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Record of Decision:

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08/22/1995

FINAL

RECORD OF DECISION

FOR

OPERABLE UNIT 6, SITE SS-3, AIRCRAFT WASHRACK AREA, HOMESTEAD AIR RESERVE BASE, FLORIDA

March 1995

Prepared for:

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

Prepared by:

Montgomery Watson
3501 North Causeway Boulevard, Suite 300
Metairie, Louisiana 70002

RECORD OF DECISION

Operable Unit 6, Site SS-3,
Aircraft Washrack Area
Homestead Air Reserve Base
Homestead, Florida
FDEP Facility No. 138521996

March 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,

MONTGOMERY WATSON

Randall S. Luwe, P.G.
Project Manager

Jerry D. Gaccetta, P.G.
Project Engineer

DECLARATION STATEMENT

FOR THE

RECORD OF DECISION FOR

OPERABLE UNIT NO. 6
HOMESTEAD AIR RESERVE BASE SUPERFUND SITE

SITE NAME AND LOCATION

Homestead Air Reserve Base
Homestead Dade County, Florida
Operable Unit No. 6, Site SS-3,
Aircraft Washrack Area (Former Site SP-7)

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for Aircraft Washrack Area, Operable Unit No. 6 (OU-6), Site SS-3, at Homestead Air Reserve Base (ARB) (formerly Homestead Air Force 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 is based on the administrative record for this site.

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 UNIT

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF THE SELECTED REMEDY

Operable Unit No. 6 represents the only unit at Homestead ARB to be addressed by this ROD. This operable unit addresses the source of contaminated soil and groundwater (i.e., LNAPL) and the removal of contaminated soil. This action addresses the principal threat at the site by removing the contaminated soils and the source, LNAPL. The localized contaminated groundwater is expected to naturally attenuate to within standards protective of human health and the environment and below acceptable risk soon after the removal of the contaminated soil and LNAPL.

The major components of the selected remedy include:

- Excavation of soil/rock from an approximate 125 ft by 75 ft by 6 ft (2,100 cubic yards) area. The soil is slated for a disposal at a RCRA permitted facility. The facility will use off-site thermal desorption technology to treat the waste. Fill material will be brought to the site to return the area to grade.

- During the excavation a maximum of approximately 5,600 gallons of LNAPL is expected to be recovered. The LNAPL is slated for energy recovery (i.e., recycling) at a facility to be determined.

- Groundwater monitoring will be performed at the site for 5 years to show that natural attenuation will meet performance standards (clean-up levels) applicable to contaminated groundwater.

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

- Institutional controls to avoid contact with contaminated groundwater until protective levels have been met.

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 the remedial action, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment and resource recovery technologies, to the maximum extent practicable, and satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element.

Because the remedy will result in hazardous substances remaining on-site above health-based levels (benzene in groundwater), a review will be conducted within five 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 years thereafter until protectiveness is achieved.

UNITED STATES AIR FORCE
HOMESTEAD AIR RESERVE BASE

By: ____ Date:____________________

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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 are 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 above mean sea level (msl). The Base is surrounded by a canal that discharges to Military 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 (USEPA, 1990). All recharge to the aquifer is through rainfall.

Homestead Army Air Field, a predecessor of Homestead Air Reserve Base, 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.

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 Fighterwing became the new host. The Base was transferred to Headquarters Air Combat Command on June 1, 1992.

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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 oversite by Dade County.

1.1 SITE DESCRIPTION

OU-6 is the Aircraft Washrack Area, Site SS-3 (former Site SP-7). OU-6/Site SS-3 is located in the central portion of Homestead ARB, approximately 720 feet north of Building 720 (Figure 1-2). The site covers an area approximately three acres in size and has dimensions of approximately 320 feet by 400 feet. The site is bordered on the northwest by a drainage ditch located parallel to Bikini Boulevard, on the southwest by a low grassy swale, on the northeast by a ditch, and on the southeast by the asphalt Flight Apron 4047 (Figure 1-3). Stormwater runoff from the Aircraft Washrack and surrounding area is collected in the drainage ditch and swale located southwest and northeast of the site. The ditch and swale flow to the northwest towards the drainage ditch. The drainage ditch, adjacent and parallel to Bikini Boulevard, flows from southwest to northeast for approximately one mile before draining into the Boundary canal which borders Homestead ARB. One to two feet of water are typically present in the drainage ditch.

Prior to Hurricane Andrew, the site consisted of a covered, concrete and asphalt aircraft washrack structure, a utility building and Building 723. Due to damages experienced during the hurricane, the cover and frame of the washrack are no longer present. The area surrounding the washrack is covered with grass. The site is underlain by heavily weathered limestone bedrock of the Miami Oolite formation, which is typically covered with less than two inches of soil. Approximately 35% of OU-6/Site SS-3 is covered with asphalt and/or concrete.

1.2 REGIONAL LAND USE

The area adjacent to Homestead ARB including OU-6/Site SS-3, 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 2 miles east of Homestead ARB; the Everglades National park is located 8 miles west-southwest of the Base; and the Atlantic Ocean is approximately 8 miles east of the Base.

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1.3 SURFACE HYDROLOGY

Surface hydrology at Homestead ARB, including OU-6/Site SS-3 is controlled by five main factors: 1) relatively impermeable areas covered by runways, buildings and roads; 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 Oolite Formation; and 5) relatively high precipitation rate compared to evapotranspiration rate. Infiltration is considered to be rapid through surfaces of oolite outcrop and areas with a thin soil layer. Infiltration rates are accelerated by fractures within the oolite, 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 Military Canal, which, in turn, flows east into Biscayne Bay, approximately 2 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 feet 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 Oolite, Fort Thompson Formation, and the uppermost part of the Tamiami Formation. In general, the most permeable parts of the aquifer lie within the Miami Oolite 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 lose 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 feet 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 feet bgs), the Floridan Aquifer is of limited usefulness as a source of potable water supply in the study area.

1.4 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 Oolite ranging in depth from 2 to 6 feet below ground surface (bgs). The weathered limestone consists of a white to brown semi-consolidated oolitic limestone. This strata is underlain by consolidated to semi-consolidated oolitic and coral limestone interbedded with coarse to fine sand and clayey sand layers and lenses down to the total depth of borings (approximately 40 feet logs).

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 feet 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, 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 tune. 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-3.

2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

2.1 OPERABLE UNIT NO. 6 HISTORY

2.1.2 Past Site Usage

Two above ground storage tanks with capacities of 750 and 1,500 gallons were used to store contaminated oils, hydraulic fluids, spent solvents, and other liquid wastes from the flightline shops. The tanks were located in the western portion of the site, as illustrated on Figure 1-3. During storage and removal operations, conducted from 1970 to 1980, frequent spills and overflows onto the ground occurred. Dumping of liquid wastes in the area of OU-6/Site SS-3 were also reported during this time. Once liquid waste disposal operations were halted, the tanks were subsequently removed for off-site disposal in 1980. Soils in the former tank area, which were reportedly discolored at the time of tank removal have either been removed from the site or covered, leaving no visible evidence of waste residue.

2.2. 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 Environmental Protection Agency's (EPA's) 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 EPA 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 EPA, 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 operable units at Homestead ARB. This ROD concludes all of the remedial investigation/feasibility study (RI/FS) requirements for Site SS-3 and selects a remedy for Operable Unit No. 6.

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, a RCRA Facility Investigation (RFI) is underway to evaluate numerous solid waste management units (SWMUs) 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)

Operable Unit No. 3, PCB Spill C.E. Storage Compound, 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. Thirteen sites of potential concern were identified by reviewing available installation records, interviewing past and present Homestead AFB employees, inventorying wastes generated and handling practices, conducting field inspections, and reviewing geologic and hydrogeologic data. In general, Phase I studies are used to determine if a site requires further investigation.

The thirteen 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 AFB 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 Aircraft Washrack. 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 Aircraft Washrack OU-6/Site SS-3 and assigned a moderate to high HARM score of 69 based on the history of a moderate quantity of liquid wastes used and disposed of at the site, the high potential for contaminant migration in surface and/or groundwaters at the site, the presence of extremely permeable soils and bedrock in the area, and the proximity of the site to a drainage ditch.

2.3.2 IRP Phase II - Confirmation/Quantification

An IRP Phase II study was performed by Science Applications International Corporation (SAIC), and wasted on in March 1986 (SAIC, 1986). The objectives of Phase II are to confirm the presence or absence of contamination, to quantify the extent and degree of contamination, and to determine if remedial actions are necessary. The Aircraft Washrack was included in the Phase II investigation.

A total of three shallow monitoring wells (I-7, I-8, and I-9) were installed at the site during Phase II investigations. Groundwater samples were collected and analyzed for oil and grease, total organic halogens (TOX), and total organic carbon (TOC). At the time of sampling, a floating non-aqueous phase liquid (NAPL) was present in well I-9. A sample of the NAPL was collected and submitted for oil and grease analysis. Although the extent of the contamination could not be delineated, the Phase II investigation indicated that contamination at OU-6/Site SS-3 was primarily attributable to oil and grease and elevated TOC, and the presence of halogenated organic compounds was insignificant. A complete discussion of the methods and results of this study are presented in the Phase II - Confirmation/Quantification Report (SAIC, 1986).

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

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, a review of all management methods and technologies that could possibly remedy site problems, and preparation of a baseline risk assessment 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.

During the Phase IV-A investigation in 1987, G&M installed ten piezometers (WP-1 through WP-10) to delineate the lateral extent and movement of contamination at OU-6/Site SS-3 (Figure 2-1). Organic vapor concentrations were monitored in the piezometers. The highest reading (>9,999 parts per million [ppm]) was recorded in piezometer WP-5, located in the immediate vicinity of the former above ground storage tank locations. Organic vapor concentrations from eight of the remaining nine piezometers ranged from 4.6 to 36.2 ppm. An apparently anomalous reading of 160.3 ppm was recorded at piezometer WP-8. Groundwater from piezometer WP-8 was subsequently determined to be uncontaminated and the organic vapor reading was not considered to be related to any source.

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Three of the piezometers (WP-5, WP-6, and WP-8) were converted to permanent monitoring wells. Nine additional monitoring wells were also installed during the Phase IV-A investigation. Six shallow wells were constructed to depths of approximately 13 feet below land surface (bls) (WGM-1 through WGM-5, and WGM-7), two intermediate wells were constructed to depths of approximately 40 feet bls (WGM-6 and WGM-8), and one deep well was constructed to a depth of approximately 70 feet bls (WGM-9). Groundwater samples from these nine newly installed wells and two of the three existing wells (I-7 and I-8) were collected in March 1987 and analyzed for VOCs (including xylenes), total recoverable petroleum hydrocarbons (TRPH), and total and dissolved lead. Samples from wells I-8 and WP-5 were also analyzed for base neutral/acid extractable compounds (BNAEs). Monitoring well I-9, which contained free product, was not sampled.

Due to an erroneously high field blank laboratory blank, sampler rinsate concentrations, and poor duplicate agreement, the TRPH data collected in 1987 was determined to be invalid and ten of the shallow wells were resampled in May 1987. The May samples were analyzed for C8-C20 hydrocarbons. Additionally, three of the ten wells resampled in May were analyzed for BNAEs (WP-5, WP-6, and I-9). A complete discussion of the methods and results of the Phase IV-A investigation is presented in G&M's 1989 report Remedial Action Plan for Oil Spills at the Aircraft Washrack (SS-3) Homestead Air Force Base, Florida.

2.3.5 1990 and 1991 Remedial Investigation

In 1990 and 1991, additional investigations were conducted at OU-6/Site SS-3 by G&M. The investigations included the collection of soil vapor data in 15 soil borings and in two monitoring well borehole locations and the subsequent collection of soil and groundwater samples. The 1990 and 1991 sampling locations are illustrated on Figure 2-2. Five soil samples were collected and submitted for laboratory analysis. Groundwater samples were collected from 20 existing monitoring wells in 1990 and 1991. In addition, sediment and surface water samples were collected from one location within the drainage ditch north-west of the site. Results of the 1990 and 1991 RI are presented in G&M's report Remedial Investigation Report for Site SS-3, Aircraft Washrack Area (Former Site SP-7), October 1992.

2.3.6 1993 Remedial Investigation Addendum

In 1993, Montgomery Watson Americas, Inc. performed additional RI activities to evaluate the current soil and groundwater quality with respect to the USEPA target compound list/target analyte list (TCL/TAL) and to fill data gaps from the previous field investigations, as well as to evaluate any impacts due to Hurricane Andrew. The 1993 investigation included the drilling of five soil borings, groundwater sampling of seven shallow and one deep monitoring well, and the collection of three sediment and surface water samples. Sampling locations are illustrated on Figure 2-3.

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2.4 COMMUNITY RELATIONS HISTORY

The Remedial Investigation/Baseline Risk Assessment Report and Proposed Plan (PP) for Homestead AFB, OU-6/Site SS-3 were released to the public in June and November 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 November 8, 1994 to December 22, 1994 as part of the community relations plan for OU-6/Site SS-3. Additionally, a public meeting was held on Tuesday, November 29, 1994, at 7:00 pm at South Dade High School. A Public Notice was published in the Miami Herald and South Dade News Leader on Tuesday, November 22, 1994. At this meeting, the USAF, in coordination with EPA Region IV, FDEP, and Dade County Environmental Resource Management (DERM), was prepared to discuss the Remedial Investigation, the Baseline Risk Assessment, Feasibility Study, and the Preferred Alternative 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 decision document presents the selected remedial action for OU-6/Site SS-3 at Homestead ARB, chosen in accordance with CERCLA, as amended by SARA and, to the extent practicable, the National Contingency Plan. The decision for this site is based on the administrative record.

2.5 SCOPE AND ROLE OF RESPONSE ACTION

As with many Superfund sites, the problems at OU-6/Site SS-3 are complex. The contamination at the site is considered to exist as three media:

One:	an immiscible layer (LNAPL) in soil/rock pore space
Two:	contaminated soil/rock
Three:	dissolved constituents in groundwater (contaminant plume)

The response action authorized by this ROD actively addresses the contamination in two of the three media; the LNAPL and the contaminated soil/rock. It is anticipated that excavation and disposal of the contaminated soil and extraction of the LNAPL will allow for rapid attenuation of the localized contaminant plume.

The site poses the principal threat to human health and the environment because of the possible, but unlikely, ingestion of contaminated groundwater. The source of the groundwater contamination is suspected to be the LNAPL and the contaminated soil/rock. The purpose of this response is to eliminate the sources and allow the groundwater to naturally attenuate at an anticipated rapid pace. This alternative offers a permanent solution for the site.

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2.6 SUMMARY OF SITE CHARACTERISTICS

The Aircraft Washrack Area used to have aboveground storage tanks with capacities of 750 and 1,500 gallons that were used to store used oils, hydraulic fluids, spent solvents, and other liquid wastes from the flightline shops. During storage and removal operations conducted from 1970 to 1980, spills and overflows onto the ground occurred. Dumping of liquid waste in the area of OU-6/Site SS-3 was also reported during this time. The total quantity of organic fluids released to the soil is unknown. Liquid waste disposal operations were halted in 1980; and the tanks were removed for off-site disposal.

Soils in the former tank area, which were reportedly discolored at the time of tank removal, have either been removed from the site or covered, leaving no visible evidence of waste residue.

2.6.1 Nature and Extent of Contamination

The following subsections summarize the five previous investigations conducted at OU-6/Site SS-3 and the nature and extent of contamination identified during these investigations.

Subsurface investigations at the site were initiated by SAIC in 1986 (SAIC, 1986). Further soil and groundwater investigations were conducted by G&M in 1987, 1990, and 1991. The results of the 1987 investigation are reported in Remedial Action Plan for Oil Spills at the Aircraft Washrack (SS-3), Homestead Air Force Base, Florida (G&M, 1989). Results of work performed in 1990 and 1991 are reported in Remedial Investigation Report for Site SS-3, Aircraft Washrack Area (Former Site SP-7) (G&M, 1992). Additional data were collected at the site by Montgomery Watson in 1993. The additional Montgomery Watson investigation was conducted in accordance with the approved Facility Work Plan and Work Plan Addenda (G&M, 1991 a,b,c). A summary of the scope of previous investigations, the current investigation, and a discussion of data collected to date at OU-6/Site SS-3 is presented below.

The initial investigation conducted by SAIC in 1986 included the installation of three groundwater monitoring wells (I-7, I-8, and I-9) in the locations shown on Figure 2-1. No soil samples were collected during the well installation; results for groundwater samples are discussed in Section 2.6.3.

Based on the presence of groundwater contamination identified by the SAIC investigation, G&M performed an investigation in 1987 that included the installation of ten temporary piezometers (WP-1 through WP-10) and the collection of soil vapor samples at each piezometer. The temporary piezometers were located in the vicinity of the suspected source area (the former above ground storage tank location), as well as both up- and down-gradient of the suspected source area, as illustrated on Figure 2-1. The piezometers were constructed such that the screened intervals intercepted the groundwater surface. Thus, organic vapors measured in the piezometers reflected off-gassing of volatile organic contaminants in groundwater as well as soil vapor. The highest organic vapor concentrations were identified in piezometers WP-8 (160.3 ppm) and WP-5 (>9,999 ppm). Based on the results of the vapor survey, piezometers WP-5, WP-6, and WP-8 were converted from temporary piezometers to permanent monitoring wells. Nine additional monitoring wells (WGM-1 through WGM-9) were also installed during this sampling event. Six of the monitoring wells (WGM-1 through WGM-5 and WGM-7) were completed to depths of approximately 15 feet bls, two wells (WGM-6 and WGM-8) were completed to depths of approximately 35 feet bls, and one well (WGM-9) was completed to a depth of 65 feet bls. No soil samples were collected for laboratory analysis during installation of the nine additional monitoring wells. Results of 1987 groundwater sampling are discussed in Section 2.6.3.

Based on the results of groundwater sampling, additional investigations were conducted by G&M in 1990 and 1991. The G&M investigations included the collection of soil organic vapor monitoring in 15 boring locations and two monitoring well borehole locations, and the subsequent collection of soil and groundwater samples. The 1990 and 1991 sampling locations are illustrated on Figure 2-2. Soil samples were collected from depths of 4 to 6 feet bls at locations SP7-SL-0002, SP7-SL-0005, SP7-SL-0007, SP7-SL-0008, and SP7-SL-0011. Location SP7-SL-0002 was identified as a background location for the site. Groundwater samples were collected from a total of 20 existing monitoring wells in 1990 and 1991. In addition, sediment and surface water samples were collected from one location within the drainage ditch northwest of the site. Results for soil, groundwater, and sediment and surface water samples are discussed in Sections 2.6.2, 2.6.3, and 2.6.4, respectively.

In 1993, Montgomery Watson performed additional investigation of soil, sediment, surface water and groundwater at OU-6/Site SS-3 to fill data gaps and evaluate impacts of Hurricane Andrew. The Montgomery investigation included the drilling of five soil borings, sampling of seven shallow and one deep monitoring well, and collection of three additional sediment and surface water samples. Results for soil, groundwater, and sediment and surface water samples collected during the Montgomery Watson investigation are discussed in Sections 2.6.2, 2.6.3, and 2.6.4, respectively. Sampling locations are illustrated on Figure 2-3.

2.6.2 Soil Investigations

This section summarizes data for soils analysis as compiled by G&M in the 1991 investigation (G&M, 1992). Results of soil analyses for the current investigation are discussed for each analytical group (i.e., VOCs, metals, etc.).

