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July 1995

EPA Superfund Record of Decision:

Homestead Air Reserve Base
OU4, Site SS-8, FL
6/22/95

FINAL

RECORD OF DECISION

FOR

OPERABLE UNIT 4
SITE SS-8, MOTOR POOL OIL LEAK AREA

HOMESTEAD AIR RESERVE BASE, FLORIDA

January 1995

Prepared for:

U. S. Army Corps of Engineers
Missouri River Division
Omaha District
Omaha, Nebraska

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RECORD OF DECISION

Operable Unit 4
Site SS-8, Motor Pool Oil Leak Area
Homestead Air Reserve Base
Homestead, Florida
FDEP Facility No. 138521996

January 1995

Montgomery Watson appreciates the opportunity to work for the U.S. Army Corps of Engineers, at the Homestead Air Reserve Base facility in Homestead, Florida. If you have any questions or comments concerning this report, please contact one of the individuals listed below.

Respectfully submitted,

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Homestead Air Reserve Base, Florida
Operable Unit 4
Site SS-8, Motor Pool Oil Leak Area

Declaration for the Record of Decision

DECLARATION STATEMENT

FOR THE

RECORD OF DECISION FOR OPERABLE UNIT NO. 4

HOMESTEAD AIR FORCE BASE SUPERFUND SITE

SITE NAME AND LOCATION

Homestead Air Reserve Base
Homestead, Dade County, Florida
Operable Unit No. 4 - Site SS-8
Motor Pool Oil Leak Area (former Site SP-2)

STATEMENT OF BASIS AND PURPOSE

The decision document presents the selected remedial action for the Motor Pool Oil Leak Area (Site SS-8) Operable Unit No. 4, at Homestead Air Reserve Base, in Homestead, Florida. The selected remedial action is chosen in accordance with CERCLA, as amended by SARA, and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision document explains the basis for selecting the remedial alternative for this Site. The information that forms the basis for this remedial action is contained in the administrative record for this site.

The selected alternative for Site SS-8 is institutional controls and groundwater monitoring. The State of Florida, the U.S. Environmental Protection Agency (USEPA), and the U.S. Air Force (USAF) concur with the selected remedy presented in this Record of Decision (ROD).

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response actions selected in this ROD may present a current or potential threat to public health, welfare, or the environment.

DESCRIPTION OF THE SELECTED REMEDY

The response action selected in the document addresses, through institutional controls, the health and environmental threats at this site, exposure to soil contamination. It also requires groundwater monitoring.

The major components of the selected remedy include:

- Implementation of deed restrictions covenants to limit usage of Site SS-8 to the Base worker and to limit construction activities to only those where workers are appropriately protected and erosion and silt control implemented.

- Site fencing and signage indicating use of the site.

- Groundwater monitoring program to assess potential release of contaminants from the identified source.

- Five year review to determine whether the site remains protective of human health and the environment.

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to remedial action, and is cost effective. This remedy utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable for this site. However, because treatment of the principal threats at the site were not found to be practicable, this remedy does not satisfy the statuary preference for treatment as a principal element of the remedy. The nature of the risk to human health is minimal. Manganese is the only chemical of concern to current and future Base workers and polynuclear aromatic hydrocarbons (PAHs) are the only chemicals of concern for future child residents. Under the current conditions, the only significant exposure is to surface soils which is minimal due to the presence of the asphalt cover over much of the site. With institutional controls these risks do not present a threat to human health or the environmental, therefore, the most cost effective remedial action is being implemented based on evaluation of this risk and potential site usage.

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining on-site above health-based levels, a review will be concluded within five (5) years after commencement of remedial action to ensure that the remedy continues to

provide adequate protection of human health and the environment. The review will be performed every five (5) years thereafter.

UNITED STATES AIR FORCE
HOMESTEAD AIR FORCE BASE

By: _____ Date: June 27, 1995

ALAN K. OLSEN
Director
Air Force Base Conversion Agency

Homestead Air Reserve Base, Florida
Operable Unit 4
Site SS-8, Motor Pool Oil Leak Area

Decision Summary for the Record of Decision

TABLE OF CONTENTS

Page

1.0 SITE NAME, LOCATION, AND DESCRIPTION 1

1.1 Operable Unit No. 4 Description 2
1.2 Regional Land Use 3
1.3 Regional Surface Hydrology 3
1.3.1 Regional Hydrogeologic Setting 4
1.4 Regional Site Geology And Hydrogeology 5

2.0 HISTORY AND ENFORCEMENT ACTIVITIES 6

2.1 Site SS-8 History 6
2.1.2 Past Site Usage 6
2.2 Base Enforcement History 7
2.2.1 CERCLA Regulatory History 7
2.3 Investigation History 8
2.3.1 IRP Phase I - Record Search 8
2.3.2 IRP Phase II - Confirmation/Quantification 9
2.3.3 IRP Phase III - Technology Base Development 10
2.3.4 IRP Phase IV - Additional Investigations 10
2.3.4.1. Phase IV-A Groundwater Investigation 11
2.3.4.2 Phase IV-A Sediment Investigation 11
2.3.4.3 Phase IV-A Surface Water Investigation 12
2.3.5 1991 Remedial Investigation of Site SS-8 12
2.3.6 1993 Remedial Investigation of Site SS-8 12
2.4 Community Participation History 13
2.5 Scope And Role Of Responsible Action 13
2.6 Summary Of Site Characteristics 14
2.6.1 Nature and Extent Contamination 14
2.6.2 Groundwater Investigations 14
2.6.2.1 Initial Investigations (1988) 14
2.6.2.2 1991 Investigation 15
2.6.2.3 1993 Investigation 16
2.6.3 Soil Sample Analytical Results 16

TABLE OF CONTENTS (continued)

Page

2.6.3.1 Initial Investigations (1988) 16
2.6.3.2 1993 Investigation 17
2.6.4 Sediment Sample Analytical Results 18
2.6.4.1 Initial Investigations (1986-1991) 18
2.6.4.2 1993 Investigation 18
2.6.5 Surface Water Sample Analytical Results 19
2.6.5.1 Initial Investigations (1991) 19
2.6.5.2 1993 Investigation 19
2.7 Summary of Site Risks 19
2.7.1 Selection of Chemicals of Potential Concern 20
2.7.2 Exposure Assessment 21
2.7.2.1 Exposure Point Concentrations 21
2.7.2.2 Land Use 21
2.7.2.3 Exposure Scenarios 22
2.7.3 Toxicity Assessment 22
2.7.4 Risk Characterization 23
2.7.4.1 Carcinogenic Risk 23
2.7.4.2 Hazards Due to Non-Carcinogenic Chemicals 24
2.7.4.3 Total Risk 25
2.7.4.4 Risk from Lead Exposure 25
2.7.5 Chemicals of Concern and Remedial Goal Options 25
2.7.6. Ecological Risk Assessment 26
2.8 Uncertainties in the Risk Assessment 26
2.9 Description of the Alternative 27
2.9.1 Alternative Number 1 - No Action with Groundwater Monitoring 27
2.9.1.1 Description 27
2.9.2 Alternative Number 2 - Institutional Controls and Groundwater Monitoring 28
2.9.3 Alternative Number 3 - Soil Excavation and Disposal with Groundwater Monitoring 29
2.10 Summary Of Comparative Analysis Of Alternatives 29
2.10.1 Overall Protection of Human Health and Environment 30

TABLE OF CONTENTS (continued)

Page

2.10.2 Compliance with Federal/State Standard 30
2.10.3 Long-term Effectiveness and Permanence..... 30
2.10.4 Treatment to Reduce Toxicity, Mobility, or Volume..... 31
2.10.5 Short-Term Effectiveness 31
2.10.6 Implementability..... 31
2.10.7 Cost 31
2.11 Selected Remedy 32
2.12 Statutory Determinations 32
2.13 Documentation of Significant Changes 33

LIST OF FIGURES

Figure No.	Title	Follows Page
1-1	Location of Homestead Air Force Base	1
1-2	Base Location Map	2
1-3	Site SS-8, Study Area	2
2-1	1991 & 1993 Field Investigations Surface water, sediment, soil, and Groundwater Sampling Locations, Site SS-8, Motor Pool Leak Area	14

LIST OF TABLES

Table No.	Title	Follows Page
2-1	Groundwater Analytical Results, Geraghty & Miller Phase IV-A (1988) Investigation	11
2-2	Sediment Analytical Results, Geraghty & Miller Phase IV-A (1988) Investigation	11
2-3	Sediment Analytical Results, Geraghty & Miller Phase IV-A (1988) Investigation	11
2-4	Summary of Groundwater Analytical Results, Geraghty & Miller (1991)	15
2-5	Summary of Constituents Detected in Groundwater Samples, Montgomery Watson, 1993	16
2-6	Summary of Constituents Detected in Soil Samples, Montgomery Watson, 1993	17
2-7	Summary of Constituents Detected in Sediment Samples, Geraghty & Miller, 1991	18
2-8	Summary of Constituents Detected in Sediment Samples, Montgomery Watson, 1993	19
2-9	Summary of Surface Water Analytical Results, Geraghty & Miller, 1991	19
2-10	Summary of Constituents Detected in Surface Water Samples, Montgomery Watson, 1993	20
2-11	Compounds of Potential Concern in Environmental Media	20
2-12	Exposure Point Concentrations for Groundwater	21
2-13	Exposure Point Concentrations for Surface Water	21
2-14	Exposure Point Concentrations for Subsurface Soil	21
2-15	Equation and Sample Calculation for Hypothetical Future Potable Groundwater Exposure	22
2-16	Equation and Sample Calculation for Surface Soil Exposure	22
2-17	Equation and Sample Calculation for Hypothetical Future Construction Work for Soil Exposure	22
2-18	Adjusted Toxicity Values Used to Assess Dermal Exposure	22

LIST OF TABLES (continued)

Table No.	Title	Follows Page
2-19	Risk-Based Remedial Goal Options - Hypothetical Future Adult Resident (Soil)	26
2-20	Risk-Based Site Specific Remedial Goal Options and FDEP Soil Target Levels, Hypothetical Current Base Worker (Soil)	26
2-21	Risk-Based Site Specific Remedial Goal Options and FDEP Soil Target Levels, Hypothetical Future Adult Resident (Soil)	26
2-22	Risk-Based Site Specific Remedial Goal Options and FDEP Soil Target Levels, Hypothetical Future Child Resident (Soil)	26
2-23	Risk-Based Site Specific Remedial Goal Options and FDEP Soil Target Levels, Hypothetical Future Construction Worker (Surface Soil)	26
2-24	Risk-Based Site Specific Remedial Goal Options and FDEP Soil Target Levels, Hypothetical Future Construction Worker (Subsurface Soil)	26
2-25	Identification of Alternatives	29
2-26	Comparative Cost Analysis of Remedial Alternatives	29
2-27	Comparative Analysis of Remedial Alternatives	29

DECISION SUMMARY

FOR THE

RECORD OF DECISION

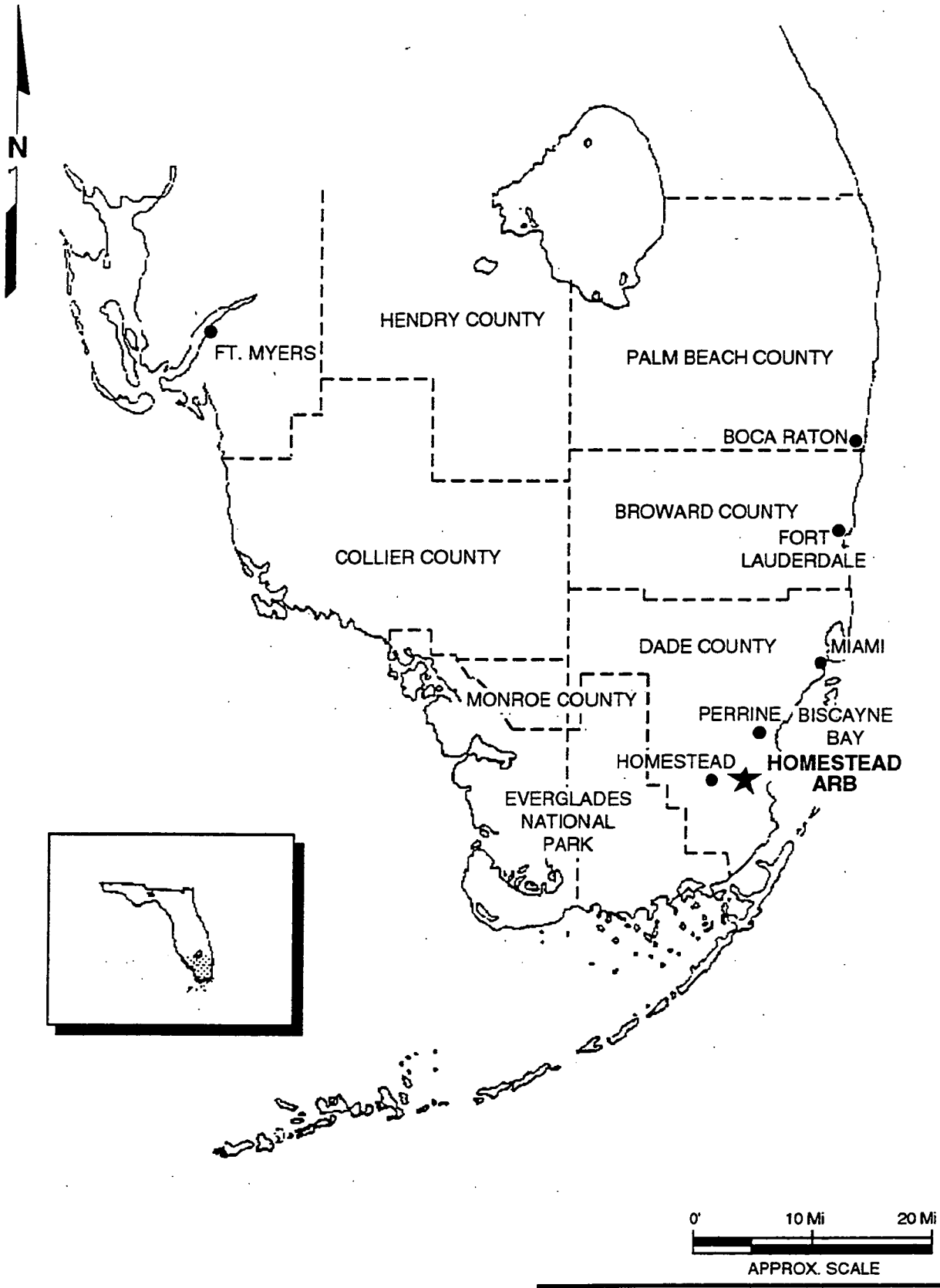
1.0 SITE NAME, LOCATION, AND HISTORICAL DESCRIPTION

Homestead Air Reserve Base (ARB) is located approximately 25 miles southwest of Miami and 7 miles east of Homestead in Dade County, Florida (Figure 1-1). The main Installation covers approximately 2,916 acres while the surrounding areas is semi-rural. The majority of the Base is surrounded by agricultural land. The land surface at Homestead ARB is relatively flat, with elevations ranging from approximately 5 to 10 feet (ft) above mean sea level (msl). The Base is surrounded by a canal that discharges to Outfall Canal and ultimately into Biscayne Bay approximately 2 miles east.

The Biscayne Aquifer underlies the Base and is the sole source aquifer for potable water in Dade County. Within 3 miles of Homestead ARB an estimated 1,600 people obtain drinking water from the Biscayne Aquifer while 18,000 acres of farmland are irrigated from aquifer wells (United States Environmental Protection Agency [USEPA], 1990). All recharge to the aquifer is through rainfall.

Homestead Army Air Field, a predecessor of Homestead ARB, was activated in September 1942, when the Caribbean Wing Headquarters took over the air field previously used by Pan American Air Ferries, Inc. The airline had developed the site a few years earlier and used it primarily for pilot training. Prior to that time, the site was undeveloped. Initially operated as a staging facility, the field mission was changed in 1943 to training transport pilots and crews.

In September 1945, a severe hurricane caused extensive damage to the air field. The Base property was then turned over to Dade County and was managed by the Dade County Port Authority for the next eight years. During this period, the runways were used by crop dusters and the buildings housed a few small industrial and commercial operations.



HOMESTEAD AIR RESERVE BASE
HOMESTEAD, FLORIDA

LOCATION OF HOMESTEAD AIR RESERVE BASE

FIGURE 1-1

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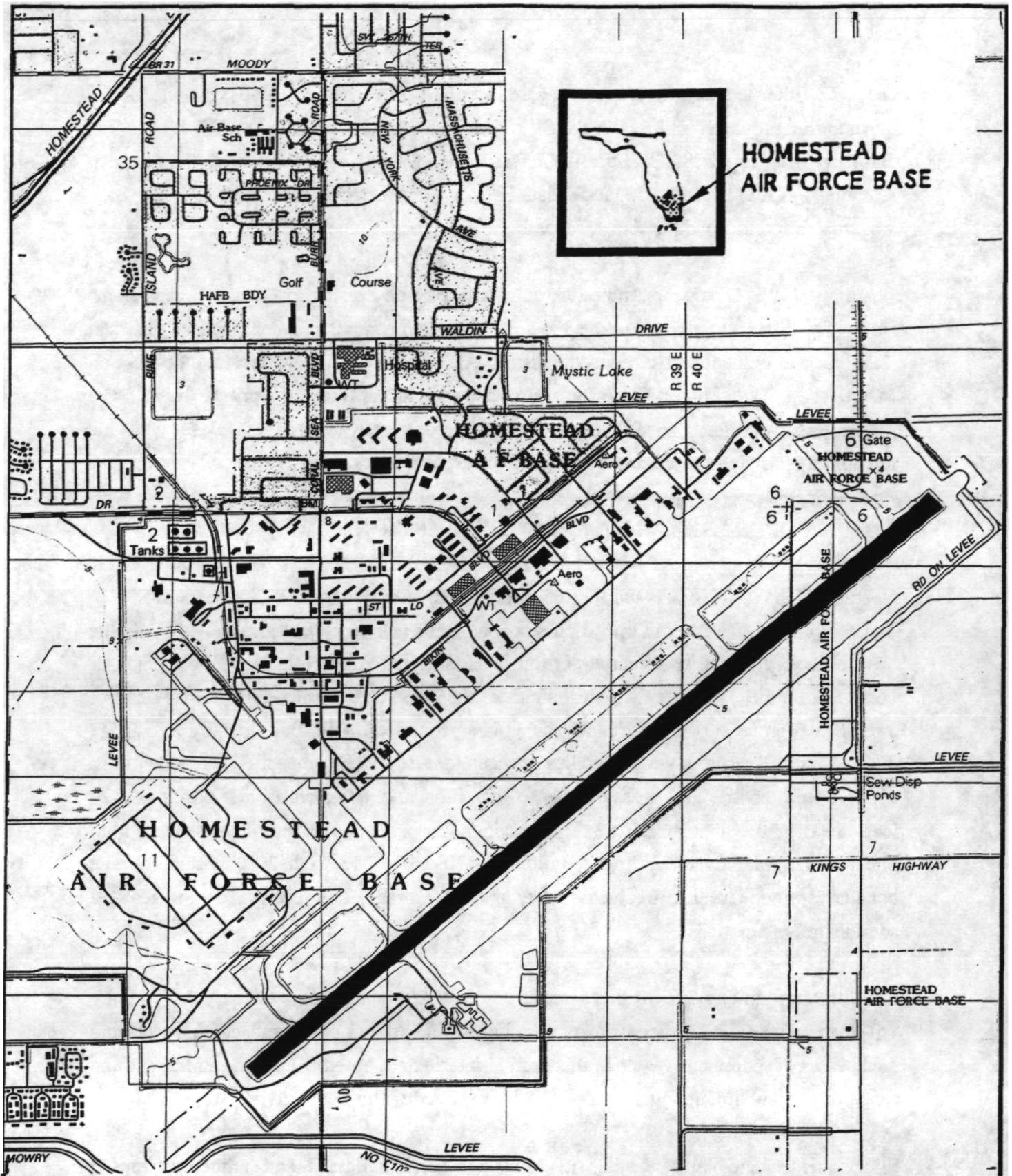

Source: USGS 7.5 minute Topographic Quadrangles Arsenicker, Homestead, Goulds, and Perrine.

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HOMESTEAD AIR RESERVE BASE
HOMESTEAD, FLORIDA

BASE LOCATION MAP

FIGURE 1-2

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In 1953, the federal government again acquired the airfield, together with some surrounding property, and rebuilt the Site as a Strategic Air Command (SAC) Base. The Base operated under SAC until July 1968, when it was changed to the Tactical Air Command (TAC) and the 4531st Tactical Fighter Wing became the new host. The Base was transferred to Headquarters Air Combat Command on June 1, 1992.

In August 1992, Hurricane Andrew struck south Florida causing extensive damage to the Base. The Base was placed on the 1993 Base Realignment and Closure (BRAC) list and slated for realignment with a reduced mission. Air Combat Command departed the Base on March 31, 1994, with Air Force Reservists activated at the Base on April 1, 1994. The 482nd Reserve Fighter Wing now occupies approximately 1/3 of the Base with the remaining 2/3 slated for use and oversight by Dade County.

1.1 OPERABLE UNIT NO. 4 DESCRIPTION

Operable Unit (OU) No. 4 is the Motor Pool Oil Leak Area, Site SS-8 (former Site SP-2). The Motor Pool has been in operation since the Base was reactivated in the 1950's. Site SS-8 is located in the west central portion of Homestead ARB (formerly Homestead Air Force Base [AFB]) (Figure 1-2), just south of the West Gate on Bougainville Boulevard. Site SS-8 (Figure 1-3) is an asphalt lot that is surrounded on all four sides by a drainage ditch system. The 3 foot wide ditch lies between the site and Elmendorf Street to the north and between the site and grassy fields to the south and west, an asphalt parking lot is located east of the site. Building 312, the main motor pool shop, is centrally located within Site SS-8. Additional buildings (Buildings 310, 307, 313, and 308) within the site boundary provide vehicle maintenance, equipment storage, tire repair and storage, and administrative functions.

The ditch surrounding Site SS-8 is a man-made feature which is approximately 3 ft wide by 3 ft deep. The ditch has been cut into the underlying Miami oölite and contains varying thicknesses of sediment. Water in the ditch is intermittent based solely on rainfall and the area along and within the ditch is moderately vegetated with weeds and grasses.

Prior to Hurricane Andrew, the site housed several buildings and numerous roofed concrete slabs used as loading bays and washracks. Due to damage experienced during the hurricane, the cover and frames of the washracks no longer exist. Site SS-8 is currently the active motor pool for Homestead ARB. The site is primarily used for cleaning,

servicing and repairing the Facility's utility vehicles. There are two monitoring wells on-site that were installed during the Phase II and Phase IV-A Installation Restoration Program (IRP) investigations.

The ground surface at Site SS-8 is almost entirely covered with asphalt. The asphalt paving ends 2 ft from the edge of the drainage ditch along the north and northwest perimeter of the site. A 75 foot wide patch of sparse grass lies between the asphalt paving and the ditch along the southwestern portion of the boundary behind Building 307. Along the east edge of the site the asphalt ends approximately 10 ft from the drainage ditch with a thin grassy area between the ditch and the asphalt. Building 308, at the northeast end of the site, is centrally located where the grassy area widens abruptly into a 150 foot by 200 foot square.

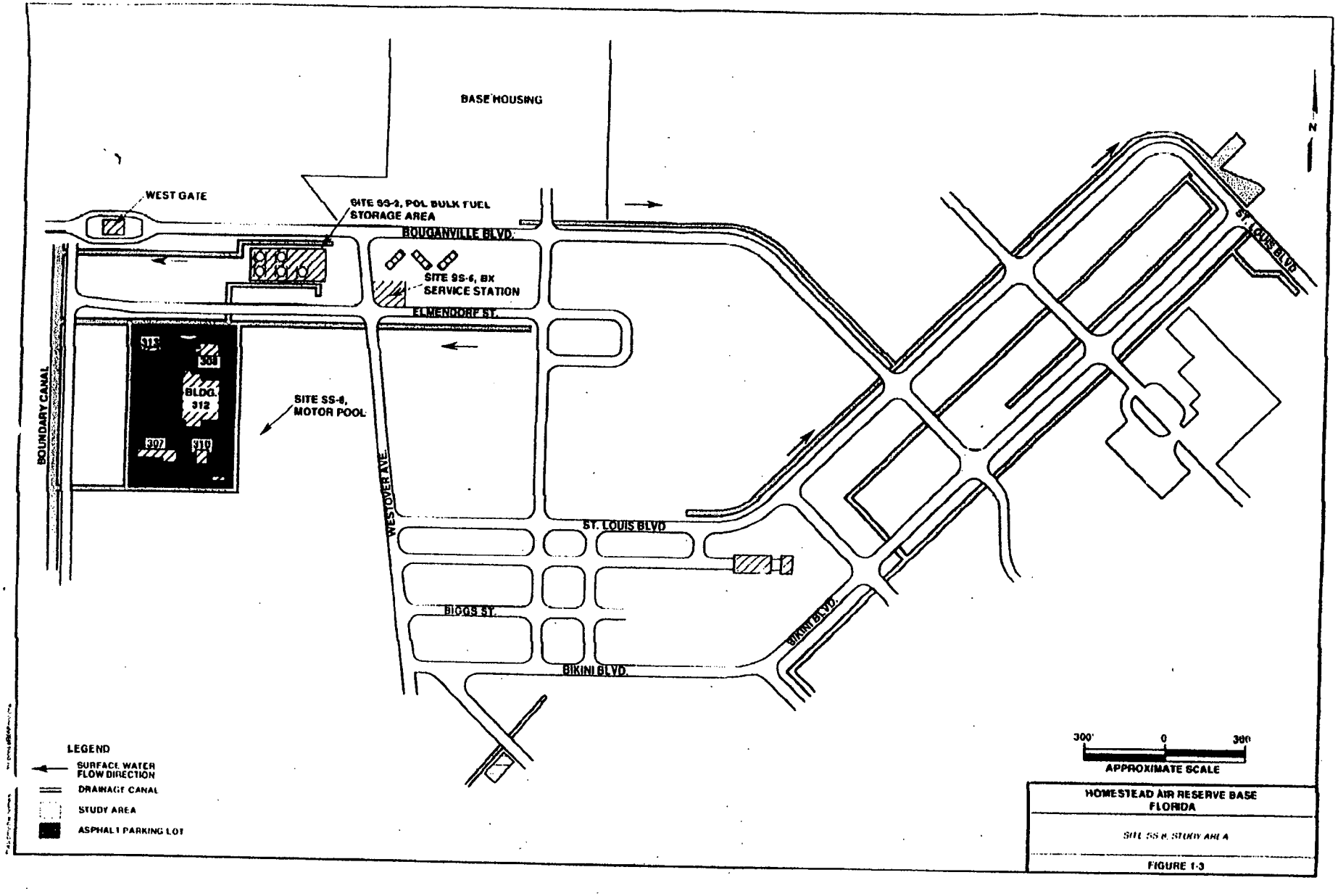
On a larger scale, Site SS-8 is located southwest of Site SS-2, the POL Bulk Fuel Storage Area (formerly Site SP-4). Directly north and south of Site SS-8 are vacant fields of sparse grasses overlying a weathered limestone surface. The Facility boundary, marked by the Boundary Canal, is adjacent to Site SS-8 to the west. The drainage canal surrounding Site SS-8 discharges into the Boundary Canal at two points west of Site SS-8.

