB	BDL	2
BROMOMETHANE	PPB	BDL	1
2-BUTANONE (MEK)	PPB	BDL	3
CARBON DISULFIDE	PPB	BDL	1
CARBON TETRACHLORIDE	PPB	BDL	2
CHLOROBENZENE	PPB	BDL	1
CHLOROETHANE	PPB	BDL	1
CHLOROFORM	PPB	BDL	2
CHLOROMETHANE	PPB	BDL	2
DIBROMOCHLOROMETHANE	PPB	BDL	5
1,1-DICHLOROETHANE	PPB	BDL	1
1,2-DICHLOROETHANE	PPB	BDL	2
1,1-DICHLOROETHENE	PPB	BDL	1
1,2-DICHLOROETHENE	PPB	BDL	5
1,2-DICHLOROPROPANE	PPB	BDL	2
CIS-1,3-DICHLOROPROPENE	PPB	BDL	1
TRANS-1,3-DICHLOROPROPENE	PPB	BDL	1
ETHYLBENZENE	PPB	BDL	1
2-HEXANONE	PPB	BDL	3
METHYLENE CHLORIDE	PPB	BDL	3
4-METHYL-2-PENTANONE	PPB	BDL	3
STYRENE	PPB	BDL	2
1,1,2,2-TETRACHLOROETHANE	PPB	BDL	2
TETRACHLOROETHENE	PPB	BDL	1
TOLUENE	PPB	BDL	1
1,1,1-TRICHLOROETHANE	PPB	BDL	5
1,1,2-TRICHLOROETHANE	PPB	BDL	2
TRICHLOROETHENE	PPB	BDL	1
VINYL ACETATE	PPB	BDL	2
VINYL CHLORIDE	PPB	BDL	1
TOTAL XYLENES	PPB	BDL	4

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-9
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-19B-3D-D-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/VOL TARGET COMPOUND LIST - VOLATILES

Parameter	Units	Result	Detection Limit
ACETONE	PPB	BDL	10
BENZENE	PPB	BDL	1
BROMODICHLOROMETHANE	PPB	BDL	1
BROMOFORM	PPB	BDL	2
BROMOMETHANE	PPB	BDL	1
2-BUTANONE (MEK)	PPB	BDL	3
CARBON DISULFIDE	PPB	BDL	1
CARBON TETRACHLORIDE	PPB	BDL	2
CHLOROBENZENE	PPB	BDL	1
CHLOROETHANE	PPB	BDL	1
CHLOROFORM	PPB	BDL	2
CHLOROMETHANE	PPB	BDL	2
DIBROMOCHLOROMETHANE	PPB	BDL	5
1,1-DICHLOROETHANE	PPB	BDL	1
1,2-DICHLOROETHANE	PPB	BDL	2
1,1-DICHLOROETHENE	PPB	BDL	1
1,2-DICHLOROETHENE	PPB	BDL	5
1,2-DICHLOROPROPANE	PPB	BDL	2
CIS-1,3-DICHLOROPROPENE	PPB	BDL	1
TRANS-1,3-DICHLOROPROPENE	PPB	BDL	1
ETHYLBENZENE	PPB	BDL	1
2-HEXANONE	PPB	BDL	3
METHYLENE CHLORIDE	PPB	BDL	3
4-METHYL-2-PENTANONE	PPB	BDL	3
STYRENE	PPB	BDL	2
1,1,2,2-TETRACHLOROETHANE	PPB	BDL	2
TETRACHLOROETHENE	PPB	BDL	1
TOLUENE	PPB	BDL	1
1,1,1-TRICHLOROETHANE	PPB	BDL	5
1,1,2-TRICHLOROETHANE	PPB	BDL	2
TRICHLOROETHENE	PPB	BDL	1
VINYL ACETATE	PPB	BDL	2
VINYL CHLORIDE	PPB	BDL	1
TOTAL XYLENES	PPB	BDL	4

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-10
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-20B-4-1 Sample Date: 06/13-14 Time: VARIOUS

CL/VOL TARGET COMPOUND LIST - VOLATILES

Parameter	Units	Result	Detection Limit
ACETONE	PPB	44	10
BENZENE	PPB	BDL	1
BROMODICHLOROMETHANE	PPB	BDL	1
BROMOFORM	PPB	BDL	2
BROMOMETHANE	PPB	BDL	1
2-BUTANONE (MEK)	PPB	5	3
CARBON DISULFIDE	PPB	BDL	1
CARBON TETRACHLORIDE	PPB	BDL	2
CHLOROBENZENE	PPB	BDL	1
CHLOROETHANE	PPB	BDL	1
CHLOROFORM	PPB	BDL	2
CHLOROMETHANE	PPB	BDL	2
DIBROMOCHLOROMETHANE	PPB	BDL	5
1,1-DICHLOROETHANE	PPB	BDL	1
1,2-DICHLOROETHANE	PPB	BDL	2
1,1-DICHLOROETHENE	PPB	BDL	1
1,2-DICHLOROETHENE	PPB	BDL	5
1,2-DICHLOROPROPANE	PPB	BDL	2
CIS-1,3-DICHLOROPROPENE	PPB	BDL	1
TRANS-1,3-DICHLOROPROPENE	PPB	BDL	1
ETHYLBENZENE	PPB	BDL	1
2-HEXANONE	PPB	BDL	3
METHYLENE CHLORIDE	PPB	BDL	3
4-METHYL-2-PENTANONE	PPB	BDL	3
STYRENE	PPB	BDL	2
1,1,2,2-TETRACHLOROETHANE	PPB	BDL	2
TETRACHLOROETHENE	PPB	BDL	1
TOLUENE	PPB	BDL	1
1,1,1-TRICHLOROETHANE	PPB	BDL	5
1,1,2-TRICHLOROETHANE	PPB	BDL	2
TRICHLOROETHENE	PPB	BDL	1
VINYL ACETATE	PPB	BDL	2
VINYL CHLORIDE	PPB	BDL	1
TOTAL XYLENES	PPB	BDL	4

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-11
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-20B-5-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/VOL TARGET COMPOUND LIST - VOLATILES

Parameter	Units	Result	Detection Limit
ACETONE	PPB	BDL	10
BENZENE	PPB	BDL	1
BROMODICHLOROMETHANE	PPB	BDL	1
BROMOFORM	PPB	BDL	2
BROMOMETHANE	PPB	BDL	1
2-BUTANONE (MEK)	PPB	BDL	3
CARBON DISULFIDE	PPB	BDL	1
CARBON TETRACHLORIDE	PPB	BDL	2
CHLOROBENZENE	PPB	BDL	1
CHLOROETHANE	PPB	BDL	1
CHLOROFORM	PPB	BDL	2
CHLOROMETHANE	PPB	BDL	2
DIBROMOCHLOROMETHANE	PPB	BDL	5
1,1-DICHLOROETHANE	PPB	BDL	1
1,2-DICHLOROETHANE	PPB	BDL	2
1,1-DICHLOROETHENE	PPB	BDL	1
1,2-DICHLOROETHENE	PPB	BDL	5
1,2-DICHLOROPROPANE	PPB	BDL	2
CIS-1,3-DICHLOROPROPENE	PPB	BDL	1
TRANS-1,3-DICHLOROPROPENE	PPB	BDL	1
ETHYLBENZENE	PPB	BDL	1
2-HEXANONE	PPB	BDL	3
METHYLENE CHLORIDE	PPB	BDL	3
4-METHYL-2-PENTANONE	PPB	BDL	3
STYRENE	PPB	BDL	2
1,1,2,2-TETRACHLOROETHANE	PPB	BDL	2
TETRACHLOROETHENE	PPB	BDL	1
TOLUENE	PPB	BDL	1
1,1,1-TRICHLOROETHANE	PPB	BDL	5
1,1,2-TRICHLOROETHANE	PPB	BDL	2
TRICHLOROETHENE	PPB	BDL	1
VINYL ACETATE	PPB	BDL	2
VINYL CHLORIDE	PPB	BDL	1
TOTAL XYLENES	PPB	BDL	4

