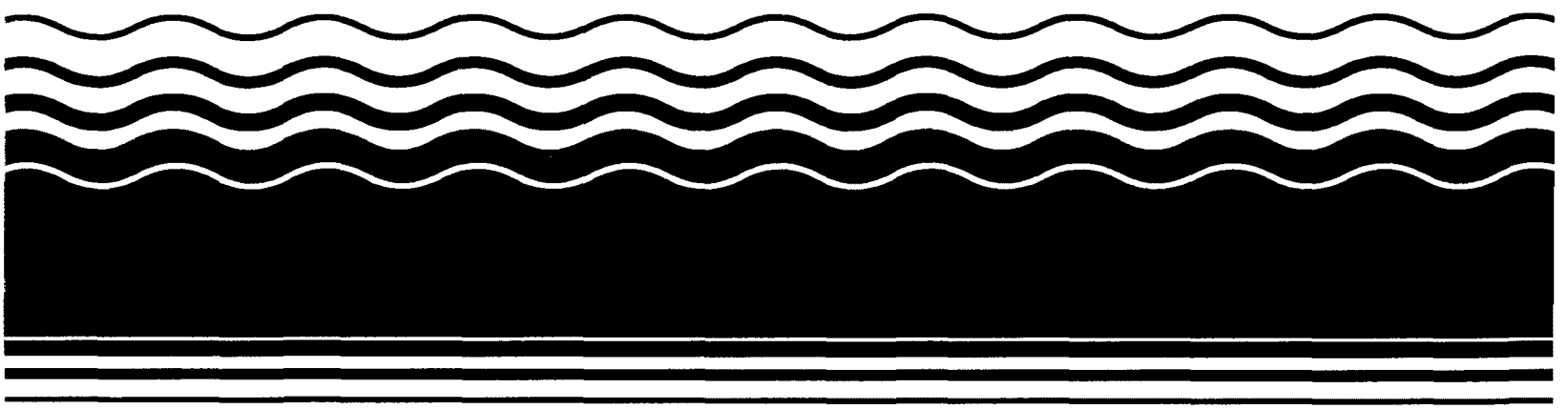
PB98-964007
EPA 541-R98-023
October 1998

EPA Superfund
Record of Decision:

Homestead Air Force Base
OU 2
Homestead, FL
7/16/1998



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

JUL 1 1998

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

4WD-FFB

Albert Lowas
Director of Air Force Base Conversion Agency
1400 North Moore Street, Suite 2300
Arlington, VA 22209-2802

SUBJ: Record Of Decision - Operable Unit 2
Homestead Air Force Base NPL Site
Homestead, Florida

Dear Mr. Lowas:

The U.S. Environmental Protection Agency (EPA) Region IV has reviewed the subject decision document and concurs with the selected remedy for the remedial action at Operable Unit (OU) 2 at the former Homestead Air Force Base (HAFB). This remedy is supported by the previously completed Remedial Investigation, Feasibility Study, and Baseline Risk Assessment Reports.

The selected remedy consists of: excavation of contaminated soils, testing of excavated soils to determine if it is a RCRA hazardous waste and appropriate offsite disposal, stabilization of soils, long-term monitoring of the groundwater, institutional controls of the area, and five-year reviews. This remedial action 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. The sediments and surface water in the drainage ditches surrounding the site will be addressed as part of the Remedial Investigation of OU-9 (Boundary Canal and associated drainage ditches). The determination to implement this course of action at this site is consistent with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA) and the National Contingency Plan (40 CFR 300).

Concurrence with the Record of Decision (ROD) is conditioned on the express understanding that the Air Force is committed to reaching an agreement with EPA Region IV and the Florida Department of Environmental Protection (FDEP) that complies with EPA's April 21, 1998 Memorandum titled "Assuring Land Use Controls at Federal Facilities." We reiterate, as we advised Air Force Regional Environmental Office representatives in our meeting

on May 21, 1998, our concurrence with this particular ROD is based on the understanding that the Air Force is committed to entering a Memorandum of Agreement (MOA) consistent with the above-referenced Land Use Control (LUC) Policy. Furthermore, once such an MOA is in place, the Homestead Air Force Base BRAC Cleanup Team (BCT) will be expected to craft specific provisions for Land Use Controls as part of the resulting Land Use Control Implementation Plan for OU- 2, that will prohibit unrestricted property reuse.

As agreed upon at the May 21, 1998, meeting, we continue to hold the expectation that final details will be worked out within 90 days after the date of this concurrence, resulting in an MOA that fully complies with the LUC policy. As emphasized at that meeting, and counter to the statement in the Air Force Regional Environmental Office's letter dated June 1, 1998, we remain steadfast in our position that in the event an MOA is not reached within 90 days, we reserve the right to reconsider this remedy, and will not be willing to concur on future Homestead RODs that rely in whole or in part on Land Use Controls unless and until an agreement is in effect.

EPA appreciates the level of effort that was put forth in the documents leading to this decision. EPA looks forward to working with HAFB as we move towards final cleanup of the National Priorities List (NPL) site.

If you have any questions, please call me at (404) 562-8651, or Doyle T. Brittain at (404) 562-8549.

Sincerely,

Richard D. Green, Director
Waste Management Division

cc: Thomas J. Bartol, HAFB/AFBCA
John Mitchell, HAFB/AFRES
Jim Woolford, EPA/FFRO
Jorge Caspary, FDEP

Although this remedy will reduce the concentrations of hazardous substances, pollutants, or other contaminates remaining on site to below Health-Based Levels, a review of the remedial action will be conducted 5 years after its commencement. The 5 year review is conducted because there is concern that potential sources of contamination in areas adjacent to OU-2 may exist since the area has not been fully characterized.