1.2 REGIONAL LAND USE

The area adjacent to Homestead ARB including Site SS-8, to the west, east, and south within a half-mile radius is primarily composed of farmland and plant nurseries. Residential areas are located within a half-mile to the north and southwest of the Base. Woodlands are located approximately one-half-mile east of the facility and mangroves and marsh occur adjacent to Biscayne Bay. The Biscayne National Park is located two miles east of Homestead ARB; the Everglades National park is located 8 miles west- southwest of the Base; and the Atlantic Ocean is approximately eight miles east of the Base. Site SS-8/OU-4 lies within the portion of the Base retained by the Air Force Reserve and will likely continue operating as the facility Motor Pool. Development of the site for other than non-military purposes is not likely in the foreseeable future.

1.3 REGIONAL SURFACE HYDROLOGY

Surface hydrology at Homestead ARB, including Site SS-8 is controlled by five main factors: 1) relatively impermeable areas covered by runways, buildings and roads;



HOMESTEAD AIR RESERVE BASE
FLORIDA

SITE SS-8, STUDY AREA

FIGURE 1-3

2) generally high infiltration rates through the relatively thin layer of soil cover; 3) flat topography; 4) generally high infiltration rates through the outcrop locations of the Miami Oölite Formation; and 5) relatively high precipitation rate compared to evapotranspiration rate. Infiltration is considered to be rapid through surfaces of oölite outcrop and areas with a thin soil layer. Infiltration rates are accelerated by fractures within the oölite, as well as naturally occurring solution channels. Precipitation percolates through the relatively thin vadose zone to locally recharge the unconfined aquifer.

Natural drainage is limited because the water table occurs at or near land surface. The construction of numerous drainage canals on Homestead ARB has improved surface water drainage and lowered the water table in some areas. Rainfall runoff from within Homestead ARB boundaries is drained via diversion canals to the Boundary Canal.

A drainage divide occurs within the Homestead ARB facility property, running from the northern end of the facility, toward the center. Water in the Boundary Canal flows generally south and east along the western boundary of the property, and south along the eastern boundary, converging at a storm-water reservoir located at the southeastern corner of the Base. Flow out of the stormwater reservoir flows into Outfall Canal, which, in turn, flows east into Biscayne Bay, approximately two miles east of the Base. Water movement is typically not visible in the canals in dry weather due to the lowered water table and the very low surface gradient (0.3 ft per mile) that exists at the Base.

1.3.1 Regional Hydrogeologic Setting

The regional hydrogeology in the southeast Florida area consists of two distinct aquifers: the surficial aquifer system, which consists of the Biscayne Aquifer and the Grey Limestone Aquifer, and the lower aquifer, the Floridan Aquifer.

Biscayne Aquifer. The Biscayne Aquifer at Homestead ARB consists of the Miami Oölite, Fort Thompson Formation, and the uppermost part of the Tamiami Formation. In general, the most permeable parts of the aquifer lie within the Miami Oölite and the Fort Thompson Formation.

The Biscayne Aquifer underlies all of Dade, Broward, and southeastern Palm Beach Counties. The Biscayne Aquifer is the sole source of potable water in Dade County and is a federally-designated sole-source aquifer pursuant to Section 1425 of the Safe Drinking

Water Act (SDWA). The Biscayne Aquifer supplies drinking water to approximately 2.5 million people within local communities. All recharge to the aquifer is derived from local rainfall, part of which is lost to evaporation, transpiration, and runoff.

The Biscayne Aquifer has reported transmissivities ranging from approximately 4 to 8 million gallons per day per foot (mgd/ft) (Allman et al., 1979).

Water-table contours indicate that under natural conditions, groundwater flows southeasterly toward Biscayne Bay. The hydraulic gradient is approximately 0.3 ft/mile. The water table at Homestead ARB generally is encountered within 5 to 6 ft of land surface, but may occur at or near land surface during the wet season (May to October). Fluctuations of groundwater levels and local variations in the direction of groundwater flow are due to several factors: 1) differences in infiltration potential; 2) runoff from paved areas; 3) water-level drawdown near pumping wells; 4) significant but localized differences in lithology (e.g., silt-filled cavities); and 5) drainage effects of canals and water-level control structures.

Floridan Aquifer. Underlying the low-permeability sediments of the Tamiami Formation and Hawthorn Group are the formations which constitute the Floridan Aquifer.

The Floridan Aquifer is made up of limestones and dolomites. It is under artesian pressure and water levels in deep wells may rise 30 to 40 ft above ground surface. Groundwater within these Miocene and Eocene age formations tends to contain dissolved constituents at levels significantly above those recommended for drinking water. In view of the poor water quality and the depth of water yielding zones (800 to 900 ft below ground surface [bgs]), the Floridan Aquifer is of limited usefulness as a source of potable water supply in the study area.

1.4 REGIONAL SITE GEOLOGY AND HYDROGEOLOGY

The stratigraphy of the shallow aquifer system as determined from soil borings performed during site investigations by Geraghty & Miller (G&M) and Montgomery Watson, consists of a surficial weathered Miami Oölite ranging in depth from 2 to 6 ft bgs. The weathered limestone consists of a white to brown semi-consolidated oölitic limestone. This strata is underlain by consolidated to semi-consolidated oölitic and coral limestone interbedded with

coarse to fine sand and clayey sand layers and lenses down to the total depth of borings (approximately 40 ft bgs). Approximately 80% of Site SS-8 is covered with asphalt.

The Biscayne Aquifer is one of the most transmissive aquifers in the world. It underlies Homestead ARB. A thin vadose zone, nominally less than 5 ft deep, overlays the groundwater table at the site. As previously stated, the aquifer structure is a calcium carbonate matrix. This lithology is known to have natural concentrations of target analyte list (TAL) metals. In descending order by concentration, calcium, aluminum, iron magnesium, manganese, sodium, and potassium can be considered the primary metals of carbonate rock. The other TAL metals occur in trace concentrations, less than 50 milligrams per kilogram (mg/kg). The range and the standard deviations are not provided at this time. It should be expected that, as precipitation infiltrates and recharge takes place, leaching of metal ions from the weathered vadose zone and shallow unsaturated zone occurs. Regional data collected suggest that concentrations of trace metals can be expected to be the greatest in the shallow portion of the aquifer because of the proximity to the source (i.e., the weathering vadose structure) and the decreasing retention time with decreasing depth of the saturated zone. These observations support a hydrogeologic model in which the shallow portion of the aquifer has a greater horizontal transmissivity than the vertical component during recharge events. However, it is not possible from the available data at the site to quantitatively differentiate horizontal and vertical components of the aquifer's hydrologic conductivity. The possible presence of vertical solution zones is well documented in literature. The site-specific effects have not been fully investigated. Nevertheless, the available data does not lead to the immediate conclusion that this is a necessary task. The conceptual model that the shallow groundwater is discharging to ditches provided sufficient detail to arrive at the remedial decision for Site SS-8.

2.0 HISTORY AND ENFORCEMENT ACTIVITIES

2.1 SITE SS-8 HISTORY

2.1.2 Past Site Usage

The Motor Pool area has been in operation since the facility was reactivated in the 1950's. Waste oils from the Facility's motor pool were collected and stored in two 500 gallon above-ground tanks northeast of Building 307, prior to disposal. Leaks in the tanks have

occurred at various times since 1960, resulting in oil spills on the surrounding ground surface. In addition to waste oils, spills from used batteries that were stored at the site were also reported.

Partly because of the site's proximity to a Base well field, the initial evaluation of Site SS-8 information resulted in a moderately high score in relation to potential environmental impact.

2.2 BASE ENFORCEMENT HISTORY

2.2.1 CERCLA Regulatory History

The Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) established a national program for responding to releases of hazardous substances into the environment. In anticipation of CERCLA, the Department of Defense (DOD) developed the Installation Restoration Program (IRP) for response actions for potential releases of toxic or hazardous substances at DOD facilities. Like the USEPA Superfund Program, the IRP follows the procedures of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). Homestead ARB was already engaged in the IRP Program when it was placed on the National Priorities List (NPL) on August 30, 1990. Cleanup of DOD facilities is paid for by the Defense Environmental Restoration Account (DERA), which is DOD's version of Superfund.

The Superfund Amendment and Reauthorization Act (SARA), enacted in 1986, requires federal facilities to follow NCP guidelines. The NCP was amended in 1990 (see 40 CFR 300 et seq.) to implement CERCLA under SARA. In addition, SARA requires greater USEPA involvement and oversight of Federal Facility Cleanups. On March 1, 1991, a Federal Facility Agreement (FFA) was signed by Homestead ARB (formerly Homestead AFB), the USEPA, and the Florida Department of Environmental Protection (FDEP). The FFA guides the remedial design/ remedial action (RD/RA) process.

The purpose of the FFA was to establish a procedural framework and schedule for developing, implementing, and monitoring appropriate response actions at Homestead ARB in accordance with existing regulations. The FFA requires the submittal of several primary and secondary documents for each of the OUs at Homestead ARB. This

Record of Decision (ROD) concludes all of the Remedial Investigation/Feasibility Study (RI/FS) requirements for Site SS-8 and selects a remedy for OU-No. 4.

As part of the RI/FS process, Homestead ARB has been actively involved in the Installation Restoration Program (IRP) since 1983, and has identified 27 Potential Sources of Contamination (PSCs). Nine sites are in various stages of reporting under the RI/FS stage of CERCLA; ten sites are being investigated in the Preliminary Assessment/Site Investigation (PA/SI) stage of CERCLA with three of these sites warranting no further investigation; one site has been closed under the Resource Conservation and Recovery Act (RCRA) guidelines; and seven sites are being investigated under the FDEP petroleum contaminated sites criteria (Florida Administrative Code 17-770). Additionally, an RCRA Facility Investigations (RFI) is underway to evaluate numerous solid waste management units (SWMU) identified during a RCRA Facility Assessment (RFA). The following PSCs are currently being investigated according to the CERCLA RI/FS guidelines:

OU-1 - Fire Protection Training Area 2 (FT-5)
OU-2 - Residual Pesticide Disposal Area (OT-11)
OU-3 - PCB Spill C.E. Storage Compound (SS-13)
OU-4 - Oil Leakage Behind the Motor Pool (SS-8)
OU-5 - Electroplating Waste Disposal Area (WP-1)
OU-6 - Aircraft Washrack Area (SS-3)
OU-7 - Entomology Storage Area (SS-7)
OU-8 - Fire Protection Training Area 3 (FT-4)
OU-9 - Boundary Canal/Military Canal (SD-27)

OU-3, PCB Spill C.E. Storage Compounds, has been closed out with the No Further Action ROD in June 1994. All other CERCLA sites at Homestead ARB are currently in various phases of the RI/FS process.

2.3 INVESTIGATION HISTORY

2.3.1 IRP Phase I - Record Search

An IRP Phase I - Records Search was performed by Engineering Science, and is summarized in their report, dated August 1983 (Engineering Science, 1983). During the Phase I study, sites with the potential for environmental contamination resulting from past

waste disposal practices were identified. 13 sites of potential concern were identified by reviewing available installation records, interviewing past and present Homestead ARB employees, inventorying wastes generated and handling practices, conducting field inspections, and reviewing geologic and hydrogeologic data.

The 13 sites identified were ranked using the Hazard Assessment Rating Methodology (HARM) developed by JRB Associates of McLean, Virginia, for the USEPA. HARM was later modified for application to the Air Force IRP. The following factors are considered in HARM: 1) the possible receptors of the contaminants; 2) the characteristics of the waste; 3) potential pathways for contaminant migration; and 4) waste management practices. HARM scores for the sites ranked at Homestead ARB ranged from a high of 72 to a low of 7 out of 100. Eight of the 13 sites were determined to have a moderate to high contamination potential, one of which was the Motor Pool Oil Leak Area. These eight sites were recommended for further investigation. The remaining five sites were determined to have low potential to exhibit environmental contamination.

The IRP Phase I Report evaluated the Motor Pool Leak Area (Site SS-8) and assigned a moderate to high HARM score of 59, due to the moderate quantity of liquid wastes used and the high potential for contaminant migration in surface and groundwaters of the site. Site SS-8 scored high as a potential migration pathway because of the extremely permeable nature of the weathered bedrock that is exposed at the surface and the proximity of the drainage canal bordering the site.

2.3.2 IRP Phase II - Confirmation/Quantification

An IRP Phase II study was performed by Science Applications International Corporation (SAIC), and a report was submitted in March 1986 (SAIC, 1986). The objectives of the Phase II study were to confirm the presence or absence of contamination, to quantify the extent and degree of contamination, and to determine if remedial actions were necessary. The Motor Pool Oil Leak Area was included in the Phase II investigation.

One shallow monitoring well (I-17), approximately 19 ft deep, was installed immediately south of Building 307 within the Motor Pool boundary during Phase II investigations. The groundwater was analyzed for oil and grease and total lead. Oil and grease were not detected above the analytical procedure detection limit and the lead detected (7.74 micrograms per liter [µg/L]) was below federal and state drinking water standards

(50 µg/L in 1986). Two sediment samples (SD-3 and SD-4) were collected from the drainage ditch immediately east of the Motor Pool fenceline. Four soil samples were collected from the strip of ground between the fenceline and the drainage canal. All the soil and sediment samples had reported concentrations of oil and grease above Ambient Soil Quality Criteria (ASQC) (ten parts per million [ppm]). Two of the soil samples (SL-5 and SL-6) and both of the sediment samples had lead levels above the ASQC (0.37 ppm) but below the normal level in soils (NLS) (100 ppm).

The relative magnitude of these constituents migrating from the site via surface water (ditches) could not be assessed because the nearby drainage ditches were dry. A complete discussion of the methods and results of the study is found in the Phase II-Confirmation/Quantification Report (SAIC, 1986).

The Phase II report contained the following alternatives for additional investigation at this site: 1) install and sample a minimum of two additional monitoring wells southeast and east of the site; these new wells could be analyzed for the Stage 1 scan parameters, followed by a more complete analysis if contamination is confirmed; 2) collect a minimum of four surface water and four sediment samples to determine the possibility of surface water as a contamination pathway; surface water sampling was recommended because of the close relationship between groundwater and surface water in this region; and 3) make a more complete characterization of local groundwater quality around Well Field No. 2 due to its close proximity to the Motor Pool Area.

2.3.3 IRP Phase III - Technology Base Development

The IRP Phase III is a research phase and involves technology development for an assessment of environmental impacts. There have been no Phase III tasks conducted at the Base to date.

2.3.4 IRP Phase IV - Additional Investigations

An IRP Phase IV-A investigation was performed at Site SS-8 by G&M during two separate field programs, the first in 1988 and the second in 1989. The IRP Phase IV investigations consist of two areas of work activity. Phase IV-A involves additional site investigations necessary to meet the Phase II objectives, review of all management methods and technologies that could possibly remedy site problems, and preparation of a baseline risk

assessment (BRA) to address the potential hazards to human health and the environment associated with the constituents detected at the site. Detailed alternatives are developed and evaluated, and a preferred alternative is selected. The preferred alternative is then described in sufficient detail to serve as a baseline document for initiation of Phase IV-B.

2.3.4.1 Phase IV-A Groundwater Investigation. An additional monitoring well (HS-9) was installed at Site SS-8 during the 1988 Phase IV-A Investigation. Groundwater samples from the two monitoring wells, I-17 and HS-9, were collected and analyzed for volatile organic compounds (VOCs) (including xylenes), base/neutral extractable organic compounds (BNAs), total recoverable petroleum hydrocarbons (TRPH) and total RCRA metals plus sodium. All the metals detected in the groundwater were either below the analytical detection limit, or were below the federal drinking water maximum contaminant level (MCL). All the metals detected in the groundwater were either below the analytical detection limit or were below the federal drinking water maximum contaminant level (MCL). Di (2-ethylhexyl) phthalate (DEHP) was the only organic compound detected in the groundwater at a concentration of 66 and 7.9 micrograms per liter (µg/L).

DEHP, also known as bis (2-ethylhexyl) phthalate, is a known laboratory contaminant; however, this compound was not detected in any of the associated blanks (field or laboratory). TRPH was not detected above the analytical detection limit. A summary of the 1988 Groundwater analytical results are presented in Table 2-1. The Phase IV-A investigation indicated that groundwater had not been impacted by activities at Site SS-8.

2.3.4.2 Phase IV-A Sediment Investigation. In 1988, two sediment samples (SED01 and SED02) were collected from the drainage ditch east of the site and analyzed for VOCs, BNAs, and total RCRA metals. Several BNAs (mostly polynuclear aromatic hydrocarbons [PAHs]) were detected in the sediment; however, the number of sampling locations were insufficient to determine the extent of contamination around the site. Concentrations of BNAs reported in sediment sample SED01 were above health based levels when compared to the "site specific remedial goal options" and the FDEP "Soil Target Levels" for both current and future risk scenarios. A summary of the 1988 sediment analytical results is presented in Table 2-2.

In 1989, eight additional sediment samples were collected from the perimeter drainage ditch to delineate the horizontal extent of contamination within the ditch sediments. Constituents detected in the sediment at Site SS-8 include BNAs and several metals, including lead. The

TABLE 2-1

GROUNDWATER ANALYTICAL RESULTS
GERAGHTY & MILLLER PHASE IV-A (1988) INVESTIGATION
AT SITE SS-8, MOTOR POOL OIL LEAK AREA
Homestead Air Reserve Base, Florida

Constituents[1]	USEPA MCL [2]	Location HS-9	I-17
Volatile Organics (µg/l)		BDL[3]	BDL
Base/Neutral Extractable Organics (µg/l)			
di(2-Ethylhexyl) phthalate [4]	14 [5]	66	7.9
Total Metals (µg/l)			
Barium	1000	[7.3]	[2.2]
Chromium	50	[8.1]	12
Lead	50	BDL	[2.3]
Silver	50	10	BDL
Sodium	NS[6]	13,200	18,500
TRPH (mg/l) [7]	NS	BDL	BDL

Explanation:

[1] Constituents not detected in any samples are not shown.
[2] Maximum Contaminant Level in Drinking Water.
[3] Below Instrument Detection Limit.
[4] Di(2-Ethylhexyl) phthalate is also known as Bis(2-ethylhexy)phthalate.
[5] Proposed MCL, Federal Register, 7/25/90.
[6] No Standard
[7] Total Recoverable Petroleum Hydrocarbons.
[ ] Value is between level of quantitation and instrument detection limit.

Source: Geraghty & Miller, Inc., 1992

TABLE 2-2

SEDIMENT ANALYTICAL RESULTS
G&M PHASE IV-A (1988) INVESTIGATION
AT SITE SS-8, MOTOR POOL OIL LEAK AREA
Homestead Air Reserve Base, Florida

Constituents [a]	Location	
	SED01	SED02
Volatile Organics (µg/kg)	BDL[b]	BDL
Base/Neutral Extractable Organics (µg/kg)		
Acenaphthene	4,540	BDL
Anthracene	[3,810]	BDL
Benzo(a)anthracene	70,200	BDL
Benzo(a)pyrene	74,900	BDL
Benzo(b)fluoranthene	134,000	BDL
Benzo(k)fluoranthene	138,000	BDL
Chrysene	73,200	[843]
Di(2-ethylhexyl)phthalate	BDL	18,900
Fluoranthene	67,200	[1,150]
Fluorene	[1,910]	BDL
Indeno (1,2,3-cd)pyrene	7,700	BDL
N-nitrosodiphenylamine(1)	[1,860]	BDL
Naphthalene	[3,090]	BDL
Phenanthrene	15,500	[863]
Pyrene	61,100	[902]
Total Metals (µg/kg)		
Arsenic	BDL	36000
Barium	[8,900]	54000
Cadmium	BDL	[600]
Chromium	11,000	69000
Lead	30,000	2,650,000
Mercury	44	180

Source: Geraghty & Miller, Inc., 1992

[a] Constituents not detected in any samples are not shown.
[b] Below Instrument Detection Limit.
[ ] Value is between level of quantitation and instrument detection limit.

TABLE 2-3

SEDIMENT ANALYTICAL RESULTS
G&M - 1989 PHASE IV-A INVESTIGATION
AT SITE SS-8, MOTOR POOL OIL LEAK AREA
Homestead Air Reserve Base, Florida

Constituents / Sample Location [1]	SP2-SED1	SP2-SED2	SP2-SED3	SP2-SED4	SP2-SED5	SP2-SED6	SP2-SED7	SP2-SED8
Base/Neutral Extractable Organics (µg/kg)								
Benzo(a)anthracene	BDL[2]	BDL	5,930	2,060	BDL	BDL	BDL	BDL
Benzo(a)pyrene	BDL	BDL	7,070	2,530	BDL	BDL	BDL	BDL
Benzo(b)fluoranthene	BDL	BDL	8,320	3,250	BDL	BDL	BDL	BDL
Benzo(g,h,i)perylene	BDL	BDL	BDL	2,870	BDL	BDL	BDL	BDL
Benzo(k)fluoranthene	BDL	BDL	7,390	2,470	BDL	BDL	BDL	BDL
Butylbenzylphthalate	BDL	BDL	BDL	BDL	BDL	10,300	BDL	BDL
Chrysene	BDL	BDL	7,910	2,700	BDL	BDL	BDL	BDL
Di-n-butylphthalate	BDL	BDL	BDL	1,060	1,890	[4,820]	BDL	[3,500]
Dibenzo(a,h)anthracene	BDL	9,140	BDL	1,140	BDL	BDL	BDL	BDL
Di(2-ethylhexyl)phthalate	10,800	BDL	BDL	2,080	[844]	[3,760]	BDL	8,630
Fluoranthene	BDL	BDL	7,280	2,110	BDL	BDL	BDL	BDL
Indeno (1,2,3-cd)pyrene	BDL	BDL	6,260	2,450	BDL	BDL	BDL	BDL
Phenanthrene	BDL	BDL	BDL	[642]	BDL	BDL	BDL	BDL
Pyrene	BDL	BDL	6,610	2,000	BDL	BDL	BDL	BDL
Total Lead (µg/kg)	2,740,000	420,000	289,000	43,000	170,000	271,000	557,000	66,000
EP Tox Metals (µg/kg)								
Barium	NA[3]	NA	NA	[160]	NA	NA	NA	NA

Source: Geraghty & Miller, Inc., 1992

[1] Constituents not detected in any samples are not shown.
[2] Below Instrument Detection Limit.
[3] Not Analyzed.
[ ] Value is between level of quantitation and instrument detection limit.

highest concentrations were detected in the northeast corner of the drainage ditch which surrounds the site. In general, BNA concentrations were an order of magnitude below the concentrations in the 1988 sediment sample SED01; however, 1989 BNA sediment concentrations were above the health based levels for both current and future risks.

The contamination associated with the ditch sediments are presently being evaluated in the Boundary and Outfall Canal (OU-9), Remedial Investigation. Further investigation was necessary to delineate the areal extent of contamination. A summary of the analytical results from the 1989 sediment sampling event are provided in Table 2-3.

2.3.4.3 Phase IV-A Surface Water Investigation. In both the 1988 and 1989 investigations, surface water samples could not be collected because the drainage ditches were dry.

2.3.5 1991 Remedial Investigation of Site SS-8

In 1991, an RI was conducted at Site SS-8 by G&M. The 1991 investigation included the collection of 25 sediment samples, ten surface water samples, and two groundwater samples. Results of the 1991 RI are presented in G&M reported titled *Remedial Investigation Report for Site SS-8, Motor Pool Oil Leak Area (Former Site SP-2)*, May 1992.

2.3.6 1993 Remedial Investigation of Site SS-8

In 1993, Montgomery Watson Americas, Inc. performed an additional RI to evaluate the current soil and groundwater quality with respect to the USEPA target compound list (TCL)/TAL utilizing USEPA Contract Laboratory Program (CLP) protocols and to fill data gaps from the previous field investigations, as well as evaluate any impacts due to Hurricane Andrew. Five soil borings were drilled and advanced to the water table at Site SS-8 during the 1993 investigation. Two samples were collected from each borehole at the surficial (0-1 ft bls) interval and from directly above the water table. Two monitoring wells (I-17 and HS-9) were sampled. Additionally, 13 sediment samples and five surface water samples were collected from the area canals and drainage ditches.

2.4 COMMUNITY PARTICIPATION HISTORY

The RI/BRA report and the Proposed Plan (PP) for Homestead ARB, Site SS-8, were released to the public in June and September of 1994, respectively. These documents were made available to the public in both the administrative record and an information repository maintained at the Miami-Dade Community College Library.

A public comment period was held from September 8, 1994, to October 22, 1994, as part of the community relations plan for OU-4. Additionally, a public meeting was held on Thursday, September 29, 1994 at 7:00 pm at South Dade High School. A public notice was published in the Miami Herald on September 9, 1994. At this meeting, the United States Air Force (USAF), in coordination with USEPA Region IV, FDEP, and Dade County Environmental Resource Management (DERM), was prepared to discuss the RI results, the BRA, FS, and the Proposed Alternative of institutional controls with groundwater monitoring, as described in the PP. A response to the comments received during this period is included in the Responsiveness Summary, which is part of this ROD.

This ROD document presents the selected remedial action for OU-4 at Homestead ARB, chosen in accordance with CERCLA, as amended by SARA and, to the extent practicable, the NCP. The decision on the selected remedy for this site is based on the administrative record.

2.5 SCOPE AND ROLE OF RESPONSIBLE ACTION

Currently, many areas within the boundaries of Homestead ARB are under investigation as part of the designated NPL status of the Base. Each of the nine CERCLA investigation areas has been designated as an individual OU.

The U.S. Air Force with concurrence from the State of Florida and the USEPA, has elected to define OU-4 as the Motor Pool Oil Leak Area. The remedial actions planned at each of the Operable Units at Homestead ARB are, to the extent practicable, independent of one another.

This response action addresses soil contamination at OU-4. Soil contamination at OU-4 poses a threat to human health and the environment, based on soil exposure to the future construction worker through dermal contact or inhalation of dust associated with

construction activities. In the unlikely event that the site is developed for residential use, the conservative evaluation indicated that the child resident scenario also results in soil exposure presenting a risk. Site risk is minimal, as the calculated risk using extremely conservative models only slightly exceeds USEPA target ranges. This response action will be the final action at Site SS-8. Neither the groundwater nor surface water was found to pose a threat to human health or the environment at OU-4.