<u>2.6.2.1 Volatile Organic Compounds</u>. 1991 Investigation. Laboratory analytical results for the 1991 soils investigation are summarized in Table 2-1; complete analytical results are presented in G&M (1992). The VOCs acetone, ethylbenzene, methylene chloride, styrene, and xylenes were detected in the 1991 soil samples collected from the 4 to 6 feet bls depth interval. Acetone was detected in only the background sample (SP7-SL-0002) at a concentration of 26 micrograms per kilogram (μg/kg). This result was qualified

because the reported concentration was less than the practical quantitation limit (PQL). Acetone was not detected in the site samples; however, the detection limit for all site samples was above the average background concentration of 713 µg/kg for acetone. The fuel constituent, ethylbenzene, was detected in samples SP7-SL-0007, SP7-SL-0008, and SP7SL-0011 at concentrations of 14,000, 42,000, and 2,400 µg/kg, respectively. All samples were qualified as indicated on Table 4-2. Xylenes, also a fuel constituent, were detected in samples SP7-SL-0005 and its duplicate SP7-SL-9005, SP7-SL-0008, and SP7SL-0011. The maximum concentration of xylene, 71,000 µg/kg, was detected in sample SP7-SL-0005. The borings that contained fuel constituents are located in the vicinity of the former above ground storage tank location where waste fuels and oil were stored (Figure 2-2).

1993 Investigation. One sample, collected from a depth of 1 foot bls in boring SP7-SL-0017, was analyzed for VOCs in the current investigation. Two VOCs, acetone and methyl ethyl ketone (MEK), were detected. Acetone was reported at concentrations of 5,200 and 9,800 µg/kg, in the soil sample and its duplicate, respectively. The acetone detected during the current investigation has been identified as an artifact of the degradation of pesticide-grade isopropanol used during field decontamination procedures.

Isopropanol samples were analyzed and found to contain acetone at concentrations up to 120,000 µg/L. Results of the isopropanol analyses are discussed in the Quality Control Summary Report (QCSR). MEK, detected at a concentration of 900 µg/kg, is a common laboratory contaminant and was not present in the soil sample in excess of 5 times the detection limit. It is thus considered to be potentially related to laboratory contamination. MEK was not detected in the duplicate sample. Details of the data validation process and subsequent data qualification are presented in the QCSR for the RI, which will be submitted under separate cover. A summary of VOCs detected in soil/bedrock samples during the 1993 investigation is provided in Table 2-2.

<u>2.6.2.2 Base Neutral/Acid Extractable Compounds</u>. 1991 Investigation. Three BNAs, bis(2-ethylhexyl)phthalate, 2-methyl-naphthalene, and naphthalene, were identified in the 1991 soil samples. Bis(2-ethylhexyl) phthalate was detected in the background sample at a concentration of 30 µg/kg; the result was qualified because it is below the PQL. Concentrations of bis(2-ethylhexyl)phthalate detected in site soil samples were qualified as undetected based on associated quality control data. The polynuclear aromatic hydrocarbon (PAH) compounds, 2-methylnaphthalene and naphthalene, were detected in all four site samples and the duplicate sample. These PAHs were not identified in the background sample (SP7-SL-0002). Concentrations of 2-methylnaphthalene ranged from 8,900 µg/kg in sample SP7-SL-0007 to 63,000 µg/kg in the duplicate of sample SP7-SL-0005. PAH compounds were not detected in the Site SS-3 background sample (SP7-SL-0002) or in samples from the five locations used to establish average background concentrations for Homestead AFB. The summary of BNAs detected during the 1991 investigation are included in Table 2-1.

1993 Investigation. Of the soil samples collected, only the soil sample SP7-SL-0017 and its duplicate were analyzed for BNAs. A total of twenty BNAs (sixteen PAH compounds, two phthalates, and the petroleum products dibenzofuran and carbazole) were identified (Table 2-2) in both the soil sample and its duplicate collected from boring SP7-SL-0017. Nineteen of the compounds detected in soil sample (SP7-SL-0017) were qualified because they were detected at concentrations less than the contract required quantitation limit (CRQL). Reported concentrations ranged from 11 µg/kg to 430 µg/kg in the sample and from 14 µg/kg to 840 µg/kg in the duplicate. The maximum concentration detected in both samples was for the PAH fluoranthene. All other BNAs were detected at concentrations less than the fluoranthene results.

BNAs, primarily PAH compounds, have been detected in one shallow surface soil sample and four subsurface soil samples at the site. They were not detected in a background sample (SP7-SL-0002) collected northwest of the site, across Bikini Blvd. on the northwest side of the drainage ditch (Figure 2-2).

TABLE 2-1

SUMMARY OF SOIL ANALYTICAL RESULTS
SITE SS-3 AIRCRAFT WASHRACK
GERAGHTY & MILLER, 1991

G&M Sample I.D. Sampling Date	Average Carbonate Composition (Hem, 1989)	Average Homestead ARB Background 4-6 ft bls	SP7-SL-0002 9/12/91 (Background Sample)	SP7-SL-0005 9/13/91	SP7-SL-9005 9/13/91	SP7-SL-0007 9/13/91	SP7-SL-0008 9/13/91	SP7-SL-0011 9/13/91
VOLATILE ORGANIC COMPOUNDS (µ/kg dw);								
Acetone	-	713	[26]J	<17000	<18000	<17000	<17000	<16000
Ethylbenzene	-	ND	<6.7	<7000	<3400	14000 J	42000J	[2400]
Methylene chloride	-	47.7	[5.3]	[2100]J	3600 J	<3400	<3400	[3000]
Styrene	-	ND	<6.7	<3400	<3400	13000 J	<3400	<3300
Xylenes	-	ND	<6.7	71000 J	50000 J	<3400	21000J	[11000]
BASE/NEUTRAL AND ACID EXTRACTABLE ORGANIC COMPOUNDS (µg/kg dw);								
bis(2-Ethylhexyl)phthalate	-	480	[30]	[500] U	[920] U	<4400	<9000	[790] U
2-Methylnaphthalene	-	ND	<440	26000	63000	8900	27000	25000 U
Naphthalene	-	ND	<440	15000	36000	4800	17000	11000
METALS (mg/kg dw);								
Aluminum	8970	425	240	670	610	1900	160	1600
Barium	30	5	4.3	5.2	5.6	6.9	4.9	4.0
Calcium	272000	400000	410000	350000	360000	400000	360000	400000
Chromium	7.1	3.9	3.1	5.2	5.1	<60	<32	<64
Iron	8190	260	<160 UJ	200 J	180 J	690 J	<170 UJ	910 J
Lead	16	1.4	1.4	3.2	<1.4	<0.64	2.5	4.1
Magnesium	45300	875	840	750	710	690	500	980
Manganese	842	5.4	2.3J	7.7J	7.5J	20J	1.5J	10J
Mercury	0.046	ND	<0.013	<0.013	0.016	<0.013	<0.013	0.016
Sodium	393	910	850	1000	1100	960	1000	600
Vanadium	13	2.3	1.7	2.0	2.0	<60	<32	<64
Zinc	16	ND	<63	3.1	<2.7	<120	<65	<130
TOTAL RECOVERABLE PETROLEUM HYDROCARBONS(mg/kg dw)	-	ND	<13	5500	4800	860	5900	2400

Source - Geraghty & Mliler, Inc., 1992
mg/kg dw - milligrams per kilogram dry weight
ug/kg dw - micrograms per kilogram dry weight
< Analyte was not detected at or above the indicated concentration.
[] 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 Result has been classified as undetected.

TABLE 2-2

SUMMARY OF CONSTITUENTS DETECTED IN SOIL SAMPLES
SITE SS-3, AIRCRAFT WASHRACK
MONTGOMERY WATSON, 1993
Homestead ARB, Florida

Analyte	Homestead ARB Background 0-2 ft bls (G&M 1992)	AVERAGE CARBONATE COMPOSITION (HEM 1988)	Sample ID. Sample Interval Date Collected	SP7SL0016	SP7SL0017	SP7SL9017	SP7SL0019	SP7SL0020
				0-2	0-1	0-1	0-2	4-6
				3/10/93	3/10/93	3/10/93	3/10/93	
						Duplicate		
VOA TCL Compounds (ug/kg)(1)								
Acetone	119.2	NS	NA	5200	9800	NA	NA	
Methyl Ethyl Ketone (2-Butanone)	<24	NS	NA	900 J	<11	NA	NA	
Pesticide/PCB TCL Compounds (ug/kg)(1)								
Endosulfan Sulfate	<2.9	NS	3.9	<3.6	<3.6	<3.6	<4.0	
p,p'-DDD	<4.7	NS	8	0.58 J	0.86 J	1 J	1.1 J	
p,p'-DDE	<4.7	NS	9.6	0.41 J	0.54 J	1.2 J	0.46 J	
p,p'-DDT	<12	NS	11	2.3BJ	3.4 BJ	5.7 B	1.9 BJ	
BNA TCL Compounds (ug/kg)(1)								
Anthracene	<390	NS	NA	79 J	160 J	NA	NA	
Acenaphthene	NA	NS	NA	41 J	75 J	NA	NA	
Benzo(a)Anthracene	67	NS	NA	160 J	320 J	NA	NA	
Benzo(a)Pyrene	66	NS	NA	160 J	290 J	NA	NA	
Benzo(b)Fluoranthene	69	NS	NA	150 J	290 J	NA	NA	
Benzo(g,h,i)Perylene	44	NS	NA	110 J	230 J	NA	NA	
Benzo(k)Fluoranthene	66	NS	NA	160 J	250 J	NA	NA	
Bis(2-Ethylhexyl)Phthalate	100	NS	NA	27 J	23 J	NA	NA	
Carbazole	NA	NS	NA	84 J	130 J	NA	NA	
Chrysene	79	NS	NA	200 J	350 J	NA	NA	
Di-n-Butyl Phthalate	<390	NS	NA	23 J	14 J	NA	NA	
Dibenz(A,H)Anthracene	17	NS	NA	45 J	97 J	NA	NA	
Dibenzofuran	<390	NS	NA	22 J	45 J	NA	NA	
Fluoranthene	52.4	NS	NA	430	840	NA	NA	
Fluorene	<400	NS	NA	41 J	83 J	NA	NA	
Indeno(1,2,3-C,D)Pyrene	45	NS	NA	110 J	210 J	NA	NA	
2-Methylnaphthalene	84	NS	NA	11 J	18 J	NA	NA	
Naphthalene	50	NS	NA	20 J	37 J	NA	NA	
Phenanthrene	<400	NS	NA	360 J	670	NA	NA	
Pyrene	49.15	NS	NA	350 J	600	NA	NA	

Metals (mg/kg)(2)							
Aluminum	2400	8970	NA	1010	1250	NA	NA
Antimony	30	NS	NA	<3.0	3.1 B	NA	NA
Arsenic	1.6	1.8	NA	<1.0	1.1 B	NA	NA
Barium	42.9	30	NA	6.2 B	6.5 B	NA	NA
Cadmium	2.9	0.048	NA	0.46 B	0.57 B	NA	NA
Calcium	345000	272,000	NA	326000	304000	NA	NA
Chromium, Total	11.5	>0.1	NA	6	7.2	NA	NA
Copper	3	4.4	NA	1.8 B	2.6 B	NA	NA
Iron	1650	8,190	NA	662 E	730 E	NA	NA
Lead	4.50	16	NA	46.9	44.1	NA	NA
Magnesium	1050	45,300	NA	1490	1680	NA	NA
Manganese	23	842	NA	22.7 E	19.9 E	NA	NA
Nickel	4.7	13	NA	<1.2	1.9 B	NA	NA
Potassium	120	2,390	NA	707 B	640 B	NA	NA
Sodium	5.7	398	NA	409 B	422 B	NA	NA
Vanadium	5.9	13	NA	4.8 B	4.9 B	NA	NA
Zinc	20	16	NA	10.6	13.4	NA	NA

All samples analyzed by Savannah Laboratories, Tallahassee, Florida.

<not detected at specified detection limit
NS - no standard
NA - not analyzed
Shaded - greater than Background

(1) Data Qualifiers for Organic Compounds
J - Estimated Value, <CRQL
B - Analytes found in associated blank

(2) Data Qualifiers for Inorganic Compounds
B - Reading is less than CRQL but greater than IDL
E - reported value is estimated due to interference

<u>2.6.2.3 Organochorine Pesticides/PCBs</u>. 1991 Investigation. Soil samples collected in the G&M 1991 investigation were not analyzed for pesticides/PCBs.

1993 Investigation. Four soil samples and a duplicate were analyzed for organochlorine (OC) pesticides. No PCBs were detected. The DDT metabolites p,p'-DDE, p,p'-DDD, and p,p'-DDT were detected in four of the samples and the duplicate (Table 2-2). Concentrations of p,p'-DDE ranged from 0.41 to 9.6 μg/kg; p,p'-DDD concentrations ranged from 5.8 to 8 μg/kg;, p,p'-DDT concentrations ranged from 1.9 to 11 μg/kg. The highest levels of these compounds were detected in 0-2-foot depth sample at boring SP7-SL-0016. This sample also contained endosulfan sulfate at a concentration of 3.9 μg/kg.

In general, higher levels of pesticides were detected in shallower samples with detected concentrations decreasing with depth. The highest levels of pesticides detected were found in the 0-2 foot sample from boring SP7-SL-0016, located northwest of the site and northwest of the drainage ditch (Figure 2-2). Relatively high levels were also present in the 0-2-foot sample from boring SP7-SL-0019, located in the central portion of the open area northwest of the washrack (Figure 2-3). The 0 to 1-foot sample from boring SP7-SL-0017, located approximately 85 feet southwest of boring SP7-SL-0019, contained lower levels than either of the 0-2-foot samples. Low levels were also detected in the 4 to 6-foot sample from boring SP7-SL-0020. There are no promulgated federal or state action levels for pesticides in soils; therefore, levels are addressed in a health risk assessment in the Baseline Risk Assessment (BRA) (Montgomery Watson, 1994).

<u>2.6.2.4 Metals and Cyanide</u>. 1991 Investigation. The metals aluminum, barium, calcium, chromium, iron, lead, magnesium, manganese, mercury, sodium, vanadium, and zinc were detected in the 1991 soil samples. The metals detected are summarized in Table 2-1. Aluminum was identified in all site samples at concentrations ranging from 160 milligrams per kilogram (mg/kg) in sample SP7-SL-0008 to 1,900 mg/kg in sample SP7-SL-0007. With the exception of the 160 mg/kg result, all aluminum concentrations were in excess of both the average Homestead AFB concentration of 425 mg/kg (Table 2-1) and the Site SS-3 background sample (SP7-SL-0002) concentration of 240 mg/kg (Table 2-1).

Barium was detected in all samples at concentrations ranging from 4.0 mg/kg in SP7-SL-0011 to 6.9 mg/kg in SP7-SL-0007. All barium results except that of SP7-SL-0011 were in excess of the Site SS-3 background result of 4.3 mg/kg; all but two results were in excess of the average Homestead AFB concentration of 5 mg/kg. Calcium levels detected in site soils were below both the Site SS-3 background level and the average for the base. Chromium was detected in sample SP7-SL-0005 and its duplicate at concentrations of 5.2 and 5.1 mg/kg, respectively. These results are in excess of the site and average base background levels of 3.1 and 3.9 mg/kg, respectively. Chromium detection limits for the remaining three soil samples collected at the site are in excess of background levels. Iron was detected in two samples (SP7-SL-0007 and SP7-SL-0011) in excess of both the site and the average Homestead AFB background levels. However, all iron results were qualified based on associated quality control measures. Lead was detected in three samples at concentrations ranging from 2.5 to 4.1 mg/kg. All three lead results exceed both the site background result and average Homestead AFB background result of 1.4 mg/kg. Magnesium was detected in only one sample (SP7-SL-0011) in excess of background levels. Manganese was detected in all but one sample in excess of both the site and the average base background concentration. However, all manganese results were qualified on the basis of associated quality control results. Mercury was detected in two samples, the duplicate (SP7-SL-9005) and SP7-SL-0011, at concentrations of 0.016 mg/kg. These results exceed background levels. Sodium levels in all site samples were in excess of background levels. Vanadium and zinc were detected at concentrations of 2.0 and 3.1 mg/kg, respectively, in sample SP7-SL-0005. Both results were in excess of background levels (Table 2-1).

While several metals were identified at levels above the one site-specific background sample and the average of the samples from 4 CERCLA sites and 1 RCRA site, (Table 2-1), all metals except sodium were detected at concentrations below their respective average concentration in a carbonate deposit, as reported by Hem (1989).

No cyanide analyses were performed during the 1991 field investigation.

1993 Investigation. One soil sample collected from a depth of one foot bls (SP7-SL-0017) and a duplicate sample (SP7-SL-9017) were analyzed for metals. Analytical results are presented in Table 2-2. Fourteen metals were detected in the soil sample and seventeen were detected in the duplicate. Cadmium, copper, and vanadium were detected in the SP7-SL-0017 sample; these analytes plus antimony and nickel were detected in the duplicate sample. These five metals were reported at concentrations that are less than the reported detection limits for the samples used to calculate the average Homestead AFB value. Thus, it is not possible to determine if the reported concentrations exceed naturally-occurring levels (i.e., the average Homestead AFB value for cadmium may be greater than the reported concentrations of 0.46 and 0.57 mg/kg but less than the detection limits of 2.8 to 3.0 mg/kg for the average background samples). Reported concentrations of aluminum, arsenic, barium, calcium, total chromium, iron, manganese, sodium, and zinc are below their respective average concentration in Homestead AFB soils. Lead, magnesium, and potassium were detected at concentrations in excess of their average Homestead AFB background level. Lead was detected at a concentration of 46.9 mg/kg; the average background concentration for lead is 4.05 mg/kg. Magnesium was detected at concentrations of 1,490 and 1,680 mg/kg in the sample and duplicate sample, respectively. The average Homestead AFB background concentration for magnesium in the 0 to 2 foot bls depth interval is 1,050 mg/kg. Potassium was not detected above 120 mg/kg in the samples used to calculate the average Homestead AFB background concentration. Reported potassium concentrations for the sample and duplicate sample are 707 and 640 mg/kg, respectively.

Sample SP7-SL-0017 was collected northwest of the former above ground storage tank location, at the approximate location of the 1991 sampling location SP7-SL-0005. Thus, results of the two samples provide an indication of the distribution of metals with depth at that location. Results were comparable for most metals detected in both the 0-1 ft bls sample (SP7-SL-0005) and the 4-6 ft bls sample (SP7-SL-0005) with the exception of lead. Lead was detected in the 0 to 1 foot interval at a concentration of 46.9 mg/kg and in the 4 to 6 foot interval at a concentration of 3.2 mg/kg.

Cyanide was not detected in either the sample or the duplicate.

2.6.2.5 Summary Section for Soils. Contaminants detected in OU-6/Site SS-3 soils include VOCs, BNAs, pesticides, and metals. The VOCs detected (acetone and MEK) are both common laboratory contaminants; the acetone is thought to be related to the decontamination process. BNAs, primarily PAHs, have been detected in shallow soils and at depths up to 6 ft bls. DDT metabolites were detected in shallow soils. The metal arsenic was identified above the background in the only soil sample analyzed for metals. A summary of constituents detected in soil samples in 1993 is presented in Table 2-2.

2.6.3 Groundwater Investigations

The Aircraft Washrack was identified initially during the Phase I IRP. The groundwater quality at OU-6/Site SS-3 has been monitored during each subsequent phase of investigations conducted at Homestead AFB. Initial groundwater samples collected from monitoring wells I-7, I-8, and I-9, by SAIC during Phase II investigations (1984) were analyzed for oil and grease (O&G), total organic halogens (TOX), and total organic carbon (TOC). Concentrations of O&G ranged from 0.15 to 732,000 mg/l, with the maximum detection found in the NAPL at monitoring well I-9. Concentrations of TOX and TOC ranged from 10 to 30 µg/L and 62,000 to 170,000 µg/L, respectively.

Groundwater samples analyzed for VOCs from fifteen monitoring wells during the Phase IV investigations (1987) indicate the presence of benzene, xylene, 1,1-dichloroethane, ethylbenzene and toluene in groundwater at monitoring well I-8. Total BTEX concentration detected in groundwater at I-8 was 108.8 µg/L with a benzene concentration of 45 µg/L. Xylene was detected in groundwater in monitoring well WGM-3 at a concentration of 1.8 µg/L. Monitoring well I-9 was not sampled due to the presence of NAPL.