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-12
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: GROUNDWATER

Sample ID.: WHF-EB2-1 Sample Date: 06/13-14 Time: VARIOUS

TCL/VOL TARGET COMPOUND LIST - VOLATILES

Parameter	Units	Result	Detection Limit
ACETONE	PPB	BDL	10
BENZENE	PPB	BDL	1
BROMODICHLOROMETHANE	PPB	BDL	1
BROMOFORM	PPB	BDL	2
BROMOMETHANE	PPB	BDL	1
2-BUTANONE (MEK)	PPB	BDL	3
CARBON DISULFIDE	PPB	BDL	1
CARBON TETRACHLORIDE	PPB	BDL	2
CHLOROBENZENE	PPB	BDL	1
CHLOROETHANE	PPB	BDL	1
CHLOROFORM	PPB	BDL	2
CHLOROMETHANE	PPB	BDL	2
DIBROMOCHLOROMETHANE	PPB	BDL	5
1,1-DICHLOROETHANE	PPB	BDL	1
1,2-DICHLOROETHANE	PPB	BDL	2
1,1-DICHLOROETHENE	PPB	BDL	1
1,2-DICHLOROETHENE	PPB	BDL	5
1,2-DICHLOROPROPANE	PPB	BDL	2
CIS-1,3-DICHLOROPROPENE	PPB	BDL	1
TRANS-1,3-DICHLOROPROPENE	PPB	BDL	1
ETHYLBENZENE	PPB	BDL	1
2-HEXANONE	PPB	BDL	3
METHYLENE CHLORIDE	PPB	BDL	3
4-METHYL-2-PENTANONE	PPB	BDL	3
STYRENE	PPB	BDL	2
1,1,2,2-TETRACHLOROETHANE	PPB	BDL	2
TETRACHLOROETHENE	PPB	BDL	1
TOLUENE	PPB	3	1
1,1,1-TRICHLOROETHANE	PPB	BDL	5
1,1,2-TRICHLOROETHANE	PPB	BDL	2
TRICHLOROETHENE	PPB	BDL	1
VINYL ACETATE	PPB	BDL	2
VINYL CHLORIDE	PPB	BDL	1
TOTAL XYLENES	PPB	BDL	4

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Client: ABB ENVIRONMENTAL, INC
10001

Lab I.D.#: 90-3345-13
Order Date: 06/15/90
Sampled By: M.H. / A.D.

Sample Site: OLF BARIN
Sample Type: WATER

Sample ID.: TRIP BLANK Sample Date: 06/13-14 Time: VARIOUS

TCL/VOL TARGET COMPOUND LIST - VOLATILES

Parameter	Units	Result	Detection Limit
ACETONE	PPB	BDL	10
BENZENE	PPB	BDL	1
BROMODICHLOROMETHANE	PPB	BDL	1
BROMOFORM	PPB	BDL	2
BROMOMETHANE	PPB	BDL	1
2-BUTANONE (MEK)	PPB	BDL	3
CARBON DISULFIDE	PPB	BDL	1
CARBON TETRACHLORIDE	PPB	BDL	2
CHLOROBENZENE	PPB	BDL	1
CHLOROETHANE	PPB	BDL	1
CHLOROFORM	PPB	BDL	2
CHLOROMETHANE	PPB	BDL	2
DIBROMOCHLOROMETHANE	PPB	BDL	5
1,1-DICHLOROETHANE	PPB	BDL	1
1,2-DICHLOROETHANE	PPB	BDL	2
1,1-DICHLOROETHENE	PPB	BDL	1
1,2-DICHLOROETHENE	PPB	BDL	5
1,2-DICHLOROPROPANE	PPB	BDL	2
CIS-1,3-DICHLOROPROPENE	PPB	BDL	1
TRANS-1,3-DICHLOROPROPENE	PPB	BDL	1
ETHYLBENZENE	PPB	BDL	1
2-HEXANONE	PPB	BDL	3
METHYLENE CHLORIDE	PPB	BDL	3
4-METHYL-2-PENTANONE	PPB	BDL	3
STYRENE	PPB	BDL	2
1,1,2,2-TETRACHLOROETHANE	PPB	BDL	2
TETRACHLOROETHENE	PPB	BDL	1
TOLUENE	PPB	BDL	1
1,1,1-TRICHLOROETHANE	PPB	BDL	5
1,1,2-TRICHLOROETHANE	PPB	BDL	2
TRICHLOROETHENE	PPB	BDL	1
VINYL ACETATE	PPB	BDL	2
VINYL CHLORIDE	PPB	BDL	1
TOTAL XYLENES	PPB	BDL	4

end of report

Navy Level "C" *Do not test sample # WHF EB2-1 unless WHF EB1 shows contamination

90-3345

CHAIN OF CUSTODY RECORD

Page ___ of ___

PROJECT NO.: 5898-05

PROJECT NAME: OLF BARIN

SAMPLERS (SIGNATURE): [signature]

	STA. NO.	DATE	TIME	COMP	GRAB	STATION LOCATION	NO. OF CONTAINERS	VOA's	A/B/N	PEST/608	T/Phenols	PP METALS	T-CYANIDE						REMARKS INDICATE SOIL/WATER/AIR SEDIMENT/SLUDGE
1	WHF-20B-1-1	6/13/90	1415		X	WHF-MW-20B-1-1	7	2	1	1	1	1	1						WATER
2	WHF-20B-2-1	6/13/90	1715		X	WHF-MW-20B-2-1	7	2	1	1	1	1	1						WATER
3	WHF-19B-1D-1	6/13/90	1845		X	WHF-MW-19B-1D-1	7	2	1	1	1	1	1						WATER
4	WHF-19B-2D-1	6/13/90	1915		X	WHF-MW-19B-2D-1	7	2	1	1	1	1	1						WATER
5	WHF-EB1-1	6/14/90	1015		X	WHF-MW-EB1-1	7	2	1	1	1	1	1						WATER
6	WHF-FB1-1	6/14/90	1030		X	WHF-MW-FB1-1	7	2	1	1	1	1	1						WATER
7	WHF-20B-3-1	6/14/90	1140		X	WHF-MW-20B-3-1	7	2	1	1	1	1	1						WATER
8	WHF-19B-3D-1	6/14/90	1400		X	WHF-MW-19B-3D-1	9	2	2	2	1	1	1						WATER
9	WHF-19B-3D-D-1	6/14/90	1400		X	WHF-MW-19B-3D-D-1	7	2	1	1	1	1	1						WATER
10	WHF-20B-4-1	6/14/90	1540		X	WHF-MW-20B-4-1	7	2	1	1	1	1	1						WATER
11	WHF-20B-5-1	6/14/90	1610		X	WHF-MW-20B-5-1	7	2	1	1	1	1	1						WATER
12	WHF-EB2-1	6/14/90	1640		X	WHF-MW-EB2-1	7	2	1	1	1	1	1						WATER
13	Trip Blank	—	—			Trip Blank	1	1											Water

RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)	RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)
[signature]	6/14/90 1810	S. Braddock / ATF 6/14/90 1810			
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RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED FOR DISPOSAL BY: (SIGNATURE)	DATE/TIME	REMARKS	

ABB Environmental Services, Inc.

CH-62

* Vol Labels for preservatives unreliable

DRAFT

APPENDIX C

TOXICOLOGICAL PROFILES FOR CHEMICALS OF CONCERN AT OLF BARIN

C.1 CYANIDE.