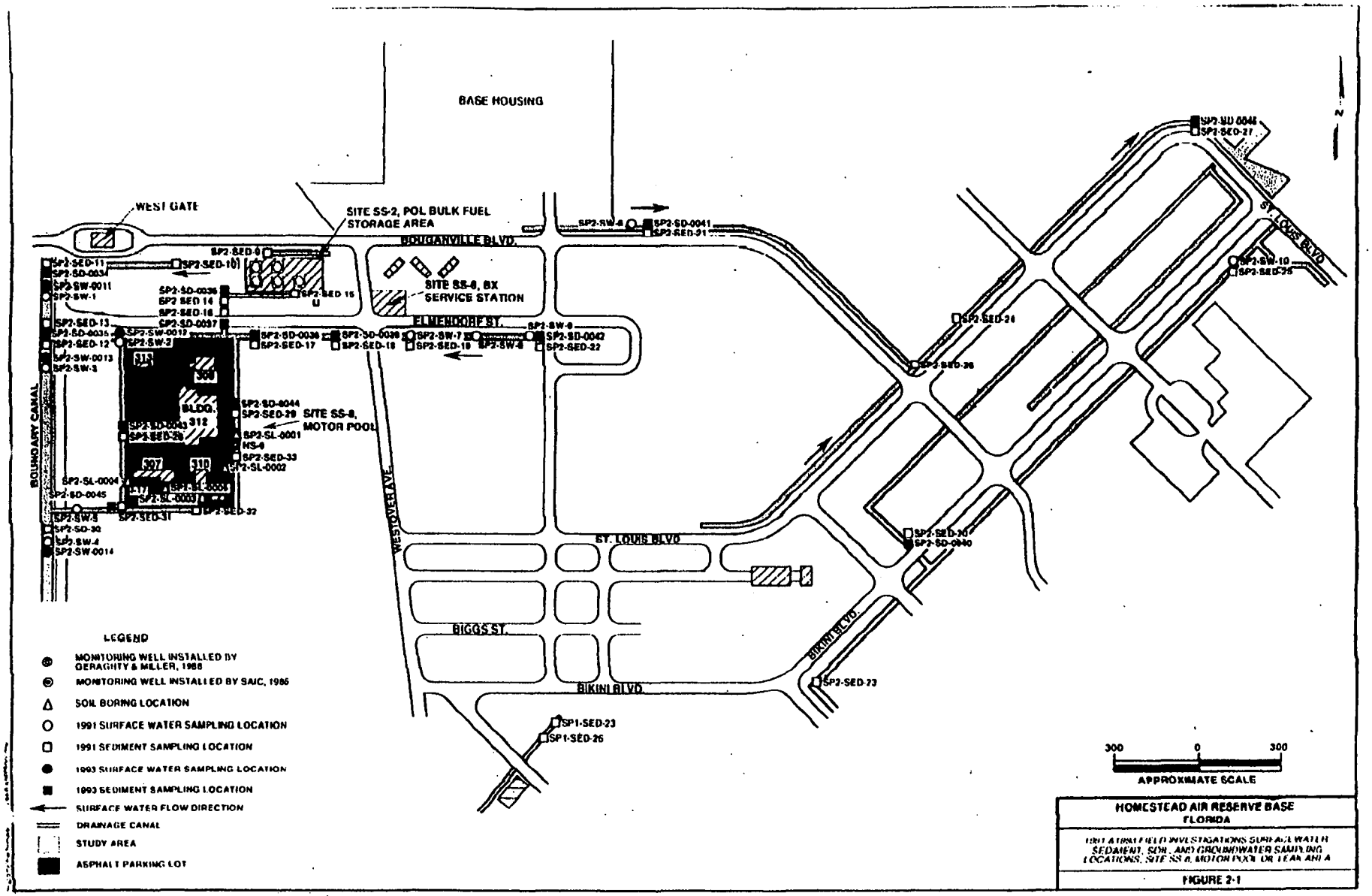
2.6 SUMMARY OF SITE CHARACTERISTICS

The Motor Pool has been in operation since the Base was re-activated in the 1950's. Waste oil from the Motor Pool vehicular maintenance activities was collected and stored in 500 gallon above-ground storage tanks. Leaks in the tanks have resulted in spills to the environment. Additionally, old batteries were stored in the Motor Pool Area. The majority of the Motor Pool Site is covered by asphalt.

The following subsections summarize the nature and extent of contamination identified at Site SS-8 during investigations conducted from 1988 through 1993. The investigations in 1991 and 1993 were conducted in accordance with the approved Facility Remedial Investigations Work Plans (G&M, 1991) and Work Plan Addendum (MW, 1993). It should be noted that "soil" at Site SS-8 is limestone or weathered limestone not typical sand, clay, or sandy clay.

2.6.1 Nature and Extent of Contamination

RIs have been performed at Site SS-8 to evaluate the nature and extent of contamination in 1991 and 1993. A detailed evaluation of the nature and extent of contamination is presented in the RI Report Addendum prepared by Montgomery Watson in 1993. A brief summary of findings is presented below. In general, the results of the sampling and analysis presented in the RI Addendum Report reveal that contamination at the site is limited to the surrounding canal system and the subsurface soil/bedrock. Contamination associated with the canal system is being evaluated separately under the OU-9, Boundary Canal investigation. Although groundwater sampling in 1991 indicated the presence of elevated metals, resampling of the wells in 1993 indicated that the 1991 samples were turbid and that the 1993 sample results indicated no metals contamination in the site wells. Figure 2-1 depicts the 1991 and 1994 surface water, sediment, soil and groundwater sampling locations for Site SS-8.


BASE HOUSING
WEST GATE
SITE SS-2, POL BULK FUEL STORAGE AREA
BOUGANVILLE BLVD.
SITE SS-6, BX SERVICE STATION
ELMENDORF ST.
SITE SS-8, MOTOR POOL
BLDG. 312
BOUNDARY CANAL
WESTOVER AVE.
ST. LOUIS BLVD
BIGGS ST.
BIKINI BLVD.
SP2-SED-11
SP2-SD-0037
SP2-SW-0011
SP2-SW-1
SP2-SED-13
SP2-SW-0013
SP2-SW-3
SP2-SD-0044
SP2-SED-29
SP2-SL-0001
HS-6
SP2-SED-33
SP2-SL-0002
SP2-SL-0004
SP2-SD-0045
SP2-SW-5
SP2-SED-31
SP2-SED-32
SP2-SD-30
SP2-SW-4
SP2-SW-0014
SP2-SD-0041
SP2-SED-21
SP2-SW-10
SP2-SED-25
SP2-SED-24
SP2-SED-26
SP2-SED-20
SP2-SD-0040
SP2-SED-23
SP1-SED-23
SP1-SED-26
LEGEND
MONITORING WELL INSTALLED BY GERAGHTY & MILLER, 1988
MONITORING WELL INSTALLED BY SAIC, 1986
SOIL BORING LOCATION
1991 SURFACE WATER SAMPLING LOCATION
1991 SEDIMENT SAMPLING LOCATION
1993 SURFACE WATER SAMPLING LOCATION
1993 SEDIMENT SAMPLING LOCATION
SURFACE WATER FLOW DIRECTION
DRAINAGE CANAL
STUDY AREA
ASPHALT PARKING LOT
300 0 300
APPROXIMATE SCALE
HOMESTEAD AIR RESERVE BASE
FLORIDA
FIRST AIRFIELD INVESTIGATIONS SURFACE WATER, SEDIMENT, SOIL, AND GROUNDWATER SAMPLING LOCATIONS, SITE SS-8, MOTOR POOL OR TEAM AREA
FIGURE 2-1

2.6.2 Groundwater Investigations

2.6.2.1 Initial Investigations (1988). Groundwater samples at Site SS-8 were analyzed for VOCs, BNAs, TRPH and total RCRA metals, plus sodium. All the metals detected in the groundwater were either below the analytical detection limit or were below the federal drinking water maximum contaminant level (MCL). Di (2-ethylhexyl) phthalate (DEHP) was the only organic compound detected in the groundwater at a concentration of 66 and 7.9 µg/L.

DEHP, also known as bis (2-ethylhexyl) phthalate, is a known laboratory contaminant; however, this compound was not detected in any of the associated blanks (field or laboratory). TRPH was not detected above the analytical detection limit. A summary of the 1988 Groundwater analytical results are presented in Table 2-1. The Phase IV-A investigation indicated that groundwater had not been impacted by activities at Site SS-8. The 1988 investigation indicated that groundwater had not been impacted by activities at Site SS-8.

2.6.2.2 1991 Investigation. The following metals were detected in the groundwater at Site SS-8: aluminum, barium, calcium, chromium, cobalt, iron, magnesium, manganese, nickel, potassium, sodium, vanadium, and mercury. Groundwater samples contained very high concentrations of total calcium: 8,400,000; 71,000; and 70,000 µg/L, respectively, in addition to significant concentrations of other TAL metals. Lead was detected in one sample at a concentration of 20 µg/L, which is above both the Florida Groundwater Guidance Concentration (FGWGC) of 5 µg/L and the Federal action level of 15 µg/L. Chromium was also detected in one sample at a concentration of 249 µg/L, above the FGWGC of 50 µg/L and above the Federal Drinking Water Standard of 100 µg/L. The sampling log for one of the wells indicated that the sample was extremely turbid when collected. Metals tend to sorb to aquifer substrates and the presence of fines in groundwater samples tends to increase the amount of metals present. It is possible that the high metal concentrations are a result of suspended sediments as artifacts of well construction, and thereby, overstate the actual concentrations of the analytes at the site. A summary of the 1991 groundwater analytical results is presented as Table 2-4.

All remaining metals detected were below the FGWGC except for aluminum, iron, and manganese. Federal Secondary Drinking Water Regulations establish recommended limits and deal with the aesthetic quality of drinking water; however, the FDEP has adopted these

TABLE 2-4
SUMMARY OF GROUNDWATER ANALYTICAL RESULTS
SITE SS-8 MOTOR POOL OIL LEAK AREA
HOMESTEAD AIR RESERVE BASE, FLORIDA
GERAGHTY AND MILLER, INC., 1991

Analyte	Florida Ground Water Guidance Concentrations	USEPA MCL 1/	G&M Sample I.D. Savannah I.D. Sampling Date	Trip Blank S135369*15	SP2-EB-0003 S135369*2 22-Aug-91	SP2-I-0017 S135369*1 22-Aug-91	SP2-HS-0009 S135369*3 22-Aug-91	SP2-HS-9009 S135369*4 22-Aug-91
VOLATILE ORGANIC COMPOUND 2/				BDL	BDL 3/	BDL	BDL	BDL
BASE/NEUTRAL AND ACID EXTRACTABLE COMPOUNDS: (ug/L)								
bis(2-Ethylhexyl) phthalate	14	NS 3/		NA 5/	[0.89] J	<10	[1.2] U	[1.3] U
INORGANIC CONSTITUENTS: (ug/L)								
Aluminum	NS	NS		NA	<200	25000	<200	<200
Barium	1000	2000		NA	<10	130	<10	<10
Calcium	NS	NS		NA	<50	8400000	71000	70000
Chromium	50	100		NA	<10	240	<10	<10
Cobalt	NS	NS		NA	<10	11	<10	<10
Iron	300	NS		NA	<50	23000	62	63
Magnesium	NS	NS		NA	<50	24000	1100	1100
Manganese	50	NS		NA	<10	320	<10	<10
Nickel	150	100		NA	<40	80	<40	<40
Potassium	NS	NS		NA	<1000	6700	1700	1600
Sodium	160,000	NS		NA	<500	84000	9900	9800
Vanadium	NS	NS		NA	<10	120	<10	<10
Mercury	2	2		NA	<0.20	0.32	<0.20	<0.20
Lead	50	50		NA	<5.0	20	<5.0	<5.0
Total Dissolved Solids: (mg/L)	500	NS		NA	NA	370	NA	NA

Source: Geraghty & Miller, Inc., 1992

1/ Maximum Contaminant Level in Drinking Water.
2/ Constituents not detected above the practical quantitation limit are not listed.
3/ All constitiuents in analyte group were below the practical quantitation limt.
4/ No Standard
5/ Not Analyzed
[ ] Value is betewen instrument detection limit and practical quantitation limit.
U Result has been classified as undetected because of analyte detection in the QA sample.

standards as the Florida Secondary Drinking Water Standards and requires that the potable groundwater shall meet these recommended limits. Iron and manganese are both regulated in terms of secondary drinking water standards. There is no FGWGC standard for aluminum, however, the Federal Secondary Drinking Water Standard for aluminum is 50 to 200 µg/L which is significantly lower than the 25,000 µg/L of aluminum that was detected in one well. Chromium was the only metal detected above the USEPA maximum contaminant level (MCL). As mentioned above, the turbidity of the groundwater samples may have contributed to the high inorganic concentrations detected which are not believed to be site related contamination.

2.6.2.3 1993 Investigation. Groundwater samples collected from the two monitoring wells in 1993, did not indicate the presence of VOCs or organochloride pesticides/PCBs. Only groundwater from the monitoring well which produced turbid samples in 1991 was analyzed for TAL metals. Both total and dissolved metals analyses were performed. Metals detected in the total fraction include aluminum, barium, calcium, chromium, iron, magnesium, manganese, nickel, potassium, sodium, vanadium, and zinc. Lead which was identified as a possible contaminant in 1991, was not detected in the groundwater sample collected in the 1993 investigation. Chromium, which was detected at elevated levels (maximum concentration 240 µg/L) in 1991, was reported at only 3.6 µg/L in the 1993 sample. Dissolved lead and dissolved chromium analyses in 1993 indicated no detectable presence of either analyte. This decrease in lead and chromium concentrations is likely related to the much higher sample turbidity observed in 1991; the total calcium concentrations of the turbid 1991 samples were over thirty times higher than those of the 1993 samples.

Aluminum is the only metal in the total fraction which exceeded state and federal standards. In general, groundwater metals were an order of magnitude lower in the 1993 sample when compared to the 1991 samples. This is likely due to the reduction in the turbidity prior to sampling. A summary of constituents detected in the 1993 groundwater samples is presented in Table 2-5.

2.6.3 Soil Sample Analytical Results

2.6.3.1 Initial Investigations (1988). During the IRP Phase II Investigation, four soil samples were collected from the strip of ground between the fenceline and the drainage canal east of the site. 1988 soil samples were only analyzed for oil and grease and total

TABLE 2-5

SUMMARY OF CONSTITUENTS DETECTED IN GROUNDWATER SAMPLES
SITE SS-8 MOTOR POOL OIL LEAK AREA
MONTGOMERY WATSON, 1993 INVESTIGATION

Analyte Date Sampled	Florida Groundwater Guidance Concentration m	EPA Drinking Water Standard	EPA Maximum Contaminant Level Goal	Sample ID Date Collected	SP2-I-17 3/8/93	SP2-I-917 3/8/93 Duplicate	SP2-I-17 F 3/8/93 Filtered	SP2-I-917 F 3/8/93 Filtered Duplicate
VOA TCL Compounds (ug/l)								
2-Butanone	NS	NS	NS		<10	<10	NA	NA
1,2-Dichloropropane	NS	NS	NS		<10	<10	NA	NA
cis-1,3-Dichloropropene	NS	NS	NS		<10	<10	NA	NA
Pesticide/PCB TCL Compounds (ug/l)	ND	ND	ND		ND	ND	ND	ND
BNA TCL Compounds (ug/l)								
Di-n-Butyl Phthalate	NS	NS	NS		0.4 J	0.5 J	NA	NA
Dissolved Metals (ug/l)								
Barium	1000	2000g	2000		NA	NA	NA	8.8 B
Calcium	NS	NS	NS		NA	NA	NA	83,300
Iron	300	300h	NS		NA	NA	NA	<7.0
Magnesium	NS	NS	NS		NA	NA	NA	3090 B
Manganese	50	50h	NS		NA	NA	NA	1.9 B
Potassium	NS	NS	NS		NA	NA	NA	6460
Sodium	160000	NS	NS		NA	NA	NA	35400
Zinc	5000	5000h	NS		NA	NA	NA	13.8 B
Total Metals (ug/l)								
Aluminum	NS	50-200h	NS		1550	1370	<20.0	<20.0
Barium	1000	2000g	2000		26.6B	27.7 B	8.8B	8.8B
Calcium	NS	NS	NS		270000	301000	82600	83300
Chromium, Total	50	100 g	100		3.6B	<3.0	<3.0	<3.0
Copper	100	130	130		<2. 0	<2.0	<2.0	<2.0
Iron	300	300h	NS		1100	1180	<7.0	<7.0
Magnesium	NS	NS	NS		3800B	3940 B	3080 B	3090 B
Manganese	50	50h	NS		20.7	22.2	1.8 B	1.9 B
Nickel					6.4B	<6.0	<6.0	<6.0
Potassium	NS	NS	NS		6730	7200	6230	6460
Silver					<2. 0	<2.0	<2.0	<2.0
Sodium	160000	NS	NS		36300	37100	36700	35400
Vanadium	NS	NS	NS		7.0B	7.6 B	<3.0	<3.0
Zinc	5000	5000h	NS		33.4	39.3	14.8 B	13.8 B

All samples analyzed by Savannah Laboratories, Tallahassee, Florida.

< - not detected at specified detection limit
NS- no standard
ND - not detected
NA - not analyzed

Data Qualifiers for Organic Compounds
J - Estimated Value, <CRQL or TIC

Data Qualifiers for Inorganic Compounds
B - Reading is less than CRQL but greater than IDL

Notes:
F Fitered samples for metals
g Numbers represent EPA's Primary MCL for Inorganics.
h Numbers represent EPA's Secondary MCL for Inorganics which are non-enforceable taste, odor or appearence guidelines.
m Florida Ground-Water Guidance Concentrations for Minimum Criteria Requirements (Rule 17-3.402,FAC), Florida Department of Environmental Regulation, February 1989.

TABLE 2-5

SUMMARY OF CONSTITUENTS DETECTED IN GROUNDWATER SAMPLES
SITE SS-8 MOTOR POOL OIL LEAK AREA
MONTGOMERY WATSON, 1993 INVESTIGATION
(CONTINUED)

Analyte Date Sampled	Florida Groundwater Guidance Concentration m	EPA Drinking Water Standard	EPA Maximum Contaminant Level Goal	Sample ID Date Collected	SP2-EB-0001 3/8/93	SP2-EB-0001F 3/8/93 Filtered	SP2-FB-0001 3/8/93 QC	SP2-TB-0001 3/8/93 QC	SP2-TB-0003 3/14/93 QC
VOA TCL Compounds (ug/l)									
2-Butanone	NS	NS	NS		4 J	NA	<10	<10	<10
1,2-Dichloropropane	NS	NS	NS		<10	NA	<10	<10	<10
cis-1,3-Dichloropropene	NS	NS	NS		3J	NA	<10	<10	<10
Pesticide/PCB TCL Compounds (ug/l)	ND	ND	ND		ND	ND	NA	NA	NA
BNA TCL Compounds (ug/l)									
Di-n-Butyl Phthalate	NS	NS	NS		<11	NA	<10	NA	NA
Dissolved Metals (ug/l)									
Barium	1000	2000g	2000		NA	<1.0	NA	NA	NA
Calcium	NS	NS	NS		NA	175 B	NA	NA	NA
Iron	300	300h	NS		NA	23.1 B	NA	NA	NA
Magnesium	NS	NS	NS		NA	<30.0	NA	NA	NA
Manganese	50	50h	NS		NA	<1.0 B	NA	NA	NA
Potassium	NS	NS	NS		NA	<325	NA	NA	NA
Sodium	160000	NS	NS		NA	50.5 B	NA	NA	NA
Zinc	5000	5000h	NS		NA	23.5	NA	NA	NA
Total Metals (ug/l)									
Aluminum	NS	50-200h	NS		21.1B	NA	<20.0	NA	NA
Barium	1000	2000g	2000		<1.0	NA	<1.0	NA	NA
Calcium	NS	NS	NS		99.7B	NA	213B	NA	NA
Chromium, Total	50	100 g	100		<3.0	NA	<3.0	NA	NA
Copper	100	130	130		<2.0	NA	3.7B	NA	NA
Iron	300	300h	NS		<7.0	NA	13.0B	NA	NA
Magnesium	NS	NS	NS		<30.0	NA	<30.0	NA	NA
Manganese	50	50h	NS		<1.0	NA	<1.0	NA	NA
Nickel					<6.0	NA	<6.0	NA	NA
Potassium	NS	NS	NS		<325	NA	<325	NA	NA
Silver					2.1B	NA	<2.0	NA	NA
Sodium	160000	NS	NS		<30	NA	49.3B	NA	NA
Vanadium	NS	NS	NS		<3.0	NA	<3.0	NA	NA
Zinc	5000	5000h	NS		15.9B	NA	24.7	NA	NA

All samples analyzed by Savannah Laboratories, Tallahassee, Florida.

< - not detected at specified detection limit
NS- no standard
ND - not detected
NA - not analyzed

Data Qualifiers for Organic Compounds
J - Estimated Value, <CRQL or TIC

Data Qualifiers for Inorganic Compounds
B - Reading is less than CRQL but greater than IDL

Notes:
F Filtered samples for metals
g Numbers represent EPA's Primary MCL for Inorganics.
h Numbers represent EPA's Secondary MCL for Inorganics which are non-enforceable taste, odor
m Florida Ground-Water Guidance Concentrations for Minimum Criteria Requirements (Rule 17-3.402,FAC), Florida Department of Environmental Regulation, February 1989.

lead. All four of the soil samples were found to contain concentrations of oil and grease above ASQC **(10 ppm)** and two of the soil samples had lead levels above the ASQC (0.37 ppm) but below the NLS (100 ppm).

2.6.3.2 1993 Investigation. In the 1993 soil investigation at Site SS-8, Montgomery Watson collected soil samples from five soil boring locations. Two soil samples were collected from each of the five soil boring locations from the 0 to 1 foot bls interval and the 3 to 4 ft bls interval. Soil samples were analyzed for the following chemical compounds: TCL VOCs, TCL/BNAs, TCL Organochlorine (OC) Pesticide/PCBs, and TAL metals and cyanide.

Contaminants detected in Site SS-8 soils include VOCs, BNAs and metals. The VOC detected (toluene) can be a common laboratory contaminant and was detected in only one sample. BNAs, primarily PAHs, were detected in the soils at Site SS-8. Because PAHs are commonly found in asphalt, the elevated PAH concentrations may be due to sampling either directly adjacent to or directly below asphalt. Additionally, these PAH concentrations are within the typical range found for areas affected by anthropogenic influences. Low levels of pesticides were also detected in four soil samples. Cyanide and PCBs were not detected in any of the soil samples.

Concentrations of barium, cobalt, magnesium, and nickel were all reported below the Homestead ARB average background soil concentration from the 0-2 ft interval. Aluminum was detected in all of the samples at concentrations above the Homestead ARB background concentrations in three samples. Concentrations of copper, manganese, sodium potassium and zinc do not exceed the average natural levels for soils. The concentrations for calcium and iron do exceed the natural levels for soils.

Lead was detected in all the soil samples. Concentrations of lead in three samples were above the maximum detected concentration of lead in the Homestead ARB background soils and the average carbonate bedrock concentration, but within the common range of soils found in the eastern U.S. A summary of constituents detected in soil samples from the 1993 investigation are presented in Table 2-6.

TABLE 2-6

SUMMARY OF CONSTITUENTS DETECTED IN SOIL SAMPLES
SITE SS-8, MOTOR POOL OIL LEAK AREA
MONTGOMERY WATSON, 1993

Analyte	Homestead AFB Background 0-2 ft bls	AVERAGE CARBONATE COMPOSITION	Sample ID. Sample Interval Date Collected	SP2SL0001 0-1 5/27/93	SP2SL0001 3-4 5/27/93	SP2SL0002 0-1 5/27/93
VOA TCL Compounds (ug/kg)						
Acetone	119.2	NS		1400 E	730	2200
Toluene	NS	NS		5 J	<12	18
Pesticide/PCB TCL Compounds (ug/kg)						
Alpha-Chlordane	<2.9	NS		<2.1	<2.2	<2.0
Beta Endosulfan	<2.9	NS		<4.1	<4.2	1.3 J
Beta-Chlordane	<2.9	NS		<2.1	<2.2	<2.0
Endrin	<29	NS		0.89 JP	2.5 JP	0.98 J
Heptachlor	<2.9	NS		<2.1	<2.2	<2.0
p,p'-DDD	<4.7	NS		<4.1	1.2 JP	<4.0
p,p'-DDE	<4.7	NS		<4.1	0.97 JP	<4.0
p,p'-DDT	<12	NS		<4.1	<4.2	<4.0
BNA TCL Compounds (ug/kg)						
Acenaphthene	<390	NS		160 J	170 J	170 J
Anthracene	<390	NS		310 J	270 J	190 J
Benzo(a)Anthracene	67	NS		3200	3200	3700 J
Benzo(a)Pyrene	66	NS		5200	5500	5300
Benzo(b)Fluoranthene	69	NS		3900	7000	5800
Benzo(g,h,i)Perylene	44	NS		3000	4300	3800 J
Benzo(k)Fluoranthene	66	NS		2200	2800	4500
Benzyl Butyl Phthalate	16	NS		11 J	29 J	<4000
Bis(2-Ethylhexyl) Phthalate	100	NS		58 BJ	230 BJ	76 BJ
Carbazole	NS	NS		320 J	310 J	170 J
4-Chlorophenyl Phenyl Ether	<390	NS		<410	<420	<4000
Chrysene	79	NS		5200	5600	4900
2,4-Dichlorophenol	<390	NS		<410	<420	<4000
Di-n-Butyl Phthalate	<390	NS		29 BJ	10 BJ	15 BJ
Di-n-Octyl Phthalate (Bis-(2-Ethylhexyl)Phthalate)	10	NS		<410	<420	20 J
Dibenz(A,H)Anthracene	17	NS		1000	1200	<4000
Dibenzofuran	<390	NS		28 J	30 J	49 J
Diethylphthalate	<390	NS		5 J	3 J	<4000
Fluoranthene	52.4	NS		5100	3200	3700 J
Fluorene	NS	NS		57 J	63 J	80 J
Indeno(1,2,3-C,D)Pyrene	45	NS		2500	3300	3200 J
2-Methylnaphthalene	84	NS		16 J	15 J	38 J
Naphthalene	50	NS		78 J	75 J	240 J
Phenanthrene	<2000	NS		1300	1200	860 J
Phenol	50	NS		<410	40 J	<4000
Pyrene	49.15	NS		5800	6500	3900 J
1,2,4-Trichlorobenzene	<390	NS		<410	<420	<4000
Metals (mg/kg)						
Aluminum	2400	8970		4560	613	4260
Arsenic	1.6	1.8		2.4S	<1.1	<1.0
Barium	42.9	30		11.2B	15.7B	10.9B
Beryllium	<2.8	NE		0.26B	<0.21	0.29B
Cadmium	<2.8	0.048		<0.41	0.55B	<0.40
Calcium	345000	272,000		383000	372000	321000
Chromium, Total	11.5	>0.1		13.4	7.7	15.9
Cobalt	<1.1	0.12		0.93B	0.76B	0.77B
Copper	<2.7	4.4		0.84B	8.6	2.1B
Iron	1650	8,190		2450	890	3240
Lead	4.05	16		15.9N*	120N*	92.4N*
Magnesium	1050	45,300		1390E	1200E	1450E
Manganese	23	842		27.0	8.8	42.9
Nickel	<4.5	13		2.9B	2.6B	3.9B
Potassium	<110	2,390		1070	993B	900B
Sodium	555	398		513B	730B	462B
Vanadium	<5.7	13		8.9B	5.0B	9.8B
Zinc	20	16		5.5	24.6	18.1

All samples analyzed by Savannah Laboratories, Tallahassee, Florida.