UNITED STATE AIR FORCE
HOMESTEAD AIR FORCE BASE

By: Alan K. Olsen _____ Date: Dec 3 '96
Director, AFBCA

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

By: Eric S. Nuzie _____ Date: _____
Federal Facilities Coordinator

U.S. ENVIRONMENTAL PROTECTION AGENCY, REGION IV

By: John H. Hankinson _____ Date: _____
Regional Administrator

DEPARTMENT OF THE AIR FORCE
AIR FORCE BASE CONVERSION AGENCY

18 Dec 96

MEMORANDUM FOR FDEP
ATTENTION: Jorge Caspary

FROM: AFBCA/OL-Y
29050 Coral Sea Blvd
Homestead ARB, FL 33039-1299

SUBJECT: OU-2 Record of Decision Signature Pages

1. Attached are two copies of the revised OU-2 Record of Decision and 3 copies of signature pages for concurrence with the OU-2 ROD for Mr. Nuzie's signature. Please send 1 copy of the revised ROD, the 3 signed signature pages and the EPA cover letter to Earl Bozeman for EPA signatures.

Humberto Rivero, GS-13
Site Manager

Attachments
Revised OU-2 ROD
Signature Pages (3)
EPA Cover Letter

Department of Environmental Protection

Lawton Chiles
Governor

Twin Towers Office Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

Virginia B. Wetherell
Secretary

October 17, 1997

Mr. Albert F. Lowas, Jr.
Acting Director
Air Force Conversion Agency
1700 N. Moore Street, Suite 2300
Arlington, Virginia 22209-2802

Dear Mr. Lowas:

The Florida Department of Environmental Protection agrees with the Air Force's selected alternative for Operable Unit 2 (Site OT-11), Residual Pesticide Disposal Area at Homestead Air Reserve Base.

The Record Of Decision specifies Excavation and Off-Site Disposal of Soils, Access Restrictions for Groundwater, Site Fencing, and Groundwater Monitoring Alternative at Site OT-11 as a cost effective remedy that provides adequate protection of public health, welfare, and the environment. The determination to remediate the soil and monitor groundwater at Site OT-11 is consistent with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA) and the National Contingency Plan (40 CFR 300). Accordingly, the site shall undergo a five-year review with the costs of the review to be absorbed by the federal government.

We appreciate your continued cooperation and look forward to an expeditious economic and environmental recovery of Homestead Air Reserve Base.

Sincerely,

Virginia Wetherell

Virginia B. Wetherell
Secretary

VBW/jrc

Florida Department of

Memorandum **Environmental Protection**

TO: Virginia B. Wetherell, Secretary

FROM: John M. Ruddell, Director
Division of Waste Management

DATE: October 17, 1997

SUBJECT: Homestead Air Reserve Base Superfund Site
Record of Decision for Site OT-11 Residual Pesticide
Disposal Area, Operable Unit 2.

Attached for your review and signature is a letter of concurrence to Mr. Albert F. Lowas, Acting Director of the Air Force Conversion Agency, regarding the Record of Decision (ROD) for Site OT-11, Homestead Air Reserve Base. The ROD specifies the selected remedial alternative as Excavation and Off-Site Disposal of Soils, Access Restrictions for Groundwater, Site Fencing, and Groundwater Monitoring.

Operable Unit No. 2 (Site OT-11), identified as the Residual Pesticide Disposal Area, is located in the eastern portion of the base and within a parcel of land known as the Cantonment Area remaining under Air Force control. Site OT-11 covers approximately 20 acres. From 1977 to 1982, Site OT-11 was used for the disposal of pesticide rinsate from equipment cleaning. These diluted materials were sprayed or dumped over an approximately 1 acre area. Chlorine bleach and ammonia were then applied to accelerate the decomposition of the pesticide compounds.

Site OT-11 is bordered by the Boundary Canal to the west, the ammunitions storage area to the south, Taxiway B to the east and by grasslands to the north. The portion of the base where Site OT-11 is located has restricted access, limited only to base personnel with specific duties in this area. There are no public roadways that lead past Site OT-11; therefore, incidental or casual exposure to contamination is not likely at the site.

The site currently is heavily vegetated with grasses, small trees, and bushes. The land is undeveloped and was used to store pre- and post-Hurricane Andrew dirt/fill material.

Investigations conducted in 1991 and 1993 included the collection of 37 soil/weathered rock samples from a similar number of borings. Soil samples were collected from depths of 0 to 1 foot below land surface (bls).

The surface soil investigations have confirmed the presence of base neutral/acid extractable (BNA) compounds, pesticides, and metals in soils. No PCBs were detected above the Department's soil remedial goals for military sites.

Likewise, two monitoring wells were installed to assess the impact of the reported pesticide disposal practices on the Biscayne Aquifer. Only BNAs were reported in groundwater above state standards during the sampling and analysis event conducted in 1993.

The sediments and surface water in the drainage ditches surrounding the site will be addressed as part of the overall Operable Unit 9 (Boundary Canal and Associated Drainage Ditches) Remedial Investigation.

A Baseline Risk Assessment has been completed and determined that due to the levels of constituents of potential concern in soil, the total site risk for a hypothetical future resident exceeds current FDEP and Dade County Department of Environmental Resources Management (DERM) criteria of total excess lifetime cancer risk of 1E-6; therefore, the previously described alternative is warranted to address the contaminants of concern at Site OT-11.

In addition, legal restrictions preventing the use of groundwater for consumption and access to the parcel will be outlined and described in a forthcoming Memorandum of Agreement (MOA) between the USEPA, the Commanding Officer for the Homestead Air Force Base, and the Department. These restrictions shall remain in effect until the groundwater standards are met and concurrence is obtained from the USEPA and the Department to remove them.

A public meeting outlining the selected alternative was held on Thursday September 18, 1995 at 7:00 PM at the South Dade High School. Representatives of the US Air Force, EPA Region IV, FDEP, and DERM participated in the meeting. Additionally, a public notice was published in the Miami Herald and South Dade News Leader on September 7, 1995. The comments received have been adequately addressed and the Air Force has elected to proceed with the Selected Remedial Alternative specified in the ROD.

I recommend that you sign the attached letter of concurrence.

JMR/jrc

Attachment

2-18-97

Replacement certification sheets for OU-2 RA Work Plan omitted from Friday 12-December submittal.

Marla Houck
OHM Remediation Services Corp.