C.1.1 Introduction Cyanide is a compound that may exist as a gas (e.g., hydrogen cyanide [HCN]) or as a salt (e.g., potassium cyanide [KCN] or sodium cyanide [NaCN]. Most cyanides, with the exception of several metallocyanides, are relatively soluble in water.

C.1.2 Human Toxic Effects

C.1.2.1 Acute Toxic Effects Inhalation of 100 ppm HCN for 0.5 to 1 hour has been fatal to humans. Numerous occupational exposures to cyanide have been reported; however, no levels of exposure are available. Exposure to HCN resulted in palpitations, shortness of breath, pain over the heart, vertigo, and involuntary eye movements (Carmelo, 1955), cyanosis, headache, altered electroencephalogram (EEG), and left-sided blindness (Sandberg, 1967). A photographic laboratory worker was exposed to potassium cyanide when a bag of the compound burst in his face. He developed abdominal pain, pallor, and collapsed, but recovered after treatment (Thomas and Brooks, 1970).

When monkeys were exposed to 87 to 196 ppm HCN, severe disruptive changes in respiration and unconsciousness were noted. Tremors, convulsions, loss of equilibrium, dyspnea, nausea, exaggerated intestinal peristalsis, and diarrhea were noted in dogs exposed to 45 ppm HCN for varying durations (USEPA, 1984h).

C.1.2.2 Chronic Toxic Effects When rats were exposed by inhalation to HCN at low concentrations, cardiac enzyme changes resulted (O'Flaherty and Thomas, 1982). The previously cited study of monkeys exposed to 87 to 196 ppm HCN from pyrolyzed polyacrylonitrile also found cardiovascular effects, including rapid induction of a semiconscious state and severe disruptive changes in respiration.

Several occupational studies of workers exposed to HCN indicated that exposure resulted in thyroid abnormalities. In a case-control study of electroplating workers exposed to HCN for five to 15 years, 56 percent of the exposed group had enlarged thyroid glands and significantly elevated hemoglobin levels and lymphocyte counts. It should be noted that these workers were also exposed to volatiles, exposure levels varied, and unmatched controls were used (El Ghawabi et al., 1975).

Workers in a silver-reclaiming factory exposed to HCN developed headaches, dizziness, and mild thyroid abnormalities (Blanc et al., 1985).

C.1.2.3 Reproductive Effects Numerous studies of orally exposed pregnant animals have found maternal toxicities and developmental abnormalities in the offspring. Pregnant hamsters exposed to cyanide exhibited maternal toxicity at 250 mg/kg and greater. Dose-related abnormalities were found in fetuses examined at 15-days gestation (ATSDR, 1988).

C.1.2.4 Ambient Water Quality Criteria The Ambient water quality criterion for protection or human health from the effect or cyanide is 200 $\mu g/\ell$ (USEPA, 1985).

C.1.3 Ecological Effects.

C.1.3.1 **Bioconcentration** Cyanide has been detected in the tissues of fish exposed to rapidly lethal cyanide levels (Murachi et al., 1978 and Holden and Marsden, 1964) but bioconcentration has not been demonstrated (EPA, 1985).

C.1.3.2 **Aquatic Toxicity** The acute toxicity of free cyanide to freshwater species range from 44 $\mu g/\ell$ to 2,490 $\mu g/\ell$ with values above 400 $\mu g/\ell$ being for invertebrates (EPA, 1985). A long-term survival, partial and life-cycle test with fish gave chronic values of 13.6, 7.8 and 16.4 $\mu g/\ell$, respectively, Chronic values for two freshwater invertebrate species were 18 and 34 $\mu g/\ell$ (EPA, 1985).

C.1.3.3 **Standards and Guidelines for the Protection of Aquatic Life** The acute and chronic AWQC values for cyanide for the protection of aquatic life are 5.2 and 22 $\mu g/\ell$, respectively (EPA, 1985).

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C.2 DDT, DDE, DDD.

C.2.1 Introduction From 1946 to 1972, DDT was one of the world's most widely used agricultural insecticides. It was also used extensively for the control of malaria, typhus and other insect transmitted diseases. All U.S. uses of DDT, with the exception of emergency public health uses, were banned in 1973. DDE is a degradation product of DDT and is found as a contaminant in technical grade DDT. DDE is also present in mammalian systems as a DDT metabolite. DDD has been used as a pesticide. The o,p-DDD isomer was used medically for treatment of cancer of the adrenal gland. DDT and its metabolites are virtually ubiquitous and are continually being transformed and redistributed in the environment (ATSDR, 1988).

C.2.2 Human Toxic Effects The symptoms of DDT poisoning are paresthesia and tremor of the extremities, confusion, malaise, headache, and vomiting. A single dose of 10 mg/kg produced illness in some subjects, but no vomiting or convulsions occurred. When the dosage was 16 mg/kg or greater, convulsions occurred frequently. Doses as high as 285 mg/kg have been ingested without fatal results. After absorption in mammals, including man, DDT is degraded to DDE is stored for an indefinite period of time in adipose tissue. The distribution of DDE in the organs usually parallels their fat content. DDE is then converted to DDD. This conversion occurs with considerable latency because the biological half-life of DDE is approximately 8 years. DDD is further metabolized to DDA which is relatively water soluble.

Hayes et al. (1956, 1971) conducted two chronic exposure studies with volunteers given DDT orally. In the first study, volunteers received doses of 0, 3.5, or 35 mg per person daily for up to 18 months. None complained of any symptoms or showed signs of any illness. In the second study, the same doses were ingested for 21.5 months and were observed for an additional 25.5 months with six being followed for 5 years. There was no clinical evidence for adverse effects in any of the volunteers.

The only human data available for DDD are related to its use in the treatment of adrenal cortical carcinoma. Toxic symptoms have been observed in 87% of the patients ingesting DDD. These include nausea, vomiting, CNS depression, and skin rash. The lowest lethal dose reported is 5000 mg/kg.

Morgan and Roan (1973) conducted the only study on chronic DDE administration. They administered one volunteer an oral dose 5 mg per day for 92 days. No abnormalities were detected.

C.2.2.1 **Acute Animal Toxicity** The LD_{50} values reported in rats exposed to single oral doses of DDT ranged from 113 to 800 mg/kg. The vehicle in which DDT is administered plays a role in its toxicity. DDT is more toxic when administered as a solution in vegetable oil or animal fat than when administered in some petroleum fraction (ATSDR, 1988; Clayton and Clayton, 1982). The oral LD_{50} value for DDE was 113 mg/kg in rats; the values for DDD range from 400 to 4000 mg/kg (ATSDR, 1988). Toxic effects are primarily on the CNS. These include tremors and convulsions. Mild effects are seen in the liver.

C.2.2.2 Chronic Animal Toxicity Subchronic and chronic exposure to DDT results in liver hyperplasia and necrosis. These effects have been reported in rats exposed to 10 to 40 mg/kg/day for 24 to 27 months (Deichmann et al., 1967). Administration of 12 mg/kg/day of DDE for 78 weeks resulted in liver necrosis (NCI, 1978). Kidney necrosis and hemorrhaging were seen in rats given oral doses of up to 10 mg/kg/day for 27 months (Deichmann et al., 1967).

C.2.2.3 Carcinogenic Effects Evidence exists from animal studies to consider DDT, DDE and DDD probable human carcinogens. Doses as low as 0.26 mg DDT/kg/day, produced liver tumors, primarily hepatomas in many strains of mice (Innes et al., 1969; Thorpe and Walker, 1973; Tomatis et al., 1972). Pulmonary adenomas occurred in mice at doses of 1.3 to 32.5 mg DDT/kg/day and malignant lymphomas occurred in mice exposed to 10 mg DDT/kg/day for 80 weeks (Kayshap et al., 1977; Shabad et al., 1973). Liver tumors occurred in rats given doses of 6.25 to 42 mg DDT/kg/day for 120 weeks and adrenal tumors occurred in hamsters given 83 mg DDT/kg/day for 120 weeks (Cabral et al., 1982; Rossi et al.,1983).