Based on the analytical results of these previous investigations, additional groundwater investigations were conducted by G&M in 1990 and 1991. The 1990 groundwater investigation consisted of sampling seven permanent monitoring wells (I-7, I-8, WGM-2, WGM-3, WGM-4, WGM-5, and WP-5). A summary of analytical results from the 1990 groundwater investigation is presented in Table 2-3. The groundwater investigations performed by G&M in 1991, consisted of collecting samples from thirteen permanent monitoring wells (I-9, WP-5, WP-6, WP-8, WGM-3, WGM-6, SP7-MW-0013 through SP7-MW 0018, and SP7-DMW-0001). NAPL was encountered during sampling in monitoring wells I-9 and SP7-MW-0016. A summary of the 1991 groundwater analytical results is presented in Table 2-4.

The 1993 remedial investigation conducted by Montgomery Watson was performed to fill data gaps from the 1991 RI conducted by G&M and evaluate the groundwater quality with respect to the USEPA target compound list (TCL) and target analyte list (TAL) to develop a comprehensive evaluation of the site. Additionally, the 1993 investigation purpose included evaluating changes in site character due to Hurricane Andrew. A summary of results is presented in the following sections. Groundwater results are compared to Florida Groundwater Guidance Concentrations, Florida 17-770 target cleanup levels, Federal EPA primary and secondary drinking water standards, Maximum Contaminant Levels (MCLs,) and MCL goals (MCLG) (Table 2-5).

TABLE 2-3
SUMMARY OF CONSTITUENTS DETECTED IN GROUNDWATER SAMPLES COLLECTED IN 1990 AT SITE SS-3, AIRCRAFT WASHRACK
Homestead Air Reserve Base, Florida

Analyte									EQUIPMENT
G&M Sample I.D.	I-7	I-8	I-8	WGM-2	WGM-3	WGM-4	WGM-5	WP-5	BLANK
Savannah I.D.	13572-1	13572-2	13572-8	13572-3	13572-4	13572-5	13572-6	13572-7	13572-9
Sampling Date	11/7/90	11/7/90	11/7/90	11/7/90	11/7/90	11/7/90	11/7/90	11/7/90	11/7/90
			DUPLICATE						
VOLATILE ORGANIC COMPOUNDS (ug/L):									
Acetone	<25	350 J	320	<25	<25	<25	<25	<25	<25
Benzene	<5.0	24	24	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
BASE/NEUTRAL AND ACID EXTRACTABLE ORGANIC COMPOUNDS (ug/L):									
Naphthalene	<10	21	<10	<10	<10	<10	<10	33	<10
TOTAL RECOVERABLE PETROLEUM HYDROCARBONS (mg/L)	<1.0	4.5	<1.0	<1.0	<1.0	<1.0	<1.0	5.4	<1.0

ug/ Micrograms per liter
mg Milligrams per liter
NS Not Standard
NA Not Analyzed
< Analyte was not detected at or above the indicated concentration
J Positive result has been classified as qualitative.

TABLE 2-4
SUMMARY OF CONSTITUENTS DETECTED IN GROUNDWATER SAMPLES COLLECTED IN 1991 AT SITE SS-3, AIRCRAFT WASHRACK
Homestead Air Reserve Base, Florida
(Page 1 of 3)

Analyte	G&M Sample I.D.	SP7-I-09	SP7-WP-5	SP7-WP-6	SP7-WP-8	SP7-WGM-3	SP7-WGM-6	SP7-MW-0013
	Savannah I.D.	37571-2	37541-3	37541-2	37541-1	37471-4	37541-6	37541-5
	Sampling Date	11/20/91	11/19/91	11/19/91	11/19/91	11/19/91	11/15/91	11/19/91
VOLATILE ORGANIC COMPOUNDS (ug/L):		11	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Ethylbenzene		<10	<10	<10	<10	<10	<10	<10
2-Hexanone		5.1 J	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Xylenes								
BASE/NEUTRAL AND ACID EXTRACTABLE ORGANIC COMPOUNDS (ug/L)								
bis(2-Ethylhexyl)phthalate		<100	[3.8] UJ	[1.4] UJ	[0.76] UJ	<10	[5.8] U	[6.0] UJ
Butylbenzylphthalate		<100	<10	<10	<10	<10	<10	<10
Di-n-octylphthalate		[28] J	<10	<10	<10	<10	<10	<10
Dibenzofuran		<100	<10	<10	<10	<10	<10	<10
Fluorene		<100	[1.6] J	<10	<10	<10	<10	<10
2-Methylnaphthalene		120	31	<10	<10	<10	<10	<10
Naphthalene		[70]	27	<10	<10	<10	<10	<10
METALS (ug/L):								
Aluminum		<200	1900 J	18000 J	300000 J	4400 J	1400	12000 J
Arsenic		<10 UJ	<10 UJ	11 J	<25 UJ	10 J	<10	<10 UJ
Barium		<10	27 J	140 J	540 J	40 J	22	83 J
Beryllium		<5.0	<5.0 UJ	<25 UJ	8.9 J	<5.0 UJ	<5.0	<25 UJ
Calcium		100000	1300000 J	8600000 J	2300000 J	1700000 J	300000	3000000 J
Chromium		<10	19 J	130 J	810 J	45 J	12	54 J
Cobalt		<10	<10 UJ	<10 UJ	36 J	<10 UJ	<10	<10 UJ
Copper		<25	<25 UJ	<25 UJ	87 J	<25 UJ	<25	<25 UJ
Iron		340 J	2100 J	7400 J	2600000 J	4200 J	1300	5500 J
Lead		<5.0 UJ	7.7 J	29 J	210 J	16 J	<5.0 UJ	49 J
Magnesium		2300	3300 J	18000 J	22000 J	6200 J	6300	7200 J
Manganese		<10	42 J	120 J	3900 J	77 J	23	120 J
Mercury		<0.20	<0.20 UJ	0.20 J	0.98 J	<0.20 UJ	<0.20	<0.20 UJ
Nickel		<40	<40 UJ	<40 UJ	160 J	<40 UJ	<40	<40 UJ
Potassium		3700	2400 J	4200 J	12000 J	3600 UJ	5300	2800 J
Selenium		<10	<10 UJ	<50 UJ	<50 UJ	<50 UJ	<10 UJ	<50 UJ
Sodium		32000	29000 J	26000 J	31000 J	33000J	63000	31000 J
Thallium		<10 UJ	<10 UJ	<10 UJ	<10 UJ	<50UJ	<10 UJ	<10 UJ
Vanadium		<10	10 J	79 J	540 J	20 J	<10	<50 UJ
Zinc		<20	<20 UJ	<100 UJ	160 J	22 J	<20	<100 UJ

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS (mg/L)	38 J	18 J	<1.0 UJ	<1.0UJ	<1.0 UJ	<1.0 UJ	<1.0 UJ
TOTAL DISSOLVED SOLIDS (mg/L)	NA	NA	NA	350	NA	NA	NA
BIOCHEMICAL OXYGEN DEMAND (mg/L)	NA	NA	NA	NA	NA	NA	NA
TOTAL SUSPENDED SOLIDS (mg/L)	NA	NA	NA	NA	NA	NA	NA
ALKALINITY (mg/L)	NA	NA	NA	NA	NA	NA	NA
TOTAL ORGANIC CARBON (mg/L)	NA	NA	NA	NA	NA	NA	NA
SULFATE (mg/L)	NA	NA	NA	NA	NA	NA	NA
SULFIDE (mg/L)	NA	NA	NA	NA	NA	NA	NA
HARDNESS as CaCO3 (mg/L)	NA	NA	NA	NA	NA	NA	NA

Footnotes on Page 3

TABLE 2-4
SUMMARY OF CONSTITUENTS DETECTED IN GROUNDWATER SAMPLES COLLECTED IN 1991 AT SITE SS-3, AIRCRAFT WASHRACK
Homestead Air Reserve Base, Florida
(Page 2 of 3)

	G&M Sample I.D.	SP7-MW-0014	SP7-MW-9014	SP7-MW-0015	SP7-MW-0016	SP7-MW-0017	SP7-MW-0018
Analyte	Savannah I.D.	37460-16	37460-17	37541-4	37571-1	37471-1	37471-5
	Sampling Date	11/14/91	11/14/91	11/19/91	11/20/91	11/15/91	11/15/91
VOLATILE ORGANIC COMPOUNDS (ug/L):		11	15	<5.0	51	<5.0	<5.0
Ethylbenzene		<10	<10	<10	89	<10	<10
2-Hexanone		14 J	6.6 J	<5.0	21 J	<5.0	<5.0
Xylenes							
BASE NEUTRAL AND ACID EXTRACTABLE ORGANIC COMPOUNDS (ug/L)							
bis(2-Ethylhexyl)phthalate		[5.5] J	[1.9] UJ	[0.68] UJ	[26] U	<10	[1.1] UJ
Butylbenzylphthalate		[0.3] J	10	<10	<100	<10	<10
Di-n-octylphthalate		[0.3] J	10	<10	<100	<10	<10
Dibenzofuran		<10	[O.5]	<10	<100	<10	<10
Fluorene		[1.1]	[1.3] J	<10	<100	<10	<10
2-Methylpaphthalene		32	41	<10	220	<10	<10
Naphthalene		37	51	<10	130	<10	<10
METALS (ug/L):							
Aluminum		7100 J	5600 J	7600 J	1500	6300 J	18000
Arsenic		<10 UJ	<10 UJ	22 J	<10 UJ	<10 UJ	<10 UJ
Barium		38 J	37 J	29 J	16	50	110 J
Beryllium		<5.0 UJ	<5.0 UJ	<5.0 UJ	<5.0	<5.0 UJ	<25 UJ
Calcium		1600000 J	1700000 J	840000 J	460000	1800000 J	4700000 J
Chromium		35 J	39 J	36 J	10	34 J	110 J
Cobalt		<10 UJ	<10 UJ	<10 UJ	<10	<10 UJ	<10 UJ
Copper		<25 UJ	<25 UJ	<25 UJ	<25	<25 UJ	28 J
Iron		4000 J	4000 J	7100 J	850 J	2400 J	9500 J
Lead		11 J	11 J	7.1 J	7.8 J	20 J	40 J
Magnesium		5000 J	5300 J	3600 J	2800	5000 J	11000 J
Manganese		42 J	45 J	130 J	32	62 J	290 J
Mercury		<0.20 UJ	<0.20 UJ	<0.20 UJ	<0.20	<0.20 UJ	<0.20 UJ
Nickel		<40 UJ	<40 UJ	<40 UJ	<40	<40 UJ	<40 UJ
Potassium		3100 J	3000 J	3600 J	2800	12000 J	2800 UJ
Selenium		<50 UJ	<50 UJ	<10 UJ	<10UJ	<10 UJ	<5.0 UJ
Sodium		37000 J	36000 J	23000 J	32000	17000 J	37000 J
Thallium		<50 UJ	<50 UJ	<10 UJ	<10UJ	<5.0 UJ	<5.0 UJ
Vanadium		23 J	20 J	13 J	<10	21 J	<5.0 UJ
Zinc		27 J	39 J	<20 UJ	<20	42 J	<100 UJ

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS (mg/L)	8.2 J	9.6 J	<1.0UJ	120 J	<1.0 UJ	<1.0 UJ
TOTAL DISSOLVED SOLIDS (mg/L)	430	410	NA	NA	NA	NA
BIOCHEMICAL OXYGEN DEMAND (mg/L)	55	35	NA	NA	NA	NA
TOTAL SUSPENDED SOLIDS (mg/L)	4300	2600	NA	NA	NA	NA
ALKALINITY (mg/L)	440	390	NA	NA	NA	NA
TOTAL ORGANIC CARBON (mg/L)	65	70	NA	NA	NA	NA
SULFATE (mg/L)	26	27	NA	NA	NA	NA
SULFIDE (mg/L)	0.1 UJ	0.1 UJ	NA	NA	NA	NA
HARDNESS as CaCO3 (mg/L)	4000	3300	NA	NA	NA	NA

Footnotes on Page 3

TABLE 2-4

SUMMARY OF CONSTITUENTS DETECTED IN GROUNDWATER SAMPLES COLLECTED IN 1991 AT SITE SS-3, AIRCRAFT WASHRACK

Homestead Air Reserve Base, Florida

(Page 3 of 3)

Analyte	G&M Sample I.D.	SP7-DMW-0001	TRIP BLANK	SP7-EB-0024	SP7-EB-0025
	Savannah I.D.	37471-3	/1	37471-2	37541-7
	Sampling Date	11/15/91	11/15/91	11/15/91	11/19/91
VOLATILE ORGANIC COMPOUNDS (ug/L):		<5.0	<5.0	<5.0	<5.0
Ethylbenzene		<10	<10	<10	<10
2-Hexanone		<5.0	<5.0	<5.0	<5.0
Xylenes					
BASE/NEUTRAL AND ACID EXTRACTABLE ORGANIC COMPOUNDS (ug/L)					
bis(2-Ethylhexyl)phthalate		[0.6] J	NA	[0.8]	[3.8]
butylbenzylphthalate		<10	NA	<10	<10
Di-n-octylphthalate		<10	NA	<10	<10
Dibenzofuran		<10	NA	<10	<10
Fluorene		<10	NA	<10	<10
2-Methylnaphthalene		<10	NA	<10	<10
Naphthalene		<10	NA	<10	<10
METALS (ug/L):					
Aluminum		6800 J	NA	<200	<200
Arsenic		<10 UJ	NA	<10	<10
Barium		50 J	NA	<10	<10
Beryllium		<5.0 UJ	NA	<5.0	<5.0
Calcium		1800000 J	NA	270	370
Chromium		52 J	NA	<10	<10
Cobalt		<10 UJ	NA	<10	<10
Copper		<25 UJ	NA	<25	<25
Iron		5900 J	NA	<50	<50
Lead		6.1 J	NA	<5.0	<5.0
Magnesium		18000 J	NA	<50	<50
Manganese		140 J	NA	<10	<10
Mercury		<0.20 UJ	NA	<0.20	<0.20
Nickel		<40 UJ	NA	<40	<40
Potassium		2400 J	NA	4200	<1000
Selenium		<5.0 UJ	NA	<10	<10
Sodium		41000 J	NA	<500	<500
Thallium		<5.0 UJ	NA	<10	<10
Vanadium		32 J	NA	<10	<10
Zinc		<20 UJ	NA	<20	21

TOTAL RECOVERABLE PETROLEUM HYDROCARBONS (mg/L)	<1.0 UJ	NA	<1.0UJ	<1.0 UJ
TOTAL DISSOLVED SOLIDS (mg/L)	NA	NA	NA	NA
BIOCHEMICAL OXYGEN DEMAND (mg/L)	NA	NA	NA	NA
TOTAL SUSPENDED SOLIDS (mg/L)	NA	NA	NA	NA
ALKALINITY (mg/L)	NA	NA	NA	NA
TOTAL ORGANIC CARBON (mg/L)	NA	NA	NA	NA
SULFATE (mg/L)	NA	NA	NA	NA
SULFIDE (mg/L)	NA	NA	NA	NA
HARDNESS as CaCO3 (mg/L)	NA	NA	NA	NA

Footnotes

1/ QC Sample (all Trip Blank Samples showed identical results and are associated with preceding ground-water samples).
ug/L - micrograms per liter
mg/L - milligrams per liter
NS - No Standard
NA - Not Analyzed
< - Analyte was not detected at or above indicated concentration
[] - Value is greater than the instrument detection limit but less than the practical quantitation limit.
J - Positive result has been classified as qualitative
U - Result has been classified as undetected.
UJ - Analyte was not detected. Classified as qualitative

2.6.3.1 Volatile Organic Compounds. 1990 and 1991 Investigations. Five VOCs, including benzene, toluene, ethylbenzene, xylenes, and acetone, were detected in groundwater samples collected during the 1990 and 1991 field investigations at OU-6/Site SS-3. Benzene was detected in groundwater sample I-8 and its duplicate, a concentration of 24 µg/L, which was above the Federal MCL of 5 µg/L and the Florida Primary Drinking Water Standard and Section 17-770, FAC cleanup target level of 1 µg/L (Tables 2-4 and 2-5). In addition, acetone was detected in sample I-8 and its duplicate at concentrations of 350 and 320 µg/L, respectively. Ethylbenzene was detected in samples I-9, SP7-MW-0014, SP7-MW-9014 (the duplicate of SP7-MW-0014), and SP7-MW-0016 at concentrations of 11, 11, 15, and 51 µg/L, respectively, which are well below the Federal MCL of 700 µg/L. However, these concentrations are above the Florida Groundwater Guidance Concentration of 2 µg/L. Xylenes were detected in samples I-9, SP7-MW-0014, SP7-MW-9014, and SP7-MW-0016 at concentrations of 5.1, 14, 6.6, and 21 µg/L which are below the Federal MCL of 10,000 µg/L and the Florida Groundwater Guidance Concentration of 50 µg/L. Additionally, 2-hexoanone was detected in sample SP7-MW-0016 at a concentration of 89 µg/L.

Concentrations of BTEX, detected in all samples except sample SP7-MW-0016, were below the Section 17-770, FAC target cleanup level of 50 µg/L. In 1987, the dissolved BTEX contaminant plume was confined to the vicinity of monitoring well I-8. During the 1990 and 1991 investigation, the dissolved BTEX plume had increased in area and is limited to the vicinity between the former above ground storage tank and the drainage ditch parallel to Bikini Boulevard.

1993 Investigation. Groundwater samples were collected from monitoring wells SP7-MW-0014, SP7-MW-0016, and SP7-DMW-0001 and analyzed for TCL VOCs. Groundwater analytical results indicate benzene, ethylbenzene, and total xylene in sample SP7-MW-0016 and its duplicate at concentrations of 38 and 70 µg/L, 120 and 160 µg/L, and 100 and 150 µg/L, respectively. These benzene concentrations are above the Federal MCLs, Florida Primary Drinking Water Standard and Section 17-770, FAC cleanup target levels. An estimated quantity of acetone was also detected in duplicate sample SP7-MW-90016 at 9 µg/L. Two anomalous values of chloroform were found at an estimated quantity of 1 µg/L in samples SP7-MW-0014 and SP7-DMW-0001. Fourteen TICs were identified in sample groundwater at SP7-MW-0016 or its duplicate. Groundwater analytical results are provided in Table 2-6.

Laboratory QA/QC data indicate 1,2-dichloropropane concentrations in one equipment blank and two field blanks. Additionally, toluene was detected in one field blank sample. QA/QC results are discussed in the QCSR submitted under separate cover.

2.6.3.2 Base Neutral/Acid Extractable Compounds. 1990 and 1991 Investigations. Seven BNAs were detected in the 22 groundwater samples, including two duplicates, collected at OU-6/Site SS-3 in 1990 and 1991, as shown in Tables 2-3 and 2-4. Three of these BNAs, fluorene, 2-methylnaphthalene and naphthalene, are PAHs. Fluorene was detected in monitoring wells SP7-MW-0014 and SP7-MW-9014 (the duplicate of SP7-MW-0014) at concentrations of 1.1 and 1.3 µg/L, respectively, which are below the Florida Groundwater Guidance Concentration of 10 µg/L. 2-methylnaphthalene was detected in monitoring wells SP7-MW-0014, SP7-MW-9014 (the duplicate of SP7-MW-0014) and SP7-MW-0016 at concentrations of 32, 41, and 220 µg/L, respectively. Naphthalene was detected in SP7-MW-0014, SP7-MW-9014 (the duplicate of SP7-MW-0014) and SP7-MW-0016 at concentrations of 37, 51, and 130 µg/L, respectively, which exceeds the Florida Groundwater Guidance Concentration of 10 µg/L.

Total naphthalene concentrations were detected in I-8 and WP-5 (collected in 1990) at a maximum concentration of 33 µg/L and I-9, WP-5, SP7-MW-0014, SP7-MW-009014 (the duplicate of SP7-MW-0014), and SP7-MW-0016 (collected in 1991) at concentrations of 190, 58, 69, 92, and 350 µg/L, respectively. The total naphthalene concentrations are below the Section 17-770, FAC cleanup criteria of 100 µg/L except for concentrations detected in I-9 and SP7-MW-0016. Naphthalene concentrations have decreased in WP-5 from 182 µg/L (detected in March 1987) to 27 µg/L (detected in 1991). The decrease in naphthalene concentrations in monitoring well WP-5 between 1987 and 1991 suggests that the naphthalene may be attenuating naturally, probably from aerobic biotransformation.