PROFESSIONAL CERTIFICATION STATEMENT

Re: Final Remedial Action Work Plan
Operable Unit 2 (OU-2)/Site OT-11
Homestead Air Reserve Base
Dade County, Florida

This is to certify that this Final Final Remedial Action Work Plan, completed by OHM Remediation Services Corp. (OHM), on 8 December 1997, for the benefit of the Air Force Center for Environmental Excellence (AFCEE), has been prepared under my responsible charge, supervision and direction, and meets the requirements of Section 472 of the Florida Statutes.

Stephen D. Offner, P.G.
State of Florida Registration No. 1406
8 December 1997

FINAL

RECORD OF DECISION

FOR

OPERABLE UNIT 2
SITE OT-11, RESIDUAL PESTICIDE DISPOSAL AREA

HOMESTEAD AIR RESERVE BASE, FLORIDA

April 1996

Prepared for:

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

Prepared by:

Montgomery Watson
107 Mallard Street, Suite D
St. Rose, Louisiana 70087

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DECISION SUMMARY

FOR THE

RECORD OF DECISION FOR OPERABLE UNIT NO. 2

1.0 SITE NAME, LOCATION, AND DESCRIPTION

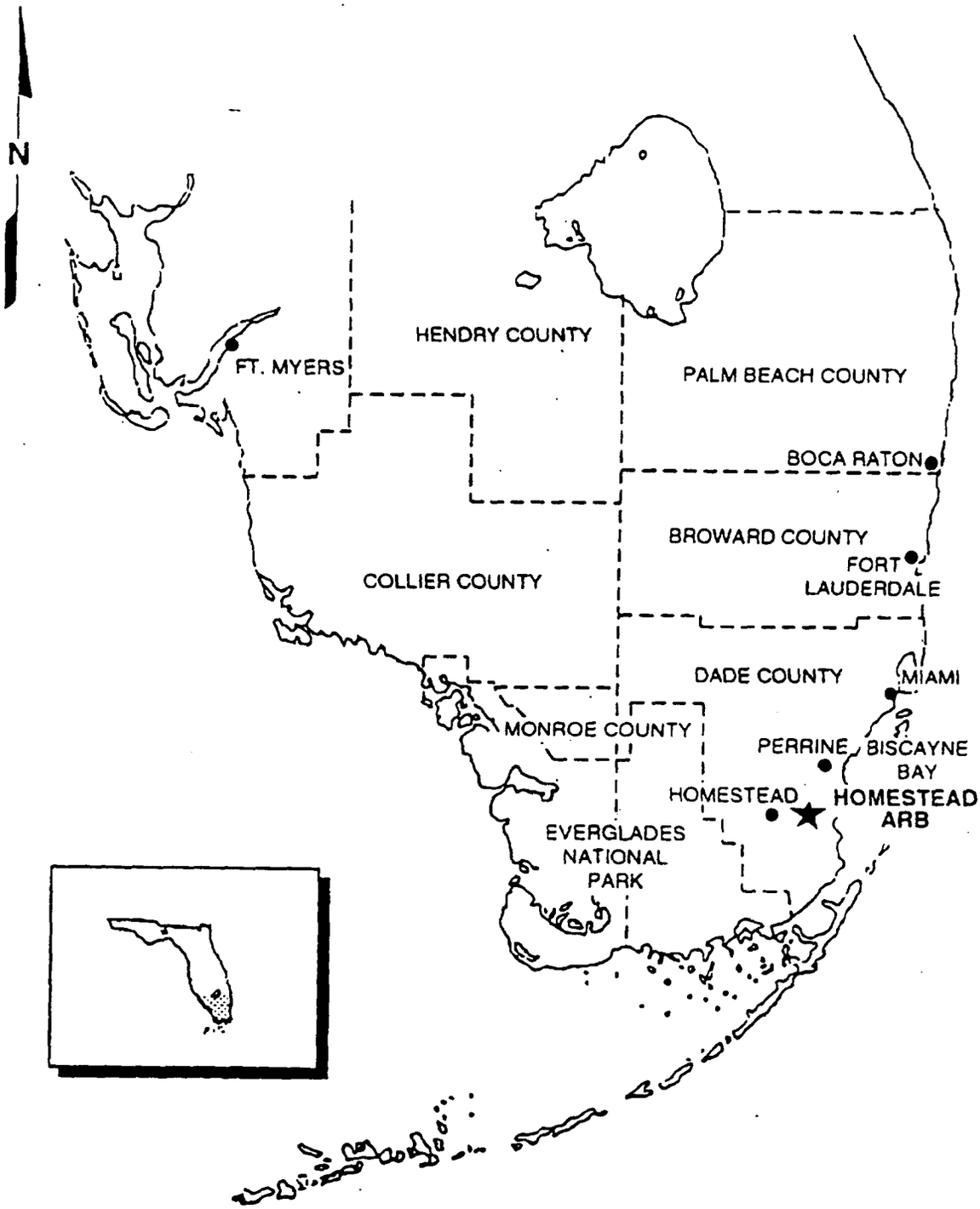
Homestead Air Reserve Base (ARB) (formerly Homestead Air Force Base) is located approximately 25 miles southwest of Miami and 7 miles east of Homestead in Dade County, Florida (Figure 1-1). The main Installation covers approximately 2,916 acres while the surrounding area is semi-rural. The majority of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

The Biscayne Aquifer underlies the Base and is the sole source aquifer for potable water in Dade County. Within a 3 mile radius of Homestead ARB, over 4,000 area residents 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