DDD caused thyroid tumors in rats fed 1647 to 3294 ppm (NCI, 1978). Liver tumors were induced in mice fed 148-261 ppm DDE and hamsters fed 500-1000 ppm DDE (Rossi et al., 1983; Tomatis et al., 1974)

C.2.2.4 Mutagenic Effects DDT, DDE, and DDD have given negative results in in vitro bacterial tests, however, in nonhuman test systems, chromosomal damage was observed after in vitro and in vivo exposures (ATSDR, 1988). Rebello et al. (1975) reported a significant increase in chromosome damage in workers occupationally exposed to DDT.

C.2.2.5 Reproductive and Teratogenic Effects Both DDT and DDE exhibit estrogenic activity as evidenced by uterotrophic effects. Intermediate oral exposure to DDT (25-50 mg/kg/day) in experimental animals has been shown to produce developmental effects such as infertility and slow development. DDT exposure of intermediate duration (15 days to one year) produced several adverse reproductive effects including a decrease in the frequency of implanted ova and decreases in ovary and testes weights. Reproductive effects were also reported for chronic or multigeneration exposures. These included stillbirths, delayed estrus and lack of mammary gland development in dogs exposed to 12 mg/kg/day for 14 months (ATSDR, 1988).

C.2.2.6 Standards and Guidelines for the Protection of Human Health USEPA has classified DDT, DDE, and DDD as Group B2 carcinogens. The OSHA PEL for DDT is 1.0 mg/m^3 as an 8 hour TWA. ACGIH has the same TLV. The carcinogenic slope factor for DDD and DDT are $2.4x10^{-1}$ and $3.4x10^{-1}$, respectively (IRIS, January 1991). The oral chronic RfD for DDT is $5.0x10^{-4}$ mg/kg/day (IRIS, January 1991).

C.2.3 Ecological Effects

C.2.3.1 Bioavailability For aquatic plants, reported bioconcentration factors for DDT range from 495 for soft-stem bullrush to 21,580 for *Cladophora* sp. (USEPA, 1980). Phytoplankton may concentrate DDT residues to as much as 270 times the water concentration (Vance and Drummond, 1969).

Reported bioconcentration factors for DDT taken up from water by invertebrates range from 1,947 for the crayfish (*Procambarus allenia*) to 12,500 for clams (a composite of five species) (USEPA, 1980).

For chemical compounds with long half-lives (such as DDT), the use of laboratory BCFs (kinetic or steady state) underestimates residues in fish tissues in the field (Oliver and Nimi, 1985). High field BCFs indicate that the rate of uptake of the chemical by the fish exceeds its ability to eliminate the chemical. It is further suggested that the higher field BCFs indicate that the primary route of fish exposure for DDT is consumption of contaminated food (Oliver and Nimi, 1985).

Reported laboratory-derived BCFs for 22 freshwater fish species as reported by USEPA for use in derivation of water quality criteria range up to 4.43×10^6 for the bloater (*Coregonus hoyi*). The geometric mean of lipid-normalized bioconcentration factors for DDT (the BCF value divided by the percent lipid value for the same species) for freshwater and saltwater aquatic life is 17,870. The reported ratio for field derived BCF values to laboratory-derived BCF values for DDE is 220.

C.2.3.2 Aquatic Toxicity Toxicity information is available for four species of aquatic plants (USEPA, 1980). Sensitivity varies by a factor 2,700, with the lowest value of 0.3 $\mu g/\ell$ DDT inhibiting growth and disrupting morphologic characteristics in the alga, *Chlorella* sp. (Sodergren, 1968).

Acute toxicity information for DDT and its metabolites is available for 18 fresh water invertebrates (USEPA, 1980). Acute toxicity (as LC_{50} values) ranged from 0.18 $\mu g/\ell$ for the crayfish (*Orconectes nais*) to 1,800 $\mu g/\ell$ for stonefly larvae (*Pteronarcys californiaca*). Chronic toxicity test values are not available for aquatic invertebrates.

Acute toxicity information (96hr LC_{50}s) is available for 24 freshwater fish species (USEPA, 1980). Sensitivities to DDT ranged from 0.6 $\mu g/\ell$ for the yellow perch (*Perca flavescens*) to 180 $\mu g/\ell$ for the goldfish (*Carassius auratus*) (USEPA, 1980).

Chronic toxicity values for DDT are available for only one freshwater fish species, the fathead minnow (*Pimephales promelas*), 0.74 $\mu g/\ell$ (Jarvinen et al., 1977).

Additional information is available regarding DDT concentrations that result in physiological or behavioral effects for fish (USEPA, 1980). The lowest reported concentration is DDT that caused adverse physiological or behavioral effects was 0.008 $\mu g/\ell$ for hyperactive locomotor response observed in the bluegill (*Lepomis macrochirus*) (Ellgaard et al., 1977).

Tissue residues of DDT in fish are associated with impaired reproduction and biochemical effects. These effects occur at concentrations as low as 2.75 mg/kg (Campbell et al., 1974).

C.2.3.3 Standards and Guidelines for the Protection of Aquatic Life

Surface Water. For DDT and its metabolites the criterion to protect freshwater aquatic life as derived using current USEPA guidelines is 0.0010 $\mu g/\ell$ as a 24-hour average and the concentration should not exceed 1.1 $\mu g/\ell$ at any time (USEPA, 1980).

The 0.0010 $\mu g/\ell$ criteria value for DDT is a final residue protective of wildlife that consume aquatic organisms.

Sediments. For DDT the mean Sediment Quality Criteria is 0.828 $\mu g/gC$ with 95 percent confidence limits of 0.183 $\mu g/gC$ and 3.80 $\mu g/gC$ (gC = gram of organic carbon) (USEPA, 1988).

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C.3 DIELDRIN.

C.3.1 Introduction Dieldrin is an insecticide first used by cotton growers in the 1950's. It was subsequently used to control various vector-borne diseases, and for mothproofing woolen goods. In 1974, the registration of products containing dieldrin was canceled due to evidence of its toxicity (Clayton and Clayton, 1981).

C.3.2 Human Toxic Effects

C.3.2.1 Acute Toxic Effects Dieldrin is acutely toxic by both inhalation and ingestion routes of exposure. Several human fatalities have resulted from drinking emulsions or solutions of dieldrin. Nonlethal doses have produced convulsions with loss of consciousness. Symptoms of acute dieldrin poisoning appeared weeks or months after the last exposure (Klaasen et al., 1986). Following inhalation exposure, dieldrin is readily absorbed through the gastrointestinal and respiratory tracts. In man, overdoses have produced headache, vertigo, nausea, and vomiting, followed occasionally by muscle twitchings and convulsions (Clayton and Clayton, 1981).

C.3.2.2 Chronic Toxic Effects Tests conducted on workers exposed during the manufacture of dieldrin from 1954 to 1968 revealed no abnormalities (Clayton and Clayton, 1981). Chronic exposure in experimental animals resulted in histologic changes in the liver (Klaasen et al., 1986).

C.3.2.3 Carcinogenic Effects There are conflicting reports of dieldrin's carcinogenicity in laboratory animals. Deichmann and MacDonald found that overall tumor incidence in rats fed dieldrin was lower than in controls (Deichmann and MacDonald, 1971). However, a later study conducted by the National Cancer Institute (NCI) found a significant increase in hepatocellular cancers in male mice (NCI, 1978c). A working group of the IARC concluded that dieldrin is hepatocarcinogenic in mice (IARC, 1974). USEPA has classified dieldrin as a B2 carcinogen.