< not detected at specified detection limit
NS - no standard
Bold - equal to or greater than BG
Bold & Shaded - equal to or greater than 10*BG

Data Qualifiers for Organic Compounds
J - Estimated Value, <CRQL
B - Analytes found in associated blank
P - Target analyte concentrations >25% difference between the two GC columns

Data Qualifiers for Inorganic Compounds
B - Reading is less than CRQL but greater than IDL
E - reported value is estimated due to interference
N - spiked sample recovery not within control limits
S - value determined by method of standard additions
* - duplicate analysis not within control limits

TABLE 2-6

SUMMARY OF CONSTITUENTS DETECTED IN SOIL SAMPLES
SITE SS-8, MOTOR POOL OIL LEAK AREA
MONTGOMERY WATSON, 1993

Analyte	Homestead AFB Background 0-2 ft bls	AVERAGE CARBONATE COMPOSITION	Sample ID. Sample Interval Date Collected	SP2SL0002 3-4 5/27/93	SP2SL0003 0-1 5/27/93	SP2SL0003 3-4 5/27/93	SP2SL0004 0-1 5/27/93
VOA TCL Compounds (ug/kg)							
Acetone	119.2	NS		1500	2000	1600	12000
Toluene	NS	NS		2 J	<13	2 J	2J
Pesticide/PCB TCL Compounds (ug/kg)							
Alpha-Chlordane	<2.9	NS		<2.4	<2.1	<2.1	<2.1
Beta Endosulfan	<2.9	NS		<4.7	<4.1	<4.1	<4.0
Beta-Chlordane	<2.9	NS		<2.4	<2.1	<2.1	<2.1
Endrin	<29	NS		<4.7	<4.1	<4.1	<4.0
Heptachlor	<2.9	NS		<2.4	<2.1	<2.1	<2.1
p,p'-DDD	<4.7	NS		<4.7	<4.1	<4.1	<4.0
p,p'-DDE	<4.7	NS		<4.7	<4.1	<4.1	<4.0
p,p'-DDT	<12	NS		<4.7	<4.1	<4.1	<4.0
BNA TCL Compounds (ug/kg)							
Acenaphthene	<390	NS		<470	<410	<410	<400
Anthracene	<390	NS		3 J	<410	<410	<400
Benzo(a)Anthracene	67	NS		**83 J**	<410	<410	<400
Benzo(a)Pyrene	66	NS		**120 J**	<410	<410	<400
Benzo(b)Fluoranthene	69	NS		**130 J**	<410	16 J	5J
Benzo(g,h,i)Perylene	44	NS		**67 J**	<410	<410	<400
Benzo(k)Fluoranthene	66	NS		**110 J**	<410	12 J	4J
Benzyl Butyl Phthalate	16	NS		<470	6 J	<410	<400
Bis(2-Ethylhexyl) Phthalate	100	NS		**100 BJ**	15 BJ	96 BJ	25BJ
Carbazole	NS	NS		<470	<410	<410	<400
4-Chlorophenyl Phenyl Ether	<390	NS		<470	<410	<410	<400
Chrysene	79	NS		**120 J**	<410	<410	<400
2,4-Dichlorophenol	<390	NS		<470	<410	<410	<400
Di-n-Butyl Phthalate	<390	NS		7 BJ	14 BJ	11 BJ	7BJ
Di-n-Octyl Phthalate (Bis-(2-Ethylhexyl)Phthalate)	10	NS		<470	<410	<410	<400
Dibenz(A,H)Anthracene	17	NS		**19 J**	<410	<410	<400
Dibenzofuran	<390	NS		<470	<410	<410	<400
Diethylphthalate	<390	NS		<470	<410	<410	<400
Fluoranthene	52.4	NS		**120 J**	3 J	17 J	7J
Fluorene	NS	NS		<470	<410	<410	<400
Indeno(1,2,3-C,D)Pyrene	45	NS		**70 J**	<410	<410	<400
2-Methylnaphthalene	84	NS		<470	<410	<410	<400
Naphthalene	50	NS		<470	<410	<410	<400
Phenanthrene	<2000	NS		20 J	<410	6 J	<400
Phenol	50	NS		<470	<410	<410	<400
Pyrene	49.15	NS		130 J	<410	17 J	7J
1,2,4-Trichlorobenzene	<390	NS		<470	<410	<410	<400
Metals (mg/kg)							
Aluminum	2400	8970		**4290**	595	314	1220
Arsenic	1.6	1.8		**3.0**	<1.0S	<1.0	**1.8B**
Barium	42.9	30		11.1B	4.8B	5.3B	5.1B
Beryllium	<2.8	NE		0.39B	<0.21	<0.21	<0.20
Cadmium	<2.8	0.048		<0.48	<0.42	<0.42	<0.41
Calcium	345000	272,000		325000	**348000**	325000	325000
Chromium, Total	11.5	>0.1		**19.6**	4.0	2.7	5.3
Cobalt	<1.1	0.12		0.89B	<0.42	<0.42	<0.41
Copper	<2.7	4.4		<0.48	<0.42	<0.42	<0.41
Iron	1650	8,190		1620	205	171	466
Lead	4.05	16		**51AN***	**7.5SN***	**4.1SN***	3.6N*
Magnesium	1050	45,300		1010BE	953BE	908BE	1020E
Manganese	23	842		**57.8**	15.6	9.9	19.4
Nickel	<4.5	13		2.3B	<1.2	<1.2	<1.2
Potassium	<110	2,390		835B	936B	787B	812B
Sodium	555	398		466B	**711B**	**776B**	509B
Vanadium	<5.7	13		7.3B	3.5B	2.8B	4.1B
Zinc	20	16		2.8B	5.9	**27.3**	2.0B

All samples analyzed by Savannah Laboratories, Tallahassee, Florida.

< not detected at specified detection limit
NS - no standard
Bold - equal to or greater than BG
Bold & Shaded - equal to or greater than 10*BG

Data Qualifiers for Organic Compounds
J - Estimated Value, <CRQL
B - Analytes found in associated blank
P - Target analyte concentrations >25% difference between the two GC columns

Data Qualifiers for Inorganic Compounds
B - Reading is less than CRQL but greater than IDL
E - reported value is estimated due to interference
N - spiked sample recovery not within control limits
S - value determined by method of standard additions
* - duplicate analysis not within control limits

TABLE 2-6

SUMMARY OF CONSTITUENTS DETECTED IN SOIL SAMPLES
SITE SS-8, MOTOR POOL OIL LEAK AREA
MONTGOMERY WATSON, 1993
(CONTINUED)

Analyte	Homestead AFB Background 0-2 ft bls	AVERAGE CARBONATE COMPOSITION	Sample ID. Sample Interval Date Collected	SP2SL0004 3-4 5/27/93	SP2SL0005 0-1 5/27/93	SP2SL9005 0-1 5/27/93 Duplicate	SP2SL0005 3-4 5/27/93
VOA TCL Compounds (ug/kg)							
Acetone	119.2	NS		10000	3100	260	9200
Toluene	NS	NS		<13	<12	<12	<13
Pesticide/PCB TCL Compounds (ug/kg)							
Alpha-Chlordane	<2.9	NS		<2.1	<2.1	0.56 JP	<2.1
Beta Endosulfan	<2.9	NS		<4.1	<4.0	<4.2	<4.0
Beta-Chlordane	<2.9	NS		<2.1	<2.1	0.51J	<2.1
Endrin	.29	NS		<4.1	<4.0	<4.2	<4.0
Heptachlor	<2.9	NS		<2.1	<2.1	0.54 J	<2.1
p,p'-DDD	<4.7	NS		<4.1	<4.0	<4.2	<4.0
p,p'-DDE	<4.7	NS		<4.1	<4.0	<4.2	<4.0
p,p'-DDT	<12	NS		<4.1	<4.0	1.6 J	<4.0
BNA TCL Compounds (ug/kg)							
Acenaphthene	<390	NS		<410	<400	<400	<420
Anthracene	<390	NS		5 J	<400	4 J	<420
Benzo(a)Anthracene	67	NS		<410	16 J	24 J	<420
Benzo(a)Pyrene	66	NS		<410	20 J	26 J	15 J
Benzo(b)Fluoranthene	69	NS		3 J	26 J	31 J	18 J
Benzo(g,h,i)Perylene	44	NS		<410	14 J	15 J	11 J
Benzo(k)Fluoranthene	66	NS		4 J	19 J	24 J	12 J
Benzyl Butyl Phthalate	16	NS		6 J	6 J	11 J	7 J
Bis(2-Ethylhexyl) Phthalate	100	NS		**120 BJ**	23 BJ	47 BJ	93 BJ
Carbazole	NS	NS		<410	3 J	4 J	<420
4-Chlorophenyl Phenyl Ether	<390	NS		<410	<400	<400	<420
Chrysene	79	NS		<410	25 J	30 J	<420
2,4-Dichlorophenol	<390	NS		<410	<400	<400	<420
Di-n-Butyl Phthalate	<390	NS		11 BJ	20 BJ	12 BJ	10 BJ
Di-n-Octyl Phthalate (Bis-(2-Ethylhexyl)Phthalate)	10	NS		<410	<400	<400	<420
Dibenz(A,H)Anthracene	17	NS		<410	<400	<400	<420
Dibenzofuran	<390	NS		<410	<400	<400	<420
Diethylphthalate	<390	NS		<410	<400	<400	<420
Fluoranthene	52.4	NS		10 J	40 J	51 J	28 J
Fluorene	NS	NS		<410	<400	<400	<420
Indeno(1,2,3-C,D)Pyrene	45	NS		<410	13 J	15 J	10 J
2-Methylnaphthalene	84	NS		<410	<400	<400	<420
Naphthalene	50	NS		<410	<400	<400	<420
Phenanthrene	<2000	NS		5 J	18 J	23 J	12 J
Phenol	50	NS		<410	<400	<400	<420
Pyrene	49.15	NS		9 J	37 BJ	44 J	24 J
1,2,4-Trichlorobenzene	<390	NS		<410	<400	<400	<420
Metals (mg/kg)							
Aluminum	2400	8970		394	720	592	323
Arsenic	1.6	1.8		<1.0	**1.6B**	1.4B	<1.1
Barium	42.9	30		4.6B	6.1B	6.3B	5.8B
Beryllium	<2.8	NE		<0.21	<0.20	<0.20	<0.21
Cadmium	<2.8	0.048		<0.42	<0.41	<0.41	<0.43
Calcium	345000	272,000		**348000**	**369000**	**367000**	**348000**
Chromium, Total	11.5	>0.1		3.5	4.7	4.2	4.1
Cobalt	<1.1	0.12		<0.42	<0.41	<0.41	<0.43
Copper	<2.7	4.4		<0.42	<0.41	<0.41	<0.43
Iron	1650	8,190		171	304	262	170
Lead	4.05	16		2.3N*	**15.5N***	**11.2N***	**4.0N***
Magnesium	1050	45,300		**1060E**	**1050E**	**1120E**	**1010BE**
Manganese	23	842		8.1	13.2	14.1	8.8
Nickel	<4.5	13		<1.2	<1.2	<1.2	<1.3
Potassium	<110	2,390		909B	986B	965B	895B
Sodium	555	398		**615B**	**670B**	**707B**	**857B**
Vanadium	<5.7	13		3.7B	3.8B	3.8B	3.1B
Zinc	20	16		2.5B	5.5	4.7	4.8

All samples analyzed by Savannah Laboratories, Tallahassee, Florida.

< not detected at specified detection limit
NS - no standard
Bold - equal to or greater than BG
Bold & Shaded - equal to or greater than 10*BG

Data Qualifiers for Organic Compounds
J - Estimated Value, <CRQL
B - Analytes found in associated blank
P - Target analyte concentrations >25% difference between the two GC columns

Data Qualifiers for Inorganic Compounds
B - Reading is less than CRQL but greater than IDL
E - reported value is estimated due to interference
N - spiked sample recovery not within control limits
S - value determined by method of standard additions
* - duplicate analysis not within control limits

2.6.4 Sediment Sample Analytical Results 2.6.4.1 Initial Investigations (1986-1991). In 1986, two sediment samples were collected from the drainage ditch immediately east of the Motor Pool fenceline. Both sediment samples had reported concentrations of oil and grease above ASQC (10 ppm). Both of the sediment samples had lead levels above the ASQC (0.37 ppm) but below the NLS (100 ppm).

In 1988, two sediment samples were collected from the drainage ditch east of the site and analyzed for VOCs, BNAs, and total RCRA concentrations of 30 mg/kg and 2,650 mg/kg. Several BNAs (mostly PAHs) were also detected in the sediment. In 1989, eight additional sediment samples were collected from the perimeter drainage ditch. constituents detected in the sediment included BNAs, and several metals including lead. The highest concentrations were detected in the northeast corner of the drainage ditch which surrounds the site.

In 1991, 25 sediment samples were collected from the ditches surrounding Site SS-8. Five of the sediment samples collected in 1991 were analyzed for BNAs. Analytical results indicated BNA's, primarily PAHs, detected in all but one sample. Total PAH concentrations ranged from 2,400 µg/kg to 20,750 µg/kg. BNA concentrations found in sediment samples are within the target risk range of 10^{-4} to 10^{-6}, considered protective of human health by the USEPA; however, the state of Florida's target risk of 10^{-6} is exceeded. Lead was detected in all samples with reported concentrations ranging from 14 to 2,300 mg/kg. Additional metals detected included aluminum, barium, calcium, chromium, copper, iron, magnesium, manganese, sodium, vanadium, zinc, mercury and arsenic. Sediment samples had reported arsenic and lead concentrations which exceed soil target clean-up levels. Contaminants associated with the ditch sediments are presently being evaluated in the Boundary and Outfall Canal (OU-9), Remedial Investigation. A summary of sediment analytical results is presented in Table 2-7.

2.6.4.2 1993 Investigation. In 1993, 13 sediment samples were collected from the area canals and drainage ditches. Each sediment sample was analyzed for TCL VOCs, TCL BNAs, TCL organochlorine pesticides/ PCBs, TAL metals, and cyanide. 23 BNAs, primarily PAHs were detected in the sediment samples collected during the 1993 investigation. In general, lower total PAH levels were reported during the 1993 samples. However, BNA concentrations were still observed above health based levels.

TABLE 2-7

SUMMARY OF CONSTITUENTS DETECTED IN SEDIMENT SAMPLES
COLLECTED AT SITE SS-8, MOTOR POOL OIL LEAK AREA
Homestead Air Reserve Base, Florida
GERAGHTY & MILLER, 1991

Analyte	NOAA1/ ER-L (ug/kg)	NOAA 2/ ER-M (ug/kg)	Interim SQC Ng/Kg OC 3/ (1% OC) 4/	G&M Sample I.D. Savannah I.D. Sampling Date	Trip Blank 35283-11	SP2-SD-0009 35303-6 8/20/91	SP2-SD-0010 35303-7 8/20/91	SP2-SD-0011 35283-2 08/19/91
VOLATILE ORGANIC COMPOUNDS: ug/Kg dw								
Acetone	N	N	NS		<10	NA	NA	220 J
2-Butanone	N	N	NS		<10	NA	NA	<67
BASE/NEUTRAL EXTRACTABLE COMPOUNDS: ug/Kg dw								
Acenaphthene	150	650	7320		NA	NA	NA	<2200
Anthracene	85	960	NS		NA	NA	NA	<2200
Benzo(a)anthracene	230	1600	13170		NA	NA	NA	<2200
Benzo(a)pyrene	400	2500	10630		NA	NA	NA	<2200
Benzo(b)fluoranthene	N	N	NS		NA	NA	NA	<2200
Benzo(g,h,i)perylene	N	N	NS		NA	NA	NA	<2200
Benzo(k)fluoranthene	N	N	NS		NA	NA	NA	<2200
Benzoic acid	N	N	NS		NA	NA	NA	[2400]
bis(2-Ethylhexyl) phthalate	N	N	NS		NA	NA	NA	[1600]
Chrysene	400	2800	NS		NA	NA	NA	<2200
Dibenzo(a,h)anthracene	60	260	NS		NA	NA	NA	<2200
Fluoranthene	600	3600	18830		NA	NA	NA	<2200
Fluorene	35	640	NS		NA	NA	NA	<2200
Indeno (1,2,3-cd)pyrene	N	N	NS		NA	NA	NA	<2200
Phenanthrene	225	1380	1390		NA	NA	NA	<2200
Pyrene	350	2200	13110		NA	NA	NA	<2200
INORGANIC CONSTITUENTS: mg/Kg dw								
Aluminum	N	N	NS		NA	NA	NA	2400
Barium	N	N	NS		NA	NA	NA	12
Calcium	80	N	NS		NA	NA	NA	81
Chromium	70	145	NS		NA	NA	NA	<63
Copper	N	390	NS		NA	NA	NA	29
Iron	N	N	NS		NA	NA	NA	3000
Magnesium	N	N	NS		NA	NA	NA	700
Manganese	N	N	NS		NA	NA	NA	39
Sodium	N	N	NS		NA	NA	NA	<330
Vanadium	N	N	NS		NA	NA	NA	33
Zinc	120	270	NS		NA	NA	NA	54
Mercury	0.15	1.3	NS		NA	NA	NA	0.091
Arsenic	33	85	NS		NA	NA	NA	<6.7
Lead	35	110	NS		NA	150	27	160 J
METAL IN TCLP EXTRACT: mg/L								
Arsenic					NA	<2.0	<4.0	<0.20
Cadmium					NA	<0.10	<0.20	.070(.075)
Lead					NA	<2.0	<4.0	<0.20

TABLE 2-7

SUMMARY OF CONSTITUENTS DETECTED IN SEDIMENT SAMPLES
COLLECTED AT SITE SS-8, MOTOR POOL OIL LEAK AREA
Homestead Air Reserve Base, Florida
GERAGHTY & MILLER, 1991
CONTINUED

Analyte	NOAA1/ ER-L (ug/kg)	NOAA 2/ ER-M (ug/kg)	Interim SQC Ng/Kg OC 3/ (1% OC) 4/	G&M Sample I.D. Savannah I.D. Sampling Date	SP2-SD-0012 35283-3 08/19/91	SP2-SD-9012 35283-4 08/19/91	SP2-SD-0013 35283-5 08/19/91
VOLATILE ORGANIC COMPOUNDS: ug/Kg dw							
Acetone	N	N	NS		99 J	23 J	NA
2-Butanone	N	N	NS		<16 UJ	<14	NA
BASE/NEUTRAL EXTRACTABLE COMPOUNDS: ug/Kg dw							
Acenaphthene	150	650	7320		<530	<480	NA
Anthracene	85	960	NS		[31]	[26]	NA
Benzo(a)anthracene	230	1600	13170		[170]	[170]	NA
Benzo(a)pyrene	400	2500	10630		[250]	[200]	NA
Benzo(b)fluoranthene	N	N	NS		[240]	[200]	NA
Benzo(g,h,i)perylene	N	N	NS		<530	[140]	NA
Benzo(k)fluoranthene	N	N	NS		[240]	[210]	NA
Benzoic acid	N	N	NS		[210]	[120]	NA
bis(2-Ethylhexyl) phthalate	N	N	NS		[180]	840	NA
Chrysene	400	2800	NS		[240]	[230]	NA
Dibenzo(a,h)anthracene	60	260	NS		<530	<480	NA
Fluoranthene	600	3600	18830		[310]	[300]	NA
Fluorene	35	640	NS		<530	<480	NA
Indeno (1,2,3-cd)pyrene	N	N	NS		[150]	[130]	NA
Phenanthrene	225	1380	1390		[120]	[87]	NA
Pyrene	350	2200	13110		[290]	[270]	NA
INORGANIC CONSTITUENTS: mg/Kg dw							
Aluminum	N	N	NS		1200	2500	NA
Barium	N	N	NS		2.3	5.3	NA
Calcium	80	N	NS		40	190	NA
Chromium	70	145	NS		<150	<140	NA
Copper	N	390	NS		<3.0	3.7	NA
Iron	N	N	NS		980	1800	NA
Magnesium	N	N	NS		170	630	NA
Manganese	N	N	NS		10	21	NA
Sodium	N	N	NS		100	270	NA
Vanadium	N	N	NS		31	13	NA
Zinc	120	270	NS		14	36	NA
Mercury	0.15	1.3	NS		0.023	0.041	NA
Arsenic	33	85	NS		<1.3	<1.4	NA
Lead	35	110	NS		17 J	14 J	210 J
METAL IN TCLP EXTRACT: mg/L							
Arsenic					<0.20	<0.20	<0.20
Cadmium					<0.50	.076(.082)	.090(.097)
Lead					<0.20	<0.20	<0.20

TABLE 2-7

SUMMARY OF CONSTITUENTS DETECTED IN SEDIMENT SAMPLES
COLLECTED AT SITE SS-8, MOTOR POOL OIL LEAK AREA
Homestead Air Reserve Base, Florida
GERAGHTY & MILLER, 1991
CONTINUED

Analyte	NOAA1/ ER-L (ug/kg)	NOAA 2/ ER-M (ug/kg)	Interim SQC Ng/Kg OC 3/ (1% OC) 4/	G&M Sample I.D. Savannah I.D. Sampling Date	SP2-SD-0014 35283-6 08/19/91	SP2-SD-0015 35283-7 08/19/91	SP2-SD-0016 35283-9 08/19/91
VOLATILE ORGANIC COMPOUNDS: ug/Kg dw							
Acetone	N	N	NS		NA	NA	NA
2-Butanone	N	N	NS		NA	NA	NA
BASE/NEUTRAL EXTRACTABLE COMPOUNDS: ug/Kg dw							
Acenaphthene	150	650	7320		NA	NA	NA
Anthracene	85	960	NS		NA	NA	NA
Benzo(a)anthracene	230	1600	13170		NA	NA	NA
Benzo(a)pyrene	400	2500	10630		NA	NA	NA
Benzo(b)fluoranthene	N	N	NS		NA	NA	NA
Benzo(g,h,i)perylene	N	N	NS		NA	NA	NA
Benzo(k)fluoranthene	N	N	NS		NA	NA	NA
Benzoic acid	N	N	NS		NA	NA	NA
bis(2-Ethylhexyl) phthalate	N	N	NS		NA	NA	NA
Chrysene	400	2800	NS		NA	NA	NA
Dibenzo(a,h)anthracene	60	260	NS		NA	NA	NA
Fluoranthene	600	3600	18830		NA	NA	NA
Fluorene	35	640	NS		NA	NA	NA
Indeno (1,2,3-cd)pyrene	N	N	NS		NA	NA	NA
Phenanthrene	225	1380	1390		NA	NA	NA
Pyrene	350	2200	13110		NA	NA	NA
INORGANIC CONSTITUENTS: mg/Kg dw							
Aluminum	N	N	NS		NA	NA	NA
Barium	N	N	NS		NA	NA	NA
Calcium	80	N	NS		NA	NA	NA
Chromium	70	145	NS		NA	NA	NA
Copper	N	390	NS		NA	NA	NA
Iron	N	N	NS		NA	NA	NA
Magnesium	N	N	NS		NA	NA	NA
Manganese	N	N	NS		NA	NA	NA
Sodium	N	N	NS		NA	NA	NA
Vanadium	N	N	NS		NA	NA	NA
Zinc	120	270	NS		NA	NA	NA
Mercury	0.15	1.3	NS		NA	NA	NA
Arsenic	33	85	NS		NA	NA	NA
Lead	35	110	NS		2300J	96 J	1400 J
METAL IN TCLP EXTRACT: mg/L							
Arsenic					<0.20	<0.20	<0.20
Cadmium					.081(.087)	.099(0.11)	.091(.098)
Lead					2.2(2.0)	<0.20	2.5(2.2)

TABLE 2-7

SUMMARY OF CONSTITUENTS DETECTED IN SEDIMENT SAMPLES
COLLECTED AT SITE SS-8, MOTOR POOL OIL LEAK AREA
Homestead Air Reserve Base, Florida
GERAGHTY & MILLER, 1991
CONTINUED

Analyte	NOAA1/ ER-L (ug/kg)	NOAA 2/ ER-M (ug/kg)	Interim SQC Ng/Kg OC 3/ (1% OC) 4/	G&M Sample I.D. Savannah I.D. Sampling Date	SP2-SD-0017 35283-10 08/19/91	SP2-SD-0018 35283-8* 08/19/91	SP2-SD-0019 35303-8 8/20/91	SP2-SD-0020 35417-9 8/24/91
VOLATILE ORGANIC COMPOUNDS: ug/Kg dw								
Acetone	N	N	NS		NA	NA	NA	NA
2-Butanone	N	N	NS		NA	NA	NA	NA
BASE/NEUTRAL EXTRACTABLE COMPOUNDS: ug/Kg dw								
Acenaphthene	150	650	7320		NA	NA	NA	NA
Anthracene	85	960	NS		NA	NA	NA	NA
Benzo(a)anthracene	230	1600	13170		NA	NA	NA	NA
Benzo(a)pyrene	400	2500	10630		NA	NA	NA	NA
Benzo(b)fluoranthene	N	N	NS		NA	NA	NA	NA
Benzo(g,h,i)perylene	N	N	NS		NA	NA	NA	NA
Benzo(k)fluoranthene	N	N	NS		NA	NA	NA	NA
Benzoic acid	N	N	NS		NA	NA	NA	NA
bis(2-Ethylhexyl) phthalate	N	N	NS		NA	NA	NA	NA
Chrysene	400	2800	NS		NA	NA	NA	NA
Dibenzo(a,h)anthracene	60	260	NS		NA	NA	NA	NA
Fluoranthene	600	3600	18830		NA	NA	NA	NA
Fluorene	35	640	NS		NA	NA	NA	NA
Indeno (1,2,3-cd)pyrene	N	N	NS		NA	NA	NA	NA
Phenanthrene	225	1380	1390		NA	NA	NA	NA
Pyrene	350	2200	13110		NA	NA	NA	NA
INORGANIC CONSTITUENTS: mg/Kg dw								
Aluminum	N	N	NS		NA	NA	NA	NA
Barium	N	N	NS		NA	NA	NA	NA
Calcium	80	N	NS		NA	NA	NA	NA
Chromium	70	145	NS		NA	NA	NA	NA
Copper	N	390	NS		NA	NA	NA	NA
Iron	N	N	NS		NA	NA	NA	NA
Magnesium	N	N	NS		NA	NA	NA	NA
Manganese	N	N	NS		NA	NA	NA	NA
Sodium	N	N	NS		NA	NA	NA	NA
Vanadium	N	N	NS		NA	NA	NA	NA
Zinc	120	270	NS		NA	NA	NA	NA
Mercury	0.15	1.3	NS		NA	NA	NA	NA
Arsenic	33	85	NS		NA	NA	NA	NA
Lead	35	110	NS		1600 J	1600 J	500	1000
METAL IN TCLP EXTRACT: mg/L								
Arsenic					<0.20	<0.20	<4.0	<2.0
Cadmium					.076(.082)	.035(.038)	<0.20	<0.10
Lead					2.1(1.8)	4.7(4.1)	0.37(.36)	<2.0