HOMESTEAD AIR RESERVE BASE
HOMESTEAD, FLORIDA

LOCATION OF HOMESTEAD AIR RESERVE BASE

FIGURE 1-1

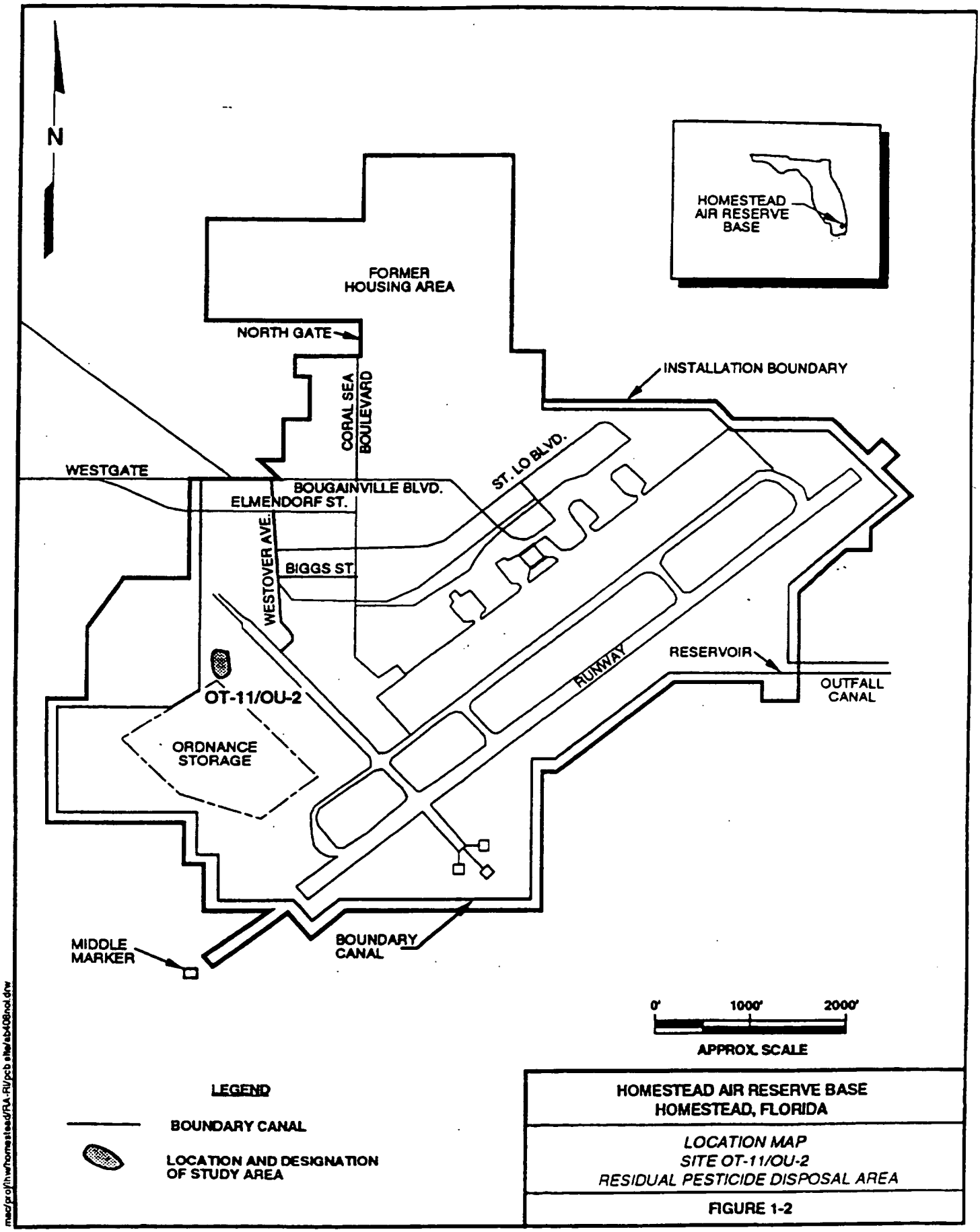
under SAC until July 1968, when it was changed to the Tactical Air Command (TAC) and the 4531st Tactical Fighterwing became the new host. The Base was transferred to Headquarters Air Combat Command (HQ/ACC) on June 1, 1992.

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

1.1 OPERABLE UNIT NO. 2 DESCRIPTION

Operable Unit 2 (OU-2)/Site OT-11 includes approximately 20 acres and is located in the west-central portion of the base (Figure 1-2). The site is bordered by the Boundary Canal to the west and the ordnance storage area to the south (Figure 1-3). Taxiway B lies approximately 600 feet to the east. The site is transected by a drainage ditch which typically contains water to a depth of a few feet. The ditch flows east to west and is interconnected with the Boundary Canal. A storage area, roughly 1 acre in size, is located on the east side of the access road which forms the eastern site boundary. The storage area is maintained by the Air Force Reserve unit and contains their supplies. The portion of the base where Site OT-11/OU-2 is located has restricted access, limited to only base personnel with specific duties in this area. There are no public roadways that lead past Site OT-11/OU-2. Therefore, incidental or casual exposure is not likely at this site. Under present conditions, access to the site would be associated with base workers performing duties that might require site access, such as cutting the grass. Site OT-11/OU-2 is in the area of the base that will be retained by the Air Force as the 482nd Air Reserve Unit, and the runway will continue to be active. This land use ensures continued limited access to the site and makes residential development at the site highly unlikely.

The site currently consists of an area characterized by weeds, grasses, trees, and bushes. The land is undeveloped and is used primarily for storage of dirt/fill material. During the 1991 field investigation (G&M, 1991), three mounds of dirt/fill material (overgrown with large weeds and trees) were present on the site, and were separated by roads. A more recent observation of the site (September 1994) indicated that Site OT-11/OU-2 was heavily vegetated, and under heavy rainfall conditions, no surface-water runoff to the drainage ditch