C.3.2.4 Mutagenic Effects Dieldrin was not found to be mutagenic in bacteria. Studies of mouse and Chinese Hamster cells treated with dieldrin revealed no chromosomal aberrations. Blood cells of workers exposed to dieldrin also did not show any chromosomal damage (Clayton and Clayton, 1981).

C.3.2.5 Standards and Guidelines for the Protection of Human Health Dieldrin is classified as a class B2 carcinogen with a carcinogenic slope factor of 16 (IRIS, January 1991). The chronic RfD for dieldrin is 5.0×10^{-5} (IRIS, January 1991).

C.3.3 Ecological Effects

C.3.3.1 Standards and Guidelines for the Protection of Aquatic Life The AWQC for the protection of freshwater aquatic life from acute and chronic effects are 1.0 $\mu g/\ell$ and 0.0019 $\mu g/\ell$, respectively (EPA, 1986).

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C.4 ETHYLBENZENE.

C.4.1 Introduction Ethylbenzene is a volatile aromatic compound with a high log K_{ow}, indicating that it adsorbs onto organic particles in the soil, slowing its transport to groundwater and surface water. Small amounts of ethylbenzene can leach into groundwater from soil (especially sandy soil) and may biodegrade in subsurface soils. The half-life of ethylbenzene in air is 35 hours; in water, it is approximately 1.5 to 7.5 days. The primary loss mechanisms from the soil surface is expected to be evaporation (USEPA, 1980).

C.4.2 Human Toxic Effects Bardodej and Bardodejava (1970) reported no toxic effects in volunteers after inhalation exposure to 100-ppm ethylbenzene for 8 hours. Their exposure to an increased concentration of ethylbenzene resulted in fatigue, headache, and mild eye and respiratory irritation.

C.4.2.1 **Acute Animal Toxicity** Acute LD_{50} values of 3.5 to 5.46 g/kg were reported in rats. Toxic effects were observed predominantly in the liver, kidney, and central nervous system (USEPA, 1987).

C.4.2.2 **Chronic Animal Toxicity** Liver and kidney effects were observed in rats given oral doses of 408 or 680 mg/kg/day in olive oil for 6 months. No effects were observed at doses of 13.6 and 136 mg/kg/day (Wolf et al.,1956).

C.4.2.3 **Carcinogenic Effects** Ethylbenzene has not been evaluated for carcinogenicity. The National Toxicology Program has plans to initiate a bioassay.

C.4.2.4 **Mutagenic Effects** Ethylbenzene has not induced mutagenic effects in bacteria, gene conversion in yeast or chromosome damage in rat liver epithelial cells (USEPA, 1987).

C.4.2.5 **Reproductive and Teratogenic Effects** Ethylbenzene did not elicit embryotoxicity, fetotoxicity or teratogenicity in inhalation studies at concentrations of up to 1000 ppm in rats and rabbits exposed for 6 to 7 hours daily on days 1 to 19 and 1 to 24 of gestation, respectively (Hardin et al., 1981).

C.4.2.6 **Standards and Guidelines for the Protection of Human Health** USEPA has classified ethylbenzene as a Class D carcinogen. The ACGIH TLV of 100 ppm for ethylbenzene was set to protect against its irritant effects. OSHA has established a PEL of 100 ppm and a STEL of 125 ppm. USEPA has proposed a drinking water MCL and MCLG of 700 $\mu g/\ell$ and an SMCL of 30 $\mu g/\ell$.

C.4.3 Ecological Effects

C.4.3.1 **Bioavailability** Information is not available on the bioconcentration of ethylbenzene by aquatic organisms.

C.4.3.2 **Aquatic Toxicity** The acute toxicity of ethylbenzene for 7 species of freshwater fish range from 14,000 $\mu g/\ell$ for rainbow trout (Johnson & Finley, 1980) to 425,000 $\mu g/\ell$ for channel catfish (Johnson & Finley, 1980). Chronic toxicity information is not available.

C.4.3.3 Standards and Guidelines for the Protection of Aquatic Life There is not currently enough information available to derive AWQC for ethylbenzene. The lowest acute EC_{50} for ethylbenzene is 32,000 $\mu g/\ell$ (USEPA, 1986).

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C.5 LEAD.

C.5.1 Introduction Lead is a toxic heavy metal used in batteries, paint and pesticides, and as a gasoline additive. Lead is not very mobile in the environment and can form insoluble compounds. Lead particles are removed from the atmosphere primarily by deposition, with an average residence time of 7 to 30 days. Long-range transport of lead in the atmosphere occurs to thousands of kilometers. Lead is extremely persistent in both water and soil.

C.5.2 Human Toxic Effects Because of decades of medical observation and scientific research on lead, the degree of uncertainty about the health effects of lead is quite low. It appears that some of the observed health effects (e.g., changes in the levels of specific blood enzymes and changes in children's neurological development) may occur at blood lead levels so low as to be essentially without a threshold. There is evidence that exposure to lead can cause renal toxicity, CNS depressions, and hemolytic effects.

IARC (1982) concluded that there is inadequate evidence that lead and lead compounds cause cancer in humans. Epidemiology studies conducted on lead smelter workers have found significant excesses of respiratory and digestive cancers; however, the workers were exposed to a number of toxic compounds, thereby preventing the establishment of a causal relationship. An insignificant increase in skin cancers has been noted in workers exposed to tetraethyl lead (IARC, 1982).

Toxic effects resulting from chronic lead exposure are well-documented and many have been associated with accompanying blood-lead (PbB) levels. Children have been found to develop symptoms at lower (PbB) levels than adults. The most serious effects associated with lead intoxication are the neurotoxic effects. Lead encephalopathy can result from blood lead levels greater than 100 μg/100 ml and is characterized by irritability, loss of memory and ability to concentrate, delirium, hallucinations, cerebral edema, and coma (USEPA, 1980). Less severe neurotic effects have been observed at lower (PbB) levels. For example, lowered nerve conduction velocities, indicative of peripheral nerve dysfunction, have been noted in adults at PbB levels of 30 to 40 μg/100 ml (USEPA, 1985).

Hematologic effects appear to be among the most sensitive indicators of lead absorption. Lead interference with heme synthesis has been noted in humans and other mammalian species at levels below 10 to 15 μg/100 ml. The step most sensitive to lead in the heme synthetic is that mediated by the enzyme &-aminolevulinic acid dehydratase (&-ALAD). (The health significance of &-ALAD inhibition at low PbB levels is unclear.) Lead can also lead to the accumulation of porphyrin in erythrocytes with elevated levels of erythrocyte protoporphyrin associated with PbB levels of 25 to 30 μg/100 ml in adults and 15 μg/100 ml in children (USEPA, 1985). Anemia is characteristic of more severe cases of lead poisoning, resulting from erythrocyte destruction and reduced hemoglobin syntheses (USEPA, 1977).

Renal toxicity has also been observed in victims of lead intoxication. Reversible proximal tubule damage has been observed primarily in cases of short-term exposure with reduced glomerular function associated with more chronic

exposures (USEPA, 1980). There is also evidence that lead affects other systems of the body. The GI system is one of the earliest to show symptoms of lead intoxication; colic (i.e., acute abdominal pain) is considered a consistent early symptom of lead poisoning. Colic is most often seen in cases of occupational lead exposure and has been reported in workers with PbB levels as low as 30 μg/100 ml (USEPA, 1983).