TABLE 2-7

SUMMARY OF CONSTITUENTS DETECTED IN SEDIMENT SAMPLES
COLLECTED AT SITE SS-8, MOTOR POOL OIL LEAK AREA
Homestead Air Reserve Base, Florida
GERAGHTY & MILLER, 1991
CONTINUED

Analyte	NOAA1/ ER-L (ug/kg)	NOAA 2/ ER-M (ug/kg)	Interim SQC Ng/Kg OC 3/ (1% OC) 4/	G&M Sample I.D. Savannah I.D. Sampling Date	SP2-SD-0021 35417-8 8/24/91	SP2-SD-0022 35303-10 8/20/91	SP2-SD-9022 35303-9 8/20/91	SP2-SD-0023 35417-10 8/24/91	SP2-SD-0024 35417-7 8/24/91	SP2-SD-0026 35417-5 8/24/91	SP2-SD-0025 35417-6 8/24/91
VOLATILE ORGANIC COMPOUNDS: ug/Kg dw											
Acetone	N	N	NS		NA	<96	<93	NA	NA	NA	NA
2-Butanone	N	N	NS		NA	<38	<37 UJ	NA	NA	NA	NA
BASE/NEUTRAL EXTRACTABLE COMPOUNDS: ug/Kg dw											
Acenaphthene	150	650	7320		NA	<1300	<1200	NA	NA	NA	NA
Anthracene	85	960	NS		NA	<1300	<1200	NA	NA	NA	NA
Benzo(a)anthracene	230	1600	13170		NA	[280]	[280]	NA	NA	NA	NA
Benzo(a)pyrene	400	2500	10630		NA	[430]	[430]	NA	NA	NA	NA
Benzo(b)fluoranthene	N	N	NS		NA	[660]	[650]	NA	NA	NA	NA
Benzo(g,h,i)perylene	N	N	NS		NA	[400]	<1200	NA	NA	NA	NA
Benzo(k)fluoranthene	N	N	NS		NA	[500]	[430]	NA	NA	NA	NA
Benzoic acid	N	N	NS		NA	<6400	<6200	NA	NA	NA	NA
bis(2-Ethylhexyl) phthalate	N	N	NS		NA	2100	2700	NA	NA	NA	NA
Chrysene	400	2800	NS		NA	[680]	[690]	NA	NA	NA	NA
Dibenzo(a,h)anthracene	60	260	NS		NA	<1300	<1200	NA	NA	NA	NA
Fluoranthene	600	3600	18830		NA	[740]	[690]	NA	NA	NA	NA
Fluorene	35	640	NS		NA	<1300	<1200	NA	NA	NA	NA
Indeno (1,2,3-cd)pyrene	N	N	NS		NA	[310]	<1200	NA	NA	NA	NA
Phenanthrene	225	1380	1390		NA	[430]	[400]	NA	NA	NA	NA
Pyrene	350	2200	13110		NA	[1300]	1300	NA	NA	NA	NA
INORGANIC CONSTITUENTS: mg/Kg dw											
Aluminum	N	N	NS		NA	20000	19000	NA	NA	NA	NA
Barium	N	N	NS		NA	40	42	NA	NA	NA	NA
Calcium	80	N	NS		NA	230000	350000	NA	NA	NA	NA
Chromium	70	145	NS		NA	53	50	NA	NA	NA	NA
Copper	N	390	NS		NA	30	26	NA	NA	NA	NA
Iron	N	N	NS		NA	13000	11000	NA	NA	NA	NA
Magnesium	N	N	NS		NA	1800	1800	NA	NA	NA	NA
Manganese	N	N	NS		NA	67	61	NA	NA	NA	NA
Sodium	N	N	NS		NA	340	750	NA	NA	NA	NA
Vanadium	N	N	NS		NA	37	33	NA	NA	NA	NA
Zinc	120	270	NS		NA	350	290	NA	NA	NA	NA
Mercury	0.15	1.3	NS		NA	0.32	0.25	NA	NA	NA	NA
Arsenic	33	85	NS		NA	36	33	NA	NA	NA	NA
Lead	35	110	NS		1200 J	520	520	320	200	49	110
METAL IN TCLP EXTRACT: mg/L											
Arsenic					<2.0	<2.0	<1.0	<2.0	0.28(0.26)	<2.0	<2.0
Cadmium					<0.10	<0.10	<0.050	<0.10	<0.10	<0.10	<0.10
Lead					0.88(0.74)	0.31(.29)	0.30(.29)	<2.0	<2.0	<2.0	<2.0

TABLE 2-7

SUMMARY OF CONSTITUENTS DETECTED IN SEDIMENT SAMPLES
COLLECTED AT SITE SS-8, MOTOR POOL OIL LEAK AREA
Homestead Air Reserve Base, Florida
GERAGHTY & MILLER, 1991
CONTINUED

Analyte	NOAA1/ ER-L (ug/kg)	NOAA 2/ ER-M (ug/kg)	Interim SQC Ng/Kg OC 3/ (1% OC) 4/	G&M Sample I.D. Savannah I.D. Sampling Date	SP2-SD-0027 35417-4 8/24/91	SP2-SD-0028 35303-1 8/20/91	SP2-SD-0029 35303-2 8/20/91	SP2-SD-0030 35283-1 08/19/91	SP2-SD-0031 35303-3 8/20/91	SP2-SD-0032 35303-4 8/20/91	SP2-SD-0033 35303-5 8/20/91
VOLATILE ORGANIC COMPOUNDS: ug/Kg dw											
Acetone	N	N	NS		130	NA	NA	320	NA	NA	NA
2-Butanone	N	N	NS		[19]	NA	NA	<24 UJ	NA	NA	NA
BASE/NEUTRAL EXTRACTABLE COMPOUNDS: ug/Kg dw											
Acenaphthene	150	650	7320			NA	NA	[280]	NA	NA	NA
Anthracene	85	960	NS		<2400	NA	NA	[460]	NA	NA	NA
Benzo(a)anthracene	230	1600	13170		<2400	NA	NA	1800	NA	NA	NA
Benzo(a)pyrene	400	2500	10630		<2400	NA	NA	2200	NA	NA	NA
Benzo(b)fluoranthene	N	N	NS		<2400	NA	NA	2100	NA	NA	NA
Benzo(g,h,i)perylene	N	N	NS		<2400	NA	NA	1200	NA	NA	NA
Benzo(k)fluoranthene	N	N	NS		<2400	NA	NA	1800	NA	NA	NA
Benzoic acid	N	N	NS		<12000	NA	NA	[460]	NA	NA	NA
bis(2-Ethylhexyl) phthalate	N	N	NS		[290]	NA	NA	<800	NA	NA	NA
Chrysene	400	2800	NS		<2400	NA	NA	1900	NA	NA	NA
Dibenzo(a,h)anthracene	60	260	NS		<2400	NA	NA	[300]	NA	NA	NA
Fluoranthene	600	3600	18830		<2400	NA	NA	3000	NA	NA	NA
Fluorene	35	640	NS		<2400	NA	NA	[230]	NA	NA	NA
Indeno (1,2,3-cd)pyrene	N	N	NS		<2400	NA	NA	1200	NA	NA	NA
Phenanthrene	225	1380	1390		<2400	NA	NA	1700	NA	NA	NA
Pyrene	350	2200	13110		<2400	NA	NA	2400	NA	NA	NA
INORGANIC CONSTITUENTS: mg/Kg dw											
Aluminum	N	N	NS		NA	NA	NA	3950	NA	NA	NA
Barium	N	N	NS		NA	NA	NA	8.6	NA	NA	NA
Calcium	80	N	NS		NA	NA	NA	351000	NA	NA	NA
Chromium	70	145	NS		NA	NA	NA	<47	NA	NA	NA
Copper	N	390	NS		NA	NA	NA	<6.2	NA	NA	NA
Iron	N	N	NS		NA	NA	NA	2610	NA	NA	NA
Magnesium	N	N	NS		NA	NA	NA	1100	NA	NA	NA
Manganese	N	N	NS		NA	NA	NA	26	NA	NA	NA
Sodium	N	N	NS		NA	NA	NA	454	NA	NA	NA
Vanadium	N	N	NS		NA	NA	NA	7.7	NA	NA	NA
Zinc	120	270	NS		NA	NA	NA	28	NA	NA	NA
Mercury	0.15	1.3	NS		NA	NA	NA	0.12	NA	NA	NA
Arsenic	33	85	NS		NA	NA	NA	<2.5	NA	NA	NA
Lead	35	110	NS		27 J	450	690	37 J	130	120	95
METAL IN TCLP EXTRACT: mg/L											
Arsenic					<2.0	<0.20	<2.0	<0.20	<2.0	<0.20	<2.0
Cadmium					<0.10	.017(.014)	<0.10	.091(.098)	<0.10	<0.010	<0.10
Lead					<2.0	<0.20	0.39(.39)	<0.20	<2.0	<0.20	<2.0

Footnotes:

ug/Kg dw micrograms per kilogram dry weight
mg/L milligrams per liter
NA not analyzed
N Not Available
NS No Standard
[ ] Value is greater than instrument detection limit but less than practical quantitation limit.
J Positive result has been classified as qualitative.
UJ Analyte was not detected. Classified as qualitative.
U Classified as undetected.
1/ National Oceanic and Atmospheric Administration (NOAA) Technical Memorandum NOS OMA 52; ER-L is effects Range - Low (10th percentile)
2/ Effects Range - Median (50th percentile)
3/ The sediment quality criteria (SQC) cannot be directly compared with the drainage swale data because the SQC are presented as normalized to organic carbon (i.e. presented on a per organic carbon weight basis). To allow a direct comparison between the sediment data and SQC, the SQC for an organic carbon content of 1.0% OC were calculated. The SQC (ug/Kg) at 1% OC were derived by multiplying the SQC (ug/Kg OC) by an OC content of 1% (.01 Kg of OC/Kg of sediment).
4/ Organic Carbon

TABLE 2-4

SUMMARY OF CONSTITUENTS DETECTED IN SEDIMENT SAMPLES
SITE SS-8, MOTOR POOL OIL LEAK AREA
MONTGOMERY WATSON, 1993

Analyte	NOAA 1/ ER-L (ug/kg)	NOAA 2/ ER-M (ug/kg)	Interim SQC ug/Kg OC 3/ (1% OC) 4/	BC-SD-0100** Background 1991	Sample ID Date Collected	SP2-SD-0034 3/15/93	SP2-SD-0035 3/15/93	SP2-SD-0036 3/15/93	SP2-SD-0037 3/15/93	SP2-SD-0038 3/15/93
VOA TCL Compounds (ug/kg)										
Acetone	NS	NS	NS	NA		<120	220	<15	<13	<16
Methyl Ethyl Ketone (2-Butanone)	NS	NS	NS	NA		<120	51 B	<15	<13	<16
Pesticide/PCB TCL Compounds (ug/kg)										
Aldrin	NS	NS	NS	NA		<12	<3.6	<2.5	<2.3	<2.7
Alpha Endosulfan	NS	NS	NS	NA		<12	<3.6	<2.5	0.92 JP	<2.7
Alpha-Chlordane	0.5 (5)	6	NS	NA		<12	0.28 JP	0.67 J	0.44 JP	0.77 JP
Beta Endosulfan	NS	NS	NS	NA		<12	<3.6	1.7 JP	1.5 JP	<2.7
Beta-Chlordane	0.5 (5)	6	NS	NA		3.2 J	0.53 JP	<2.5	1.1 JP	1.3 JP
Endosulfan Sulfate	NS	NS	NS	NA		5.7 JP	<7.0	2.4 JP	4.0 JP	1.8 JP
Endrin	0.02	45	NS	NA		<24	<7.0	<4.9	<4.5	<5.3
Endrin Ketone	NS	NS	NS	NA		<24	<7.0	2.1 JP	2.9 J	<5.3
Heptachlor	NS	NS	NS	NA		2.6 J	<3.6	<4.9	<4.5	1.3 J
Heptachlor Epoxide	NS	NS	NS	NA		<12	<3.6	<2.5	<2.3	<2.7
Methoxychlor	NS	NS	NS	NA		<12	<3.6	8.4 J	7.9 JP	<27
p,p'-DDD	2	20	NS	NA		5.3 JP	1.4 J	1.0 JP	1.3 J	2.1 J
p,p'-DDE	2	15	NS	NA		4.7 JP	2.2 J	1.4 JP	0.99 J	1.2 J
p,p'-DDT	1	7	NS	NA		9.8 J		3.1 JP	2.1 JP	3.5 JP
BNA TCL Compounds (ug/kg)										
2,4-Dimethylphenol	NS	NS	NS	<1400		<2400	<700	<490	<450	<530
2-Methylnaphthalene	65	670	NS	<1400		<2400	<700	<490	15 J	13 J
4-Chloro-3-Methylphenol	NS	NS	NS	<1400		<2400	<700	<490	<450	<530
4-Methylphenol (P-Cresol)	NS	NS	NS	<1400		<2400	<700	<490	<450	<530
Acenaphthene	150	650	7320	<1400		<2400	<700	<490	<450	<530
Acenaphthylene	NS	NS	NS	<1400		<2400	<700	5 J	<450	<530
Anthracene	85	960	NS	<1400		<2400	20 J	18 J	16 J	20 J
Benzo(a)Anthracene	230	1600	13,170	<1400		<2400	89 J	82 J	120 J	67 J
Benzo(a)Pyrene	400	2500	10,630	<1400		110 J	120 J	130 J	130 J	81 J
Benzo(b)Fluoranthene	NS	NS	NS	<1400		170 J	140 J	180 J	130 J	76 J
Benzo(g,h,i)Perylene	NS	NS	NS	<1400		<2400	<700	160 J	36 J	110 J
Benzo(k)Fluoranthene	NS	NS	NS	<1400		180 J	120 J	150 J	200 J	99 J
Benzyl Butyl Phthalate	NS	NS	NS	<1400		100 J	36 J	14 J	10 J	13 J
Bis(2-Ethylhexyl) Phthalate	NS	NS	NS	<1400		290 J	120 J	1,900	2,500	1,300
Carbazole	NS	NS	NS	<1400		<2400	<700	<490	<450	<530
Chrysene	400	2800	NS	<1400		150 J	120 J	150 J	190 J	100 J
Di-n-Butyl Phthalate	NS	NS	NS	<1400		150 BJ	37 BJ	20 BJ	21 BJ	25 BJ
Dibenz(A,H)Anthracene	60	260	NS	<1400		<2400	<700	<490	11 J	<530
Dibenzofuran	NS	NS	NS	<1400		<2400	<700	<490	8 J	<530
Dimethyl Phthalate	NS	NS	NS	<1400		<2400	<700	6 J	<450	9 J
Fluoranthene	600	3600	18,830	<1400		260 J	180 J	220 J	360 J	140 J
Fluorene	35	640	NS	<1400		<2400	8 J	<490	<450	13 J
Indeno(1,2,3-C,D)Pyrene	NS	NS	NS	<1400		64 J	80 J	110 J	130 J	70 J
Naphthalene	340	2100	NS	<1400		<2400	<700	<490	<450	29 J
Pentachlorophenol	NS	NS	NS	<1400		<5700	<1700	<1200	57 J	<1300
Phenanthrene	225	1380	1,390	<1400		<2400	53 J	61 J	130 J	65 J
Pyrene	350	2200	13,110	<1400		230 J	170 J	180 J	280 J	130 J
Metals (mg/kg)										
Aluminum	NS	NS	NS	2700		4540 *	4750 *	7680 *	1860 *	4380 *
Arsenic	33	85	NS	2		3.0 N	3.5 N	64.0 N	42.9 N	21.9 N
Barium	NS	NS	NS	14		14.6 BN*	11.9 BN*	39.5 BN*	13.8 BN*	20.2 BN*
Beryllium	NS	NS	NS	NA		0.20 B	<0.20	0.27 B	<0.20	<0.20
Cadmium	5	9	NS	<2.1		1.5	0.47 B	0.89 B	0.41 B	<0.40
Calcium	NS	NS	NS	310,000		261000	315000	302000	359000	330000
Chromium, Total	80	145	NS	11 J		17.5	16.4	34.6	13.7	22.9
Cobalt	NS	NS	NS	<4.2		2.1 B	1.0 B	2.1 B	0.45 B	0.68 B
Copper	70	390	NS	16 J		14.3	7.7	18.7	6.2	10.3
Iron	NS	NS	NS	1700		2820 E	4440 E	10300 E	1810 E	3020 E
Lead	35	110	NS	11		55.6	64.0	1480	1600	643
Magnesium	NS	NS	NS	1000		816 BE	1170 E	1680 E	1230 E	1440 E
Manganese	NS	NS	NS	<29		34.5 E	59.8 E	122 E	28.9 E	51.4 E
Nickel	30	50	NS	NA		6.0 B	4.8 B	6.5 B	1.5 B	2.8 B
Potassium	NS	NS	NS	NA		703 B	818 B	839 B	953 B	936 B
Sodium	NS	NS	NS	290 J		402 B	570 B	469 B	473 B	594 B
Vanadium	NS	NS	NS	5.7 J		60.0	14.3	14.2	6.6 B	9.9 B
Zinc	120	270	NS	27 J		211 E	60.8 E	390 E	171 E	228 E

All samples analyzed by Savannah Laboratories, Tallahassee, Florida.
< not detected at specified detection limit
NA - not available
** - Source Geraghty & Miller Electroplating Waste Disposal Area RI - 6/92
NS - No Standard

Data Qualifiers for Organic Compounds
J - estimated quantity
B - compound detected in an associated blank
C - Compound confirmed by GC/MS

Data Qualifiers for Inorganic Compounds
B - Reading is less than CRQL but greater than IDL
E - reported value is estimated due to interference
N - spiked sample recovery not within control limits
* - duplicate analysis not within control limits

Footnotes:
1/ National Oceanic and Atmospheric Administration (NOAA) Technical Memorandum NOS OMA 52; ER-L is effects Range - Low (10th percentile)
2/ Effects Range - Median (50th percentile)
3/ The sediment quality criteria (SQC) cannot be directly compared with the drainage swale data because the SQC are presented as normalized to organic carbon (i.e. presented on a per organic carbon weight basis). To allow a direct comparison between the sediment data and SQC, the SQC for an organic carbon content of 1.0% OC were calculated. The SQC (ug/Kg) at 1% OC were derived by multiplying the SQC (ug/Kg OC) by an OC content of 1% (.01 Kg of OC/Kg of sediment).
4/ Organic Carbon
5/ As Total Chlordane

TABLE 2-8

SUMMARY OF CONSTITUENTS DETECTED IN SEDIMENT SAMPLES
SITE SS-8, MOTOR POOL OIL LEAK AREA
MONTGOMERY WATSON, 1993
(CONTINUED)

Analyte	NOAA 1/ ER-L (ug/kg)	NOAA 2/ ER-M (ug/kg)	Interim SQC ug/Kg OC 3/ (1% OC) 4/	BC-SD-0100** Background 1991	Sample ID Date Collected	SP2-SD-0039 3/15/93	SP2-SD-0040 3/15/93	SP2-SD-0041 3/15/93	SP2-SD-0042 3/15/93	SP2-SD-0043 3/15/93
VOA TCL Compounds (ug/kg)										
Acetone	NS	NS	NS	NA		<16	<14	160	130	<45
Methyl Ethyl Ketone (2-Butanone)	NS	NS	NS	NA		<16	<14	<21	<29	<45
Pesticide/PCB TCL Compounds (ug/kg)										
Aldrin	NS	NS	NS	NA		<2.5	<2.2	<35	1.4 JP	<5.5
Alpha Endosulfan	NS	NS	NS	NA		<2.5	<2.2	<35	<2.8	<5.5
Alpha-Chlordane	0.5 (5)	6	NS	NA		2.9 P	3.0	<35	1.0 J	1.6 J
Beta Endosulfan	NS	NS	NS	NA		<2.5	<2.2	<35	<2.8	<5.5
Beta-Chlordane	0.5 (5)	6	NS	NA		7.5 P	2.5 P	<35	2.6 J	2.5 J
Endosulfan Sulfate	NS	NS	NS	NA		<4.9	14 P	<69	<5.4	<11
Endrin	0.02	45	NS	NA		<4.9	<4.3	22 J	<5.4	<11
Endrin Ketone	NS	NS	NS	NA		13	4.8 P	<69	<5.4	<11
Heptachlor	NS	NS	NS	NA		<2.5	<2.2	<35	0.76 JP	<5.5
Heptachlor Epoxide	NS	NS	NS	NA		<2.5	<2.2	<35	0.94 J	<5.5
Methoxychlor	NS	NS	NS	NA		19 JP	16 JP	<350	<28	<5.5
p,p'-DDD	2	20	NS	NA		7.1	140	58 JPC	4.1 JP	<11
p,p'-DDE	2	15	NS	NA		6.2	42	11 JPC	31	6.7 JP
p,p'-DDT	1	7	NS	NA		7.3 P	51	60 JPC	3.3 J	<11
BNA TCL Compounds (ug/kg)										
2,4-Dimethylphenol	NS	NS	NS	<1400		<490	<430	21 J	<540	<1100
2-Methylnaphthalene	65	670	NS	<1400		360 J	57 J	560 J	<540	<1100
4-Chloro-3-Methylphenol	NS	NS	NS	<1400		<490	<430	26 J	<540	<1100
4-Methylphenol (P-Cresol)	NS	NS	NS	<1400		21 J	<430	<690	<540	<1100
Acenaphthene	150	650	7320	<1400		1,400	250 J	2,100	15 J	<1100
Acenaphthylene	NS	NS	NS	<1400		15 J	<430	23 J	4 J	<1100
Anthracene	85	960	NS	<1400		2,000	420 J	4,300	63 J	<1100
Benzo(a)Anthracene	230	1600	13,170	<1400		4,000	970	16,000	290 J	<1100
Benzo(a)Pyrene	400	2500	10,630	<1400		2,700	870	13,000	230 J	90 J
Benzo(b)Fluoranthene	NS	NS	NS	<1400		3,400	990	14,000	320 J	170 J
Benzo(g,h,i)Perylene	NS	NS	NS	<1400		2,200	690	9,400	110 J	97 J
Benzo(k)Fluoranthene	NS	NS	NS	<1400		2,000	910	16,000	180 J	170 J
Benzyl Butyl Phthalate	NS	NS	NS	<1400		29 J	19 J	170 J	31 J	34 J
Bis(2-Ethylhexyl) Phthalate	NS	NS	NS	<1400		580 B	310 J	2,000	160 BJ	220 J
Carbazole	NS	NS	NS	<1400		2,000	390 J	4,000	<540	<1100
Chrysene	400	2800	NS	<1400		3,900	1,100	19,000	310 J	90 J
Di-n-Butyl Phthalate	NS	NS	NS	<1400		<490	<430	<690	50 BJ	59 BJ
Dibenz(A,H)Anthracene	60	260	NS	<1400		<490	<430	<690	<540	<1100
Dibenzofuran	NS	NS	NS	<1400		900	180 J	1,800	<540	<1100
Dimethyl Phthalate	NS	NS	NS	<1400		<490	<430	<690	<540	<1100
Fluoranthene	600	3600	18,830	<1400		7,800	1,800	35,000	570	150 J
Fluorene	35	640	NS	<1400		1,800	330 J	3,200	38 J	<1100
Indeno(1,2,3-C,D)Pyrene	NS	NS	NS	<1400		2,200	570	8,600	190 J	34 J
Naphthalene	340	2100	NS	<1400		640	110J	1,200	<540	<1100
Pentachlorophenol	NS	NS	NS	<1400		<1200	<1100	<1700	<1300	<2600
Phenanthrene	225	1380	1,390	<1400		7,600	1,600	29,000	280 BJ	<1100
Pyrene	350	2200	13,110	<1400		8,200	2,700	32,000	450 J	150 J
Metals (mg/kg)										
Aluminum	NS	NS	NS	-2700		4940 *	732 *	3650 *	30600 *	3320 *
Arsenic	33	85	NS	2		39.8 N	9.5 N	17.2 N	57.3 N	2.7 N
Barium	NS	NS	NS	14		22.6 BN*	114 N*	291 N*	37.8 BN*	10.4 BN*
Beryllium	NS	NS	NS	NA		<0.20	<0.20	<0.20	0.77 B	<0.20
Cadmium	5	9	NS	<2.1		0.76B	1.3	1.1	0.76 B	0.57 B
Calcium	NS	NS	NS	310,000		239000	272000	343000	155000	272000
Chromium, Total	80	145	NS	11J		21.9	14.6	20.8	67.1	12.0
Cobalt	NS	NS	NS	<4.2		1.00 B	0.41 B	0.84 B	2.5 B	0.69 B
Copper	70	390	NS	16 J		9.4	6.9	16.8	8.4	7.4
Iron	NS	NS	NS	1700		3160 E	656 E	2140 E	15600 E	2100 E
Lead	35	110	NS	11		852	66.8	472	176	87.2
Magnesium	NS	NS	NS	1000		1250 E	1030 E	1310 E	1770 E	778 BE
Manganese	NS	NS	NS	<29		56.1 E	11.8 E	27.0 E	84.3 E	17.3 E
Nickel	30	50	NS	NA		3.9 B	<1.2	5.8 B	15.5	4.7 B
Potassium	NS	NS	NS	NA		684 B	685 B	986 B	707 B	667 B
Sodium	NS	NS	NS	290 J		343 B	530 B	693 B	407 B	420 B
Vanadium	NS	NS	NS	5.7 J		9.7 B	5.3 B	12.7	38.7	12.7
Zinc	120	270	NS	27 J		305 E	68.6 E	235 E	82.8 E	36.0 E

All samples analyzed by Savannah Laboratories, Tallahassee, Florida.
< not detected at specified detection limit
NA - not available
** - Source Geraghty & Miller Electroplating Waste Disposal Area RI - 6/92
NS - No Standard

Data Qualifiers for Organic Compounds
J - estimated quantity
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C - Compound confirmed by GC/MS

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* - duplicate analysis not within control limits

Footnotes:
1/ National Oceanic and Atmospheric Administration (NOAA) Technical Memorandum NOS OMA 52; ER-L is effects Range - Low (10th percentile)
2/ Effects Range - Median (50th percentile)
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4/ Organic Carbon
5/ As Total Chlordane

TABLE 2-8

SUMMARY OF CONSTITUENTS DETECTED IN SEDIMENT SAMPLES
SITE SS-8, MOTOR POOL OIL LEAK AREA
MONTGOMERY WATSON, 1993
(CONTINUED)