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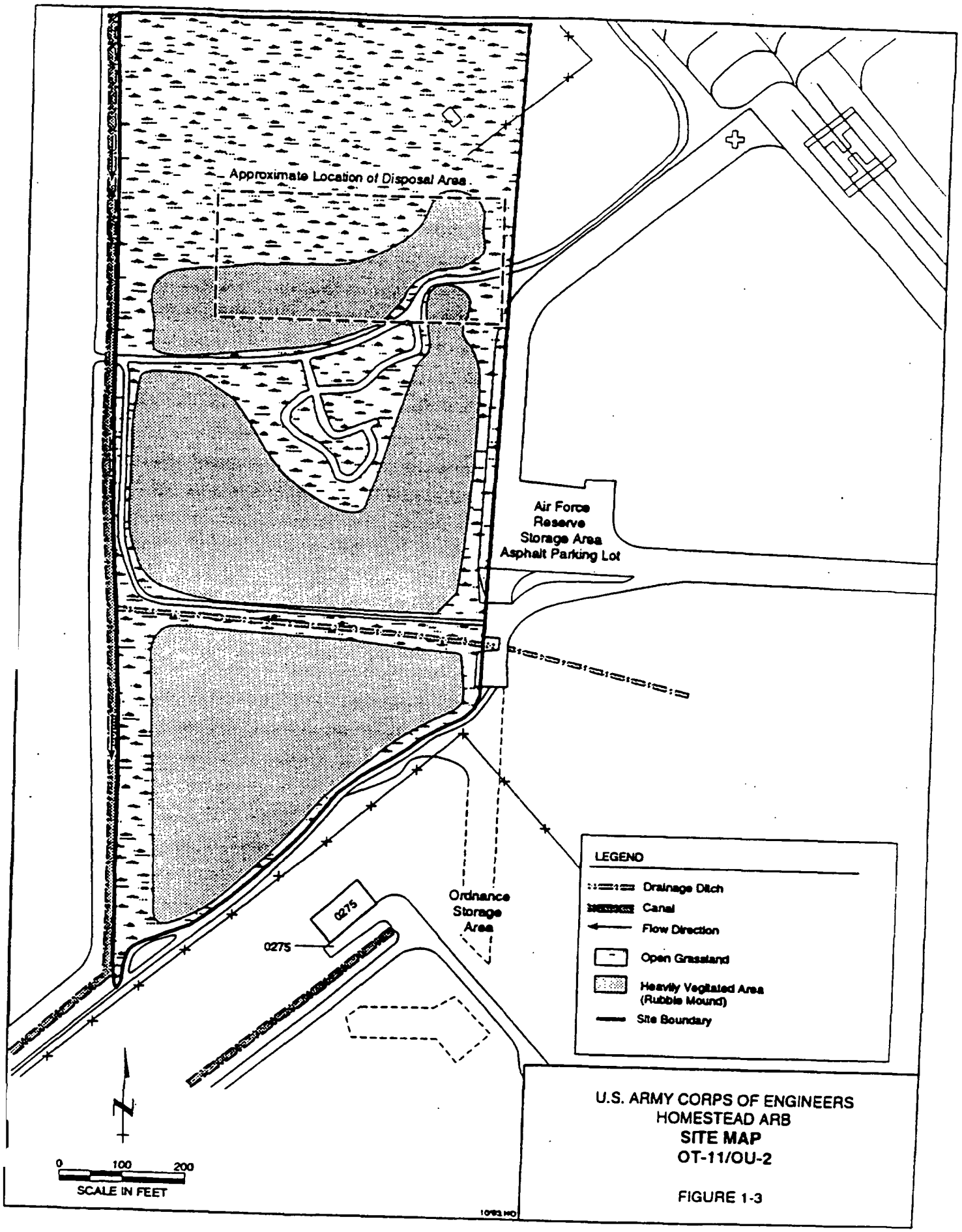


U.S. ARMY CORPS OF ENGINEERS
HOMESTEAD ARB
SITE MAP
OT-11/OU-2

FIGURE 1-3

or the Boundary Canal was observed. The drainage ditch does receive runoff during rainfall events from pavement in the area.

1.2 REGIONAL LAND USE

The area adjacent to Homestead ARB, including Site OT-11/OU-2, 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. OU-2/Site OT-11 is located in a portion of the Base scheduled to be retained by the Air Force. Due to its proximity to Taxiway B, development of the site is not likely in the foreseeable future. The groundwater at the site is not suitable for potable use due to the site's proximity to the saltwater front, as defined by water containing at least 1,000 milligrams per liter (mg/l) chloride.

1.3 REGIONAL SURFACE HYDROLOGY

Surface hydrology at Homestead ARB, including Site OT-11/OU-2 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 Oölite Formation; and 5) relatively high precipitation rate compared to evapotranspiration rate. Infiltration is considered to be rapid through surfaces of oölite outcrop and areas with a thin soil layer. Infiltration rates are accelerated by fractures within the oölite, as well as naturally occurring solution channels. Precipitation percolates through the relatively thin vadose zone to locally recharge the unconfined aquifer.

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

A drainage divide occurs within the Homestead ARB facility property, running from the northern end of the facility, toward the center. Water in the Boundary Canal flows generally south and east along the western boundary of the property, and south along the eastern boundary, converging at a storm-water reservoir located at the southeastern corner of the Base. Flow out of the storm water reservoir enters the Outfall 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 Florida Aquifer.

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

The Biscayne Aquifer underlies all of Dade, Broward, and southeastern Palm Beach Counties. The Biscayne Aquifer is the sole source of potable water in Dade County and is a federally-designated sole-source aquifer pursuant to Section 1425 of the Safe Drinking Water Act (SDWA). The Biscayne Aquifer supplies drinking water to approximately 2.5 million people within local communities. All recharge to the aquifer is derived from local rainfall, part of which is lost to evaporation, transpiration, and runoff.

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

Water-table contours indicate that under natural conditions, groundwater flows southeasterly toward Biscayne Bay. The hydraulic gradient of the aquifer 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 composed of limestone and dolomite. 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 below land surface [bls]), the Floridan Aquifer is of limited usefulness as a source of potable water in the study area.

1.4 REGIONAL SITE GEOLOGY AND HYDROGEOLOGY

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

The Biscayne Aquifer is one of the most transmissive aquifers in the world, and 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. These metals include, in descending order by concentration; calcium, aluminum, iron, magnesium, sodium, and potassium. The other TAL metals occur in trace concentrations, less than 50 milligrams per kilogram (mg/kg). It should be expected that as precipitation, infiltration, and recharge take 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). 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 at the site. The conceptual model that shallow groundwater is discharging to ditches provided sufficient detail to arrive at the remedial decision for Site OT-11/OU-2.