Recently, environmental epidemiological studies have produced results suggestive of possible lead-induced reproductive effects. The authors of one study of women living within a 30- to 50-mile radius of a lead mining area of Missouri reported an increased incidence of premature fetal membrane rupture in term and preterm infants (17 percent), as compared to the rate reported for women living in an urban area of Missouri (0.44 percent). It was also reported that average maternal and fetal PbB levels in cases of membrane rupture were significantly higher than the average levels found for normal deliveries (USEPA, 1980).

C.5.2.1 Acute Animal Toxicity The early signs of acute lead intoxication are fatigue and sleep disturbances followed by colic, anemia, and neuritis. When lead is attached to moieties such as arsenate and chromate, which have contributory toxicities, the acute toxicity for laboratory animals increases. When lead is combined with organic acids, as in oleate and naphthenate, acute toxicity is lowered (Clayton and Clayton, 1981).

C.5.2.2 Chronic Animal Toxicity Kopp et al. (1980) reported that administration of lead acetate (5 mg Pb/ℓ water) to female Long-Evans rats for 20 months produced slight effects on conduction tissue excitability, systolic blood pressure and cardiac ATP concentrations. This represents the lowest concentration at which chronic exposure to lead in drinking water or diet has been demonstrated to cause adverse effects.

C.5.2.3 Carcinogenic Effects Rats appear to be the most sensitive species for lead-induced carcinogenic effects. Mice appear to be less sensitive and hamsters appear to be insensitive. Azar et al. (1973) exposed rats to 0 to 2000 ppm lead acetate in the diet for 2 years and found a statistically significant increase in kidney tumors at levels of 500 to 2000 ppm. No kidney tumors were found at dietary levels of 100 ppm or lower. Renal carcinoma was found in 7 of 25 mice exposed to 0.1 percent lead subacetate in the diet. Substantial death was reported at the 1.0 percent level. Hamsters exposed to 0.5 or 1.0 percent in the diet experienced no significant increase in renal neoplasms (Van Esch and Kroes, 1969).

C.5.2.4 Mutagenic Effects Mutagenicity tests of lead acetate, lead nitrate and lead chloride in microbial systems have consistently given negative results. Conflicting results were obtained for <u>in vitro</u> and <u>in vivo</u> mammalian test systems (ATSDR, 1988).

A number of studies that involved cytogenetic investigations of the cells of lead-exposed workers have reported an increased incidence of chromosomal aberration. The results are conflicting, however, as a number of similar studies reported negative results (IARC, 1982).

C.5.2.5 Reproductive and Teratogenic Effects Numerous oral teratogenicity studies in rats and mice have provided no evidence that oral exposure to lead causes malformations (ATSDR, 1988). Testicular damage was seen in male rats treated orally with lead acetate at 100 ug per day (0.29 mg/kg/day Pb) for 30 days (Hilderbrand et al., 1973). Grant et al. (1980) reported delayed vaginal opening in rats that were exposed to 25, 50 or 100 ppm lead (as lead acetate) in drinking water indirectly through their dams during gestation and lactation and then directly. This effect was not seen at 25 ppm.

C.5.2.6 Standards and Guidelines for the Protection of Human Health USEPA has classified lead as a B2 carcinogen. Under the National Primary Drinking Water Regulations, the MCL for lead is 50 $\mu g/\ell$. The proposed MCL is 20 $\mu g/\ell$. The proposed MCLG is zero. OSHA has a PEL of 50 $\mu g/m^3$ averaged over an 8-hour period. The ACGIH has established a TLV of 0.15 mg/m^3 and a STEL of 0.45 mg/m^3 for "inorganic compounds, dust and fume, as Pb." No cancer slope factor has been developed for lead.

In the presence of adequate and appropriate population characterization data and exposure data, site-specific quantitative risks assessment for lead is developed rising a biokinetic uptake model for predicting blood lead levels. In the absence of adequate data USEPA has set interim draft guidance for actio levels for lead in soils at 500 ppm for residential saturations and up to 1,000 ppm for industrial areas USEPA, 1989.

C.5.3 Ecological Effects

C.5.3.1 Bioconcentration Bioconcentration factors for four invertebrate species and two fish species range from 42 to 1,700 (EPA, 1986).

C.5.3.2 Aquatic Toxicity The toxicity of lead to freshwater aquatic organisms decreases with increasing water hardness. At a hardness of 50 mg/ℓ as CaCO3 acute toxicity values (LC_{50}s) for 10 species range from 143 $\mu g/\ell$ for an amphipod to 235,900 $\mu g/\ell$ for a midge (EPA, 1986). Chronic toxicity values for a cladoceran exposed to lead are 12 and 128 $\mu g/\ell$ in soft and hard water, respectively (EPA, 1986).

C.5.3.3 Standards and Guidelines for the Protection of Aquatic Life The AWQC for lead are hardness dependant. At hardnesses of 50, 100 and 200 mg/ℓ as CaCO3, respectively, the acute AWQC values for the protection of aquatic life are 34, 82 and 200 $\mu g/\ell$. The respective chronic values are 1.3, 3.2 and 7.7 $\mu g/\ell$ (EPA 1986).

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C.6 MERCURY.

C.6.1 Introduction Mercury ore is found in limestone, calcareous shales, sandstone, and serpentine. Mercury is most commonly used in electrical apparatus and as a catalyst in polyurethane foams. Organomercuric compounds are used as fungicides. Mercury forms organic compounds that are toxicologically and environmentally significant, particularly methyl mercury, and to a lesser extent, phenyl mercury (USEPA, 1984a).

The mobility of mercury in the soil is minimal. Mercury is strongly bound to soil and therefore the possibility of groundwater contamination through soil leaching appears unlikely. The major removal mechanism from a natural water system is absorption onto the surfaces of particulates and settling to the bed sediment (Callahan et al., 1979). Mercury is present in trace amounts in the atmosphere as elemental mercury vapor from electrical and chlor-alkali industries and the burning of fossil fuels (USEPA, 1984a). The residence time of this form of mercury in the atmosphere is on the order of months, possibly years.

C.6.2 Human Toxic Effects Mercury enters the body primarily through respiratory and oral exposures. Approximately 80 percent of inhaled elemental mercury is retained and transported to the tissues of the body. Most dietary inorganic mercurials dissociate to divalent mercury in the gastrointestinal tract which results in poor absorption while absorption rates of greater than 90 percent have been observed for lipophilic mercurials such as methyl mercury which is the most important form in terms of toxicity (USEPA, 1984a).

Although mercury becomes widely distributed in the body, it tends to concentrate in specific areas. Both inorganic and organic mercury usually concentrate primarily in the kidneys (Magos, 1973) with the liver, blood, spleen, and thyroid containing appreciable amounts (Nordberg and Skerfving, 1972).

Acute ingestion of high levels of mercuric mercury causes severe abdominal cramps due to corrosive ulceration, bleeding, and necrosis of the gastrointestinal tract, accompanied by shock and circulatory collapse. If death does not occur, renal failure occurs due to necroses of the renal tubules leading to anuria and uremia. Not all renal damage is irreversible.

Occupational studies have demonstrated that chronic exposure to metallic mercury vapor primarily affects the central nervous system and the kidneys. Nonspecific effects associated with the lowest exposure levels (<100 ug mercury/m^3) include insomnia, anxiety, and biochemical alterations. Exposure to higher levels can result in memory loss, personality changes, and body tremors, and damage to lung tissue has been reported for exposures >1 mg mercury/m^3. Workers chronically exposed to inorganic mercury compounds have reduced nerve conduction velocities (Singer et al., 1987).