Analyte	NOAA 1/ ER-L (ug/kg)	NOAA 2/ ER-M (ug/kg)	Interim SQC ug/Kg OC 3/ (1% OC) 4/	BC-SD-0100** Background 1991	Sample ID Date Collected	SP2-SD-0044 3/15/93	SP2-SD-9044 3/15/93	SP2-SD-0045 3/15/93	SP2-SD-0046 3/15/93
VOA TCL Compounds (ug/kg)									
Acetone	NS	NS	NS	NA		<16	<16	<23	<19
Methyl Ethyl Ketone (2-Butanone)	NS	NS	NS	NA		<16	<16	<23	<19
Pesticide/PCB TCL Compounds (ug/kg)									
Aldrin	NS	NS	NS	NA		<2.6	<2.7	<3.7	<18
Alpha Endosulfan	NS	NS	NS	NA		<2.6	<2.7	<3.7	<18
Alpha-Chlordane	0.5 (5)	6	NS	NA		<2.6	<2.7	<3.7	18 J
Beta Endosulfan	NS	NS	NS	NA		<2.6	<2.7	<3.7	<18
Beta-Chlordane	0.5 (5)	6	NS	NA		<2.6	0.93 JP	<3.7	26
Endosulfan Sulfate	NS	NS	NS	NA		<5.1	<5.2	<7.2	<35
Endrin	0.02	45	NS	NA		<5.1	<5.2	<7.2	<35
Endrin Ketone	NS	NS	NS	NA		1.4 J	3.0 J	<7.2	<35
Heptachlor	NS	NS	NS	NA		<2.6	<2.7	<3.7	<18
Heptachlor Epoxide	NS	NS	NS	NA		<2.6	<2.7	<3.7	<18
Methoxychlor	NS	NS	NS	NA		<2.6	<2.7	<3.7	<18
p,p'-DDD	2	20	NS	NA		<2.6	<2.7	<3.7	63 C
p,p'-DDE	2	15	NS	NA		<5.1	0.94 J	1.8J	220 C
p,p'-DDT	1	7	NS	NA		<5.1	1.6 JP	<7.2	19 CJ
BNA TCL Compounds (ug/kg)									
2,4-Dimethylphenol	NS	NS	NS	<1400		<510	<520	<720	<700
2-Methylnaphthalene	65	670	NS	<1400		<510	<520	<720	<700
4-Chloro-3-Methylphenol	NS	NS	NS	<1400		<510	<520	<720	<700
4-Methylphenol (P-Cresol)	NS	NS	NS	<1400		<510	<520	<720	<700
Acenaphthene	150	650	7320	<1400		14 J	12 J	<720	<700
Acenaphthylene	NS	NS	NS	<1400		<510	<520	<720	<700
Anthracene	85	960	NS	<1400		34 J	26 J	24 J	32 J
Benzo(a)Anthracene	230	1600	13,170	<1400		440 J	340 J	170 J	150 J
Benzo(a)Pyrene	400	2500	10,630	<1400		580	440 J	230 J	220 J
Benzo(b)Fluoranthene	NS	NS	NS	<1400		640	530	290 J	400 J
Benzo(g,h,i)Perylene	NS	NS	NS	<1400		620	380 J	<720	<700
Benzo(k)Fluoranthene	NS	NS	NS	<1400		670	500 J	200 J	450 J
Benzyl Butyl Phthalate	NS	NS	NS	<1400		<510	<520	37 J	15 J
Bis(2-Ethylhexyl) Phthalate	NS	NS	NS	<1400		<510	<520	110 J	79 J
Carbazole	NS	NS	NS	<1400		<510	<520	<720	<700
Chrysene	400	2800	NS	<1400		600	440 J	230 J	340 J
Di-n-Butyl Phthalate	NS	NS	NS	<1400		51 BJ	29 BJ	66 BJ	61 BJ
Dibenz(A,H)Anthracene	60	260	NS	<1400		<510	<520	<720	<700
Dibenzofuran	NS	NS	NS	<1400		4 J	<520	<720	<700
Dimethyl Phthalate	NS	NS	NS	<1400		<510	<520	<720	<700
Fluoranthene	600	3600	18,830	<1400		650	520J	330 J	490 J
Fluorene	35	640	NS	<1400		8 J	7 J	<720	22 J
Indeno(1,2,3-C,D)Pyrene	NS	NS	NS	<1400		540	350 J	<720	82 J
Naphthalene	340	2100	NS	<1400		<510	<520	<720	<700
Pentachlorophenol	NS	NS	NS	<1400		<1200	<1300	<1700	<1700
Phenanthrene	225	1380	1,390	<1400		170 BJ	130 J	110 J	120 J
Pyrene	350	2200	13,110	<1400		790	710	310 J	550 J
Metals (mg/kg)									
Aluminum	NS	NS	NS	2700		5050 *	4670 *	4160 *	3450 *
Arsenic	33	85	NS	2		3.0 N	3.2 N	2.6 N	10.9 N
Barium	NS	NS	NS	14		12.2 BN*	12.3 BN*	10.2 BN*	24.5 BN*
Beryllium	NS	NS	NS	NA		<0.20	<0.20	<0.20	<0.20
Cadmium	5	9	NS	<2.1		0.91 B	0.91 B	<0.40	0.89 B
Calcium	NS	NS	NS	310,000		294000	309000	297000	286000
Chromium, Total	80	145	NS	11J		23.5	21.2	12.2	17.6
Cobalt	NS	NS	NS	<4.2		0.73 B	0.41 B	0.56 B	<0.40
Copper	70	390	NS	16 J		7.1	7.8	2.9 B	17.3
Iron	NS	NS	NS	1700		2500 E	2440 E	2100 E	2140 E
Lead	35	110	NS	11		82.5	68.6	75.7	42.1
Magnesium	NS	NS	NS	1000		970 BE	1060 E	988 BE	1240 E
Manganese	NS	NS	NS	<29		26.1 E	24.6E	22.5 E	74.5 E
Nickel	30	50	NS	NA		4.1 B	4.0 B	3.3 B	2.3 B
Potassium	NS	NS	NS	NA		773 B	804 B	808B	687 B
Sodium	NS	NS	NS	290 J		836 B	842 B	650 B	312 B
Vanadium	NS	NS	NS	5.7 J		8.4 B	8.2 B	10B	7.5 B
Zinc	120	270	NS	27 J		82.1 E	88.5E	32.6 E	49.6 E

All samples analyzed by Savannah Laboratories, Tallahassee, Florida.
< not detected at specified detection limit
NA - not available
** - Source Geraghty & Miller Electroplating Waste Disposal Area RI - 6/92
NS - No Standard

Footnotes:
1/ National Oceanic and Atmospheric Administration (NOAA) Technical Memorandum NOS OMA 52; ER-L is effects Range - Low (10th percentile)
2/ Effects Range - Median (50th percentile)
3/ The sediment quality criteria (SQC) cannot be directly compared with the drainage swale data because the SQC are presented as normalized to organic carbon (i.e. presented on a per organic carbon weight basis). To allow a direct comparison between the sediment data and SQC, the SQC for an organic carbon content of 1.0% OC were calculated. The SQC (ug/Kg) at 1% OC were derived by multiplying the SQC (ug/Kg OC) by an OC content of 1% (.01 Kg of OC/Kg of sediment).
4/ Organic Carbon
5/ As Total Chlordane

Data Qualifiers for Organic Compounds
J - estimated quantity
B - compound detected in an associated blank
C - Compound confirmed by GC/MS

Data Qualifiers for Inorganic Compounds
B - Reading is less than CRQL but greater than IDL
E - reported value is estimated due to interference
N - spiked sample recovery not within control limits
* - duplicate analysis not within control limits

The pesticides heptachlor, heptachlor epoxide, alpha and beta endosulfan, endosulfate, methoxychlor, endrin ketone, alpha-chlordane, beta-chlordane, and the DDT metabolites p,p'-DDE and p,p'-DDD were detected in sediment samples at Site SS-8. Concentrations of pesticides were below health based cleanup levels. No PCBs were detected in sediment samples obtained during the 1993 investigation.

18 TAL metals (aluminum, arsenic, barium, beryllium, cadmium, calcium chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, potassium, sodium, vanadium and zinc) were detected in sediment samples at Site SS-8 during the 1993 investigation. Arsenic was detected in all sediment samples with concentrations exceeding background soil levels and background sediment concentration in six samples. Lead was detected in sediment samples ranging from 55.6 to 1600 mg/kg. Lead concentrations in the canal surrounding the Motor Pool were lower in the 1993 samples when compared to 1991 levels. Sediment metals concentrations exceeded health based cleanup levels for lead and arsenic. A summary of constituents detected in sediment samples from the 1993 investigation are presented in Table 2-8.

2.6.5 Surface Water Sample Analytical Results

2.6.5.1 Initial investigations (1991). In the samples collected in 1991, no VOCs were detected. Only one BNA, DEHP, had a quantifiable concentration detected. DEHP is a common laboratory contaminant and its presence may be due to laboratory conditions and not representative of site conditions. A summary of the 1991 surface water analytical results is presented in Table 2-9.

Mercury was detected in five of the seven samples (six sample locations plus one duplicate sample) that were analyzed for mercury. Mercury concentrations ranged from less than 0.10 to 0.22 µg/L. In three of the samples where mercury was detected, the concentrations were above the Federal Water Quality Criteria (FWQC) of 0.012 µg/L and the Florida Surface Water Guidance Criteria (FSWGC) of 0.012 µg/L. Other inorganic constituents detected in the surface water included: aluminum, barium, calcium, copper, iron, magnesium, potassium, sodium, and zinc. Aluminum was the only constituent detected above the FSWGC or the FWQC.

2.6.5.2 1993 Investigation. Four surface water samples were collected at Site SS-8. No VOCs were detected, as were no BNAs and no organochlorine pesticides/PCB

TABLE 2-9
SUMMARY OF SURFACE WATER ANALYTICAL RESULTS
SITE SS-8; MOTOR POOL OIL LEAK AREA
GERAGHTY & MILLER, INC., 1991
HOMESTEAD ARB, FLORIDA

Analyte	Florida Surface Water Quality Standards	Federal Water Quality Criterion	G&M Sample I.D. Savannah I.D. Sampling Date	Trip Blank 35328-8 8/21/91	SP2-EB-0004 35394-5 8/23/91	SP2-SW-0001 35328-3 8/21/91	SP2-SW-0002 35328-5 8/21/91	SP2-SW-0003 35328-1 8/21/91	SP2-SW-0004 35328-2 8/21/91
VOLATILE ORGANIC COMPOUNDS: (ug/L)		1/		BDL /2	BDL	BDL	BDL	BDL	BDL
BASE/NEUTRAL AND ACID EXTRACTABLE COMPOUNDS: (ug/L)									
Benzoic acid	NS	NS 3/		NA	<25	<25	NA 4/	<25	<25
bis(2-Ethylhexyl) phthalate	NS	NS		NA	<5.0	<5.0	NA	71	140
Butylbenzylphthalate	NS	NS		NA	<5.0	<5.0	NA	<5.0	<10
2-Chlorophenol	NS	NS		NA	<5.0	[0.34]	NA	<5.0	<5.0
Di-n-butylphthalate	NS	NS		NA	<5.0	<5.0	NA	[0.11]	<5.0
INORGANIC CONSTITUENTS: (ug/L)									
Aluminum	NS	87			<200	<200	NA	<200	<200
Barium	NS	NS		NA	<10	13	NA	13	14
Calcium	NS	NS		NA	150	100000	NA	93000	98000
Copper	30	25 5/		NA	<2.0	2.1 J	NA	<2.0	<2.0 UJ
Iron	1000	1,000		NA	<50	<50	NA	<50	<50
Magnesium	NS	NS		NA	<50	3000	NA	2800	2900
Potassium	NS	NS		NA	<1000	6200	NA	5700	6600
Sodium	NS	NS		NA	<500	13000	NA	12000	12000
Zinc	NS	223 5/		NA	<20	63	NA	270	23
Mercury	0.012	0.012		NA	<0.10	0.17 U	NA	0.21 U	0.13 U
Lead	30	9.7 5/		NA	<5	<5	<5	<5	<5

TABLE 2-9
SUMMARY OF SURFACE WATER ANALYTICAL RESULTS
SITE SS-8, MOTOR POOL OIL LEAK AREA
GERAGHTY & MILLER, INC., 1991
HOMESTEAD ARB, FLORIDA
CONTINUED

Analyte	Florida Surface Water Quality Standards	Federal Water Quality Criterion	G&M Sample I.D. Savannah I.D. Sampling Date	SP2-SW-9004 35328-4 8/21/91	SP2-SW-0005 35328-7 8/21/91	SP2-SW-0006 35445-5 8/27/91	SP2-SW-0007 35328-6 8/21/91	SP2-SW-0008 35394-11 8/23/91	SP2-SW-0009 35394-6 8/23/91	SP2-SW-0010 35445-6 8/27/91
VOLATILE ORGANIC COMPOUNDS: (ug/L)		1/		BDL	BDL	BDL	BDL	BDL	BDL	BDL
BASE/NEUTRAL AND ACID EXTRACTABLE COMPOUNDS: (ug/L)										
Benzoic acid	NS	NS 3/		[0.61]	NA	NA	NA	NA	<25	<25
bis(2-Ethylhexyl) phthalate	NS	NS		<5.0	NA	NA	NA	NA	<5.0	<5.0
Butylbenzylphthalate	NS	NS		<5.0	NA	NA	NA	NA	<5.0	[1.6]
2-Chlorophenol	NS	NS		[0.32]	NA	NA	NA	NA	<5.0	<5.0
Di-n-butylphthalate	NS	NS		<5.0	NA	NA	NA	NA	<5.0	<5.0
INORGANIC CONSTITUENTS: (ug/L)										
Aluminum	NS	87		<200	NA	NA	NA	NA	680	<200
Barium	NS	NS		13	NA	NA	NA	NA	<10	<10
Calcium	NS	NS		97000	NA	NA	NA	NA	19000	14000
Copper	30	25 5/		<2.0	NA	NA	NA	NA	<2.0 UJ	<2.0 UJ
Iron	1000	1,000		<50	NA	NA	NA	NA	720 J	<50
Magnesium	NS	NS		2900	NA	NA	NA	NA	450	410
Potassium	NS	NS		6400	NA	NA	NA	NA	<1000	<1000 UJ
Sodium	NS	NS		12000	NA	NA	NA	NA	2000	2400
Zinc	NS	223 5/		110	NA	NA	NA	NA	27	<20
Mercury	0.012	0.012		0.22 U	NA	NA	NA	NA	0.22	<0.10
Lead	30	9.7 5/		<5	<5 UJ	<5	<5	<5 UJ	<5	<5 UJ

Source: Geraghty & Miller, Inc. 1992

1/ Constituents not detected above the practical quantitation limit are not listed.
2/ All constitiuents in analyte group were below the practical quantitation limt.
3/ NS: No Standard
4/ NA: Not Analyzed
5/ Federal Water Quality Criterion (FWQC) calculated using average hardness of 240 mg/L Boundary Canal
[ ] Value is between instrument detection limit and practical quantitation limit.

TABLE 2-10

SUMMARY OF CONSTITUENTS DECTECTED IN SURFACE WATER SAMPLES COLLECTED AT SITE SS-8 MOTOR POOL OIL LEAK AREA MONTGOMERY WATSON, 1993

Analyte	Florida Surface Water Quality Standards	Federal Water Quality Criterion **	Sample ID Date Collected	SP2-SW-0011 3/14/93	SP2-SW-0012 3/14/93	SP2-SW-0013 3/14/93	SP2-SW-9013 3/14/93 Duplicate	SP2-SW-0014 3/14/93
VOA TCL Compounds (ug/l)								
Chloroform	NS	28900		< 10	< 10	1 J	1 J	1 J
Pesticide/PCB TCL Compounds (ug/l)	ND	ND		ND	ND	ND	ND	ND
BNA TCL Compounds (ug/l) ***								
Bis(2-Ethylhexyl) Phthalate	<3000	<3000		<10	0.2 J	<11	<10	<11
Di-n-Butyl Phthalate	<3000	<3000		0.5 BJ	<10	<11	0.2 BJ	<11
Diethylphthalate	<3000	<3000		0.1 J	<10	<11	<10	<11
Metals (mg/kg)								
Barium	NS	NS		11.7B	3.5B	8.0B	9.9B	6.5B
Calcium	NS	NS		99600	37300	89700	96800	91800
Copper	25*	18		<2.0	4.0B	5.1B	4.8B	<2.0
Iron	1	1,000		23.8B	58.2B	16.5B	8.8B	17.0B
Magnesium	NS	NS		2910B	1020B	2920B	3010B	3000B
Manganese	NS	NS		3.4B	1.8B	1.6B	<1.0	1.5B
Potassium	NS	NS		6710	1730B	6820	7950	6850
Sodium	NS	NS		13300	4350B	13500	12700	14000
Zinc	223*	320		26.6	28.9	23.2	22.6	38.4

All samples analyzed by Savannah Laboratories, Tallahassee, Florida.

< - not detected at specified detection limit
NS- no standard
ND - not detected
NA - not analyzed

Data Qualifiers for Organic Compounds
J - estimated quantity
B - compound detected in an associated blank

Data Qualifiers for Inorganic Compounds
B - Reading is less than CRQL but greater than IDL

Notes:

* Florida WaterQuality Criterion (FWQC) calculated using average hardness of 240 mg/L Boundary Canal
** Fresh water acute
** Reported as Total Phthalate Esters

compounds. The metals barium, calcium, iron, magnesium, manganese, potassium, sodium, and zinc were detected in surface water samples. Metals results are below state and federal groundwater quality criteria and Florida surface water quality criteria. Cyanide was not detected in any of the 1993 surface waster samples. A summary of constituents detected in surface water samples collected in 1993 are presented in Table 2-10.

2.7 SUMMARY OF SITE RISKS

In order to evaluate whether existing or future exposure to contaminated media at Site SS-8 could pose a risk to people or the environment, USAF completed a BRA in July 1994, with USEPA oversight of this process. In estimating potential site risks, USAF assumed no further action would be taken to address contamination at the site. This evaluation then served as a baseline for determining whether cleanup of each site media was necessary. In the BRA, USAF evaluated site risks for several environmental media. This ROD addresses the risks attributable to chemicals in the groundwater, soil and sediment at Site SS-8. Sediment and surface water will also be addressed as part of OU-9, the site-wide canal assessment. The risk assessment included the following major components: selection of chemicals of potential concern, exposure assessment, toxicity assessment, risk characterization, development of remedial goal options, ecological risk, and uncertainties.

2.7.1 Selection of Chemicals of Potential Concern

Samples collected at Site SS-8 indicated that groundwater contains semi-volatile organic chemicals (SVOCs) and metals. Soils at the site contain VOCs, SVOCs, pesticides, and metals.

Chemicals are included in the risk assessment as chemicals of potential concern (COPCs) if the results of an initial screening indicate that the chemical might pose a current or future risk above levels deemed protective of human health and the environment by the USEPA. COPCs at Site SS-8 included all detected organic chemicals and inorganic chemicals that are not human nutrients and are present at levels greater than twice the average background concentrations. A concentration toxicity screen was performed to eliminate from consideration chemicals that contributed less than 1% of the total estimated risk in a given medium.

COPC for groundwater and soil are shown in Table 2-11.

TABLE 2-11

COMPOUNDS OF POTENTIAL CONCERN IN ENVIRONMENTAL MEDIA AT SITE SS-8, MOTOR POOL OIL LEAK AREA
Homestead Air Reserve Base, Florida

Constituent	Affected Media		
		Soil	
	Groundwater	Surface	Subsurface
BNAs			
Benzo(a)anthracene		X	X
Benzo(a)pyrene		X	X
Benzo(b)fluoranthene		X	X
Benzo(g,h,i)perylene		X	X
Benzo(k)fluoranthene		X	
Chrysene		X	X
Dibenzo(a,h)anthracene		X	X
Fluoranthene		X	
Indeno(1,2,3-c,d)pyrene		X	X
Pyrene		X	X
Metals			
Aluminum	X		X
Arsenic		X	X
Barium			X
Cadmium			X
Calcium	X		
Chromium	X	X	X
Cobalt	X		
Copper			X
Iron	X		
Lead	X	X	X
Manganese	X	X	X
Mercury	X		
Nickel	X		
Vanadium	X		X

BNAs Base/Neutral and Acid Extractable Compounds

2.7.2 Exposure Assessment

In the exposure assessment, USAF considered ways in which people could come into contact with contaminated media under both current and future conditions. A critical step in assessing the potential risk to public health is to identify the pathways through which exposure to chemicals could occur. A typical transport pathway consists of four necessary elements: 1) a source and mechanism of chemical release; 2) an environmental transport medium; 3) a point of potential contact with the contaminated medium; and 4) exposure routes (inhalation of vapors, ingestion of groundwater, etc.). All four of these elements must be present for a pathway to be complete.

2.7.2.1 Exposure Point Concentrations. the exposure point concentration for each contaminant was derived using the 95 percent upper confidence limit (UCL_{95}) on the arithmetic mean as defined by the following formula:

$$UCL_{95} = e\left(\bar{x} + \left[\frac{s^2}{2} + \frac{sH}{\sqrt{n-1}}\right]\right)$$

where:
- $\bar{x}$ = arithmetic mean of the log-transformed data
- s = standard deviation of the log-transformed data
- H = statistical parameter
- UCL = Upper Confidence Limit

Often, with limited data sets, the UCL_{95} is higher than the maximum detected concentration. If so, the maximum concentration detected was used as the exposure point concentration rather than the UCL_{95}. Exposure point concentration for groundwater, surface soil, and subsurface soil are presented in Tables 2-12, 2-13, and 2-14, respectively.

2.7.2.2 Land Use. Hypothetical future use of the site for residential purposes in unlikely. However, for the purposes of the baseline risk assessment, the hypothetical future risks were evaluated for the possibility of future residential development of the site and installation of a potable well.

TABLE 2-12

EXPOSURE POINT CONCENTRATIONS FOR GROUNDWATER
SITE SS-8 (FORMERLY SP-2) MOTOR POOL OIL LEAK AREA
HOMESTEAD AIR RESERVE BASE

Constituent	Geraghty & Miller Samples Collected 1990-1991	Montgomery Watson Samples Collected 1993			G&M	MW	Value Used
	No. Samples Collected & Avg.	No. Samples Collected	Total No. Samples Averaged 1990-93	UCL[1]	Max[1]	Max[1]	In Calculation
METALS (µg/L)							
Chromium	2	1	3	4.52E+12	240	3.6	240
Manganese	2	1	3	2.13E+20	320	22.2	320
Mercury	2	1	3	11.64	0.32	0.1	0.32
Nickel	2	1	3	1.20E+08	80	6.4	80
Vanadium	2	1	3	7.16E+13	120	7.6	120
Lead	2	1	3	3.76E+08	20	1.5	20

Note: UCLs based on the 95 percent UCL of the arithmetic average of the log-transformed data.
UCL Upper Confidence Limit
µg/L micrograms per Liter
-- Not Detected
[1] UCLs are used as exposure point concentrations unless calculation produces a UCL greater than the maximum detected concentration, in which case the maximum detected concentration is used. This UCL value is for the combined sample sets.

TABLE 2-13

EXPOSURE POINT CONCENTRATIONS FOR SURFACE SOIL
SITE SS-8 (FORMERLY SP-2) MOTOR POOL OIL LEAK AREA
HOMESTEAD AIR RESERVE BASE

Constituent	Geraghty & Miller Samples Collected 1990-1991	Montgomery Watson Samples Collected 1993			MW	Value Used in Calculation
	No. Samples Collected & Avg.	No. Samples Collected	Total No. Samples Averaged 1990-93	UCL[1]	Max[1]	
BNAS (µg/kg)						
Benzo(a)anthracene		5	5	1.62E+08	3,700	3,700
Benzo(a)pyrene		5	5	1.94E+09	5,300	5,300
Benzo(b)fluoranthene		5	5	6.01E+13	5,800	5,800
Benzo(g,h,i)perylene		5	5	9.57E+08	3,800	3,800
Benzo(k)fluoranthene		5	5	1.20E+13	4,500	4,500
Chrysene	[No soil samples collected in 1990-1991]	5	5	8.74E+08	5,200	5,200
Dibenzo(a,h)anthracene		5	5	3.86E+03	1,000	1,000
Fluoranthene		5	5	6.94E+16	5,100	5,100
Ideno(1,2,3-c,d)pyrene		5	5	3.13E+08	3,200	3,200
Pyrene		5	5	4.32E+12	5,800	5,800
METALS (mg/kg)						
Arsenic		5	5	6.24	2.4	2.4
Chromium		5	5	27.0	15.9	15.9
Lead		5	5	999.0	92.4	92.4
Manganese		5	5	45.5	42.9	42.9

Note: UCLs based on the 95 percent UCL of the arithmetic average of the log-transformed data.
UCL Upper Confidence Limit
µg/L micrograms per Liter
-- Not Detected
[1] UCLs are used as exposure point concentrations unless calculation produces a UCL greater than the maximum detected concentration, in which case the maximum detected concentration is used.

TABLE 2-14

EXPOSURE POINT CONCENTRATIONS FOR SUBSURFACE SOIL
SITE SS-8 (FORMERLY SP-2) MOTOR POOL OIL LEAK AREA
HOMESTEAD AIR RESERVE BASE

Constituent	Geraghty & Miller Samples Collected 1990-1991	Montgomery Watson Samples Collected 1993			MW	Value Used
	No. Samples Collected & Avg.	No. Samples Collected	Total No. Samples Averaged 1990-93	UCL[1]	Max[1]	in Calculation
BNAS (µg/kg)						
Benzo(a)anthracene		5	5	7.41E+04	3,200	3,200
Benzo(a)pyrene		5	5	7.36E+07	5,500	5,500
Benzo(b)fluoranthene		5	5	4.67E+12	7,000	7,000
Benzo(g,h,i)perylene		5	5	1.10E+08	4,300	4,300
Chrysene	[No soil samples collected in 1990-1991]	5	5	3.62E+05	5,600	5,600
Dibenzo(a,h)anthracene		5	5	9.69E+04	1,200	1,200
Indeno(1,2,3-c,d)pyrene		5	5	4.43E+07	3,300	3,300
Pyrene		5	5	3.59E+10	6,500	6,500
METALS (mg/kg)						
Arsenic		5	5	4.78	3	3
Barium		5	5	19.5	15.7	15.7
Cadmium		5	5	0.50	0.55	0.5
Chromium		5	5	38.3	19.6	19.6
Copper		5	5	1030	8.6	8.6
Lead		5	5	9.01E+04	120	120
Manganese		5	5	108.8	57.8	57.8
Vanadium				7.39E+00	7.3	7.3

Note: UCLs based on the 95 percent UCL of the arithmetic average of the log-transformed data.
UCL Upper Confidence Limit
µg/L micrograms per Liter
-- Not Detected
[1] UCLs are used as exposure point concentrations unless calculation produces a UCL greater than the maximum detected concentration, in which case the maximum detected concentration is used.