2.0 HISTORY AND ENFORCEMENT ACTIVITIES

2.1 OU-2/SITE OT-11 HISTORY

2.1.1 Past Site Usage

From 1977 to 1982, Site OT-11/OU-2 was used for the disposal of excess pesticides or pesticide rinsate, along with pesticide rinsates from equipment cleaning. These diluted materials were disposed by spraying or dumping them over an approximately 1 acre area shown on Figure 1-3, and then applying chlorine bleach and ammonia to accelerate the decomposition of the pesticide compounds. In principle, long-term exposure to ultraviolet light and soil microorganisms was expected to break down the pesticides and reduce the risk of contamination.

The storage, use, and disposal of pesticides at Homestead ARB has historically been the responsibility of the Entomology Shop. Insecticides have been used heavily for many years. The use of herbicides increased in the late 1970s, when control of the materials was transferred from the Buildings and Grounds Department to the Entomology Shop. Some of the pesticides known to have been used at Homestead ARB are listed in Table 2-1.

Waste pesticides are currently disposed of through the Defense Reutilization and Marketing Office (DRMO). Prior to 1977, when pesticide disposal began at Site OT-11/OU-2, pesticide rinsate materials were routinely discharged into the base sewage treatment plant. Empty drums and containers have been disposed of in an approved off-base facility since 1955; however, since 1976, the containers have been triple-rinsed prior to disposal, in accordance with standard regulatory disposal practices.

The northern area of the site served as an asphalt and rubble storage area on an intermittent basis. Asphalt debris collected from around the base was occasionally stored on Site OT-11/OU-2. The asphalt piles were often moved around during site maintenance but were generally located in the northern portion of the site. An asphalt pile was last reported to be near the eastern boundary of the site. The pile was approximately 50 feet long, 6 feet high, and 15 feet wide. The use of this site as an asphalt staging area has been discontinued and access restrictions have been implemented.

TABLE 2-1

PESTICIDES STORED AT HOMESTEAD ARB

Vaponite 2EC	chloropicrin
Wasp Freeze	SA-77, Cide Kick
Ficam W (bendiocarb)	Nalco-Trol
malathion 95%	Dal-e-rad
Cynthion 57%	Velpar
baygon strips	Hyvar X (bromacil)
baygon 1.5%	diquat
Dibrom (85% Naled)	Aquazine (simazine)
Dursban Granules 0.5% (chlopyrifos)	Balan
Dursban 4E	Banvel 720
Inspector PT 565	Pramitol 5PS
Knox-Out 2FM (Diazinon)	paraquat
baygon bait	Eptam 7-E
Precor 5E	Round-Up (glyphosphate)
Talon-G	Karmex (diuron)
Baytex	AATREX
d-Phenothrin (spray cans)	Promitol 25e
Nemacur	Asulox
Seven (carbaryl)	Dowpon (dalapon)
Keithane MF	Dithane M-45
Dowfume MC-2 (methyl bromide)	Fungo 50 (methyl thiophanate)
Phostoxin (aluminum phosphide)	Tersan 1991 (benomyl)

Note: Capitalization of the first letter indicates that the name is a registered trademark.

Source: IRP Phase I - Records Search (Engineering Science, 1983)

2.2 BASE ENFORCEMENT HISTORY

2.2.1 CERCLA Regulatory History

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) established a national program for responding to releases of hazardous substances into the environment. In anticipation of CERCLA, the Department of Defense (DOD) developed the Installation Restoration Program (IRP) for response actions for potential releases of toxic or hazardous substances at DOD facilities. Like the 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, the USEPA, and the Florida Department of Environmental Protection (FDEP). The FFA guides the remedial design/remedial action (RD/RA) process.

The purpose of the FFA was to establish a procedural framework and schedule for developing, implementing, and monitoring appropriate response actions at Homestead ARB in accordance with existing regulations. The FFA requires the submittal of several primary and secondary documents for each of the operable units at Homestead ARB. This ROD concludes all of the RI/FS requirements for Site OT-11/OU-2 and selects a remedy for Operable Unit No. 2.

As part of the RI/FS process, Homestead ARB has been actively involved in the Installation Restoration Program (IRP). From 1983 to 1992, 27 Potential Sources of Contamination (PSCs) were identified at Homestead ARB. Ten sites have been investigated in the Preliminary Assessment/Site Investigation (PA/SI) stage of CERCLA, with five sites warranting no further investigation and five sites requiring further investigation. One of the PSCs sites has been closed under the Resource Conservation and Recovery Act (RCRA) guidelines, and seven sites were investigated under the FDEP petroleum contaminated sites

criteria (Florida Administrative Code 62-770). Additionally, a RCRA Facility Investigation (RFI) has been conducted to evaluate numerous solid waste management units (SWMUs) identified during the RCRA Facility Assessment (RFA). A cleanup effort was initiated after Hurricane Andrew to prepare the base for realignment. Additional PSCs have been identified subsequent to 1992 as a result of investigations and/or remediation of the base. The following PSCs are currently in various stages of reporting under the CERCLA RI/FS guidelines:

PSC Name	Operable Unit No.
Fire Protection Training Area 2	1
Residual Pesticide Disposal Area	2
Oil Leakage Behind the Motor Pool	4
Electroplating Waste Disposal Area	5
Aircraft Washrack Area	6
Entomology Storage Area	7
Fire Protection Training Area 3	8
Boundary Canal	9
Landfill LF-12	10
Sewage Treatment Plant	11
Entomology Shop	12
Landfill SS-22	13
Drum Storage Area	14
Hazardous Storage Bldg.	15
Missile Site	16
Hanger 793	17
Construction Debris Landfill	18
Bldg. 208	19
Bldg. 618 Parking Lot	20
#32, Bldg. 619 Parking Lot	21
Bldg. 761/764	22
Bldg. 814	25
Bldg. 745	26
Bldg. 268 &268A	27
Bldg. 750	28
Bldg. 760	29

Operable Unit No. 3 PCB Spill, C.E. Storage Compound has been closed out with a No Further Action Record of Decision (ROD) in June 1994. Operable Units 1, 4, and 6 have been completed through the ROD stage, requiring various levels of remedial action/remedial design. Two solid waste management units, OU-23 and OU-24, have been closed out while three areas of concern, (AOC-1, AOC-3, and AOC-5) are in the preliminary assessment phase of investigations.