Additional BNAs (non-PAHs) detected in groundwater samples include BEHP detected in sample SP7-MW-0014 at a concentration of 5.5 µg/L; butylbenzylphthalate detected in sample SP7-MW-0014 at a concentration of 0.3 µg/L; dibenzofuran detected in sample SP7-MW-0014 at a concentration of 0.5 µg/L; and di-n-octylphthalate detected in samples I-9 and SP7-MW-0014 at concentrations of 0.28 and 0.3 µg/L, respectively. The concentrations of these non-PAHs were between the method detection limit and practical quantitation limit. Concentrations of di-n-butylphthalate and butylbenzylphthalate were below the Florida Groundwater Guidance Concentration of 10 and 1,400 µg/L, respectively (Tables 2-4 and 2-5). The concentrations of di(2-ethylhexyl)phthalate (DEPH) in samples SP7-MW-0014 and SP7-MW-0016 were above the proposed Federal Primary MCL of 4 µg/L. In addition, the concentration of DEPH in sample SP7-MW-0016 was above the Florida Groundwater Guidance Concentration of 14 µg/L.

TABLE 2-5

GROUNDWATER QUALITY CRITERIA

Analyte	Florida Drinking Water Standards	Florida 17-1770	EPA Drinking Water Standards	EPA Maximum Contaminant Level Goal
VOLATILE ORGANIC COMPOUNDS (ug/L):	700	b	700 i	700 i
Ethylbenzene	NS	NS	NS	NS
2-Hexanone	10,000 k	b	10000 i	10000 i
Xylenes	1 k	1	5	
Benzenes				
BASE/NEUTRAL AND ACID EXTRACTABLE ORGANIC COMPOUNDS (ug/L):				
bis(2-Ethylhexyl)phthalate	6	NS	4f	0 f
Butylbenzylphthalate	1400	NS	NS	NS
Di-n-octylphthalate	10	NS	NS	NS
Dibenzofuran	NS	NS	NS	NS
Fluorene	10	c	NS	NS
2-Methylnapthalene	NS	d	NS	NS
Naphthalene	10	d	NS	NS
Phenanthrene	NS	NS	NS	NS
METALS (ug/L):				
Aluminum	200 l	NS	50 TO 200 h	NS
Arsenic	50 k	NS	50g	NS
Barium	2000 k	NS	2000 i	2000 i
Beryllium	4	NS	4	4
Calcium	NS	NS	NS	NS
Chromium	100 k	NS	100 i	100 i
Cobalt	NS	NS	NS	NS
Copper	1000 l	NS	1300 s	1300
Iron	300 l	NS	300 h	NS
Lead	15 k	50	15	0
Magnesium	NS	NS	NS	NS
Manganese	50 l	NS	50 h	NS
Mercury	2 k	NS	2 i	2 i
Nickel	100 k	NS	100 g	100
Potassium	NS	NS	NS	NS
Selenium	50 k	NS	50 i	50 i
Sodium	160,000 k	NS	NS	NS
Thallium	2	NS	2/1 f	0.5 f
Vanadium	NS	NS	NS	NS
Zinc	5000 1	NS	5000 h	NS
TOTAL RECOVERABLE PETROLEUM HYDROCARBONS (mg/L)	NS	5	NS	NS

ug/L - micrograms per liter
mg/L - milligrams per liter
NS - No Standard
b - The total of volatile aromatics (benzene, toluene, ethylbenzene and xylenes) must be <50 ug/L to meet FAC 17-770 guidelines
c - The total of polynuclear aromatic hydrocarbons excluding naphthalenes must be <10 ug/L to meet FAC 17-770 guidelines.
d - The total of naphthalenes and methyl naphthalenes must be <100 ug/L to meet FAC 17-770 guidelines.
f - Numbers represent EPA's Proposed Primary MCL or Proposal MCLG, Federal Register, Vol. 55, No. 143, July 1990.
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 appearance guidelines.
i - Numbers represent EPA's Final MCL effective July 1992, Federal Register, January 30, 1991 and July 1, 1991.
k - Florida Primary Drinking Water Standard.
l - Florida Secondary Drinking Water Standard.
m - Numbers represent EPA's MCL's (July 1992)
s - Final Action Level - The final lead action level is exceeded if the level of lead/copper in more than 10 percent of the targeted tap samples is greater than the action level (90th percent).

TABLE 2-6

SUMMARY OF CONSTITUENTS DETECTED IN GROUNDWATER
SITE SS-3, AIRCRAFT WASHRACK
MONTGOMERY WATSON, 1993
Homestead ARB, Florida

Analyte	Florida Drinking Water Standards	EPA Drinking Water Standard	EPA Maximum Contaminant Level Goal	Sample ID	SP7-MW-0014	SP7-MW-0016	SP7-MW-9016	SP7-MW-0017	SP7-MW-0018
Date Sampled				Date Collected	3/2/93	3/2/93 Duplicate	3/2/93	3/2/93	3/2/93
VOA TCL Compounds (ug/l)(1)	NS	NS	NS		<10	<10	9 J	NA	NA
Acetone	1a	5b	NS		<10	38	70	NA	NA
Benzene	100af	100fb	NS		1 J	<10	<10	NA	NA
Chloroform	5a	NS	NS		<10	<10	<10	NA	NA
1,2-Dichloropropane	1000a	NS	NS		<10	<10	<10	NA	NA
Toluene	700	700b	700		<10	120	160	NA	NA
Ethylbenzene	10,000a	10,000b	10,000		<10	100	150	NA	NA
Xylenes, Total									
Pesticide/PCB TCL Compounds (ug/l)(1)									
p,p'-DDD	NS	NS	NS		<0.12	<0.11	<0.11	0.032 J	0.025 J
BNA TCL Compounds (ug/l)(1)									
Bis (2-Ethylhexyl) phthalate	6a	4b	0		0.8 J	7 J	<230	NA	NA
Di-n-Butyl Phthalate	NS	NS	NS		0.4 J	<2.50	<230	NA	NA
Di-n-octylphthalate	10a	NS	NS		0.2 J	<2.50	<230	NA	NA
Fluorene	10a	NS	NS		<13	17 J	13 J	NA	NA
2-Methylnaphthalene	NS	NS	NS		2 J	860	810	NA	NA
Naphthalene	10a	NS	NS		1 J	480	480	NA	NA
Phenanthrene	NS	NS	NS		<13	8 J	7 J	NA	NA
Total Metals (ug/l)(2)									
Aluminum	200 c	50-200b	NS		<20.0	23.9 B	30.5 B	NA	NA
Barium	2000a	2000b	2000		6.6 B	7.2 B	7.6 B	NA	NA
Cadmium	5a	5b	5		<2.0	3.5 B	<2.0	NA	NA
Calcium	NS	NS	NS		77,600	89,400	87,900	NA	NA
Copper	1000c	1300b	1300		<2.0	6.2 B	5.6 B	NA	NA
Iron	300c	300d	NS		42.3 B	81.5 B	78.5 B	NA	NA
Lead	15a	15e	0		<3.0	3.4	5.2	NA	NA
Magnesium	NS	NS	NS		2,270 B	2,300 B	2,300 B	NA	NA
Manganese	50c	50d	NS		<1.0	5.6 B	5.6 B	NA	NA
Nickel	100a	100b	100		<6.0	<6.0	6.6 B	NA	NA
Potassium	NS	NS	NS		4,160 B	4,080	3,950	NA	NA
Sodium	160000a	NS	NS		29,500	29,200	29,000	NA	NA
Zinc	5000c	5000b	NS		12.3 B	13.6 B	23	NA	NA

Dissolved Metals (ug/l)(2)								
Aluminum	NS	NS	NS	21.2 B	<20.0	<20.0	NA	NA
Barium	NS	NS	NS	7.2 B	5.7 B	5.7 B	NA	NA
Calcium	NS	NS	NS	79,500	87,200	86,000	NA	NA
Copper	NS	NS	NS	<2.0	3.9 B	2.8 B	NA	NA
Iron	NS	NS	NS	42.9 B	57.9 B	64.1 B	NA	NA
Magnesium	NS	NS	NS	2,290 B	2,290 B	2,290 B	NA	NA
Manganese	NS	NS	NS	1.1 B	4.9 B	4.9 B	NA	NA
Potassium	NS	NS	NS	4,490 B	3,960 B	4,020 B	NA	NA
Sodium	NS	NS	NS	29,700	29,000	28,600	NA	NA
Zinc	NS	NS	NS	34.7	40.8	10.0B	NA	NA

All samples analyzed by Savannah Laboratories, Tallahassee, Florida.

< - not detected at specified limit
NS - no standard
NA - not analyzed
Shaded - greater than Regulatory Standards

(1) Date Qualifiers for Organic Compounds
J - estimated quantity, quality control criteria were not met.

(2) Data Qualifiers for Inorganic Compounds
B - Reading is less than CRQL but greater than IDL.

Notes:

a Florida Primary Drinking Water Standard.
b EPA Primary MCL.
c Florida Secondary Drinking Water Standard.
d EPA Secondary MCL - non-enforceable guidance values
e Final Action Level - final lead action level is exceed if level of lead/copper in more than 10 % of the targeted tap samples is greater than action level (90th%)
f Value is for Total Trihalomethanes

TABLE 2-6

SUMMARY OF CONSTITUENTS DETECTED IN GROUNDWATER
SITE SS-3, AIRCRAFT WASHRACK
MONTGOMERY WATSON, 1993
Homestead ARB, Florida
CONTINUED

Analyte Date Sampled	Florida Drinking Water Standards	EPA Drinking Water Standard	EPA Maximum Contaminant Level Goal	Sample ID Date Collected	SP7-DMW-0001 3/3/93	SP7-EB-001 3/8/93 QC	SP7-FB-0001 3/8/93 QC	SP7-FB-0002 3/8/93 QC
VOA TCL (Compounds) (ug/l)(1)								
Acetone	NS	NS	NS		<10	<10	<10	<10
Benzene	1a	5b	NS		<10	<10	<10	<10
Chloroform	100af	100fb	NS		1 J	<10	<10	<10
1,2-Dichloropropane	5a	NS	NS		<10	2 J	4 J	4 J
Toluene	1000a	NS	NS		<10	<10	1 J	<10
Ethylbenzene	700a	700b	700		<10	<10	<10	<10
Xylenes, Total	10,000a	10,000B	10,000		<10	<10	<10	<10
Pesticide/PCB TCL Compounds (ug/l)(1)								
p,p'-DDD	NS	NS	NS		<10	<0.10	<.10	<10
BNA TCL Compounds (ug/l)(1)								
Bis(2-Ethylhexyl) phthalate	6a	4a	0		0.4 J	0.6 J	0.3 J	<10
Di-n-Butyl Phthalate	NS	NS	NS		1 J	<10	<10	<10
Di-n-octylphthalate	10a	NS	NS		<11	<10	<10	<10
Fluorene	10a	NS	NS		<11	<10	<10	<10
2-Methylnaphthalene	NS	NS	NS		0.6 J	<10	<10	<10
Naphthalene	10a	NS	NS		0.6 J	<10	<10	<10
Phenanthrene	NS	NS	NS		<11	<10	<10	<10
Total Metals (ug/l)(2)								
Aluminum	200 c	50-200b	NS		44 B	<20.0	<20.0	<20.0
Barium	2000a	2000b	2000		11.1 B	<1.0	<1.0	<1.0
Cadmium	5a	5b	5		<2.0	<2.0	<2.0	<2.0
Calcium	NS	NS	NS		83,800	45.1 B	120 B	107 B
Copper	1000c	1300b	1300		2.8 B	2.2 B	9.0 B	<2.0
Iron	300c	300d	NS		17.5 B	<7.0	8.9 B	7.8 B
Lead	15a	15e	0		<3.0	<3.0	<3.0	<3.0
Magnesium	NS	NS	NS		3,670 B	<30.0	<30.0	<30.0
Manganese	50c	50d	NS		<1.0	<1.0	<1.0	<1.0
Nickel	100a	100b	100		<6.0	<6.0	33.8 B	<6.0
Potassium	NS	NS	NS		5,810	<325	<32.5	<325
Sodium	160000a	NS	NS		30,500	34.4 B	43.2 B	<30.0
Zinc	5000c	5000b	NS		11.8 B	9.0 B	68.6	33

Dissolved Metals (ug/l)(2)							
Aluminum	NS	NS	NS	<20.0	<20.0	NA	NA
Barium	NS	NS	NS	10.8 B	<5.0	NA	NA
Calcium	NS	NS	NS	79,000	<20.0	NA	NA
Copper	NS	NS	NS	<2.0	<2.0	NA	NA
Iron	NS	NS	NS	<7.0	13.6 B	NA	NA
Magnesium	NS	NS	NS	3,560 B	<1.0	NA	NA
Manganese	NS	NS	NS	<1.0	<6.0	NA	NA
Potassium	NS	NS	NS	5,560	42.2 B	NA	NA
Sodium	NS	NS	NS	29,900	<3.0	NA	NA
Zinc	NS	NS	NS	19.5 B	4.7 B	NA	NA

All samples analyzed by Savannah Laboratories, Tallahassee, Florida.

< - not detected at specified quantitation limit
NS - no standard
NA - not analyzed
QC - Quality Control Sample
Shaded - greater than Regulatory Standards

(1) Data Qualifiers for Organic Compounds
J - estimated quantity, quality control criteria were not met.

(2) Data Qualifiers for Inorganic Compounds
B - Reading is less than CRQL but greater than IDL.

Notes:

a Florida Primary Drinking Water Standard.
b EPA Primary MCL.
c Florida Secondary Drinking Water Standard.
d EPA Secondary MCL non-enforceable guidance values
e Final Action Level - final lead action level is exceeded if level of lead/copper in more than 10 % of the targeted tap samples is greater than action level(90th%)
f Value is for Toxic Trihelomethanes

1993 Investigation. A total of seven BNAs were detected in the three groundwater and one duplicate sample (SP7-DMW-0001, SP7-MW-0014, SP7-MW-0016, and SP7-MW-9016) collected in the 1993 OU-6/Site SS-3 groundwater investigation. Naphthalene and 2-methylnaphthalene (PAH compounds) were detected in each sample at concentrations ranging from 0.6 to 480 µg/L and 0.6 to 860 mg/l, respectively. Total naphthalene concentrations have decreased in sample SP7-MW-0014 from 92 to 3 µg/L between 1991 and 1993. Total naphthalene concentrations in sample SP7-MW-0016 (1340 µg/L) and its duplicate SP7-MW-9016 (1,290 µg/L) exceed the Florida Groundwater Guidance Concentration of 10 µg/L and the 17-770 target level of 100 µg/L. Total naphthalene concentrations have significantly increased in SP7-MW-0016 between 1991 and 1993. Fluorene and phenanthrene, also PAH compounds, were found in SP7-MW-0016 and its duplicate with a maximum concentration of 17 and 8 µg/L, respectively. Bis(2-ethylhexyl)phthalate was detected in all samples excluding the duplicate at a maximum concentration of 7 µg/L. Di-n-butyl phthalate was detected in the samples SP7-DMW-0001 and SP7-MW-0014 at concentrations of 1 and 0.4 µg/L, respectively, and di-n-octyl phthalate was found at SP7-MW-0014 at 0.2 µg/L. The summary of BNAs detected in 1993 is provided in Table 2-6.

Six TICs were identified in the groundwater samples at Site SS-3.

2.6.3.3 Organochlorine Pesticides/PCBs. 1990 and 1991 Investigations Groundwater samples were not previously analyzed for organochloride pesticides/PCBs in the 1990 and 1991 investigation.

1993 Investigation. Groundwater samples from eight monitoring wells (I-8, I-9, SP7-MW-0013, SP7-MW-0014, SP7-MW-0016 (SP7-MW-9016, duplicate), SP7-MW-0017, SP7-MW-0018, and SP7-DMW-0001) were analyzed for OC pesticides/PCBs. The DDT metabolite, p,p'-DDD was the only detected OC pesticide found in two OU-6/Site SS-3 wells. Samples SP7-MW-O017 and SP7-MW-0018 contained detectable concentrations of 0.032 and 0.025 µg/L, respectively. These concentrations are estimated because they are less than the CRQL. PCBs were not detected in any samples collected in 1993. The summary of OC pesticides/PCBs is presented in Table 2-6.

2.6.3.4 Inorganic Compounds. No metals analyses were performed on groundwater during the 1990 field investigation program conducted by G&M. Total metals analyses were performed on 1991 samples. Groundwater samples collected in 1991 identified the following metals as present in all of the monitoring wells including WP-6 and WP-8 (the background wells): aluminum, barium, beryllium, calcium, chromium, cobalt, copper, iron, magnesium, manganese, potassium, sodium, thallium, vanadium, zinc, lead, mercury, and arsenic. Calcium, magnesium, and potassium were detected in the 14 groundwater samples including the duplicate sample analyzed for TAL metals; however, no groundwater quality standards or guidelines exist for these metals (Table 2-3). Groundwater samples WP-5, WP-6, WP-8, WGM-3, SP7-MW-0013, SP7-MW-0014, SP7-MW-9014 (the duplicate of SP7-MW-0014), SP7-MW-0017, SP-MW0018, and SP7-DMW-0001 contained very high concentrations of total calcium, 1,300,000, 8,600,000, 2,300,000, 1,700,000, 3,000,000, 1,600,000, 1,700,000, 1,800,000, 4,700,000, and 1,800,000 µg/L, respectively, in addition to significant concentrations of many other TAL metals. The sampling logs for all 15 samples indicate that the samples were turbid when collected. It is possible that the high TAL metal concentrations, particularly that of calcium, are a result of suspended sediments and thereby overstate the actual concentrations of the analyses at the site (G&M, 1992). Calcium concentrations reported for groundwater samples collected in 1991, including the duplicate sample, ranged from 100,000 to 8,600,000 µg/L. These concentrations are much higher than the range of dissolved calcium concentrations (55,000 to 140,000 µg/L) reported in the Biscayne Aquifer by Sonntag (1987) except for the calcium concentration of 100,000 µg/L detected in sample I-9.

Mercury was detected in samples WP-6 and WP-8 (the background samples) at concentrations of 0.20 and 0.98 µg/L, respectively, which is below the Florida Primary Drinking Water Standard and Federal MCL for drinking water of 2 µg/L for mercury. Arsenic was detected in samples WP-6 (a background sample), WGM-3, and SP7-MW-0015, at concentrations of 11, 10, and 22 µg/L which are well below the Florida Primary Drinking Water Standard and Federal MCL for drinking water of 50 µg/L for arsenic (Table 2-5). Barium was detected in all samples collected, except for sample I-9, at concentrations ranging from 16 to 540 µg/L which are well below the Florida Primary Drinking Water Standard and Federal MCL for drinking water of 2000 µg/L.

Chromium concentrations were detected above the Florida Primary Drinking Water Standard and the Federal MCL for drinking water of 100 µg/L in three of these samples: background samples WP-6 and WP-8, and in sample SP7-MW-0018 with concentrations of 130, 810, and 110 µg/L, respectively.

Copper was detected in two samples, WP-8 (a background sample) and SP7-MW-0018, at concentrations of 87 and 28 µg/L, respectively, which are below the Florida Secondary Drinking Water Standard of 1,000 µg/L and the Federal Action Level of 1,300 µg/L. Sodium was detected in all wells sampled at concentrations ranging from 17,000 to 63,000 µg/L which were well below the Florida Primary Drinking Water Standard of 160,000 µg/L.

Lead was detected in all of the monitoring wells except for I-9 and WGM-6, with concentrations ranging from 6.1 to 210 µg/L. Six samples, background samples WP-6 and WP-8, WGM-3, SP7-MW-0013, SP7-MW-0017 and SP7-MW-0018, contained lead concentrations which exceeded the Federal Action Level for lead of 15 µg/L. Additionally, one of these samples, WP-8 (a background sample), contained lead concentrations above 50 µg/L. Concentrations of lead detected in groundwater samples WP-6, WP-8, and WGM-3 (210, 29, and 16 µg/L, respectively), collected in 1991, were higher than concentrations detected in the same wells sampled in 1987. WP-6, WP-8, and WGM-3 were reported to have been very turbid or showed high turbidity on the sampling logs. The higher lead concentrations detected in 1991 may be the result of the suspended sediments and thereby overstate the actual concentration of lead at the site.