TABLE 2-15

EQUATIONS AND SAMPLE CALCULATIONS FOR HYPOTHETICAL FUTURE POTABLE GROUNDWATER EXPOSURE AT SITE SS-8, MOTOR POOL OIL LEAK AREA
Homestead Air Reserve Base, Florida

Equation Definition:

$$GWExD = \frac{C_{gw} \times IR \times EF}{BW \times AP}$$

$$ELCR = GWExD \times CSF_o$$

$$HQ = \frac{GWExD}{RfD_o}$$

where:

AP	Averaging period (25,550 days/lifetime [365 days/yr for 70 years] for carcinogenic effects; 10,950 days/lifetime [365 days/yr for 30 years] for non-carcinogenic effects (USEPA, 1989a).
BW	Body weight (70 kg) (USEPA, 1991a).
CSF_o	Cancer slope factor for oral exposure $(mg/kg\text{-}day)^{-1}$ (Table 3-3).
C_{gw}	Concentration in ground water (mg/L) (lesser of 95 percent upper confidence limit on the arithmetic mean or the maximum detected concentration) (Table 4-2).
ELCR	Excess lifetime cancer risk.
EF	Exposure frequency (10,500 days/lifetime [350 days/year for 30 years]) (USEPA, 1991a).
GWExD	Potable ground-water exposure dose (mg/kg-day).
HQ	Hazard quotient.
IR	Ingestion rate - drinking water (2 liters/day) (USEPA, 1991a).
RfD_o	Reference dose for oral exposure (mg/kg-day) (Table 3-2).

Sample Calculation - chromium, cancer effects

$$GWExD = \frac{(0.24\ mg/L) \times (2\ L/day) \times (10{,}500\ days/lifetime)}{(70\ kg) \times (25{,}550\ days/lifetime)}$$

$$= 2.8E\text{-}03\ mg/kg\text{-}day$$

ELCR = Not calculated because chromium is carcinogenic through inhalation only

TABLE 2-15 (continued)

EQUATIONS AND SAMPLE CALCULATIONS FOR HYPOTHETICAL FUTURE POTABLE GROUNDWATER EXPOSURE AT SITE SS-8, MOTOR POOL OIL LEAK AREA Homestead Air Force Base, Florida

Sample Calculation - chromium, non-cancer effects

$$GWExD = \frac{(0.24\ mg/L) \times (2\ L/day) \times (10{,}500\ days/lifetime)}{(70\ kg) \times (10{,}950\ days/lifetime)}$$

$$= 6.6E\text{-}03\ mg/kg\text{-}day$$

$$HQ = \frac{6.6E\text{-}03\ mg/kg\text{-}day}{5E\text{-}03\ mg/kg\text{-}day}$$

$$= 1.3E+00$$

TABLE 2-16

EQUATIONS AND SAMPLE CALCULATIONS FOR SURFACE SOIL EXPOSURE AT SITE SS-8, MOTOR POOL OIL LEAK AREA
Homestead Air Reserve Base, Florida

Equation Definitions:

$$SExD_o = \frac{C_s\ (\text{or } C_sTEF) \times IR \times EF \times ED \times UC_1}{BW \times AP}\ ^{(1)}$$

$$SExD_d = \frac{C_s \times SSA \times SAR \times ABS \times EF \times ED \times UC_1}{BW \times AP}\ ^{(1)}$$

$$SExD_i = \frac{C_s\ (\text{or } C_sTEF) \times BR \times ET \times EF \times ED \times RF \times (1-G) \times (W/U_t)^3 \times F(x)}{BW \times AP \times Q/C \times UC_2} \quad \text{(particulates)}$$

or

$$\frac{C_s\ (\text{or } C_sTEF) \times BR \times ET \times H \times EF \times ED \times 2 \times Dei \times Pa \times UC_5/Kd}{BW \times AP \times Q/C \times (3.1416 \times \text{alpha} \times ED \times UC_3)^{1/2} \times UC_4} \quad \text{(vapors)}\ ^{(2)}$$

$$ELCR = (SExD_o \times CSF_o) + (SExD_d \times CSF_a) + (SExD_i \times CSF_i)$$

$$HQ = (SExD_o/RfD_o) + (SExD_d/RfD_a) + (SExD_i/RfD_i)$$

where:

ABS	Dermal absorption efficiency, constituent-specific (from Table 3-1).
AP	Averaging period (equal to ED x 365 days/year for non-cancer effects; 25,550 days [70 years x 365 days/year] for cancer effects) (USEPA, 1989a).
BR	Breathing rate (0.83 m^3/hour [20 m^3/day] for residents [USEPA, 1991a]; 2.5 m^3/hour for base worker [USEPA, 1989b]).
BW	Body weight (70 kg for adults; 15 kg for a young child [aged 0 to 6 years]) (USEPA, 1991a).
C_s	Constituent concentration in the soil (mg/kg) (from Table 4-3).
C_sTEF	Constituent concentration in the soil (mg/kg) (from Table 4-3) multiplied by toxicity equivalency factors (TEFs). TEFS have been applied to constituent concentrations based on each compounds relative potency to the potency of benzo(a)pyrene.
CSF_a	Cancer slope factor for dermal exposure, adjusted for absorbed dose $(mg/kg\text{-}day)^{-1}$ (Table 3-4).
CSF_i	Cancer slope factor for inhalation exposure $(mg/kg\text{-}day)^{-1}$ (Table 3-3).
CSF_o	Cancer slope factor for oral exposure $(mg/kg\text{-}day)^{-1}$ (Table 3-3).
ED	Exposure duration (25 years for base worker; 24 years for an adult resident; 6 years for a child resident [aged 0 to 6 years]) (USEPA, 1991a).
EF	Exposure frequency (350 days/year for residents [USEPA, 1991a]; 12 days/year [1 day/month for 12 months per year] for a base worker).
ELCR	Excess lifetime cancer risk (unitless).

TABLE 2-16 (continued)

EQUATIONS AND SAMPLE CALCULATIONS FOR SURFACE SOIL EXPOSURE AT SITE SS-8, MOTOR POOL OIL LEAK AREA
Homestead Air Reserve Base, Florida

ET	Exposure time (1 hour/day for a base worker; 24 hours/day for residents).
H	Henry's Law Constant (atm-m^3/mol; constituent specific) (Table 3-6).
HQ	Hazard quotient (unitless).
IR	Incidental ingestion rate for soil (50 mg/day for workers; 100 mg/day for an adult resident; 200 mg/day for a child resident [aged 0 to 6 years]) (USEPA, 1991a).
RfD_a	Reference dose for dermal exposure, adjusted for absorbed dose (mg/kg-day) (Table 3-4).
RfD_i	Reference dose for inhalation exposure (mg/kg-day) (Table 3-2).
RfD_o	Reference dose for oral exposure (mg/kg-day) (Table 3-2).
SAR	Soil adherence rate (1 mg/cm^2-day) (USEPA, 1992c).
$SExD_d$	Soil exposure dose from dermal contact (mg/kg-day).
$SExD_i$	Soil exposure dose from inhalation of particulates or vapors from soil (mg/kg-day).
$SExD_o$	Soil exposure dose from incidental ingestion (mg/kg-day).
SSA	Exposed skin surface area (3,160 cm^2 for adult resident and base worker [USEPA, 1991a]; 3,652 cm^2 for child resident [aged 0 to 6 years] [USEPA, 1989b]).
F(x)	Unitless function dependent on W/Ut (0.0497)
G	Fraction of vegetative cover (unitless) (0)
RF	Respirable fraction of dust (0.036 g/m^2-hr)
UC_1	Unit conversion (10^{-6} kg/mg).
UC_2	Unit conversion 2 (3,600 sec/hr)
Ut	Equivalent threshold windspeed at a height of 10 meters (12.8 m/sec)
Q/C	Emission flux per unit concentration (g/m^2-sec/kg/m^3); calculated as follows:

$$Q/C = \exp(Y + 2.92s(Y))^{-1}$$

$$Y = 0.1004X - 5.3466$$

$$s(Y) = 0.02685 \times \left(0.25 + \frac{(X - 11.0509)^2}{26.3608}\right)$$

X — Natural logarithm of the contiguaous area of contamination in m^2 (8.02) (based on one fourth of a three-acre contaminated area being free of structures)

TABLE 2-16 (continued)

EQUATIONS AND SAMPLE CALCULATIONS FOR SOIL EXPOSURE AT SITE SS-3 (FORMER SP-7), AIRCRAFT WASHRACK AREA
Homestead Air Reserve Base, Florida

alpha	Convenient collection of variables (cm^2/sec); calculated as follows: $alpha = \frac{D_{ei} \times P_a}{P_a + [roe \times (1-P_a) \times K_d/(UC_5 \times H)]}$
beta	Soil bulk density (1.5 g/cm^3)
D_{ei}	Effective diffusivity (cm^2/sec); calculated as follows: $D_{ei} = D_i(P_a^{3.33}/P_t^2)$
D_i	Chemical-specific diffusivity in air (cm^2/sec)
P_a	Air-filled porosity (unitless); calculated as follows: $P_a = P_t$ - (theta x beta)
P_t	Total soil porosity (unitless); calculated as follows: $P_t = 1$ - (beta/roe)
roe	Soil particulate density (2.65 g/cm^3)
theta	Average soil mositure content (0.1 cm^3 water/gram of soil)
UC_3	Unit conversion 3 (31,500,000 sec/yr)
UC_4	Unit conversion 4 (0.0001 m^2/cm^2)
UC_5	Unit conversion 5 (41 mol/atm-m^3) (Hwang and Falco, 1986)

TABLE 2-16 (continued)

EQUATIONS AND SAMPLE CALCULATIONS FOR SURFACE SOIL EXPOSURE AT SITE SS-8, MOTOR POOL OIL LEAK AREA
Homestead Air Reserve Base, Florida

Sample Calculation - benzo(a)pyrene, cancer effects, base worker (mowing scenario):

$$SExD_O = \frac{(5.3\ mg/kg) \times (50\ mg/day) \times (52\ days/yr) \times (25\ yrs) \times (10^{-6}\ kg/mg)}{(70\ kg) \times (25{,}550\ days)}$$

$$= 1.9 \times 10^{-7}\ mg/kg\text{-}day$$

$$SExD_d = \frac{(5.3\ mg/kg) \times (3{,}160\ cm^2) \times (1\ mg/cm^2\text{-}day) \times (0.01) \times (52\ days/yr) \times (25\ yrs) \times (10^{-6}\ kg/mg)}{(70\ kg) \times (25{,}550\ days)}$$

$$= 1.2 \times 10^{-7}\ mg/kg\text{-}day$$

$SExD_i$ (3)

(Particulate)

$$\frac{5.3\frac{mg}{kg} x 2.5\frac{m^3}{hr} x 1\frac{hrs}{day} x 52\frac{days}{yr} x 25 yrs\ x\ 0.036\frac{g}{m^2-hr} x (1-0) x (4\frac{m}{sec} / 12.8\frac{m}{sec})^3 x 0.0497}{70\,kg\, x 25{,}500\, days\, x 89.5\frac{\frac{g}{m^2-sec}}{\frac{kg}{m^3}} x 3{,}600\frac{sec}{hr}}$$

$$= 1.6 \times 10^{-12}\ mg/kg\text{-}day$$

$$ELCR = [(1.9 \times 10^{-7}\ mg/kg\text{-}day) \times (7.5\ kg\text{-}day/mg)] + [(1.2 \times 10^{-7}\ mg/kg\text{-}day) \times (6.6\ kg\text{-}day/mg)] + [(1.6 \times 10^{-12}\ mg/kg\text{-}day) \times (7.5\ kg\text{-}day/mg)]$$

$$= 2.2 \times 10^{-6}$$

TABLE 2-16 (continued)

EQUATIONS AND SAMPLE CALCULATIONS FOR SOIL EXPOSURE AT SITE SS-3 (FORMER SP-7), AIRCRAFT WASHRACK AREA
Homestead Air Reserve Base, Florida

Sample Calculation - manganese, noncancer effects, future child resident:

$$SExD_o = \frac{(42.9\ mg/kg) \times (200\ mg/day) \times (350\ days/yr) \times (6\ yrs) \times (10^{-6}\ kg/mg)}{(15\ kg) \times (2{,}190\ days)}$$

$$= 5.5 \times 10^{-4}\ mg/kg\text{-}day$$

$$SExD_d = \frac{(42.9\ mg/kg) \times (3{,}652\ cm^2) \times (1 mg/cm^2\text{-}day) \times (0.001) \times (350\ days/yr) \times (6\ yrs) \times (10^{-6}\ kg/mg)}{(15\ kg) \times (2{,}190\ days)}$$

$$= 1.0 \times 10^{-5}\ mg/kg\text{-}day$$

$SExD_i$ =

(Particulate)

$$\frac{42.9\frac{mg}{kg} x 0.83\frac{m^3}{hr} x 24\frac{hrs}{day} x 350\frac{days}{yr} x 6\,yrs\ x\ 0.036\frac{g}{m^2-hr} x (1-0) x (4\frac{m}{sec} / 12.8\frac{m}{sec})^3 x 0.0497}{15\,kg\,x\,2{,}190\,days\,x\,89.5\frac{\frac{g}{m^2-sec}}{\frac{kg}{m^3}} x 3{,}600\frac{sec}{hr}}$$

$$= 9.3 \times 10^{-9}\ mg/kg\text{-}day$$

$$HQ = \frac{5.5 \times 10^{-4} mg/kg\text{-}day}{0.10\ mg/kg\text{-}day} + \frac{1.0 \times 10^{-5} mg/kg\text{-}day}{5.0 \times 10^{-3}\ mg/kg\text{-}day} + \frac{9.3 \times 10^{-9} mg/kg\text{-}day}{1.1 \times 10^{-4}\ mg/kg\text{-}day}$$

$$= 7.6 \times 10^{-3}$$

(1) This equation as presented in Risk Assessment Guidance Volume I (USEPA, 1989)

(2) This equation as presented in RAGs Volume I, modified to estimate air concentrations based on soil concentrations.

(3) Calculations not performed for vapors due to absence of volatile organic compounds (VOCs) at this site.

TABLE 2-17

EQUATIONS AND SAMPLE CALCULATIONS FOR HYPOTHETICAL FUTURE CONSTRUCTION WORKER FOR SOIL EXPOSURE AT SITE SS-8, MOTOR POOL OIL LEAK AREA Homestead Air Reserve Base, Florida

Sample Calculation - arsenic, cancer effects, construction worker, subsurface soil:

$$SExD_o = \frac{(3\ mg/kg) \times (480\ mg/day) \times (250\ days/yr) \times (1\ yr) \times (10^{-6}\ kg/mg)}{(70\ kg) \times (25{,}550\ days)}$$

$$= 2.0 \times 10^{-7}\ mg/kg\text{-}day$$

$$SExD_i = \frac{(3\ mg/kg) \times (5\ mg/m^3) \times (2.5\ m^3/hr) \times (8\ hr/day) \times (250\ days/yr) \times (1\ yr) \times (10^{-6}\ kg/mg)}{(70\ kg) \times (25{,}550\ days)}$$

$$= 4.2 \times 10^{-8}\ mg/kg\text{-}day$$

$$ELCR = [(2.0 \times 10^{-7}\ mg/kg\text{-}day) \times (1.75\ kg\text{-}day/mg)] + [(4.2 \times 10^{-8}\ mg/kg\text{-}day) \times (5.0 \times 10^{+1}\ kg\text{-}day/mg)]$$

$$= 2.4 \times 10^{-6}$$

Sample Calculation - benzo(g,h,i)perylene, noncancer effects, construction worker, surface soil:

$$SExD_o = \frac{(3.8\ mg/kg) \times (480\ mg/day) \times (250\ days/yr) \times (1\ yr) \times (10^{-6}\ kg/mg)}{(70\ kg) \times (365\ days)}$$

$$= 1.8 \times 10^{-5}\ mg/kg\text{-}day$$

$$SExD_i = \frac{(3.8\ mg/kg) \times (5.0\ m^3/hr) \times (2.5\ m^3/hr) \times (8\ hrs/day) \times (250\ days/yr) \times (1\ yr) \times (10^{-6}\ cm^3/m^3)}{(70\ kg) \times (365\ days)}$$

$$= 3.7 \times 10^{-6}\ mg/kg\text{-}day$$

$$HQ = \frac{1.8 \times 10^{-5}\ mg/kg\text{-}day}{3.0 \times 10^{-2}\ mg/kg\text{-}day} + \frac{3.7 \times 10^{-6}\ mg/kg\text{-}day}{1.0 \times 10^{-2}\ mg/kg\text{-}day}$$

$$= 9.7 \times 10^{-4}$$

TABLE 2-17

EQUATIONS AND SAMPLE CALCULATIONS FOR HYPOTHETICAL FUTURE CONSTRUCTION WORKER FOR SOIL EXPOSURE AT SITE SS-8, MOTOR POOL OIL LEAK AREA
Homestead Air Reserve Base, Florida

Equation Definitions:

$$SExD_o = \frac{C_s \times IR \times EF \times ED \times UC_1}{BW \times AP}$$

$$SExD_i = \frac{C_s \times SPM \times BR \times ET \times EF \times ED \times UC_1}{BW \times AP}$$

$$ELCR = (SExD_o \times CSF_o) + (SExD_i \times CSF_i)$$

$$HQ = (SExD_o/RfD) + (SExD_i/RfD_i)$$

where:

AP	Averaging period (equal to ED x 365 days/year for non-cancer effects; 25,550 days [70 years x 365 days/year] for cancer effects) (USEPA, 1989a).
BR	Breathing rate (2.5 m^3/hour [20 m^3/day] for construction workers [USEPA, 1991a].
BW	Body weight (70 kg for adults (USEPA, 1991a).
C_s	Constituent concentration in the soil (mg/kg) (from Table 4-4).
CSF_i	Cancer slope factor for inhalation exposure $(mg/kg\text{-}day)^{-1}$ (Table 3-3).
CSF_o	Cancer slope factor for oral exposure $(mg/kg\text{-}day)^{-1}$ (Table 3-3).
ED	Exposure duration (1 year for a construction worker)(USEPA, 1991a).
EF	Exposure frequency (250 days/year for a construction worker).
ELCR	Excess lifetime cancer risk (unitless).
ET	Exposure time (8 hour/day for a construction worker;).
HQ	Hazard quotient (unitless).
IR	Incidental ingestion rate for soil (480 mg/day for construction workers) (USEPA, 1991a).
RfD_i	Reference dose for inhalation exposure (mg/kg-day) (Table 3-2); subchronic value used if available.
RfD_o	Reference dose for oral exposure (mg/kg-day) (Table 3-2); subchronic value used if available.
$SExD_i$	Soil exposure dose from inhalation of particulates or vapors from soil (mg/kg-day).
$SExD_o$	Soil exposure dose from incidental ingestion (mg/kg-day).
SPM	Suspended particulate matter (5 mg/m^3) (OSHA).
UC_1	Unit conversion (10^{-6} kg/mg).
UC_3	Unit conversion 3 (10^6 cm^3/m^3).
UC_4	Unit conversion 4 (10^3 g/kg).

2.7.2.3 Exposure Scenarios. Potential current risks at the site were evaluate based on a base worker accessing the site for job-related duties. Hypothetical future risks at the site were evaluated based upon the following exposure scenarios: groundwater ingestion by a hypothetical future adult resident; soil exposure by hypothetical future adult and child residents; and, soil exposure by hypothetical future construction workers. Risks were evaluated based on conservative use of Reasonable Maximum Exposure (RME) assumptions.

The exposure assumptions for each pathway are provided in Tables 2-15, 2-16, and 2-17. Based on the exposure point concentrations derived from site data for the chemicals shown in Table 2-11 and using the exposure assumptions identified in Tables 2-15, 2-16, and 2-17, USEPA estimated the chronic daily intake (CDI) associated with each exposure pathway and population combination. The formulas used to calculate the CDI for each pathway are provided in Tables 2-15, 2-16, and 2-17.

2.7.3 Toxicity Assessment

The toxicity assessment evaluated possible harmful effects of exposure to each COPC. A number of chemicals found at the site, including polycyclic aromatic hydrocarbons (PAHs), arsenic, chromium and lead have the potential to cause cancer (carcinogenic). Slope factors (SFs) have been developed by USEPAs Carcinogenic Assessment Group for estimating lifetime cancer risks associated with exposure to potentially carcinogenic compounds. These SFs, which are expressed in units of $(mg/kg/day)^{-1}$ are multiplied by the estimated CDI of a potential carcinogen to provide an upper bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upper bound" reflects the conservative estimate of the risks calculated from the SF. Use of this approach makes underestimation of the actual cancer risk highly unlikely. Slope factors are derived from results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied. The SFs for the carcinogenic contaminants of concern are contained in Table 2-18.

As an interim procedure until more definitive Agency guidance is established. Region IV has adopted a toxicity equivalency factor (TEF) methodology for evaluating the carcinogenic risk from PAHs. This methodology relates the relative potency of each individual carcinogenic PAH to the potency of benzo(a)pyrene, the most carcinogenic PAH. The TEFs for the PAHs are also presented in Table 2-18.

TABLE 2-18

ADJUSTED TOXICITY VALUES USED TO ASSESS DERMAL EXPOSURE AT SITE SS-8, MOTOR POOL OIL LEAK AREA
Homestead Air Reserve Base, Florida

Constituent	Oral Toxicity Values				Oral Absorption Efficiency	Source	Dermal Toxicity Values (Adjusted Oral)	
	RfDo	Source	CSFo	Source			RfDa	CSFa
BNAs								
Benzo(a)anthracene	1.0E-02	a	7.3E+00	d	0.90	e	9.0E-03	NAP
Benzo(a)pyrene	1.0E-02	a	7.3E+00	c	0.90	e	9.0E-03	NAP
Benzo(b)fluoranthene	1.0E-02	a	7.3E+00	d	0.90	e	9.0E-03	NAP
Benzo(g,h,i)perylene	3.0E-02	b	NA		0.90	e	2.7E-02	NA
Benzo(k)fluoranthene	1.0E-02	a	7.3E+00	d	0.90	e	9.0E-03	NAP
Chrysene	1.0E-02	a	7.3E+00	d	0.90	e	9.0E-03	NAP
Dibenzo(a,h)anthracene	1.0E-02	a	7.3E+00	d	0.90	e	9.0E-03	NAP
Fluoranthene	4.0E-02	c	NA		0.90	e	3.6E-02	NA
Indeno(1,2,3-c,d)pyrene	1.0E-02	a	7.3E+00	d	0.90	e	9.0E-03	NAP
Pyrene	3.0E-02	c	NA		0.90	e	2.7E-02	NA
Metals								
Aluminum	NA	c	NA	c	0.02	e	NA	NA
Arsenic	3.0E-04	c	1.75E+00	c	0.95	e	2.9E-04	1.8E+00
Barium	7.0E-02	c	NA	c	0.05	e	3.5E-03	NA
Cadmium (food) [b]	1.0E-03	c	NAP	c	0.06	e	6.0E-05	NA
Cadmium (water)	5.0E-04	c	NAP	c	0.06	e	3.0E-05	NA
Calcium	NA		NA		NA		NA	NA
Chromium	5.0E-03	c	NAP	c	0.05	e	2.5E-04	NA
Cobalt	NA		NA		0.30	e	NA	NA
Copper [c]	3.7E-02	c	NA	c	0.60	e	2.2E-02	NA
Iron	NA	c	NA	c	0.15	e	NA	NA
Lead	NA	c	NA	c	0.08	e	NA	NA
Manganese	1.0E-01	c	NA	c	0.05	e	5.0E-03	NA
Mercury	3.0E-04	c	NA	c	0.95	e	2.9E-04	NA
Nickel	2.0E-02		NA		0.06	e	1.2E-03	NA
Vanadium	7.0E-03	c	NA	c	0.01	e	7.0E-05	NA

[a]	The RfD for food should be used for soil exposure.
[b]	Based on current drinking water standard.
CSFa	Adjusted cancer slope factor (mg/kg/day)^-1.
CSFo	Oral cancer slope factor (mg/kg/day)^-1.
NA	Not available.
NAP	Not applicable. Carcinogenic only by inhalation route.
RfDa	Adjusted reference dose (mg/kg/day).
RfDo	Oral reference dose (mg/kg/day).
a	Environ, 1986.
b	Inferred from pyrene.
c	USEPA Integrated Risk Information System (1993).
d	USEPA Region 4 TEF guidance (USEPA, 1992b)
	BaP (USEPA, 1992b).
	See Table 3-1.

Other COPCs, including other PAHs and metals, may cause health problems other than cancer. Reference doses (RfDs) have been developed by USEPA for indicating the potential for adverse health effects from exposure to contaminants of concern exhibiting noncarcinogenic effects. RfDs, which are expressed in units of mg/kg/day, are estimates of lifetime daily exposure levels for humans, including sensitive individuals, that are believed to be safe by USEPA. RfDs are derived from human epidemiological studies or animal studies to which uncertainty factors have been applied (e.g., to account for the use of animal data to predict effects on humans). Estimated intakes of COPCs from contaminated media can be compared to their respective RfDs. The RfDs for the noncarcinogenic contaminants of concern are also provided in Table 2-18.

2.7.4 Risk Characterization

The centerpiece of the BRA is the risk characterization, which combines the other components of the evaluation to estimate the overall risk from exposure to site contamination.

In summary, the results of the BRA indicate that human health risks associated with potential future scenarios at Site SS-8 slightly exceed USEPAs target risk range for protection of human health.

2.7.4.1 Carcinogenic Risk. For cancer-causing compounds, risk is a probability that is expressed in scientific notation. For example an excess lifetime cancer risk of $1x10^{-6}$ means that an individual has an additional 1 in 1,000,000 chance of developing cancer as a result of site-related exposure over an estimated 70 year lifetime. USEPA has established a target risk range for DOD and Superfund cleanups of between $1x10^{-4}$ (1 in 10,000) and $1x10^{-6}$.

The formula used for calculating cancer risks is shown below:

$$\text{Risk} = \text{CDI} \times \text{SF}$$

where:

Risk = a unitless probability of an individual developing cancer
CDI = chronic daily intake averaged over 70 years (mg/kg/day)
SF = slope factor, expressed as $(\text{mg/kg/day})^{-1}$

Potential current total site risk for an on-site worker (e.g., a mower exposed to soils results in a total site excess lifetime cancer risk of 6.1×10^{-6}. The excess lifetime cancer risks for an hypothetical future construction worker were 1.4×10^{-5} and 1.8×10^{-5} for surface and subsurface soils respectively.

The excess lifetime cancer risk for a hypothetical future adult resident exposed to groundwater at the site was not calculated because none of the COPCs in groundwater are considered carcinogenic via the ingestion exposure route. The excess lifetime cancer risk for an adult resident exposed to soils at the site is 4.5×10^{-5}. The excess lifetime cancer risk for an hypothetical future child resident is 1.2×10^{-4}, slightly above the upper end for the risk range deemed protective of human health by the USEPA.