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 Facility 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 ARB ranged from a high of 72 to a low of 7 out of 100. Eight of the thirteen sites were determined to have a moderate-to-high contamination potential, and were recommended for additional monitoring. The remaining five sites, one of which was the Residual Pesticide Disposal Area, were determined to have a low potential for environmental contamination.

According to the IRP Phase I Report, although the wastes applied at the Residual Pesticide Disposal Site were not applied in a concentrated form on a localized area, the extremely permeable nature of the surface soils and underlying rock in the area made the site a potential source of groundwater contamination. However, a HARM score of 58 was received by Site OT-11/OU-2 (then Site P-3), which was described as "low" due to the waste's moderate hazard ranking. A No Further Action recommendation was made for Site OT-11/OU-2 in the Phase I report.

2.3.2 IRP Phase II - Confirmation/Quantification

An IRP Phase II study was performed by Science Applications International Corporation (SAIC), and was reported 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. During the Phase II study, additional investigations were performed at the eight sites recommended for monitoring in the Phase I report, as well as two of the other thirteen originally-identified sites. The Residual Pesticide Disposal Area was included in this investigation.

Six soil samples were collected at the Residual Pesticide Disposal Site and analyzed for pesticides. Five of the six samples were found to contain organochlorine pesticides (Table 2-2). These detections of organochorine pesticides were all at concentrations below the State of Florida Health-Based Soil Target Levels. The one sample (SL-13) that did not contain any pesticides was collected from outside of the disposal area. The pesticides detected were aldrin, 4,4'-DDD, 4,4'-DDT, dieldrin, and methoxychlor. These compounds were identified as having a high affinity for soil but an extremely low solubility in water. The compounds were also described as persistent, degrading very slowly in soils, and persisting almost indefinitely if they enter groundwater.

During the Phase II investigation, Entomology Shop personnel indicated that residual pesticide rinsates were not only sprayed on the site, as described in the Phase I report, but were also poured on the ground. Therefore, the possibility that the more mobile compounds may have entered the groundwater was considered. Additional concerns relative to the groundwater quality were introduced, due to the thin soil layer and shallow water table in the area. The recommendations for additional investigations at this site included the following: (1) install one monitoring well and collect groundwater samples for analysis of priority pollutant pesticides to determine if groundwater has been contaminated at the site; and (2) collect ten soil samples for pesticide analysis, to delineate the extent of contaminant migration.

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 site to date.

2.3.4 IRP Phase IV - Additional Investigations

The IRP Phase IV investigations consists 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

TABLE 2-2
ANALYTICAL RESULTS OF PHASE II SOIL SAMPLES COLLECTED IN 1986 AT SITE OT-11/OU-2
RESIDUAL PESTICIDE DISPOSAL AREA
Homestead Air Reserve Base, Florida

ANALYTE	LOCATION	SL-9	SL-10	SL-11	SL-12	SL-13	SL-14
PESTICIDES (ug/kg)							
Aldrin		<20	<20	<20	70	<20	<20
DDD		<20	80/80 1/	<20	<20	<20	<20
DDT		90	670/620	260	370	<20	30
Dieldrin		<20	<20	40	30	<20	<20
Endrin		<20	<20	<20	<20	<20	<20
Heptachlor		<20	<20	<20	<20	<20	<20
Heptachlor Expoxide		<20	<20	<20	<20	<20	<20
Lindane		<10	<10	<10	<10	<10	<10
Methoxychlor		<20	90/120	<200	90	<200	<200
Toxaphene		<10	<10	<10	<10	<10	<10
Diazinon		<20	<20	<20	<20	<20	<20
Malathion		<100	<100	<100	<100	<100	<100
Parathion		<20	<20	<20	<20	<20	<20
2,4-D		<60	<60	<60	<60	<60	<60
2,4,5-T		<60	<60	<60	<60	<60	<60
2,4,5-TP (silvex)		<60	<60	<60	<60	<60	<60
Sevin		<1000	<1000	<1000	<1000	<1000	<1000

EXPLANATION:

1/ Replicate sample.

Source: Geraghty & Miller, Inc. (G&M Project No. TF430.01)

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.

An IRP Phase IV-A investigation was performed at Site OT-11/OU-2 by Geraghty & Miller in 1988. The results of this investigation are included in the report entitled "Draft Remedial Investigation Report for the Building 207 Underground Storage Tank Area, Residual Pesticide Disposal Area, and the Electroplating Waste Disposal Area, Homestead Air Force Base, Florida".

Six soil borings were drilled to depths of approximately eight feet (ft) below land surface (bls). A soil sample was collected from the 0 to 2 ft bls depth interval in each soil boring and analyzed for organochlorine pesticides and chlorinated herbicides. Organochlorine pesticides were detected in three of the six samples collected (Table 2-3). These detections of organochorine pesticides were all at concentrations below the State of Florida Health-Based Soil Target Levels. Four organochlorine pesticides were detected: 4,4'-DDE, 4,4'-DDT, alpha-chlordane, and gamma-chlordane. No chlorinated herbicides were detected in any of the samples. The concentrations of organochlorine pesticides detected in soil samples during the 1988 investigation were an order of magnitude lower than those detected during the Phase II investigation.

Groundwater samples were also collected during the Phase IV-A investigation. Groundwater samples were collected from each of the six soil borings, with the exception of boring B-3 which caved in before a groundwater sample could be collected. The groundwater samples were also analyzed for organochlorine pesticides and chlorinated herbicides. None of the constituents analyzed for were detected in any of the samples (Table 2-4).