Beryllium was detected in one sample, WP-8 (the background sample), at a concentration of 8.9 µg/L which exceeds the Florida Groundwater Guidance Concentration of µg/L and the Federal MCL for drinking water of 1 µg/L. Nickel was detected in one sample, WP-8 (a background sample), at a concentration of 160 µg/L, which exceeds the Florida Groundwater Guidance Concentration and the Federal MCL of 100 µg/L. Additionally, the sulfate concentration detected in sample SP7-MW-0014 (26 µg/L) and its duplicate, sample SP7-MW-9014 (27 µg/L), were below the Florida Groundwater Guidance Concentration of 250 µg/L and the proposed Federal MCL for drinking water of 250 µg/L.

Federal Secondary Drinking Water Regulations establish recommended limits and deal with the aesthetic qualities of drinking water; however, the FDEP has adopted these standards as the Florida Secondary Drinking Water Standards and requires that potable groundwater shall meet these recommended limits. Iron, which is naturally high in the Biscayne Aquifer and commonly exceeds the Florida Standard Secondary Drinking Water Standard (Sonntag, 1987), was detected in all of the monitoring wells sampled for TAL metals at concentrations ranging from 340 µg/L to 260,000 µg/L which exceeded the Federal Secondary MCL for drinking water and the Florida Secondary Drinking Water Standard of 300 µg/L (Table 2-5). The Federal Secondary MCL for drinking water and Florida Secondary Drinking Water Standard for manganese (50 µg/L) was exceeded in seven samples, WP-6 and WP-8 (the background samples), WGM-3, SP7-MW-0013, SP7-MW-0015, SP7-MW-0017, SP7-MW-0018, and SP7-DMW-0001, at concentrations of 120, 3,900, 77, 120, 130, 62, 290, and 140 µg/L, respectively. Aluminum was detected in all samples at concentrations ranging from 1,400 to 300,000 µg/L. The Federal Secondary MCL for aluminum (50 to 200 µg/L) was exceeded in all samples, except I-9. Zinc was detected in five samples, WP-8 (a background sample), WGM-3, SP7-MW-0014, SP7-MW-9014, and SP7-MW-0017 at concentrations ranging from 22 to 160 µg/L. Concentrations of zinc did not exceed the Florida Secondary Drinking Water Standard and Federal Secondary MCL of 5,000 µg/L in samples analyzed for this constituent. The total dissolved solids concentration detected in WP-8 (350 mg/l) did not exceed the Florida and Federal Secondary Drinking Water Standard of 500 mg/l.

1993 Investigation. Total (unfiltered) and dissolved (filtered) groundwater samples were analyzed for TAL metals at locations SP7-MW-0014, SP7-MW-0016, SP7-MW-9016 (duplicate), and SP7-DMW-0001. The metals aluminum, barium, calcium, copper, iron, magnesium, manganese, potassium, sodium, ant zinc were detected in the filtered groundwater samples, while the unfiltered groundwater samples also included cadmium, lead, and nickel. None of the metals detected were above Federal or Florida MCLs. Groundwater analytical results for total and dissolved metals are summarized in Table 2-6.

Evaluation of dissolved metals results indicate that barium, calcium, magnesium, potassium and sodium are comparable to the total concentrations detected in the groundwater. Total barium concentrations ranged from 6.6 to 11.1 µg/L and dissolved concentrations ranged from 5.7 to 10.8 µg/L. Barium values are reported as less than the CRQL. Calcium was detected in each sample ranging in concentration from 77,600 to 89,400 µg/L in the total fraction and 79,000 to 87,200 in the dissolved samples. Total potassium concentrations ranged from 3,950 to 5,810 µg/L and 3,960 to 5,560 in the dissolved samples. Sodium values ranged from 29,000 to 30,500 µg/L in the total samples and 28,600 to 29,900 in the dissolved samples. These values are within the range of dissolved inorganics detected in the Biscayne Aquifer and below the groundwater quality criteria (Table 2-5).

Cadmium was detected in sample SP7-MW-0016 at a concentration of 3.5 µg/L and was not detected in the duplicate. The result was qualified as estimated because it is below the CRQL. The unfiltered groundwater samples were also analyzed for cyanide which was not detected above the detection limit in any sample.

<u>2.6.3.5 Summary Section for Groundwater.</u> Groundwater contaminants consist of VOC, primarily benzene, xylene, ethylbenzene, and hexanone, and the BNA compounds, naphthalenes, bis(2-ethylhexyl)phthalate and fluorene. Metals were not detected in groundwater at levels which exceeds Florida and/or Federal standards. Although some analytical results for the contaminants identified in groundwater are qualified, all data were found to be of acceptable quality based on USEPA CLP data validation protocols. Since a worst case scenario includes discharge of groundwater to the drainage ditch as a surface water, a comparison of concentrations in groundwater was made in the BRA to the Florida Surface Water Standard and the Federal Freshwater Ambient Water Quality Criteria. Iron, n-hexane (TRPH surrogate) and phthalate esters exceeds the Florida Standards, DDD has no standard and was compared to DDT. The DDD

concentrations of 3E-5 mg/L exceed the DDT standard of 1E-6 mg/L but falls below the USEPA Ambient Water Quality criteria (acute) for DDT of 6E-4 mg/L. The summary of constituents detected is presented in Table 2-6.

NAPL was observed in previous investigations (1984, 1990, and 1991) at monitoring well I-9. NAPL was not observed in I-9 during the 1993 investigation; however, a layer 0.5 feet in thickness was found in monitoring well SP7-MW-0016.

2.6.4 Sediment And Surface Water Investigations

Sediment and surface water samples were collected from the drainage ditch located northwest of the site, along the southeast side of Bikini Blvd. Sampling locations for the 1991 investigation are illustrated on Figure 2-2; sampling locations for the current investigation are illustrated on Figure 2-3. A description of the type and quantity of compounds detected is presented below. Surface water analysis results are compared to established Florida Class III Fresh Water Surface Water Quality Standards and Federal Fresh Water Quality Criteria for surface water quality presented in Table 2-7. Sediment analytical results are compared to NOAA ER-L and ER-M sediment screening values in Table 2-8. Sediment and surface water quality were investigated in conjunction with the OU-6/Site SS-3 investigation, the results of which are summarized in the following sections. The contaminants detected in drainage ditch samples may be related to runoff from Bikini Boulevard. Contaminants identified at OU-6/Site SS-3 may be carried to groundwater discharge areas, such as the drainage ditch, where volatilization or photo oxidation would occur. Organic compounds entering the groundwater may act as nutrient substrate for the indigenous microbial population and may stimulate biodegradation of susceptible compounds along the contaminant pathway. This summary of sediment and surface water investigations is presented for the purpose of review only. Sediment and surface water and will be fully evaluated in the investigation of OU-9, Boundary Canal.

2.6.4.1 Volatile Organic Compounds. 1991 Investigation. One sediment sample and a duplicate were analyzed for VOCs in the 1991 investigation. Two VOCs, carbon disulfide and methylene chloride, were detected in both the sample and the duplicate. Both compounds were also detected in the associated trip blank.

The surface water sample collected in the 1991 investigation was not analyzed for VOCs. Constituents detected in the 1991 sediment sampling are summarized in Table 2-8. Results for the 1991 surface water sampling are summarized in Table 2-9. The complete analytical results are included in the investigation report (G&M, 1992).

1993 Investigation. Three sediment samples and two duplicates were collected from the drainage ditch northwest of the site. The VOCs methylene chloride, acetone, carbon disulfide, and MEK, and sixteen TICs, were detected in the samples. Methylene chloride and carbon disulfide were detected in only one sample (SP7-SD-0003) at concentrations of 2 µg/kg and 5 µg/kg, respectively. MEK was detected in three samples (SP7-SD-0003, SP7-SD-0004, and the duplicate) at a maximum concentration of 18 µg/kg. Acetone was detected in all samples at concentrations ranging Som 98 µg/kg to 220 µg/kg. Acetone is related to the degradation of the isopropanol used in the decontamination process, as discussed in Section 2.6.2.1. MEK and methylene chloride are common laboratory contaminants that were detected at less than 5 times the detection limit; thus, they are considered laboratory contaminants and will be qualified in the data validation process. Details of the data validation process will be discussed in the QCSR for the RI which will be submitted at a later date. A summary of compounds detected in 1993 is presented in Table 2-10.

Surface water samples collected in conjunction with the sediment samples were also analyzed for VOCs. No VOCs were detected. The summary of VOCs detected in surface water in 1993 is provided in Table 2-11.

2.6.4.2 Base Neutral/Acid Extractable Compounds. 1991 Investigation. The sediment sample and the duplicate collected in the 1991 investigation were analyzed for BNAs. Ten PAH compounds, two phthalates, 2 phenol compounds, and benzoic acid were detected. Reported concentrations of PAH compounds ranged from 41 µg/kg to 300 µg/kg The highest levels of BNA detected were bis(2-ethylhexyl)phthalate at concentrations of 730 and 640 µg/kg in the sample and duplicate, respectively. Bis(2-ethylhexyl)phthalate was also detected in the surface water sample collected in conjunction with the sediment sample at a concentration of 52 µg/L. It was not detected in the duplicate surface water sample. Analytical results for the 1991 sediment and surface water samples are summarized in Table 2-8 and 2-9, respectively.

TABLE 2-7

SURFACE WATER QUALITY CRITERIA

		Florida Class III Fresh Water Quality Standards(a)	Federal Fresh Water Quality Criteria(b)
		acute	chronic
BNA, µg/L			
PAHs (Total)	0.031, ave.	NS	NS
Phenanthrene	NS	NS	NS
Fluroanthene	370	3980	NS
Pyrene	11,000	NS	NS
Phthalate Esters	3.0 (ave)	940	3
Bis(2-ethylhexyl)phthalate	NS	NS	NS
Di-n-Butyl Phthalate	NS	NS	NS
Pesticides/PCBs, µg/L			
p,p'-DDD	0.001 (DDT)(max)	11(DDT), 1050(DDE)	0.001(DDT), NS(DDE)
Metals, µg/L			
Aluminum	NS	NS	NS
Arsenic (Total)	50	360	190
Barium	NS	NS	NS
Calcium	NS	NS	NS
Copper	3.9	18	12
Iron	1000	1000	NS
Magnesium	NS	NS	NS
Manganese	NS	NS	NS
Potassium	NS	NS	NS
Sodium	NS	NS	NS
Vanadium	NS	NS	NS
Zinc	86	320	47

a - Florida Administrative Code, 17 - 302.510 April 4, 1993
b - U.S. EPA, 1986, 1991
ave. - average annual flow conditions
NS - No standard established

TABLE 2-8
SUMMARY OF SEDIMENT ANALYTICAL RESULTS
SITE SS-3 AIRCRAFT WASHRACK
GERAGHTY & MILLER, 1991

G&M Sampling I.D.	NOAA	NOAA	SP7-SD-0001	SP7-SD-9001	TRIP BLANK	BC-SD-0010*
Analyte Sampling Date	ER-L 3/	ER-M 4/	11/18/91	11/18/91	11/18/91	8/27/1991*
VOLATILE ORGANIC COMPOUNDS (ug/kg dw):						
Carbon disulfide	NS	NS	61 J	79 J	5.0	NA
Methylene chloride	NS	NS	21 J	37 J	5.0	NA
BASE/NEUTRAL AND ACID EXTRACTABLE COMPOUNDS (ug/kg dw):						
Benzo(a)anthracene	230	1600	[75]	<460	NA	<1400
Benzo(a)pyrene	400	2500	[120]	[110]	NA	<1400
Benzo(b)fluroanthene	NS	NS	[300]	[290]	NA	<1400
Benzo(g,h,i)perylene	NS	NS	[120]	[130]	NA	<1400
Benzo(k)fluoroanthene	NS	NS	[280]	[200]	NA	<1400
Benzoic acid	NS	NS	[23] J	[170] J	NA	<6800
bis(2-Ethylhexyl) phthalate	NS	NS	730	640 J	NA	<1400
Butylbenzylphthalate	NS	NS	<470	[110] J	NA	<1400
Chrysene	400	2800	<470	[230]	NA	<1400
2-Chlorophenol	NS	NS	[17]	<460	NA	<1400
Fluoranthene	600	3600	[230]	[180]	NA	<1400
Ideno(1,2,3-cd)pyrene	NS	NS	[130]	[130]	NA	<1400
4-Methylphenol (p-cresol)	NS	NS	[65]	<460	NA	<1400
Phenanthrene	225	1380	<470	[41]	NA	<1400
Pyrene	350	2200	[260]	[220] J	NA	<1400
METALS (mg/kg dw):						
Aluminum	NS	NS	380 J	580 J	NA	2700
Arsenic	33	85	13	14	NA	2.0
Barium	NS	NS	4.7	5.7	NA	14
Cadmium	5	9	0.96	1.2	NA	<2.1
Calcium	NS	NS	110000	130000	NA	310000
Chromium	80	145	370 J	270 J	NA	11
Copper	70	390	4.4	4.9	NA	16
Iron	NS	NS	660	870	NA	1700
Lead	35	110	6100	7400 J	NA	11
Magnesium	NS	NS	340	390	NA	1000
Manganese	NS	NS	5.1	6.5	NA	<29
Mercury	0.15	1.3	0.18 J	1.3 J	NA	0.043
Sodium	NS	NS	130	190	NA	290
Vanadium	NS	NS	1.9	2.1	NA	5.7
Zinc	120	270	60	89	NA	27
TOTAL RECOVERABLE PETROLEUM HYDROCARBONS (ug/kg dw)	NS	NS	84	120	NA	NA

ug/kg dw	micrograms per kilogram dry weight
mg/kg dw	milligrams per kilogram dry weight
NA	Not Analyzed
<	Analyte was not detected at or above the indicated concentration.
[ ]	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	Result has been classified as undetected.
/	Effects Range-Low
4/	Effects Range-Median

*BC-SD-0010 - Boundary Canal Background Sample

TABLE 2-9

SUMMARY OF SURFACE WATER ANALYTICAL RESULTS
SITE SS-3 AIRCRAFT WASHRACK
GERAGHTY & MILLER, 1991
Homestead ARB, Florida

Analyte (a)	G&M Sample I.D. Sampling Date	TRIP/BLANK 11/18/91	SP7-SW-0001 11/18/91 Duplicate	SP7-SW-9001 11/18/91
VOLATILE ORGANIC COMPOUNDS (ug/L):		BDL	BDL	BDL
BASE/NEUTRAL and ACID EXTRACTABLE ORGANIC COMPOUNDS (ug/L):				
bis(2-Ethylhexyl) phthalate		NA	52 J	[1.0] UJ
METALS (ug/L):				
Arsenic		NA	18	26
Calcium		NA	30000	30000
Iron		NA	81	88
Magnesium		NA	1300	1300
Manganese		NA	13	13
Potassium		NA	4400	4500
Sodium		NA	20000	20000

ug/L	microgams per liter
NA	Not Analyzed
NS	No Standard
BDL	Below Detection Limit
<	Analyte was not detected at or above the indicated concentration.
[ ]	Value is greater than instrument detection limit but less than PQL.
J	Positive result has been classified as qualitative.
UJ	Analyte was not detected. Classified as qualitative.
a/	Constituents not detected in any samples are not shown.

TABLE 2-10

SUMMARY OF CONSTITUENTS DETECTED IN SEDIMENT SAMPLES
SITE SS-3, AIRCRAFT WASHRACK AREA
MONTGOMERY WATSON, 1993
Homestead ARB, Florida

Analyte	NOAA ER-L	NOAA ER-M	BC-SD-0100** Background	Sample ID Date Collected 1991	SP7-SD-0002 3/10/93	SP7-SD-9002 3/10/93 Duplicate	SP7-SD-0003 3/10/93	SP7-SD-0004 3/10/93	SP7-SD-9004 3/10/93 Duplicate
VOA TCL Compounds (ug/kg)(1)	NS	NS	NA		190	140	98	110	220
Acetone	NS	NS	NA		<39	<18	5 J	<24	<26
Carbon Disulfide	NS	NS	NA		<39	<18	2 J	<24	<26
Methylene Chloride	NS	NS	NA		<39	<18	15 J	6 J	18 J
Methyl Ethyl Ketone (2-Butanone)									
Pesticide/PCB TCL Compounds (ug/kg)(1)									
Beta BHC	NS	NS	NA		<3.9	<4.0	<220	.85 J	<15
Beta-Chlordane	NS	NS	NA		<3.9	<4.0	<220	1.6 J	<15
p,p'-DDD	2	20	NA		210	60	12000	59	41
p,p'-DDE	2	15	NA		330	100	1300	48	29 J
p,p'-DDT	1	7	NA		31 B	15 B	140 BJ	8.8 B	22 BJ
BNA TCL Compounds (ug/kg)(1)									
2-Chlorophenol	NS	NS	<1400		12BJ	<770	<9400	<1700	14 BJ
2-Methylnaphthalene	65	670	<1400		620	630 J	87 J	180 J	230 J
4-Methylphenol (p-cresol)	NS	NS	<1400		41 J	<770	<9400	<1700	17 J
Acenaphthene	150	650	<1400		1,600	120 J	310 J	650 J	730 J
Acenaphtylene	NS	NS	<1400		<590	<770	130 J	14 J	13 J
Anthracene	85	960	<1400		2,200	330 J	720 J	710 J	880
Benzo(a)Anthracene	270	1600	<1400		4,200	930	1,900 J	1,800	1,800
Benzo(a)Pyrene	400	2500	<1400		3,100	1,200	2,300 J	1,800	1,700
Benzo(b)Fluoranthene	NS	NS	<1400		4,500	2,200	4,800 J	2,700	2,900
Benzo(g,h,i)Perylene	NS	NS	<1400		2,000	1,200	2,000 J	1,400 J	1,000
Benzo(k)Fluoranthene	NS	NS	<1400		3,500	1,200	3,100 J	2,100	2,300
Benzyl Butyl Phthalate	NS	NS	<1400		28 J	<770	120 J	29 J	<790
Bis(2-Ethylhexyl)Phthalate	NS	NS	<1400		1200B	2,300	9,300 J	950 BJ	1,100 B
Carbazole	NS	NS	<1400		1,800	<770	<9400	760 J	800
Chrysene	400	2800	<1400		3,900	1,900	4200 J	2,900	2,200
Di-n-Butyl-Phthalate	NS	NS	<1400		940 B	66 J	800 BJ	36 BJ	<790
Dibenz(A,H)Anthracene	400	2600	<1400		760	340 J	<9400	530 J	350 J
Dibenzofuran	NS	NS	<1400		1,200	110 J	210 J	390 J	490 J
Di-n-Octyl Phthalate	NS	NS	<1400		<590	15 J	64 J	<1700	80 J
Fluoranthene	600	3600	<1400		10,000	3,000	6,200 J	4,100	4,200
Fluorene	NS	NS	<1400		1,800	230 J	510 J	740 J	810
Indeno(1,2,3-C,D)Pyrene	NS	NS	<1400		1,900	1,400	2,000 J	1,200 J	1,000
Naphthalene	340	2100	<1400		1,100	100 J	130 J	470 J	650 J
Phenanthrene	225	1380	<1400		10,000	1,400	3200 DJ	3,200	3,800
Pyrene	350	220	<1400		8,900	2,600	5,500 DJ	5,400	4,500