The diet is by far the dominant, if not sole, source of human exposure to methyl mercury. Methyl mercury compounds are known to be toxic via oral exposures, and prenatal and newborn infants are particularly susceptible. Subchronic methyl mercury poisoning has occurred in humans consuming contaminated fish from Minamata Bay in Japan. The median level of total mercury in fish caught in

Minamata Bay during this period was estimated to be about 11 mg/kg fresh weight (Klaasen et al., 1986). Methyl mercury poisoning also occurred from ingesting bread produced from seed grain dressed with methyl mercury fungicide. Nerve damage causing "pins and needles" sensations in the hands and feet occurred at an estimated body burden of 25 mg of methyl mercury (Bakir et al., 1973).

C.6.2.1 Acute Animal Toxicity Exposure of rabbits to mercury vapor for four hours at an average concentration of 28.8 mg/m^3 produced severe damage to kidneys, liver, brain, heart and lungs (USEPA, 1984b).

C.6.2.2 Chronic Animal Toxicity Rats exposed for up to 12 weeks to mercuric chloride by subcutaneous injection displayed kidney damage and proteinuria (Druet et al., 1978). Fitzhugh et al. (1950) administered dietary mercury acetate to rats for up to two years. Kidney changes were noted at the two highest dose levels (2.0 and 8.0 mg/kg).

C.6.2.3 Carcinogenic Effects No confirmed, positive reports of mercury carcinogenicity in man have appeared to date, and animal experiments have generally yielded negative results (Leonard et al., 1983; USEPA, 1984a). Mitsumori et al. (1981) and, from the same laboratory, Hirano et al. (1986) reported that methyl mercury chloride in the diet at 0.9 mg/kg/day or more for up to 98 weeks caused renal tumors in ICR male mice but not in female mice nor in Sprague-Dawley rats (Mitsumori et al, 1984). These studies lack confirmation from another laboratory.

C.6.2.4 Mutagenic Effects Methyl mercury and mercury chloride are associated with increased mutations as measured by sister chromatid exchange in vitro. This effect was antagonized by sodium selenite (Morimoto et al., 1986). A recent study of eskimos has indicated a correlation between mercury in the blood and mutagenic effects as measured by sister chromatid exchange (Wulf et al., 1986). Cantoni and Costa (1983) have presented data suggesting that the genotoxic effects of mercury are related to inhibition of DNA repair rather than direct interaction with the DNA.

C.6.2.5 Reproductive and Teratogenic Effects Baranski and Szymczyk (1973) exposed female rats for 21 days to 2.5 mg elemental $mercury/m^3$. They noted changes in the estrus cycle and CNS symptoms. Prenatally exposed rats displayed high mortality, but no teratogenic effects were observed. Increased abortions have been observed in monkeys given 0.5 mg methyl mercury chloride/kg body weight orally during pregnancy (Dougherty et al., 1974).

C.6.2.6 Standards and Guidelines for the Protection of Human Health USEPA classifies inorganic mercury as a Group D compound. Methyl mercury has not been evaluated for its carcinogenic potential. The American Conference for Governmental and Industrial Hygienists has a time-weighted-average threshold limit value for mercury vapor and inorganic mercury of 50 and 100 $\mu g/m^3$, respectively. Under the National Primary Drinking Water Regulations, the MCL for mercury is 2 $\mu g/\ell$. The proposed MCLG is 2 $\mu g/\ell$. An RfD for methyl mercury has been set at 3×10^{-4} mg/kg/dry, IRIS, 1991.

C.6.3 Ecological Effects

C.6.3.1 Bioavailability Mercury accumulated in freshwater fish flesh is predominantly in the form of methylmercury compounds (Goldwater and Clarkson, 1972). Bioconcentration factors (BCFs) determined under laboratory conditions for freshwater fish and invertebrates for methylmercury range from 10,000 to 85,7000 (USEPA, 1985).

C.6.3.2 Aquatic Toxicity Available information for various organomercury compounds and mercurous nitrate indicates that these compounds are 4 to 31 times more accurately toxic to aquatic organisms than inorganic mercury (USEPA, 1985). Acute toxicity information is available for 28 freshwater invertebrate and fish genera with the cladoceran *Daphnia magna* and rainbow trout being the most sensitive organisms tested (USEPA, 1985). Methylmercury is the most chronically toxic of the tested mercury compounds. Chronic toxicity testing of methylmercury with *Daphnia magna* and brook trout resulted in values less than 0.07 $\mu g/\ell$ while testing with mercury (II) with *D. magna* resulted in values of about 1.1 $\mu g/\ell$ (USEPA, 1985).

Sublethal effects of mercury on aquatic organisms include adverse effects on reproduction, growth, behavior, metabolism, blood chemistry, osmoregulation and oxygen exchange of freshwater fish (Eisler, 1987).

Accumulated tissue levels of 5-7 mg Hg/kg as methylmercury were associated with death in the brook trout (*Salvelinus fontinalis*) (McKim et al., 1976) while 20 to 30 mg/kg as methylmercury were associated with reduced appetite, loss of equilibrium and hyperplasia of gill epithelium in the rainbow trout (*Salmo gairdneri*) (Nimi and Lowe-Jinde, 1984).

Aquatic plants are not as sensitive as aquatic invertebrates or fish to mercury. The blue alga *Microcystiis aeruginosa* was the most sensitive of the algae tested with an 8-day incipient inhibition level of 5 $\mu g/\ell$ of mercury (II). Other toxicity values for algae exposed to mercury (II) range from 53 to 3,400 $\mu g/\ell$ (EPA, 1985). Methylmercury is more toxic to algae than mercury (II) with toxicity values ranging from 0.8 to 6.0 $\mu g/\ell$ (EPA, 1985).

C.6.3.3 Standards and Guidelines for the Protection of Aquatic Life Application of the procedures described in the "Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses" (USEPA, 1986) indicate that, except possibly where a locally important species is very sensitive, freshwater aquatic organisms and their uses should not be affected unacceptably if the four-day average concentration of mercury does not exceed 0.012 $\mu g/\ell$ more than once every three years on the average and if the one-hour average conentration does not exceed 2.4 $\mu g/\ell$ more than once every three years on average (USEPA, 1985).

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C.7 METHYLENE CHLORIDE.

C.7.1 Introduction Methylene chloride (also known as dichloromethane) is widely used in a variety of industrial and commercial applications including metal degreasing, paint stripping, and solvent extraction in the food processing industry. It replaced trichloroethylene as the caffeine extractant in the production of decaffeinated coffee. It is also used to extract spice oleoresins and the beer flavoring in hops. It has additional uses as an aerosol propellent, an insecticidal fumigant and as a solvent in the manufacture of photographic film and synthetic fiber (ADL, 1985).

C.7.2 Human Toxic Effects Exposure to methylene chloride can be fatal in humans following inhalation and ingestion. One case of accidental death resulted from acute methylene chloride exposure during paint stripping operations (Bonventre et al., 1977). A primary adverse health effect associated with short-term exposure to methylene chloride is impairment of CNS functions. Inhalation of methylene chloride for up to 5 hours decreased visual and auditory functions and various psychomotor functions (Fodor and Winneke, 1971; Winneke, 1974). Longer-term exposure also produced CNS effects. Neurotoxicity was the most prominent symptom complex reported in over 100 cases involving occupational exposure to methylene chloride.

C.7.2.1 **Acute Animal Toxicity** Short-term inhalation studies showed that methylene chloride produced central nervous system effects. Acute studies showed that methylene chloride altered liver structure and cytochrome activity.

C.7.2.2 **Chronic Animal Toxicity** Long-term exposure to methylene chloride caused liver toxicity. Continuous inhalation exposure to methylene chloride (100 ppm) for 10 weeks resulted in centrilobular fat accumulation in mice. The increase in fat was accompanied by a decrease in glycogen that persisted after termination of the study (Weinstein and Diamond, 1972).

Methylene chloride produces cardiotoxic effects; however, these effects are most likely mediated by CO via CO-Hb. Data from experimental exposure studies indicate that blood CO-Hb levels, following exposure to methylene chloride, are elevated in a manner that is dependent on the inhaled concentration of methylene chloride and the length of exposure (ATSDR, 1988).