2.7.4.2 Hazards Due to Non-carcinogenic Chemicals. For compounds which cause toxic effects other than cancer, USEPA compared the exposure point concentration of a contaminant found at the site with a reference dose representing the maximum amount of a chemical a person could be exposed to without experiencing harmful effects. The ratio of the average daily intake to the reference dose is called a hazard quotient (HQ). The formula for calculation the HQ is shown below:

$$\text{Noncancer HQ} = \text{CDI}/\text{RfD}$$

where: CDI = chronic daily intake
RfD = reference dose

CDI and RfD are expressed in the same units (mg/kg/day) and represent the same exposure period (i.e., generally chronic, but also subchronic or short-term).

The hazard index (HI) can be generated by adding the HQs for all contaminants of concern that affect the same target organ (such as the liver) within a medium or across all media to which a given population may reasonably be exposed. In general, USEPA considers an HI of 1.0 to be the maximum acceptable hazard.

The hazard index for a current base worker is 0.002. The hazard indices for a future construction worker exposed to surface and subsurface soils are above the USEPA risk benchmark, 3 and 4 respectively.

The non-cancer hazard index (HI) for hypothetical future adult resident exposure to groundwater (3.7) is above the USEPA risk benchmark of 1. Hypothetical future hazards for residents exposed to soils (both an adult and a young child [aged 0 to 6 years]) are at or below the USEPA risk benchmarks (0.03 and 0.2 for the adult and child respectively).

2.7.4.3 Total Risk. The total site risk for hypothetical future resident exposure is obtained by summing all of the residential exposures considered in the risk assessment groundwater ingestion by an adult resident, soil exposure by child (6 year period) and adult (24 year period) residents. The combined risk across these on-site exposure media (groundwater and soils) for a hypothetical future resident results in a total site excess lifetime cancer risk of 1.6×10^{-4} and an HI of 3.9. The total hypothetical future site risk for the construction worker is equivalent to the risk estimates calculated for the future construction worker exposed to surface and subsurface soils for ingestion and inhalation exposure routes. The cancer risk estimates are 3.2×10^{-5} and the HI is 7.0 for surface soils and subsurface soils, combined.

2.7.4.4 Risk from Lead Exposure. Based on the Integrated Exposure Uptake/Biokinetic (TEUBK) model for lead, hypothetical future sensitive receptors (children age 0 to 6 years) exposed to soils at Site SS-8 would not have blood lead levels that exceed 10 micrograms per deciliter (µg/dL) (the blood concentration of concern identified by the CDC[1]) assuming exposure to site concentrations of lead in soil and groundwater.

2.7.5 Chemicals of Concern and Remedial Goal Options

Chemicals of concern (COCs) contribute significantly to a use scenario for a receptor that (a) exceeds a 10^{-4} total carcinogenic risk; (b) exceeds an HI of 1; or (c) exceeds a state or federal chemical specific ARAR. Chemicals need not be included if their individual carcinogenic risk contribution is less than 1×10^{-6} or their non-carcinogenic HQ is less than 0.1. The COCs in groundwater at Site SS-8 are chromium and manganese. The COCs in soil are manganese and, to a much lesser extent, PAHs.

Remedial Goal Options (RGOs) are risk-based cleanup levels. They are developed by combining the intake levels to each chemical by a receptor from all appropriate routes of

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[1] **CDC (1991) Preventing Lead Poisoning in Young Children. A statement by the Centers for Disease Control. October 1991.**

TABLE 2-19
RISK-BASED REMEDIAL GOAL OPTIONS
HYPOTHETICAL FUTURE ADULT RESIDENT AT
SITE SS-8, MOTOR POOL OIL LEAK AREA
GROUNDWATER (mg/L)

COMPOUNDS	SITE SPECIFIC REMEDIAL GOAL OPTIONS HAZARD INDEX			SITE SPECIFIC REMEDIAL GOAL OPTIONS CARCINOGENIC RISK			EPA Maximum Contaminat Level	Florida Drinking Water Standard
	0.1	1.0	10.0	1E-06	1E-05	1E-04		
Chromium	2E-2	2E-1	2E+0	2E-1	2E+0	2E+1	1E-01	0.1 (a)
Manganese	2E-2	2E-1	2E+0	NAP	NAP	NAP	NS	.050 (b)

NAP - Not Applicable. The constiuent is not a carcinogen via oral exposure.
NS - No Standard.
(a) - Florida Primary Drinking Water Standard (mg/L).
(b) - Florida Secondary Drinking Water Standard (mg/L).
(c) - Final Action Level - The final lead action level is exccede if the level of lead/copper is more than 10 percent.

TABLE 2-20
RISK-BASED SITE SPECIFIC REMEDIAL GOAL OPTIONS
AND FDEP SOIL TARGET LEVELS
HYPOTHETICAL CURRENT BASE WORKER (MOWING SCENARIO) AT
SITE SS-8, MOTOR POOL OIL LEAK AREA
SOIL (mg/kg)

COMPOUNDS	SITE SPECIFIC REMEDIAL GOAL OPTIONS HAZARD INDEX			FDEP Soil Target Levels Based on a Hazard Index of 1	SITE SPECIFIC REMEDIAL GOAL OPTIONS CARCINOGENIC RISK			FDEP Soil Target Levels Based on an Excess Cancer Risk of 1E-06
	0.1	1.0	10.0		1E-06	1E-05	1E-04	
Manganese	6E+4	6E+5	6E+6	5E+3	NA	NA	NA	ND

NA - Not Applicable
ND - Not Determined

TABLE 2-21
RISK-BASED SITE SPECIFIC REMEDIAL GOAL OPTIONS
AND FDEP SOIL TARGET LEVELS
HYPOTHETICAL FUTURE ADULT RESIDENT AT
SITE SS-8, MOTOR POOL OIL LEAK AREA
SOIL (mg/kg)

COMPOUNDS	SITE SPECIFIC REMEDIAL GOAL OPTIONS HAZARD INDEX			FDEP Soil Target Levels Based on a Hazard Index of 1	SITE SPECTIFIC REMEDIAL GOAL OPTIONS CARCINOGENIC RISK			FDEP Soil Target Levels Based on an Excess Cancer Risk of 1E-06
	0.1	1.0	10.0		1E-06	1E-05	1E-04	
Manganese	5E+3	5E+4	5E+5	2E+3	NA	NA	NA	ND

NA - Not Applicable
ND - Not Determined

TABLE 2-22
RISK-BASED SITE SPECIFIC REMEDIAL GOAL OPTIONS
AND FDEP SOIL TARGET LEVELS
HYPOTHETICAL FUTURE CHILD RESIDENT AT
SITE SS-8, MOTOR POOL OIL LEAK AREA
SOIL (mg/kg)

COMPOUNDS	SITE SPECIFIC REMEDIAL GOAL OPTIONS HAZARD INDEX			FDEP Soil Target Levels Based on a Hazard Index of 1	SITE SPECIFIC REMEDIAL GOAL OPTIONS CARCINOGENIC RISK			FDEP Soil Target Levels Based on an Excess Cancer Risk of 1E-06
	0.1	1.0	10.0		1E-06	1E-05	1E-04	
Semi-Volatiles								
Benzo(a)anthracene (1)	7E+1	7E+2	7E+3	ND	4E-2	4E-1	4E+0	1E+0
Benzo(a)pyrene	7E+1	7E+2	7E+3	ND	1E-1	1E+0	1E+1	1E-1
Benzo(b)fluoranthene(1)	7E+1	7E+2	7E+3	ND	4E-2	4E-2	4E+0	1E+0
Benzo(g,h,i)perylene	2E+2	2E+3	2E+4	2E+3	NA	NA	NA	ND
Benzo(k)fluoranthene(1)	7E+1	7E+2	7E+3	ND	4E-2	4E-1	4E+0	1E+0
Chrysene(1)	7E+1	7E+2	7E+3	ND	6E-3	6E-2	6E-1	1E+1
Dibenzo(a,h)anthracene(1)	7E+1	7E+2	7E+3	ND	1E+1	1E+0	1E+1	1E-1
Fluoranthene	3E+2	3E+3	3E+4	3E+3	NA	NA	NA	ND
Indeno(1,2,3-c,d)pyrene(1)	7E+1	7E+2	7E+3	ND	4E-1	4E-1	4E+0	1E+0
Pyrene	2E+2	2E+3	2E+4	2E+3	NA	NA	NA	ND
Manganese	7E+2	7E+3	7E+4	4E+2	NA	NA	NA	ND

(1) - Toxicity Equivalent Factors (TEFs) have been applied to constituent concentrations based on each compound relative potency to the potency of benzo(a)pyrene (oral and inhalation exposure only) for the carcinogenic risk only.
NA - Not Applicable

TABLE 2-23
RISK-BASED SITE SPECIFIC REMEDIAL GOAL OPTIONS
AND FDEP SOIL TARGET LEVELS
HYPOTHETICAL FUTURE CONSTRUCTION WORKER AT
SITE SS-8, MOTOR POOL OIL LEAK AREA
SURFACE SOIL (mg/kg)

COMPOUNDS	SITE SPECIFIC REMEDIAL GOAL OPTIONS HAZARD INDEX			FDEP Soil Target Levels Based on a Hazard Index of 1	SITE SPECIFIC REMEDIAL GOAL OPTIONS CARCINOGENIC RISK			FDEP Soil Target Levels Based on an Excess Cancer Risk of 1E-06
	0.1	1.0	10.0		1E-06	1E-05	1E-04	
Manganese	1E+0	1E+1	1E+2	5E+3	NA	NA	NA	ND

NA - Not Applicable
ND - Not Determined

TABLE 2-24
RISK-BASED SITE SPECIFIC REMEDIAL GOAL OPTIONS
AND FDEP SOIL TARGET LEVELS
HYPOTHETICAL FUTURE CONSTRUCTION WORKER AT
SITE SS-8, MOTOR POOL OIL LEAK AREA
SUBSURFACE SOIL (mg/kg)

COMPOUNDS	SITE SPECIFIC REMEDIAL GOAL OPTIONS HAZARD INDEX			FDEP Soil Target Levels Based on a Hazard Index of 1	SITE SPECIFIC REMEDIAL GOAL OPTIONS CARCINOGENIC RISK			FDEP Soil Target Levels Based on an Excess Cancer Risk of 1E-06
	0.1	1.0	10.0		1E-06	1E-05	1E-04	
Manganese	1E+0	1E+1	1E+2	5E+3	NA	NA	NA	ND

NA - Not Applicable
ND - Not Determined
NP - Not Provided

exposure (i.e., inhalation, ingestion and dermal) and pathways within a scenario and rearranging the site-specific CDI equations used in the risk characterization to solve for the concentration term. RGOs are developed for each medium, each land use, and each receptor type.

The RGO are presented here in tabular form and include cleanup levels for the 10^{-4}, and 10^{-5}, and 10^{-6} risk levels for each COC medium and scenario and the HQs of 0.1, 1, and 10 levels, as well as any chemical-specific ARARs. A summary of the risk based RGOs are presented in Tables 2-19 through 2-24.

2.7.6 Ecological Risk Assessment

Because of the developed character of this site, it does not provide suitable habitat for wildlife; thus, plants and animals are not likely to contact chemicals present at Site SS-8. Site canals are to be more fully addressed in the OU-9 site-wide canal assessment.

2.8 UNCERTAINTIES IN THE RISK ASSESSMENT

The factors that contribute uncertainty to the estimates of exposure concentrations, daily intakes, and toxicity information also contribute uncertainty to the estimates of risk. These factors include:

- Chemicals not included in the risk assessment;
- Exposure pathways not considered;
- Derivation of exposure point concentrations;
- Intake uncertainty; and
- Toxicological dose response and toxicity values.

There are uncertainties associated with summing cancer risks or hazard indices for different chemicals. The cumulative dose ignores possible synergism of antagonism among chemicals and differences in mechanisms of action and metabolism.

In addition, the assumption was made that all chromium present was in the more toxic hexavalent form. Generally, the trivalent form is predominant.

Lead exposure was evaluated with a model that predicts blood levels based on levels measured in environmental media. Another uncertainty is the faithfulness of this model in reproducing the actual blood levels. Although any pharmacokinetic model is subject to uncertainties, the predicted blood lead level in children (indicating that lead is not a COC) are believed to be a reasonable estimate.

2.9 DESCRIPTION OF THE ALTERNATIVE

An FS was conducted to develop and evaluate remedial alternatives for OU-4 at Homestead ARB. The following discussion presents a brief description of the alternatives considered in the FS for the Motor Pool Oil Leak Area. The alternatives are numbered to correspond to the numbers in the FS report, which presents each alternative in more detail.

2.9.1 Alternative Number 1 - No Action With Groundwater Monitoring

2.9.1.1 Description. The no action alternative provides a baseline case for comparison with other alternatives. This alternative includes semi-annual sampling of the site's monitoring wells for two years. The samples would be analyzed for BNAs and metals. The groundwater monitoring program would be used to monitor the validity of the sampling and analysis events of years 1991 and 1993. Per CERCLA, site reviews would be conducted as part of this alternative as COCs exceeding USEPA target risk ranges would remain on-site.

There are no chemical-, location-, or action-specific ARARs for soil at Site SS-8. The State of Florida has developed health-based cleanup goals which are TBCs for the site. The COCs present at Site SS-8 under the most likely scenario (construction worker) do not exceed the State of Florida goals.

The No Action alternative does not provide control measures to prevent access to the contamination. Under current land use conditions, this alternative does not pose an unacceptable cancer and non-cancer risk. However, if the future risk scenario of an on-site construction worker or the unlikely scenario of a future child resident were to occur, risks would exceed USEPA risk ranges and the no action alternative would not be protective of human health. If the asphalt pavement at Site SS-8 were removed, exposure to fugitive dust would be the largest contributor to the total site health risks. Assuming that the asphalt

cap remains in place and that construction does not occur at the site, the No Action Alternative is protective of human health.

The estimated cost in present worth for this alternative is $ 65,000

2.9.2 Alternative Number 2 - Institutional Controls and Groundwater Monitoring

This alternative includes access restrictions that would limit entry to the site by unauthorized base personnel. This alternative includes fencing the site and posting signs indicating access to the site is limited to authorized personnel. In addition, a periodic monitoring of the asphalt cap would be undertaken and made available to regulatory agencies. Deed restrictions would be established to limit the use of the property to non-residential dwelling purposes. Deed restrictions would also be established to prevent schools, playgrounds, hospitals, and residential areas from being built at the site. Restrictions would also be established (by deed and/or construction bid documents) to limit any construction activity to only those activities where workers are appropriately protected (e.g., personal protective equipment) from exposure to any COCs above health-based levels. Restrictions would be established (by deed and/or construction bid documents) to ensure that any construction activities would utilize erosion and dust control as well as silt control measures to protect the drainage canal system adjacent to Site SS-8.

This alternative includes semi annual sampling of the site's monitoring wells for two years to monitor the validity of previous sampling events. The samples would be analyzed for the BNAs and metals. The groundwater monitoring program would be used to monitor the validity of the sampling and analysis of years 1991 and 1993. Applicable performance standards and guidance for monitoring of the groundwater at Site SS-8 include Federal and State groundwater MCLs. No groundwater access restrictions are contemplated because the two sampling events of 1991 and 1993 indicated that groundwater has not been adversely impacted with respect to Federal and State groundwater standards and/or guidance. Site reviews every five years would be conducted as part of this alternative, as per CERCLA guidance. Presently, current land use conditions do not pose any risks to human health. Under the potential scenario of a construction worker at the site, Alternative 2 protects human health through environmental control measures described above. The control measures also would prohibit the use of residential development, and thereby, protects human health.

Because of the developed character of this site (paved surface) there would be no adverse impacts to the environment under Alternative 2. In the event of construction or redevelopment, the use of environmental and personal control measures will protect human health. Construction controls will ensure the adjacent drainage canal is protected.

The estimated cost for implementation of this alternative is $ 85,000 in present worth.

2.9.3 Alternative Number 3 - Soil Excavation and Disposal with Groundwater

With this alternative, the contaminated soil would be excavated to water table (2-3 ft bls) and disposed. The areal extent of the contaminated soil is assumed to be the total areal extent of the soil under the asphalt pavement. Assuming the soil would be excavated to the water table, the total volume of soil to be excavated and disposed is approximately 2,700 cubic yards. Field screening supported by laboratory analysis will be conducted to verify that "clean" soil is encountered after soil is excavated. Where warranted, excavation activities would implement erosion control and silt control measures to protect the drainage/canal system adjacent to the site.

Before the disposal facility will accept the waste, toxicity characteristics leaching procedure (TCLP) analysis must be performed. It is expected and assumed for this analysis that the waste will pass TCLP and disposal will occur in Class III landfill. In the unlikely scenario that the waste is indicated by TCLP to be hazardous, then disposal of the waste would occur in a RCRA, Subtitle C, TSD facility.

Under this alternative, post-removal groundwater sampling will also be performed to evaluate groundwater conditions. This alternative protects human health by removing all COCs from the Site SS-8. This alternative meets the cleanup goals for the site, for both the current and future land use conditions. If warranted, erosion control and silt control measures will be implemented during the excavation of Site SS-8. Alternative 3 is therefore protective of the environment as well as human health.

This alternative also reduces potential mobility and volume of constituents at the site through their complete removal.

Alternative 3 is expected to take one to two years to implement and complete at a cost of $1,238,000 including post removal sampling.

2.10 SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

An evaluation and comparison of the alternatives are presented in Tables 2-25, 2-26, and 2-27. The comparison is based on the nine key criteria required under the National

TABLE 2-25

IDENTIFICATION OF ALTERNATIVES
SITE SS-8

Remedial technologies are assembled into alternatives in this section and table, and enable the review of the Focused Feasibility Study (FFS). A limited number of alternatives are developed and all are carried into the detailed analysis. Three remedial alternatives were developed for Site SS-8 as follows:

Alternative	No Action	Access Restrictions	Deed Restrictions	Groundwater Monitoring	Soil Excavation
1 No Action	X			X	
2 Institutional Controls & Groundwater Monitoring		X	X	X	
3 Soil Excavation/Disposal				X	X

Source:
Homestead Air Force Base, Florida
Focused Feasibility Study
Operable Unit 4, Motor Pool
Oil Leak (Site SS-8)

TABLE 2-26

COMPARATIVE COST ANALYSIS OF REMEDIAL ALTERNATIVES
SITE SS-8

Alternative #	Title	Capital Expense	Annual O&M Expense	Total Present Cost/Alternative	Notes:
1	No Action	$17,000	$48,000	$65,000	See #1
2	Institutional Control & Groundwater Monitoring	$31,000	$54,000	$85,000	See #2
3	Excavation & Soil Disposal	$1,052,000	$186,000	$1,238,000	See #3

Notes:

1. No Action Capital Expenses incorporate administrative and legal costs associated with curtailing re-use of property other then by current owner, and establisl record of controlled ownership by the US Air Force to ensure no disruption of soil sedimentations. O&M annual expenses are the Operating and Maintenan costs associated with the sampling of groundwater for 2 years.

2. Institutional Control & Groundwater Monitoring capital expenses involve the installation of site perimeter fencing and signage to ensure no access to the property title shall remain under controlled ownership by the US Air Force. O&M annual expenses are the Operating and Maintenance costs associated with sampling events for 2 years.

3. Excavation & Soil Disposal capital costs are the removal of costs for the removal of costs for an approximate quantity of 2,700 cubic yards of contaminated soils to an offsite area. O&M costs are associated with confirmatory samples taken during the year.

4. Detailed cost estimates of the above alternatives are currently on file at Homestead Air Reserve Base, Florida and may be duplicated from the RACER II estimating system onto diskettes for public review.

Source:
Homestead Air Force Base, Florida
Focused Feasibility Study
Operable Unit 4, Motor Pool
Oil Leak (Site SS-8)

TABLE 2-27

COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES, SITE SS-8

Evaluation Criteria	REMEDIAL ACTION		
	No Action	Institutional Controls & Groundwater Monitoring	Excavation & Disposal
Overall Protection of Human Health & Environment	X	O	O
Compliance w/ARAS	O	O	O
Long Term Effectiveness and Performance	X	O	O
Reduction of Toxicity, Mobility, or Volume	X	X	O
Short Term Effectiveness	*	*	O
Implementability	Easy	Easy	Moderate
Estimated Present Worth	65,000	85,000	1,238,000

O Meets Criteria
X Does Not Meet Criteria
* No Remedial Activity/Therfore No Effects From Implementation
Source:
Homestead Air Force Base, Florida
Focused Feasibility Study
Operable Unit 4, Motor Pool
Oil Leak (Site SS-8)

Contingency Plan and CERCLA Section 121 for use in evaluation of remedial alternatives by USEPA. The nine criteria are as follows:

- Overall protection of human health and the environment.
- Compliance with Applicable or Relevant and Appropriate Requirements.
- Long-term effectiveness and permanence.
- Reduction of toxicity, mobility, or volume.
- Short-term effectiveness.
- Implementability.
- Cost.
- State acceptance.
- Community acceptance.

2.10.1 Overall Protection of Human Health and Environment

Alternatives 2 and 3 meet Remedial Action Objectives for the site and provide protection of human health and the environment. Alternative 3 provides the best protection through excavation of the site. While Alternative 2 does not satisfy the statutory preference for treatment, this alternative effectively protects human health and the environment through the utilization of institutional controls that would limit exposure to site contaminants. Alternative 1 would have no treatment or monitoring mechanism and, therefore, would not be protective of human health and the environment.

2.10.2 Compliance with Federal/State Standards

There are no ARARs that apply for Site SS-8. State of Florida soil cleanup goals would be met for all alternatives. No state or federal MCL is exceeded for any of the COCs for OU-4, Site SS-8.

2.10.3 Long-term Effectiveness and Permanence

Alternative 3 provides the best long-term effectiveness and permanence for Site SS-8. Although Alternative 2 allows for hazardous substances to remain on site, it utilizes institutional controls, which are adequate, reliable and effective to manage untreated hazardous substances in a safe manner. In addition, institutional controls would need to be evaluated during the five-year review. Alternative 1 does not change the conditions of the

Site; therefore, any contaminants remaining at the site would not be expected to decrease over time.

2.10.4 Treatment to Reduce Toxicity, Mobility or Volume

None of the alternatives would provide treatment of the COCs at the Site. Alternative 3 would reduce the mobility of the contaminants through excavation of the contaminants from the Site and disposal in an engineered landfill. Alternative 1 and 2 would not provide any additional reduction in toxicity, mobility or volume of the contaminants. Under Alternatives 1 and 2 site contaminants are nearly immobile due to the asphalt covering the site.

2.10.5 Short-term Effectiveness

Alternative 3 is expected to be completed within one to two years. The excavation of soil may impose risks by disturbing the remaining contamination, however, it would not be expected to pose unacceptable short-term environmental or health hazards, which could not be controlled. Under Alternatives 1 and 2, there is no construction activities against which short term effectiveness may be evaluated. Alternative 2 would deem to be protective as soon as the institutional controls are in place and in effect. Most likely, the institutional controls should be in place within 12 months from the selection of the remedy.

2.10.6 Implementability

Alternative 1 and 2 would be easy to implement. The ease to implement Alternative 3 would be moderate.

2.10.7 Cost

The "no action" alternative is the least expensive option, but it is not protective under potential future scenarios of an on-site construction worker or a child resident. Alternative 2 is also minimal in expense and is protective. Alternative 3 would attain the fullest protection but at high cost relative to Alternatives 1 and 2.

2.11 SELECTED REMEDY

Based upon consideration of the requirements of CERCLA, the detailed evaluation of the alternatives and public comments, the U.S. Air Force and concurrence with the USEPA and the State of Florida has determined that Institutional Controls and Groundwater Monitoring is the most appropriate course of action at Site SS-8.

The primary media of concern at Site SS-8 is soil/bedrock. The site is currently covered by asphalt providing an in situ barrier to surficial contact. The implementation of institutional controls will include deed restrictions and covenants on future use and activities at the site to minimize exposure by construction workers. Requirements for use of appropriate personal protective equipment with implementation of a site health and safety plan during any construction activities will protect workers at the site. Deed restrictions would also establish erosion and silt control measures for use as warranted to protect the area drainage canal system.

These deed restrictions would also prevent residential use and construction of schools, playgrounds or hospitals at Site SS-8.

A fence would be installed surrounding Site SS-8 to minimize unauthorized or inadvertent access to the site. The estimated cost of fence installation is $31,000. This is the only capital expenditure to be incurred. This site is also to remain under Air Force jurisdiction within the Cantonment Area.

Annual, O&M costs include the groundwater monitoring which is scheduled semi-annually for 2 years. This annual cost is estimated at $54,000.

In accordance with CERCLA requirements for sites where contaminants remain in place above USEPA Target Levels, five year reviews of the site will be performed.

2.12 STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment as required by Section 121 of CERCLA. Existing or potential risks from exposure to soils are reduced and controlled through institutional controls.

There are no chemical-, location-, or anction-specific ARARs that apply for soil at Site SS-8. State of Florida soil cleanup goals would be met for the one chemical of concern (manganese) under the construction worker scenario.

The selected remedy is cost effective because it has been determined to provide overall effectiveness proportioned to its costs, the present net worth is estimated at $85,000.

Neither Permanent Solutions nor alternative treatments were employed at this site due to the minimal risks associated with the COCs present and the unlikely scenario of residential development as well as associated costs for removal of site contaminants. The statutory preference for treatment as a Principal Element is not met. However, Site contaminants are currently nearly immobile due to the presence of an asphalt covering.

2.13 DOCUMENTATION OF SIGNIFICANT CHANGES

The PP was released for public comment in September 1994. The PP identified Alternative 2, Institutional Controls and Groundwater Monitoring, as the preferred alternative for remedial action at Site SS-8, OU-4.

Homestead Air Reserve Base, Florida
Operable Unit 4
Site SS-8, Motor Pool Oil Leak Area

Responsiveness Summary for The Record of Decision

RESPONSIVENESS SUMMARY

FOR THE

RECORD OF DECISION

The responsiveness summary serves three purposes. First, it provides regulators with information about the community preferences regarding both the remedial alternatives and general concerns about OU-4, Homestead ARB. Second, the responsiveness summary documents how public comments have been considered and integrated into the decision making process. Third, it provides USEPA with the opportunity to respond to each comment submitted by the public on the record.

The Remedial Investigation/Baseline Risk Assessment report and the Proposed Plan for Homestead ARB Site SS-8 were released to the public in June and September of 1994, respectively. These documents were made available to the public in both the administrative record and an information repository maintained at the Miami-Dade Community College Library.

A public comment period was held from September 8,1994 to October 22, 1994 as part of the community relations plan for OU-4. Additionally, a public meeting was held on Thursday, September 29, 1994 at 7:00 pm at South Dade High School. A public notice was published in the Miami Herald on September 9, 1994. At this meeting, the USAF, in coordination with USEPA Region IV, FDEP, and DERM were prepared to discuss the investigation, results of the Baseline Risk Assessment, and the Preferred Alternative described in the Proposed Plan.

No comments were received during the public comment period and no comments were made at the public meeting regarding the implementation of Institutional Controls and Groundwater Monitoring.