Metals(mg/kg)(2)								
Aluminum	NS	NS	2700	3,300	3,370	3,400	2,860	3,740
Antimony	NS	NS	NA	3.6 B	<3.0	4.0 B	<3.0	<3.0
Arsenic	33	85	2	30.4 N	29.3 N	31.3 N	12.4 N	18.4 N
Barium	NS	NS	14	21.9 B	20.4 B	27.2 B	19.1 B	23.9 B
Cadmium	5	9	<2.1	6.6	5.1	10.6	23	2.6
Calcium	NS	NS	310,000	285,000	291,000	364,000	263,000	344,000
Chromium	80	145	11	61.8	52.7	301	22.3	27
Cobalt	NS	NS	<4.2	1.0 B	1.1 B	1.2 B	0.89 B	0.79 B
Copper	70	390	16 J	18.2	23.7	23.8	26.3	16.2
Iron	NS	NS	1700	2,280 E	2,040E	1,880 E	2,030 E	2,170 E
Lead	35	110	11	176	156 O	446	93.5	129
Magnesium	NS	NS	1000	1,050	1,120	2,200	1,720	1,170
Manganese	NS	NS	<29	29.3 E	28.5 E	36 I E	27.9 E	34.3 E
Nickel	30	50	NA	4.6 B	4.4 B	4.1 B	8.6	4.0 B
Potassium	NS	NS	NA	586 B	673 B	856 B	612 B	908 B
Sodium	NS	NS	290	618 B	627 B	596 B	573 B	752 B
Vanadium	NS	NS	5.7	8.3 B	7.7 B	10.1	7.8 B	8.0 B
Zinc	120	270	27	509	388	538	142	176

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
(Boundary Canal Sediment Sampling)
Shaded - greater than Background

(1) Data Qualifiers for Organic Compounds
J - estimated quantity, <CRQL
B - compound detected in an associated blank

(2) Data Qualifiers for Inorganic Compounds
B - Reading is less than CRQL but greater than IDL
E - reported value is estimated due to interference

TABLE 2-11
SUMMARY OF CONSTITUENTS DETECTED IN SURFACE WATER SAMPLES COLLECTED AT SITE SS-3, AIRCRAFT WASHRACK
MONTGOMERY WATSON, 1993
Homestead ARB, Florida

Analyte	Florida Surface Water Standards FAC 17-302.530*	EPA Water Quality Criterion (Acute)	Sample ID	SP7-SW-0002	SP7-SW-9002	SP7-SW-0003
			Date Collected	3/10/93	3/10/93 Duplicate	3/10/93
VOA TCL Compounds (ug/l)(1)						
Acetone	NS	NS		ND	ND	ND
1,2-Dichloropropene	NS	6060		ND	ND	ND
Toluene	NS	17500		ND	ND	ND
Pesticides/PCB TCL Compounds (ug/l)(1)						
p,p'-DDD	0.00059(a)	NS		ND	ND	0.022 J
BNA TCL Compounds (ug/l)(1)						
Bis(2-Ethylhexyl) Phthalate	3(b)	940(b)		<11	ND	0.2 J
Di-n-Butyl Phthalate	3(b)	940(b)		0.1 J	ND	<11
Fluoranthene	.031(c)	3980		<11	ND	0.2 J
Phenanthrene	.031(c)	NS		<11	ND	0.2 J
Pyrene	11	NS		<11	ND	0.1 J
Metals (ug/l)(2)						
Aluminum	NS	NS		66.8 B	72.7 B	149 B
Arsenic	50	360		15.8	16.1	25.5
Barium	NS	NS		8.2 B	8.2 B	9.6 B
Calcium	NS	NS		35,700	36,500	34,200
Copper	3.9	18		<2.0	<2.0	2.2 B
Iron	1000	1000		12.3 B	19 B	45.4 B
Magnesium	NS	NS		1,980 B	2010 B	2120 B
Manganese	NS	NS		<1.0	1.0 B	4.6 B
Nickel	100	1800		<6.0	<6.0	<6.0
Potassium	NS	NS		3,340 B	3550 B	3280 B
Sodium	NS	NS		30,700	30900	37000
Vanadium	NS	NS		4.1 B	<3.0	5.4 B
Zinc	86	320		21.3	20.5	20.6

All samples analyzed by Savannah Laboratories, Tallahassee, Florida.

< - not detected at specified detection limit
NS - no standard
ND - not detected
* - Class III Freshwater
Shaded - greater than Regulatory Standards

(1) Data Qualifiers for Organic Compounds.
J - Estimated Value, <CRQL or TIC
B - compound detected in an associated blank

(2) Data Qualifiers for Inorganic Compounds
B - Reading is less than CRQL but greater than IDL.

Notes:

a average annual for DDT
b as phthalate esters
c annual average as Total PAHs
d for DDT

TABLE 2-11
SUMMARY OF CONSTITUENTS DETECTED IN SURFACE WATER SAMPLES
COLLECTED AT SITE SS-3, AIRCRAFT WASHRACK
MONTGOMERY WATSON, 1993
Homestead ARB, Florida
(CONTINUED)

Analyte	Florida Surface Water Standards FAC 17-302.530*	EPA Water Quality Criterion (Acute)	Sample ID	SP7-SW-0004	SP7-SW-9004	SP2-FB-0001	SP7-SW-0002
			Date Collected	3/10/93	3/10/93 Duplicate	3/10/93	3/10/93
VOA TCL Compounds (ug/l)(1)							
Acetone	NS	NS		10	ND	1 J	1 J
1,2-Dichloropropene	NS	6060		<10	ND	4 J	4 J
Toluene	NS	17500		<10	ND	1 J	<10
Pesticides/PCB TCL Compounds (ug/l)(1)							
p,p'-DDD	0.00059(a)	NS		ND	ND	<0.10	<0.10
BNA TCL Compounds (ug/l)(1)							
Bis(2-Ethylhexyl)Phthalate	3(b)	940(b)		0.2 J	0.3 J	0.3 J	<10
Di-n-Butyl Phthalate	3(b)	940(b)		<11	<11	<10	<10
Fluoranthene	.031(c)	3980		<10	<10	<10	<10
Phenanthrene	.031(c)	NS		<10	<10	<10	<10
Pyrene	11	NS		<10	<10	<10	ND
Metals (ug/l)(2)							
Aluminum	NS	NS		84 B	87.4 B	<20.0	<20.0
Arsenic	50	360		25.0	26.2	<5.0	<5.0
Barium	NS	NS		11.5 B	13.5 B	<1.0	<1.0
Calcium	NS	NS		34,300	35,500	120.0 B	107 B
Copper	3.9	18		<2.0	<2.0	9.0 B	<2.0
Iron	1000	1000		39.1 B	37.4 B	8.9 B	7.8 B
Magnesium	NS	NS		2040 B	2100 B	<30.0	<30.0
Manganese	NS	NS		3.9 B	3.7 B	<1.0	<1.0
Nickel	100	1800		<6.0	<6.0	33.8 B	<6.0
Potassium	NS	NS		3100 B	3240 B	<325	<325
Sodium	NS	NS		35100	35600	43.2 B	<30.0
Vanadium	NS	NS		3.3 B	4.1 B	<3.0	<3.0
Zinc	86	320		26.1	18.3 B	68.6	33

All samples analyzed by Savannah Laboratories, Tallahassee, Florida.

< not detected at specified detection limit
NS - no standard
ND - not detected
* - Class III Freshwater
Shaded - greater than Regulatory Standards

(1) Data Qualifiers for Organic Compounds
J - Estimated Value, <CRQL or TIC
B - compound detected in an associated blank

(2) Data Qualifiers for Inorganic Compounds
B - Reading is less than CRQL but greater than IDL.

Notes:
a average annual for DDT
b as phthalate esters
c annual average as Total PAHs
d for DDT

1993 Investigation. Three sediment samples and two duplicates were analyzed for BNAs. A total of 25 BNA compounds were detected in site samples. Sample SP7-SD-0002, collected from the same approximate location as the 1991 sample, contained 23 BNA compounds including all of those detected in the 1991 sample except benzoic acid. Of the 23 detected compounds, 17 are PAHs, 4 are phthalates, and 2 are phenols; dibenzofuran and carbazole were also detected. Concentrations of the PAHs ranged from 10,000 µg/kg (phenanthrene and fluoranthene in SP7-SD-0002) to 120 µg/kg (acenaphthalene in SP7-SD-9002). PAH concentrations are generally higher than those reported for the other classes of BNA compounds. The surface water samples collected in conjunction with the sediment samples contained low levels (0.1 to 0.2 µg/L) of three PAH compounds (phenanthrene, fluoranthene, and pyrene). Two phthalates (di-n-butyl phthalate and bis(2-ethylhexyl)phthalate) were also detected at levels ranging from 0.2 to 0.3 µg/L. Six TICs were also reported for surface water samples. Analytical results for the 1993 sediment and surface water samples are summarized in Tables 2-10 and 2-11, respectively.

Concentrations of PAHs detected in sediments are higher than those detected to date in site soil samples. Concentrations of the BNAs detected in surface water are generally less than those detected in site groundwater samples. BNAs were detected in samples both upstream and downstream of OU-6/Site SS-3.

<u>2.6.4.3 Organochloride Pesticides/PCBs</u>. Sediment and surface water samples were not analyzed for organochlorine pesticides/PCBs in the 1991 investigation.

1993 Investigation. No PCBs were detected in sediment samples. The pesticides beta hexachlorocyclohexane (beta BHC), beta-chlordane, and the DDT metabolites p,p'-DDE, p,p'-DDD, and p,p'-DDT were detected in sediment samples. Beta BHC and beta-chlordane were only detected in sample SP7-SD-0004 at concentrations of 0.85 and 1.6 µg/kg, respectively. The DDT metabolites were detected in all three samples and the two duplicates at concentrations ranging from 8.8 µg/kg to 12,000 µg/kg. The highest concentrations of DDT metabolites were detected in sample SP7-SD-0003, collected from a location downstream of the site. Results for the metabolite p,p'-DDT are qualified as estimated due to blank contamination. However, as discussed in the QCSR, the blank contamination is a result of carryover from the previously run sample. Control samples analyzed subsequent to the blank did not contain p,p'-DDT; thus, the sample results are not considered suspect. Analytical results for pesticides/PCBs in 1993 sediment and surface water samples are summarized in Tables 2-10 and 2-11, respectively. DDT and its metabolites have been observed in soil and sediment samples collected at CERCLA sites throughout the Base.

The DDT metabolite p,p'-DDD was also detected in surface water sample SP7-SW-0003 at a concentration of 0.022 µg/L, below the CRQL. No standards or criteria for the metabolite p,p'-DDD have been established. The detected concentration is in excess of established Florida Surface Water Quality Standards for DDT of 0.001 µg/L maximum and below established federal criteria for acute exposure to DDE and DDT (Table 2-7). No other pesticides or PCBs were detected in surface water samples.

<u>2.6.4.4 Metals and Cyanide</u>. 1991 Investigation. The metals aluminum, arsenic, barium, cadmium, calcium, chromium, copper, iron, lead, magnesium, manganese, mercury, sodium, vanadium, and zinc were detected in the sediment sample and duplicate sample collected during the 1991 investigation. These metals are commonly detected in limestone. Concentrations of most constituents detected in the sediment samples were below average carbonate concentrations except for the trace metals, cadmium, chromium, zinc, arsenic, mercury, and lead, which were above concentrations given for the average carbonate composition (Hem, 1989).

Concentrations of chromium detected in sample SP7-SD-0001 and its duplicate SP7-SD-9001 exceeded the NOAA ER-L and ER-M values. Sediment sample SP7-SD-0001 contained mercury concentrations which exceeded the NOAA ER-L value. Lead concentrations detected in sample SP7-SD-0001 and its duplicate, SP7-SD-9001, exceeded the NOAA ER-M and ER-L values.

The surface water sample and duplicate collected in conjunction with the sediment sample contained arsenic, calcium, iron, magnesium, manganese, potassium, and iron. None of these metals was detected in excess of established federal or state surface water quality standards; and, therefore, none were identified as compounds of concern in the report of the investigation (G&M, 1992). No analyses for cyanide were performed in the 1991 investigation. Analytical results for sediment samples are summarized in Table 2-8; surface water analytical results are summarized in Table 2-9.

1993 Investigation. Three sediment samples and two duplicate samples were analyzed for metals. With the exception of mercury, the metals detected in the 1991 sediment sample were detected in all of the current samples. Nickel, which was not found in the 1991 sample, was also found in all current sediment samples. Samples SP7-SD-0002 and SP7-SD-0003 also contained antimony. In the absence of background concentrations for metals in sediment, it is not possible to assess whether OU-6/Site SS-3 has contributed metals contamination to the ditch sediments. Surface water samples collected in conjunction with the sediment samples contained those metals identified in the 1991 sample plus aluminum, barium, calcium, vanadium, and zinc. Copper was also detected in sample SP7-SD-0002. None of the metals were detected in excess of established state or federal surface water quality criteria Analytical results for sediment and surface water samples are summarized in Tables 2-10 and 2-11

No regulatory standards currently exist for sediments. However, comparing analytical results to NOAA Effects Range-Low (ER-L) values, only cadmium, lead, and zinc exceed these criteria (Table 2-10). The environmental impact evaluation is deferred to the Site SS-3 Baseline Risk Assessment Phase II Report, Section 6.2.1.2.

2.6.4.5 Summary for Surface Water and Sediment. Drainage ditch sediments contained detectable concentrations of carbon disulfide, methylene chloride, BNAs (17 PAHs) and DDT-metabolites. The contaminants detected in drainage ditch sediments may be related to sources other than OU-6/Site SS-3. PAHs and metals in particular may be related to runoff from Bikini Boulevard. Surface water samples contained detectable concentrations of the PAH compounds phenanthrene, fluoranthene and pyrene. In general, compounds detected in surface water samples, primarily BNAs, pesticides, and metals, are lower than those detected in groundwater at OU-6/Site SS-3. Similar concentrations of constituents were observed in both upgradient and downgradient surface water and sediment samples.

The contaminants detected in the drainage ditch samples may be related to runoff from Bikini Blvd. The contamination present at OU-6/Site SS-3 have demonstrated persistence and limited migration since 1984. Hence, the present site condition at OU-6 does not represent a significant likelihood to further impact the drainage ditch sediments or surface water. However, should contaminants be carried via groundwater to discharge areas, such as the drainage ditch, volatilization or photo oxidation would occur. Organic compounds entering the groundwater may act as nutrient substrate for the indigenous microbial population and may stimulate biodegradation of susceptible compounds along the contaminant pathway.

The significant and potential human health and environmental impacts of occurrences of constituents detected in drainage ditch sediments and surface water will be fully evaluated in the RI/BRA for Site SD-27, (OU-9) Boundary Canal Investigation.

2.7 SUMMARY OF SITE RISKS

In order to evaluate whether existing or future exposure to contaminated media at OU-6/Site SS-3 could pose a risk to people or the environment, USAF completed a Baseline Risk Assessment (BRA) in July 1994 with EPA oversight of this process. 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 soil and groundwater at OU-6/Site SS-3. Sediment and surface water will be addressed as part of OU-9, Boundary and Military Canal investigation. 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. The USAF estimated potential site risk in the absence of any future remediation.

2.7.1 Selection of Chemicals of Potential Concern

Samples collected at OU-6/Site SS-3 indicated that the groundwater contains VOCs, PAHs, TRPH, and metals. Soils at the site contain VOCs and BNAs.

Chemicals detected that are the most toxic and that are anticipated to create the greatest potential risk were selected as chemicals of potential concern (COPCs). All the detected constituents were included as COPCs for the risk assessment with the following exception:

Chemicals that are essential human nutrients and constituents that are toxic only at very high doses (i.e., much higher than those that could be associated with contact at the site) were eliminated risk assessment.

Inorganic constituents present at concentrations less than twice background concentrations were excluded from the list of COPCs. Only those constituents for which the maximum detected concentration was greater than twice the background concentration were retained as COPCs.

Inorganic and semi-volatile organics considered to be present in background concentrations according to the scientific literature for the specific chemical or those chemicals considered ubiquitous and determined not to be site-related. Although phthalate esters are relatively ubiquitous in the environment, the presence of these constituents in media at the site may be due to sampling or laboratory artifacts. Since these phthalates may not be site-related, for purposes of the BRA only the significant phthalates were considered COPCs.

Based on this evaluation a group of COPCs was carried through the quantitative risk assessment for each affected media.

COPCs for groundwater and soil are shown in Table 2-12.

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) an exposure route (inhalation of vapors, ingestion of groundwater, etc.). All four of these elements must be present for a pathway to be complete.

Exposure Point Concentration. The exposure point concentration for each contaminant was derived using the 95 percent upper confidence limit (UCL) on the arithmetic mean as defined by the following formula:

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

where: x = arithmetic mean of the log-transformed data
s = standard deviation of the log-transformed data
H = statistical parameter

Often, with limited data sets, the UCL, is higher than the maximum detected concentration. If so, the maximum concentration detected was used as the exposure point concentration rather than the UCL95. Exposure point concentrations for COPCs are shown in Tables 2-13 and 2-14.

Land Use. Hypothetical future use of the site for residential purposes is 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.

Exposure Scenarios. Potential current risks at the site were evaluated 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; and soil exposure by hypothetical; future adult and child residents. 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 and 2-16. Based on the exposure point concentrations derived from site data for the chemicals shown in Table 2-12 and using the exposure assumptions identified in Tables 2-15 and 2-16, EPA 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 also provided in Tables 2-15 and 2-16.

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 VOCs, Bis (2-ethylhexyl)phthalate, cadmium, and lead have the potential to cause cancer (carcinogenic). Slope factors (Sfs) have been developed by EPA's 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 the intake level. The term "upper bound" reflects the conservative estimate of the risks calculated from the SF. Use of the 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 Tables 2-17 and 2-18.

TABLE 2-12

CHEMICALS OF POTENTIAL CONCERN
SITE SS-3 (Former SP-7), AIRCRAFT WASHRACK AREA
Homestead Air Reserve Base, Florida

	Soil	Ground Water
VOCs		
Benzene		X
Chloroform		X
Ethylbenzene	X	X
Methyl ethyl ketone	X	
Methylene chloride	X	
Styrene	X	
Xylenes	X	X
BNA's		
Bis(2-Ethylhexyl)phthalate		X
Di(n-octyl)phthalate		X
Dibenzofuran	X	
Fluorene		X
n-Hexane (1)	X	X
2-Methylnaphthalene	X	X
Naphthalene	X	X
Metals		
Cadmium		X

(1) n-Hexane is used as a surrogate for Total Recoverable Petroleum Hydrocarbons (TRPH) and Alkane Tentatively Identified Compounds (TICs).

TABLE 2-13

EXPOSURE POINT CONCENTRATIONS FOR GROUNDWATER
SITE SS-3 (FORMERLY SP-7) AIRCRAFT WASHRACK
Homestead Air Reserve Base, Florida

Constituent [1]	Geraghty & Miller Samples Collected 1990-1991 No. Samples Collected & Avg.	Mean	UCL	Montgomery Watson Samples Collected 1993 No. Samples Collected	No. Samples Averaged 1990-93	G&M UCL[3]	MW Min	Max[3]	Min	Max[3]
VOCs (µg/L)										
Benzene Recalculated	17	3.8	13.21	3	20	8.54	<5.0	24	<10	70
Ethylbenzene	17	6.6	12	3	20	17.65	<5.0	51	<10	160
Xylenes Recalculated	17	4.4	6.6	3	20	13.15	<5.0	21	<10	150
Chloroform Added	17	-	-	3	20	2.86	--	--	<10	1
BNAs (µg/L)										
Bis(2-Ethylhexyl)phthalate Recalc	17	4	4.8	3	20	15.47	<10	26	<1	7
Di-n-octylphthalate	17	7.4	11	3	20	34.93	<10	28	<11	28
Fluorene Recalculated	17	1.6	1.6	3	20	14.41	<10	1.6	<11	17
n-Hexane [2] Recalculated	17	12,000	24,000	3	20	83,090	<1000	120,000	64	20,628
2-Methylnaphthalene Recalculated	17	28	52	3	20	182.7	<10	220	0.6	860
Naphthalene Recalculated	17	23	37	3	20	126.5	<10	130	0.6	480
METALS (µg/L)										
Cadmium Added	10	-	-	3	13	4.45	--	--	<2.0	3.5

µg/L micrograms per Liter
-- Not Detected

[1] Additional data collected in 1993 required some reconstruction of existing database for use in this risk assessment. Where indicated, UCLs were recalculated or compounds added.