C.7.2.3 **Carcinogenic Effects** Several studies were found in the literature that demonstrated the carcinogenic potential of methylene chloride. Lung and liver tumors were reported in mice of both sexes following exposure through inhalation for a lifetime (NTP, 1986). Inhalation studies involving rats and hamsters revealed sarcomas in the salivary gland region of male rats, but no malignant responses were reported in female rats and in hamsters of both sexes (Burek et al., 1984). The NCA (1983) evaluated the carcinogenicity of ingested methylene chloride in mice from drinking water for 2 years. The incidence of liver tumors was higher in treated males than in male control groups (but not in females); however, the increase was reported not to be dose-related or statistically significant when compared with concurrent control rates.

C.7.2.4 **Mutagenic Effects** Methylene chloride produced dose-related increases in chromosomal aberrations in human peripheral lymphocytes, in Chinese hamster ovary cells, and in mouse lymphoma cells (Thilagar and Kumaroo, 1983). No evidence of chromosome abnormalities were seen in bone marrow cells of rats exposed by inhalation to methylene chloride for 6 months (Burek et al., 1980). Methylene chloride was not mutagenic in three studies utilizing mammalian cell systems (Andrae and Wolff, 1983; Thilagar et al., 1984; Schumann et al., 1984).

C.7.2.5 **Reproductive and Teratogenic Effects** Only one study was found in the available literature that evaluated reproductive end points (Nitschke et al., 1985). The results of this study were negative.

C.7.2.6 **Standards and Guidelines for the Protection of Human Health** USEPA has classified methylene chloride as a B2 carcinogen. The most recent cancer slope factor derived for methylene chloride is 7.5×10^{-3} $(mg/kg/day)^{-1}$. A verified reference dose RfD also is available. The most current RfD is 0.06 mg/kg/day (IRIS, 1991). The OSHA PEL is 500 ppm with a ceiling level of 1000 ppm and a peak of 2000 ppm. The ACGIH TLV is 100 ppm.

C.7.3 Ecological Effects

C.7.3.1 **Bioconcentration** Bioconcentration factors are not available for methylene chloride.

C.7.3.2 **Aquatic Toxicity** Acute toxicity values (LC_{50}s) for freshwater fish exposed to methylene chloride include 193,000 $\mu g/\ell$ for the fathead minnow (Alexander et al., 1978) and 224,000 $\mu g/\ell$ for the bluegill (EPA, 1978). Cladocerans are equally sensitive with a 48 hr EC50 (Immobilization) of 224,000 $\mu g/\ell$ (EPA, 1978). Amphibian embryos exposed to methylene are more sensitive with a 4 day LC_{50} value of 17,780 $\mu g/\ell$ for the frog (*Rana catesbeiana*)(Birge et al., 1980).

C.7.3.3 **Standards and Guidelines for the Protection of Aquatic Life** AWQC for methylene chloride for the protection of aquatic life are not available as there is not enough toxicity data to derive the criteria.

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C.8 TOLUENE.

C.8.1 Introduction Toluene is an aromatic hydrocarbon that is flammable, practically insoluble in water, and fully miscible with many organic liquids. Toluene is produced primarily from petroleum sources. The major use of toluene is as a component of gasoline. It is also used in chemical extractions and chemical synthesis and as a solvent in paints, inks, adhesives, and cleaning agents.

The largest source of toluene release to the environment is production, transport and use of gasoline which contains about 5-7 percent toluene by weight. Toluene is degraded in the atmosphere is degraded by reaction with hydroxyl radicals, with a typical half life of 13 hours. Toluene in soil or water tends to volatilize to the air, and that which remains is subject to microbial degradation (ATSDR, 1988).

C.8.2 Human Toxic Effects Acute toluene exposure can cause subjective CNS symptoms (e.g., nausea, headache, and fatigue) as well as eye irritation, at levels equal to or exceeding 200 ppm.

Chronic exposure to toluene was also reported to cause CNS disturbances. In 100 workers exposed to toluene for one to three weeks, and who sought medical attention, 30 percent were exposed to 200 to 500 ppm and complained of headache, nausea, anorexia, lassitude, impairment of coordination, and loss of memory (Wilson, 1943). The workers exposed to 500 to 1,500 ppm complained of nausea, headache, dizziness, anorexia, extreme weakness, and pronounced impairment of coordination and reaction time. It was unclear whether toluene levels below 200 ppm caused adverse effects.

There is no conclusive evidence that toluene causes genotoxic or reproductive effects in humans.

C.8.2.1 Acute Animal Toxicity The acute oral LD_{50} for rats ranges from 6 to 7.5 g/kg. Inhalation LD_{50} values range from 500 to 700 ppm for mice and 4,000 ppm for rats (USEPA, 1983). The most noted effect of toluene in animals is CNS depression. Vapor levels at or below 1,000 ppm appear to have little effect on gross parameters, although more sensitive indicators (e.g., electroencephalogram [EEG] changes) were noted in rats.

C.8.2.2 Chronic Animal Toxicity In rats exposed to vapor levels of 100 or 300 ppm, 5 days per week, 6 hours per day for 2 years, no renal, hepatic, respiratory or cardiovascular effects were noted. In females, toluene significantly reduced hematocrit levels and increased mean corpuscular hemoglobin concentration (CIIT, 1980).

C.8.2.3 Carcinogenic Effects No treatment-related neoplastic lesions were noted in a 2-year study in F344 rats exposed to vapor levels of up to 300 ppm (CIIT, 1980). This study was limited by the fact that the maximum tolerated dose was not tested. The National Toxicology Program (NTP) is currently conducting an inhalation carcinogenicity bioassay in rats and mice.

C.8.2.4 Mutagenic Effects In vitro assays indicate that toluene is not mutagenic or genotoxic (ATSDR, 1988).

C.8.2.5 Reproductive and Teratogenic Effects Toluene has been shown to induce adverse developmental effects in laboratory animals. Acute inhalation exposures to 267 ppm caused skeletal anomalies, signs of retarded skeletal development and low fetal weights in mice, rats, and rabbits (Ungvary, 1985; Ungvary and Tatrai, 1985).

C.8.2.6 Standards and Guidelines for the Protection of Human Health USEPA has proposed a drinking water MCL and MCLG of 2.0 mg/ℓ and an SMCL of 0.04 mg/ℓ for toluene. OSHA has a time-weighted-average Permissible Exposure Limit (PEL) of 100 ppm and a Short-term Exposure Limit (STEL) of 150 ppm. ACGIH has a Threshold Limit Value (TLV) of 100 ppm and a STEL of 150 ppm. The verified reference dose (RfD) for toluene is 0.3 mg/kg/day (IRIS, 1991).

C.8.3 Ecological Effects

C.8.3.1 Bioavailability A bioconcentration factor of 380 for toluene by the alga genera Chlorella is reported by Geyer et al., (1984).

C.8.3.2 Aquatic Toxicity The lowest reported acute toxicity level (LC_{50}) for freshwater fish in available literature is 12,700 μg/ℓ for the bluegill. The results of toxicity testing of toluene with freshwater invertebrates is limited to the cladoceran Daphnia magna with the lowest 48 hour EC50 concentration reported at 11,513 μg/ℓ (Abernathy et al., 1986).

C.8.3.3 Standards and Guidelines for the Protection of Aquatic Life AWQC for toluene for the protection of aquatic life are not available as there is not enough toxicity data to derive the criteria.

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C.9.3.3 Standards and Guidelines for the Protection of Aquatic Life AWQC for xylenes for the protection of aquatic life are not available as there is not enough toxicity data to derive the criteria.

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