[2] n-Hexane is used as a surrogate for TRPH and Alkane and aromatic TIC's. Total obtained from the following petroleum TIC categories: alkanaes, unknown hydrocarbons, substitute benzene, PAHs, cycloalkanes, and aromatic.

[3]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 CONCENTRATION FOR SOIL
SITE SS-3 (FORMERLY SP-7) AIRCRAFT WASHRACK
Homestead Air Reserve Base, Florida

Constituent[1]	Geraghty & Miller Samples Collected 1991 No. Samples Collected & Avg.	Mean	UCL	Montgomery Watson Samples Collected 1993 No. Samples Collected	No. Samples Averaged 1990-93	G&M UCL	Min	MW Max.[3]	Min	Max.[3,4]
VOC's (µg/kg)										
Ethylbenzene	4	15000	37000	1	5	6E+15	<3400	42,000	- -	- -
Methyl chloride	4	2500	3600	1	5	1E+10	<3400	3,600	- -	- -
Styrene	4	4500	11000	1	5	1E+12	<3400	13,000	- -	- -
Xylenes	4	26000	63000	1	5	1E+17	<3400	71,000	- -	- -
Methyl Ethyl Ketone Addex	4	- -	- -	1	5	7E+03	- -	- -	- -	900
BNA's (µg/kg)										
h-Hexane [2] Recalculated	4	3,700,000	6,500,000	1	5	1E+23	860,000	5,900,000	- -	303
2-Methylnaphthalene	4	31000	58000	1	5	- -	8900	63,000	- -	18
Naphthalene	4	17000	33000	1	5	8E+10	4800	36,000	- -	37
Dibenzofuran Added	4	- -	- -	1	5	1E+17	2,200	4,550	- -	45

mg/kg milligrams per kilogram
µg/kg micrograms per kilogram
-- Not Detected
[1] Additional data collected in 1993 required some reconstruction of existing database for use in this risk assessment. Where indicated, UCLs were recalculated or compounds added.
[2] n-Hexane is used as a surrogate for TRPH and Alkane TICs
[3] Maximum used as exposure point concentration when UCL was greater than maximum concentration detected.
[4] No minimum/maximum values presented for Montgomery Watson data since there was only one sample point.

TABLE 2-15

EQUATIONS AND SAMPLE CALCULATIONS FOR HYPOTHETICAL FUTURE POTABLE GROUNDWATER EXPOSURE AT SITE SS-3 (FORMER SP-7, AIRCRAFT WASHRACK AREA

Homestead Air Reserve Base, Florida

Equation Definition:

$$\text{GWExD} = \frac{\text{Cgw x IR x EF}}{\text{BW x AP}}$$

$$\text{ELCR} = \text{GWExD x CSFo}$$

$$\text{HQ} = \frac{\text{GWExD}}{\text{RfDo}}$$

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).
CSFo	Cancer slope factor for oral exposure (mg/kg-day)-1 (Table 3-4 BRA 1994).
Cgw	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 BRA 1994).
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).
RfDo	Reference dose for oral exposure (mg/kg-day) (Table 3-3 BRA 1994).

Sample Calculation - benzene. cancer effects

$$\text{GWExD} = \frac{\text{(0.006 mg/L) x (2 L/day) x (10,500 days/lifetime)}}{\text{(70 kg) x (25,550 days/lifetime)}}$$

= 7.0 x 10-5 mg/kg-day

ELCR = (7.0 x 10-5 mg/kg-day) x (2.9 x 10-2 kg-day/mg)

= 2.0 x 10-6

Sample Calculation - naphthalene, non-cancer effects

$$\text{GWExD} = \frac{\text{(0.037 mg/L) x (2 L/day) x (10,500 days/lifetime)}}{\text{(70 kg) x (10,500 days/lifetime)}}$$

= 1.0 x 10-3 mg/kg-day

$$\text{HQ} = \frac{\text{1.0 x 10-3 mg/kg-day}}{\text{4.0 x 10-2 mg/kg-day}}$$

= 0.025

Note: This calculation does not include a consideration of the inhalation of volatiles during showering. This concentration is generally assumed to equal the exposure received from the ingestion of 2 L/day, the default water ingestion value (Patton, 1991). Further discussion of this is provided in Section 5.0 of the BRA (Montgomery Watson 1994).

TABLE 2-16

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

Homestead Air Reserve Base, Florida

Equation Definitions:

$$SExDo = \frac{Cs \times IR \times EF \times ED \times UC1}{BW \times AP}$$

$$SExDd = \frac{Cs \times SSA \times SAR \times ABS \times EF \times ED \times UC1}{BW \times AP}$$

$$SExDi = \frac{Cs \times BR \times ET \times EF \times ED \times RF \times (1-G) \times (W/Ut)3 \times F(x)\ \text{(particulates)}}{BW \times AP \times Q/C \times UC2}$$

or

$$\frac{Cs \times BR \times ET \times H \times EF \times ED \times 2 \times Dei \times Pa \times UC5/Kd\ \text{(vapors)}}{BW \times AP \times Q/C \times (3.1416 \times alpha \times ED \times UC3)^{1/2} \times UC4}$$

$$ELCR = (SExDo \times CSFo)+(SExDd \times CSFa)+(SExDi \times CSFi)$$

$$HQ = (SExDo/RfDo)+(SExDd/RfDa)+(SExDi/RfDi)$$

where:

ABS	Dermal absorption efficiency, constituent-specific (from Table 3-2 BRA 1994).
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 m3/hour [20 m3/day] for residents [USEPA, 1991a]; 2.5 m3/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).
Cs	Constituent concentration in the soil (mg/kg) (maximum detected concentration) (from Table 4-3 BRA 1994).
CSFa	Cancer slope factor for dermal exposure, adjusted for absorbed dose (mg/kg-day)-1 (Table 3-5 BRA 1994).
CSFi	Cancer slope factor for inhalation exposure (mg/kg-day)-1 (Table 3 4 BRA 1994).
CSFo	Cancer slope factor for oral exposure (mg/kg-day)-1 (Table 3-4 BRA 1994).
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).
EP	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).
ET	Exposure time (1 hour/day for a base worker; 24 hours/day for residents).
H	Henry's Law Constant (atm-m3/mol; constituent specific) (Table 3-6 BRA 1994).
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).
RfDa	Reference dose for dermal exposure, adjusted for absorbed dose (mg/kg-day) (Table 3-5 BRA 1994).
RfDi	Reference dose for inhalation exposure (mg/kg-day) (Table 3-3 BRA 1994).
RfDo	Reference dose for oral exposure (mg/kg-day) (Table 3-3 BRA 1994).
SAR	Soil adherence rate (1 mg/cm2-day) (USEPA, 1992c).
SExDd	Soil exposure dose from dermal contact (mg/kg-day).
SExDi	Soil exposure dose from inhalation of particulates or vapors from soil (mg/kg-day).
SExDo	Soil exposure dose from incidental ingestion (mg/kg day).
SSA	Exposed skin surface area (3,160 cm2 for adult resident and base worker [USEPA, 1991a]; 3,652 cm2 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/m2-hr)
UC2	Unit conversion 2 (3,600 sec/hr)
Ut	Equivalent threshold windspeed at a height of 10 meters (12.8 m/sec)

TABLE 2-16 (c0ntinued)

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

Q/C Emission flux per unit concentration (g/m2-sec/kg/m3); 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 contiguous area of contamination in m2 (9.11) (based on three fourths of a three-acre contaminated area being free of structures)

alpha Convenient collection of variables (cm2/sec); calculated as follows:

$$alpha = \frac{Dei \times Pa}{Pa + [roe \times (1-Pa) \times Kd/(UC5 \times H)]}$$

beta Soil bulk density (1.5 g/cm3)

Dei Effective diffusivity (cm2/sec); calculated as follows:

$$Dei = Di(Pa3.33/Pt2)$$

Di Chemical-specific diffusivity in air (cm2/sec)

Pa Air-filled porosity (unitless); calculated as follows:

$$Pa = Pt - (theta \times beta)$$

Pt Total soil porosity (unitless); calculated as follows:

$$Pt = 1 - (beta/roe)$$

roe	Soil particulate density (2.65 g/cm3)
theta	Average soil moisture content (0.1 cm3 water/gram of soil)
UC3	Unit conversion 3 (31,500,000 sec/yr)
UC4	Unit conversion 4 (0.0001 m2/cm2)
UC5	Unit conversion 5 (41 mol/atm-m3) (Hwang and Falco, 1986)

Sample Calculation - n-hexane, noncancer effects, child resident:

$$SExDo = \frac{(5{,}900\ mg/kg) \times (200\ mg/day) \times (350\ days/yr) \times (6\ yrs) \times (10\text{-}6\ kg/mg)}{(15\ kg) \times (2{,}190\ days)}$$

$$= 7.5 \times 10\text{-}2\ mg/kg\text{-}day$$

$$SExDd = \frac{(5{,}900\ mg/kg) \times (3{,}652\ cm2) \times (1mg/cm2) \times (0.01) \times (350\ days/yr) \times (6\ yrs) \times (10\text{-}6\ kg/mg)}{(15\ kg) \times (2{,}190\ days)}$$

$$= 1.4 \times 10\text{-}2\ mg/kg\text{-}day$$

$$SExDi = \frac{5900\frac{mg}{kg} \times 0.83\frac{m3}{hr} \times 24\frac{hrs}{day} \times 350\frac{days}{yr} \times 6\ yrs \times 0.036\frac{8}{m2 - hr} \times (1-0) \times \left(4\frac{m}{sec}/12.8\frac{m}{sec}\right)3 \times 0.0497\ (Particulate)}{15\ kg \times 2{,}190\ days \times 81.6\frac{\frac{g}{m2 - sec}}{\frac{kg}{m3}} \times 3{,}600\frac{sec}{hr}}$$

$$= 1.4 \times 10\text{-}6\ mg/kg\text{-}day$$

$$HQ = \frac{7.5 \times 10\text{-}2\ mg/kg\text{-}day}{0.06\ mg/kg\text{-}day} + \frac{1.4 \times 10\text{-}2\ mg/kg\text{-}day}{0.06\ mg/kg\text{-}day} + \frac{1.2 \times 10\text{-}6\ mg/kg\text{-}day}{0.057\ mg/kg\text{-}day}$$

$$= 1.5E+00$$

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 - methylene chloride, cancer effects, base worker (mowing scenario):

SExDo = (3.6 mg/kg) x (50 mg/day) x (12 days/yr) x (25 yrs) x (10-6 kg/mg)
(70 kg) x (25,550 days)

= 3.0 x 10-8 mg/kg-day

SExDd = (3.6 mg/kg) x (3.160 cm-2) x (1 mg/cm2-day) x (0.01) x (12 days/yr) x (25 yrs) x (10-6 kg/mg)
(70 kg) x (25,550 days)

= 1.9 X 10-8 mg/kg-day

```
                                                         mol
SExDi                                                    41---------
               mg     m3   hr      days               cm2        atm-m3    atm -m3
(vapor)   =       3.6--  2.5--  1---  12---- (25 yrs)(2) 0.0075 --  (0.28) 0.0027 -----  ----------
               kg     hr   day      yrs               sec          mol           cm3
                                                        0.087—
                                                             g


                            g
                            ---------                                 ½
                             m2 - sec           cm2              sec     m2
            (70 kg)(25,550 days) 8.16 --------  (3,1416) 0.0012---- (25 yrs)  3.15x107---     10-4 —
                             kg            sec               yr     cm2
                             --
                             m3
```

= 5.9 x 10-7 mg/kg-day

ELCR = [(3.0 x 10-8 mg/kg-day) x (7.5 x 10-3 kg-day/mg)] + [(1.9 x 10-8 mg/kg-day) x (7.5 x 10-3 kg-day/mg)]+
[(5.9 x 10-7 mg/kg-day) x (1.6 x 10-3 kg-day/mg)]

= 1.3 x 10-9

Other COPCs, including VOCs and BNAs, may cause health problems other than cancer. Reference doses (RfDs) have been developed by EPA 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 EPA. 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 2-17.

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.

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. EPA 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:

$$\text{Risk} = \text{CDIXSF}$$

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 (mg/kg-day)-1

Potential current total site risk for an on-site workers (e.g. a mower exposed to soils) results in a total site excess lifetime cancer risk of 1E-09.

The excess lifetime cancer risk for a hypothetical future adult resident exposed to groundwater at the site was 5E-06. The excess lifetime cancer risk for an adult resident exposed to soils at the site is 2E-7. The excess lifetime cancer risk for an hypothetical future child resident is 5E-7.

Hazards due to Non-carcinogenic Chemicals: For compounds which cause toxic effects other than cancer, EPA 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 calculating the HQ is shown below:

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

where CDI = chronicle 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, EPA considers HI of 1.0 to be the maximum acceptable hazard.

The HI for a current base worker is 3.9E-3.

The non-cancer HI for hypothetical future adult resident exposure to groundwater 3.8E+1 is above the USEPA risk benchmark of 1. The HI for hypothetical future adult resident exposure to soils (1.9E-1) is below the USEPA risk benchmark of 1. The HI for hypothetical future child resident exposure to soils (1.5) is above the USEPA risk benchmark of 1.

TABLE 2-17

REFERENCE DOSES FOR CONSTITUENTS OF CONCERN AT SITE SS-3 (FORMER SP-7), AIRCRAFT WASHRACK AREA
Homestead Air Reserve Base, Florida

Constituent	Oral RfD (mg/kd/day)	Reference	Inhalation RfD (mg/kg/day)	Reference
VOCs				
Benzene	NA		5.7E 04	IRIS
Chloroform	1.0E-02	IRIS	NA	IRIS
Ethylbenzene	1.0E-01	IRIS	2.9E-01e	IRIS
2-Hexanone	NA		NA	
Methylene chloride	6.0E-2	IRIS	8.6E-01	IRIS
Methyl ethyl Ketone	6.0E-01	HEAST	2.8E-01e	IRIS
Styrene	2.0E-01	IRIS	NA	IRIS
Xylenes	2.0E+00	IRIS	NA	IRIS
BNAs				
Bis(2-ethylhexyl)phthalate	2.0E-2	IRIS	NA	
Di-n-octylphthalate	2.0E-02	c	NA	
Dibenzofuran	3.0E-02	IRIS	NA	
Fluorene	4.0E-02	IRIS	NA	
n-Hexanea	6.0E-02	IRIS	5.7E-02	IRIS
2-Methylnaphthalene	3.0E-02	d	NA	
Naphthalene	4.0E-02	IRIS	NA	
PESTICIDES				
DDD	5.04E-04	IRIS	NA	
INORGANICS				
Cadmium(food)b	1.0E-03	IRIS	NA	
Cadmium (water)	5.0E-04	IRIS	NA	

References: IRIS, 1993; USEPA, 1992a

a n-Hexane is used as a surrogate for total recoverable petroleum hydrocarbons and hydrocarbon TICs.

b The RfD for food should be used when calculating soil exposure.

c Inferred from Bis(2-ethylhexyl)phthalate.

d Inferred from naphthalene.

e Conversion from RfC.

TABLE 2-18

CANCER SLOPE FACTORS, TUMOR SITES, AND USEPA CANCER CLASSIFICATION
FOR CONSTITUENTS OF CONCERN AT
SITE SS-3 (FORMER SITE SP-7), AIRCRAFT WASHRACK AREA
Homestead Air Reserve Base, Florida

	CSF (mg/kg/day)-1				Tumor site		USEPA
Constituent	Oral	(Reference)	Inhalation	(Reference)	Oral	Inhalation	Classification
VOCs							
Benzene	2.9E-02	IRIS	2.9E-02	a	leukemia	leukemia	A
Chloroform	1.6E-03	IRIS	8.1E-02	b	liver	NA	B2
Methylene chloride	7.5E-03	IRIS	1.6E-03	c	liver	lung, liver	B2
Styrene	NA	NA	NA		NA		B2
BNAs							
Bis(2-ethylhexyl)phthalate	1.4E-02	IRIS	NA		liver	NA	B2
Metals							
Cadmium	NAP	IRIS	6.3E+00	d	NA	respiratory tract	B1
Lead	NA	NA	NA		NA		B2
Pesticides							
DDD	2.4E-01	IRIS	NA		liver	NA	B2

References:	IRIS, 1992; USEPA,1992a,b. IRIS, 1993
mg/kg day	Milligrams per kilogram per day.
NA	Not available.
NAP	Not applicable since it is solely carcinogenic by inhalation.
a	Converted from inhalation unit risk 8.3E-06 (µg/cu m) (IRIS).
b	IRIS 11/92.
c	Converted from inhalation unit risk 4.7E-07 (µg/cu m) (IRIS).
d	Converted from inhalation unit risk 1.8E-03 (µg/cu m) (IRIS).

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 6E-6 and an HI 40.2. The carcinogenic total site risk estimate is below the USEPA risk benchmark of <10-4 while the HI exceeds the USEPA benchmark of <=1.

Risk from Lead Exposure. Based on the Integrated Exposure Uptake/Biokinetic (IEUBK) 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) assuming exposure to site concentrations of lead in soil and groundwater.

2.7.5 Development of 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 or (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 1x10-6 or their non-carcinogenic HQ is less than 0.1.

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 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 RGOs are presented here in tabular from and include cleanup levels for the 10-4, 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 2-21.

2.7.6 Ecological Risk Assessment

OU-6/Site SS-3 is located southeast of Bikini Boulevard in the approximate center of Homestead AFB. Most of the site is occupied by the large concrete and asphalt pavement of the aircraft wash rack, which is skirted by a maintained lawn of St. Augustine grass and few weedy grasses and lawn weeds. The ecosystem compatible with operation of base is not expected to be the natural ecosystem for South Florida. It is unlikely that animals would predominantly inhabit or utilize OU-6 in lieu of nearby natural resource areas (Biscayne National Park to the east, the Everglades to the west, and the surrounding agricultural land). Because of the developed character of this site, and the Base, it does not provide suitable habitat for wildlife thus plants and animals are not likely to contact chemicals present at OU-6/Site SS-3. Site canals are to be more fully addressed in the OU-9 Boundary Canal assessment.

2.7.7 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 risks. These factors include:

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

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

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 pharmackinetic 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.

TABLE 2-19
RISK-BASED REMEDIAL GOAL OPTIONS
HYPOTHETICAL FUTURE ADULT RESIDENT
SITE SS-3 (FORMER SP-7), AIRCRAFT WASHRACK AREA
GROUNDWATER (mg/L)
Homestead Air Reserve Base, Florida

	HAZARD INDEX		CARCINOGENIC RISK			EPA Maximum Contaminant	Florida Drinking Water
COMPOUNDS	0.1	1.0	10	1E-06	1E-05	Level(1)	Standard(1)
Benzene	- -	- -	- -	0.0029	0.029	0.005	0.001
Chloroform	0.037	0.3700	3.7000	0.0532	0.532	0.1(a)	0.1(a)
Bis(2-ethylhexyl)phthalate	0.073	0.730	7.30	0.0061	0.061	0.004	0.006
Ethylbenzene	0.365	3.650	36.500	- -	- -	0.700	0.700
Xylenes	7.30	73.00	730.00	- -	- -	10.0	10.0
Di-n-octylphthalate	0.073	0.7300	7.300	- -	- -	NS	NS
Fluorene	0.146	1.460	14.60	- -	- -	NS	0.010
n-Hexane [a]	0.219	2.190	21.90	- -	- -	NS	NS
2-Methylnaphthalene	0.110	1.100	11.00	- -	- -	NS	NS
Naphthalene	0.146	1.460	14.60	- -	- -	NS	0.01
Cadmium	0.0018	0.0180	0.1800	- -	- -	0.005	0.005

- - Not applicable
(a) as Total Trihalomethanes
NS = No Standard
(1) units are mg/L

TABLE 2-20
RISK-BASED REMEDIAL GOAL OPTIONS AND FDEP SOIL TARGET LEVELS
HYPOTHETICAL FUTURE ADULT RESIDENT
SITE SS-3 (FORMER SP-7), AIRCRAFT WASHRACK AREA
SOIL (mg/kg)
Homestead Air Reserve Base, Florida

	HAZARD INDEX			CARCINOGENIC RISK			FDEP Soil Target Levels Based on a Hazard Index of 1
COMPOUNDS	0.1	1.0	10	1E-06	1E-05	1E-04	
Methylene chloride	1,398	13,980	139,800	15.5	155.0	1,550	10,600
Ethylbenzene	2,014	20,140	201,400	- -	- -	- -	23,400
Methyl ethyl ketone	1,924	19,240	192,400	- -	- -	- -	33,000
Styrene	11,094	110,940	1,109,400	- -	- -	- -	NS
Xylenes	11,094	110 940	1,109,400	- -	- -	- -	93,400
Dibenzofuran	1,620	16,200	162,000	- -	- -	- -	2,010
n-Hexane [a]	3,328	33,280	332,800	- -	- -	- -	30,200
2-Methylnaphthalene	1,621	16,210	162,100	- -	- -	- -	90,000
Naphthalene	2,161	21,610	216,100	- -	- -	- -	9,600

- - Not applicable

[a] n-Hexane is used as a surrogate for total petroleum hydrocarbons.

TABLE 2-21
RISK-BASED REMEDIAL GOAL OPTIONS AND FDEP SOIL TARGET LEVELS
HYPOTHETICAL FUTURE CHILD RESIDENT
SITE SS-3 (FORMER SP-7), AIRCRAFT WASHRACK AREA
SOIL (mg/kg)
Homestead Air Reserve Base, Florida

	HAZARD INDEX			CARCINOGENIC RISK			FDEP Soil Target Levels Based on a Hazard Index of 1
COMPOUNDS	0.1	1.0	10	1E-06	1E-05	1E-04	
Methylene chloride	296	2,960	29,600	7.55	75.5	755	3,590
Ethylbenzene	462	4,620	46,200	- -	- -	- -	6,530
Methyl ethyl ketone	298	2,980	29,800	- -	- -	- -	20,500
Styrene	1,320	13,200	132,000	- -	- -	- -	NS
Xylenes	1,320	13,200	132,000	- -	- -	- -	37,900
Dibenzofuran	195	1,950	19,500	- -	- -	- -	307
n-Hexane [a]	397	3,970	39,700	- -	- -	- -	4,610
2-Methylnaphthalene	195	1,950	19,500	- -	- -	- -	190
Naphthalene	260	2,600	26,000	- -	- -	- -	2,280

- - Not applicable

[a] n-Hexane is used as a surrogate for total petroleum hydrocarbons.

2.8 DESCRIPTION OF ALTERNATIVES

The alternatives analyzed for OU-6/Site SS-3, Aircraft Washrack are presented below. These are numbered to correspond with the numbers in the FS report. The alternatives for site clean-up are the following:

- Alternative 1: No Action with Groundwater Monitoring
- Alternative 2: Passive LNAPL Recovery, Institutional Controls, and Natural Attenuation
- Alternative 3: Passive LNAPL Recovery, Bioremediation/Air Sparging, and Institutional Controls
- Alternative 4: Excavation and Off-Site Thermal Treatment, Disposal of Contaminated Soils, and Natural Attenuation and Institutional Controls

Each alternative includes long-term groundwater monitoring. Alternative 3 is the only alternative that requires active remediation of the groundwater. These monitoring activities will be conducted to gauge the effectiveness of the selected remedy.

Except for Alternative 1 all alternatives have the potential to meet USEPA remedial action objectives and potentially meet the clean-up goals. It is the time, cost, and certainty in reaching these standards that differentiates the alternatives.

2.8.1 Alternative 1 - No Action with Groundwater Monitoring

The No-Action alternative serves as a "baseline" against which other alternatives are compared. The No-Action alternative is evaluated as required by the NCP, the regulation implementing CERCLA. No additional monitoring wells would be required with this alternative. The existing monitoring wells would be sampled semi-annually for 30 years to monitor groundwater contamination.

Per CERCLA, site reviews would be conducted every 5 years as part of this alternative which allows COCs exceeding EPA target risk ranges to remain onsite. The No-Action alternative is readily implementable; however, the alternative fails to satisfy all of the requirements evaluated except for short-term effectiveness. The estimated present worth cost of this alternative is $700,000 and assumes a duration of 30 years.

2.8.2 Alternative 2 - Passive LNAPL Recovery, Institutional Controls, and Natural Attenuation

This alternative consists of:

- Institutional controls to restrict the placement of potable wells in the contaminated groundwater near or beneath the site until such time as the protectiveness of the groundwater is reached. It is estimated that protectiveness (i.e., benzene concentrations in groundwater to be <1 μg/l) will be achieved within a 20 year span of treatment.
- Installation of a monitoring/recovery well with an oleophilic bailer approximately 25 feet northeast of SP7-MW-0016.
- Passive LNAPL recovery at an existing monitoring well (SP7-MW-0016) using an oleophilic bailer. The final beneficial use/disposal of the recovered LNAPL will be identified by the Base.
- A groundwater monitoring program with a five year review until the data confirms that OU-6 is not a threat to human health or the environments.

There is an estimated, maximum volume of 5,600 gallons of LNAPL at the site. The LNAPL is the likely source of soil and groundwater contamination. Of specific concern is the concentration of benzene, 38 μg/L in the one well where LNAPL was observed in 1993. LNAPL will be removed with two recovery wells. Because this alternative removes the mobile portion of the potential source of groundwater contamination (i.e., LNAPL), the concentration of benzene is expected to decrease with time more rapidly than with the No-Action alternative. The recovered LNAPL will be evaluated for possible recycling or disposal alternatives.

The estimated present worth cost of this alternative is $740,000 and assumes a duration of 20 years.

2.8.3 Alternative 3 - Passive LNAPL Recovery, Bioremediation/Air Sparging, and Institutional Controls

This alternative consists of:

- Passive LNAPL recovery as described in Alternative 2.
- Implementation of institutional controls to restrict the placement of potable wells in the contaminated groundwater near or beneath the site until such time as the protectiveness of the groundwater is reached.
- A recommended pilot-test of the innovative sparging technology.
- Groundwater monitoring as described in Alternative 1 with additional sampling to evaluate the effectiveness of the air sparging system.
- Installation of 10 air sparging wells within the contaminated groundwater plume.
- A groundwater monitoring program with a five year review until the data confirms that OU-6 is not a threat to human health or the environments.

Air sparging and enhanced bioremediation technologies would be implemented after LNAPL recovery is no longer practicable. Air sparging is a relatively new technology gaining increased acceptance and application. It simply involves injecting air below the contaminant plume to "strip off" volatile contaminants from groundwater and soil and enhance natural bioremediation processes by supplying oxygen to the subsurface. Nutrients and/or special biological cultures may be added to enhance the bioremediation of nonvolatile compounds.

This alternative was included in the review to meet CERCLA requirements for evaluation of innovative technologies. The estimated present worth cost of this alternative is $590,000 with a 5 year duration.

2.8.4 Alternative 4 - Excavation and Off-Site Thermal Treatment, Disposal of Contaminated Soils, and Natural Attenuation and Institutional Controls of Groundwater

This alternative consists of:

- Institutional controls to restrict the placement of potable wells in the contaminated groundwater near or beneath the site until such time as the protectiveness of the groundwater is reached. It is estimated that protectiveness (i.e., benzene concentrations in groundwater to be <1 μg/l) will be achieved within a 5-year span of treatment.
- Excavation of soil/rock to meet performance standards, approximately 2,100 cubic yards and replacement with equal volume of fill material.
- Off-site thermal treatment and disposal of excavated soil.
- LNAPL recovery during soil excavation using a skimmer pump.
- Sending LNAPL to off-site disposal through energy recovery.
- Disposal of water collected during excavation meeting standards required by the POTW at a POTW. If the water does not meet performance standards, treatment will need to occur before disposal.
- Groundwater monitoring with five year site review until contaminants are at levels considered protective of human health and the environment, as described in Alternative 1.

Soil will be excavated to a depth of 6 feet over the inferred aerial extent of soil contamination (approximately 125 feet by 75 feet). Field screening supported by laboratory analyses will be conducted to verify, that soil meeting the performance standards is encountered at the bottom and extent of excavation.

An oil skimmer will be employed during the excavation to collect the estimated 5,600 gallons of LNAPL. The soil will be sent to an approved thermal treatment facility. The LNAPL will be removed to an energy recovery facility and any water generated during removal operations disposed of through a POTW.

The sampling and analysis for soils show that the only constituents of concern at Site SS-3 are Naphthalene and 2-Methylnapthalene. In accordance with Capther 62-775 Florida Administrative Code

(F.A.C.), the applicable performance standard for soil cleanup shall be 1 mg/kg for PAHs and 50 mg/kg for TRPH. Since the lateral and vertical extent of soil contamination will be removed to conform to the applicable State standard referred above, no access and land development restrictions are contemplated to be enacted and/or enforced by deed.

This alternative also includes semiannual sampling of the site's monitoring wells for two years to monitor the effect of removing the source (LNAPL) of groundwater contamination. The samples would be analyzed for the BNAs and VOAs. Applicable performance standards and guidance for monitoring of the groundwater include Federal and State groundwater MCLs (see Table 2-19). Should the monitoring program indicate that contaminant levels have not naturally attenuated to performance standards described in Chapters 62-550 F.A.C. (Drinking Water Standards), active groundwater remediation will be contemplated. Groundwater use restrictions enacted by deed are expected until groundwater at Site SS-3 conforms with the performance standards described in Chapters 62-550 and 62-520 (Groundwater Standards and Classification) F.A.C.

The estimated present worth cost of this alternative if $690.000 with a 5 year duration.

2.9 SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

A summary and comparison of the alternatives are presented in Tables 2-22 and 2-23. The comparison is based on the nine key criteria required under the National Contingency Plan and CERCLA Section 121 for use in evaluation of remedial alternatives by EPA. 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.

2.9.1 Overall Protection of Human Health and Environment

Alternatives 3 & 4 meet Remedial Action Objectives for the site and provide protection of human health and the environment. Alternative 4 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.

2.9.2 Compliance with Federal/State Standards

That are no ARARs for soil/weathered bedrock contamination at OU-6/Site SS-3. The ARARs for groundwater contamination at OU-6/Site SS-3 are the state and federal MCLs, the federal non-zero MCLGs, the state SMCLs, and the Florida 17-770 regulations. Benzene is the only contaminant found in the groundwater at OU-6/Site SS-3 at a concentration above either its state or federal ARAR. Benzene was detected in the groundwater sample collected in 1993, from the one well that contained LNAPL, at a concentration of 70 µg/L, which is above the state MCL of 1 µg/L and the federal MCL of 5 µg/L. LNAPL, a likely source for the benzene, is present in the pore space vadose zone. The more soluble constituents of the LNAPL and the high percent constituents of the LNAPL composition are slowly dissolving into the groundwater thereby providing a continuing source of groundwater contamination. Alternative 3 and 4 meet the ARAR objective for OU-6.

It is possible that the excavated soil at OU-6 may be hazardous waste as defined by toxic characteristic leaching procedure (TCLP). As TCLP has not been conducted at this site, several action specific ARARs may be applied to the Site. These ARARs would include Resource Conservation and Recovery Act (RCRA) land disposal restrictions (40 CFR 268), RCRA Standards Applicable to Transporters of Hazardous Waste (40 CFR 263), Department of Transportation Rules for Transporting of Hazardous Waste (49 CFR 107, 171, 173, 178, aud 179), and Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities (40 CFR 264).

TABLE 2-22

SUMMARY OF SCREENING OF REMEDIAL ALTERNATIVES FOR SITE SS-3

Alternative	Effectiveness	Implementability	Present Worth Cost
1 - No Action with Groundwater Monitoring	No reduction of MTVa of contaminants. Meets USEPA remedial action objectives (providing groundwater is not considered a source for potable water) but does not meet cleanup goals	Includes groundwater monitoring and 5-year site reviews. Easily implementable.	$ 710,000
2 - LNAPL Recovery, Institutional Controls, and Natural Attenuation	Reduces MTV of hydrocarbons in soils and groundwater. Meets USEPA remedial action objectives (providing groundwater is not considered a source for potable water) and uses deed restrictions to meet cleanup goals.	Includes deed restrictions, groundwater monitoring and 5-year site reviews. LNAPL recovery is easily implementable.	$ 740,000
3 - LNAPL Recovery, Bioremediation/Air Sparging, and Institutional Controls	Reduces MTV of hydrocarbons in soils and groundwater. Meets USEPA remedial action objectives and meets cleanup goals. Air sparging may release harmful vapors to atmosphere.	Uses conventional equipment and demonstrated technologies. Fouling of the wells and/or plugging of the aquifer could occur. Requires pilot test; may be moderately difficult to implement. Could potentially remediate site in 3 years.	$ 590,000
4 - Excavation and Off-site Thermal Treatment, Disposal of Contaminated Soils, Natural Attenuation, and Institutional Controls.	Reduces MTV of hydrocarbons in soils and groundwater. Meets USEPA remedial action objectives and relies on natural attenuation of benzene in groundwater to meet cleanup goals.	Uses conventional equipment and proven methods. Easily implementable. Excavation could be implemented within 6 months; may require 5 years for natural attenuation of dissolved benzene.	$ 677,000

(a-MTV=mobility, toxicity, and volume)

TABLE 2-23

COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES, OU-6/SITE SS-3

	Remedial Alternative			
Evaluation Criteria	No Action	LNAPL Recovery, Institutional Controls, and Natural Attenuation	LNAPL Recovery, Bioremediation/ Air Sparging, and Institutional Controls	Excavation and Off-Site Thermal Treatment, Disposal, Natural Attenuation and Institutional Controls
Overall Protection of Human Health & Environment			O	O
Compliance w/ARARs			O	O
Long-Term Effectiveness and Permanence			O	O
Reduction of Toxicity, Mobility, or Volume		O	*	O
Short-Term Effectiveness	O	O	O	O
Implementability	Easy	Easy	Difficult	Easy
Estimated Present Worth	$710,000	$740,000	$590,000	$677,000

Does not meet criterion
O Meets criterion
* Has potential to meet criterion

2.9.3 Long-term Effectiveness and Permanence

Alternative 4 provides the best long-term effectiveness and permanence for OU-6/Site SS-3. Alternative 3 also provides long-term effectiveness and permanence. However, not as much as Alternative 4. Alternative 2 utilizes institutional controls, which though effective, would need to be evaluated during the five-year review. Alternative 1 does not change the conditions of OU-6; therefore, any contaminants remaining at the site would not be expected to decrease significantly over time.

2.9.4 Treatment to Reduce Toxicity, Mobility or Volume

Alternative 4 would reduce the mobility of the contaminants through excavation of the contaminants from the Site and off-site treatment and disposal. Alternatives 2 and 3 both reduce the mobility, toxicity, or volume of the contaminants while Alternative 2 uses deed restrictions to meet clean-up goals. Alternative 1 would not provide any additional reduction in toxicity, mobility or volume of the contaminants.

2.9.5 Short-term Effectiveness

Alternative 1 provides no short term effectiveness and could represent excess risk at the site for thirty years or more.

Alternative 2 provides immediate protection through the implementation of the institutional controls. Alternative 2 could possibly meet MCLs within 15 to 20 years. This is assuming that an average of one gallon per day of LNAPL is removed from the well, total recovery at 15 years and then another five years for benzene concentrations to decrease below 1 µg/l.

It is anticipated that under Alternative 3, passive LNAPL recovery may be completed within two years and that the concentration of dissolved benzene will be below the MCL of 1 µg/l within one year of air sparging. The total timeframe for the site to achieve protection is estimated to be between three and five years.

The excavation associated with Alternative 4 is expected to be completed within one year. The excavation of soil may impose risks by disturbing the contamination, however, it would not be expected to pose unacceptable short-term environmental or health hazards, which could not be controlled. The alternative is expected to achieve attainment five years after excavation is complete. Total time for the site to attain protectiveness is estimated at six years.

2.9.6 Implementability

Alternative 1 and 2 would be easy to implement. Alternative 4 would be easy to moderately easy to implement. Alternative 3 would be difficult to implement.

2.9.7 Cost

All alternatives are moderately expensive with Alternative 4 having the best opportunity for long-term effectiveness and permanence given the relatively small differences in cost between alternatives.

2.9.8 State and Community Acceptance

The no action alternative is not acceptable to the state and community because it does not actively remediate the groundwater or the source of contamination. Alternative 2 and 3 may be acceptable to the state and community because it removes the LNAPL at the site. Alternative 4 has been accepted by the state and community because it offers a permanent solution and is protective of human health and the environment. Community concerns were addressed during the public meeting and have been summarized in the "Responsive Summary of this ROD. This remedy is acceptable by both the state and community.

2.10 SELECTED REMEDY

Based on consideration of the requirements of CERCLA, the detailed evaluation of the alternatives and public comments, the USAF in concurrence with the USEPA and the State of Florida has determined the selected remedy for OU-6/Site SS-3 to be Alternative 4 - Excavation and Off-Site Thermal Treatment and Disposal of Contaminated Soils. It is the most reliable and expedient solution identified. It offers a permanent solution that is protective of human health and the environment. It will serve to protect the groundwater from further contamination. The NCP (40 CPR 300) views groundwater as a valuable resource to be protected and restored to beneficial use wherever possible.

The major components of the selected remedy include:

- Excavation of soil/rock to meet performance standard from an approximate 125 ft by 75 ft by 6 ft (2,100 cubic yards) area. The soil is slated for disposal at a RCRA permitted facility. The facility will use thermal desorption technology to treat the waste. Fill material will be brought to the site to grade the area.

- During the excavation an approximate maximum of 5,600 gallons of LNAPL is expected to be recovered. The LNAPL is slated for energy recovery (i.e., recycling) at an approved facility to be decided.

- Groundwater monitoring will be performed at the site for 5 years to show that natural attenuation will meet performance standards (clean-up levels) applicable to contaminated groundwater.

- If after the five year review, the selected remedial action has not restored the condition of OU-6 to a level that assures protection of human health and the environment, the EPA, FDEP, DERM, and the Air Force will evaluate the need for further action.

2.11 STATUTORY DETERMINATIONS

Under its legal authorities, EPA's primary responsibility at Superfund sites is to undertake remedial actions that achieve adequate protection of human health and the environment. In addition, Section 121 of CERCLA establishes several other statutory requirements and preferences. These specify that when complete, the selected remedial action for this site must comply with applicable or relevant and appropriate environmental standards established under Federal and State environmental laws unless a statutory waiver is justified. The selected remedy also must be cost-effective and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to me maximum extent practicable. Finally, the statute includes a preference for remedies that employ treatment that permanently and significantly reduce the volume, toxicity, or mobility of hazardous wastes as their principal element. The selection of Alternative 4 - Excavation and Off-Site Thermal Treatment of Contaminated Soils at OU-6, Aircraft Washrack meets the statutory determinations for this site.

2.12 DOCUMENTATION OF SIGNIFICANT CHANGES

The PP was released for public comment in November 1994. The PP identified Alternative 4 Excavation and Off-Site Thermal Treatment, Disposal of Contaminated Soils, and Natural Attenuation and Institutional Controls as the preferred alternative for Remedial Action at OU-6/Site SS-3. No changes were necessary to the alternative from public input. However, the title of the alternative was expanded from Excavation and Off-Site Thermal Treatment and Disposal of Contaminated Soils to its present name to represent the alternative more accurately.

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 Operable Unit No. 6, Homestead AFB. Second, the responsiveness summary documents how public comments have been considered and integrated into the decision making process. Third, it provides EPA 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 AFB OU-6/Site SS-3 were released to the public in June and November 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 November 8, 1994 to December 22, 1994 as part of the community relations plan for Operable Unit No. 6. Additionally, a public meeting was held on Tuesday, November 29, 1994, at 7:00 pm at South Dade High School. A public notice was published in the Miami Herald and South Dade News Leader on Tuesday, November 22, 1994. At this meeting, the USAF, in coordination with EPA 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 made during the public comment period regarding the preferred remedial alternative. However, several comments were made during the public meeting which addressed OU-1, which was also addressed during the public meeting on November 29, 1994.