The Draft RI Report concluded that no organochlorine pesticides or chlorinated herbicides were detected in groundwater samples, and no chlorinated herbicides were detected in Phase II or Phase IV-A soil samples. The only contaminants detected were organochlorine pesticides in Phase II and Phase IV-A soil samples at concentrations below the State of Florida Health-Based Soil Target Levels. The lateral and vertical extent of contaminants were delineated over most of the area, with the vertical extent considered to be at the groundwater table at a depth of approximately 4 ft. The risk assessment utilized the highest "hot spot" concentrations which makes the risk conservatively high, the results of which

TABLE 2-3

ANALYTICAL RESULTS OF PHASE IV SOIL SAMPLES COLLECTED IN 1988 AT SITE OT-11/OU-2

RESIDUAL PESTICIDE DISPOSAL AREA

Homestead Air Reserve Base, Florida

CONSTITUENTS 1/ LOCATION	B-1	B-2	B-3	B-4	B-5	B-6
ORGANOCHLORINE PESTICIDES (ug/kg)						
4,4'-DDE	< 14	< 13	< 14	< 13	57	< 13
4,4'-DDT	< 14	< 13	< 14	50	< 14	< 13
Alpha-chlordane	< 71	41 J	< 70	8 J	14 J	< 66
Gamma-chlordane	< 71	50 J	< 70	21 J	25 J	< 66
CHLORINATED HERBICIDES (ug/kg)	BDL 2/	BDL	BDL	BDL	BDL	BDL

EXPLANATION:

1/ Constituents not detected in any samples are not shown.
2/ Below Instrument Detection Limit.
J Value is between level of quantitation and instrument detection limit.

Source: Geraghty & Miller, Inc. (G&M Project No. TF430.01)

TABLE 2-4
ANALYTICAL RESULTS OF PHASE IV GROUND-WATER SAMPLES COLLECTED IN 1988 AT SITE OT-11/OU-2
RESIDUAL PESTICIDE DISPOSAL AREA
Homestead Air Reserve Base, Florida

CONSTITUENTS 1/ LOCATION	B-1	B-2	B-3	B-4	B-5	B-6
ORGANOCHLORINE PESTICIDES (ug/kg)	BDL 2/	BDL	BDL	BDL	BDL	BDL
CHLORINATED HERBICIDES (ug/kg)	BDL	BDL	BDL	BDL	BDL	BDL

EXPLANATION:

1/ Constituents not detected in any samples are not shown.
2/ Below Instrument Detection Limit.

Source: Geraghty & Miller, Inc. (G&M Project No. TF430.01)

indicated that the site presented minimal potential hazards to public health or the environment; and no further action at the site was recommended. No Phase IV-B tasks have been performed for this site.

2.3.5 1991 Remedial Investigation of Site OT-11/OU-2

In 1991, a remedial investigation (RI) was conducted at Site OT-11/OU-2 by G&M to evaluate the current soil, surface water, and sediment quality with respect to the USEPA Target Compound List (TCL) and Target Analyte List (TAL) for VOCs, BNAs, pesticides, and metals. The 1991 RI included the collection of 19 surficial soil samples (0 to 1 foot below original land surface) and six surface water and sediment samples from the drainage ditches around the site. The 19 soil samples were collected around the central and southern rubble piles to investigate potential dumping of pesticide rinsates and runoff from the mounds.

2.3.6 1993 Remedial Investigation of Site OT-11/OU-2

In 1993, G&M performed additional RI assessment activities to further evaluate the soil, groundwater, surface water, and sediment quality with respect to the USEPA TCL/TAL for VOCs, BNAs, organochlorine (OC) pesticides/PCBs, and metals, utilizing EPA Contract Laboratory Program (CLP) protocols. These RI activities were conducted to fill data gaps from previous field investigations as well as evaluate any impacts as a result of Hurricane Andrew. Eighteen surficial soil samples (0 - 1 foot below original land surface) were collected from an expanded area around Site OT-11/OU-2, two groundwater samples were collected from the site's existing monitoring wells, and four surface water and sediment samples were collected from the drainage ditch which surrounds the site.

2.4 COMMUNITY PARTICIPATION HISTORY

The Remedial Investigation, Baseline Risk Assessment, Feasibility Study Reports, and the Proposed Plan (PP) for Homestead ARB Site OT-11/OU-2 were released to the public in July of 1994 and September of 1995, 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.

The public comment period was held from September 18, 1995 to November 3, 1995 as part of the community relations plan for Operable Unit No. 2. Additionally, a public meeting was held on Monday, September 18, 1995 at 7:00 PM at South Dade High School. A public notice was published on September 6, 1995 in the South Dade News Leader and on September 7, 1995 in the Miami Herald. At this meeting, the USAF, in coordination with USEPA Region IV, FDEP, and Dade County Environmental Resource Management (DERM), discuss the RI results, the Baseline Risk Assessment, the Feasibility Study, and the Proposed Plan. A response to the comments received during this period is included in the Responsiveness Summary, which is part of this ROD.

This record of decision document presents the selected remedial action for OU-2 at Homestead Air Reserve Base, chosen in accordance with CERCLA, as amended by SARA and, to the extent practicable, the NCP. The decision on the selected remedy for this site is base on the administrative record.

2.5 SCOPE AND ROLE OF RESPONSIVE ACTION

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

The U.S. Air Force, with concurrence from the state of Florida and the USEPA, has elected to define OU-2 as the Residual Pesticide Disposal Area. The remedial actions planned at each of the OUs at Homestead ARB are, to the extent practicable, independent of each other. This response action addresses the contamination identified at OU-2. The purpose of this response is to remove the soil contamination from the site, thereby eliminating the current and potential future exposure pathways and the potential for migration to groundwater and the Boundary Canal. This alternative offers a permanent solution for the site because the contaminated soils are removed, eliminating risk to base personnel and potential future residents.

2.6 SUMMARY OF SITE CHARACTERISTICS

From 1977 to 1982, Site OT-11 was used for the disposal of excess or pesticide rinsate, along with pesticide rinsates from equipment cleaning. The materials were disposed by spraying or

dumping and then applying chlorine bleach and ammonia to accelerate the decomposition of the pesticide compounds. In principle, long-term exposure to ultraviolet light and soil microorganisms was expected to break down the pesticides and reduce the risk of contamination.

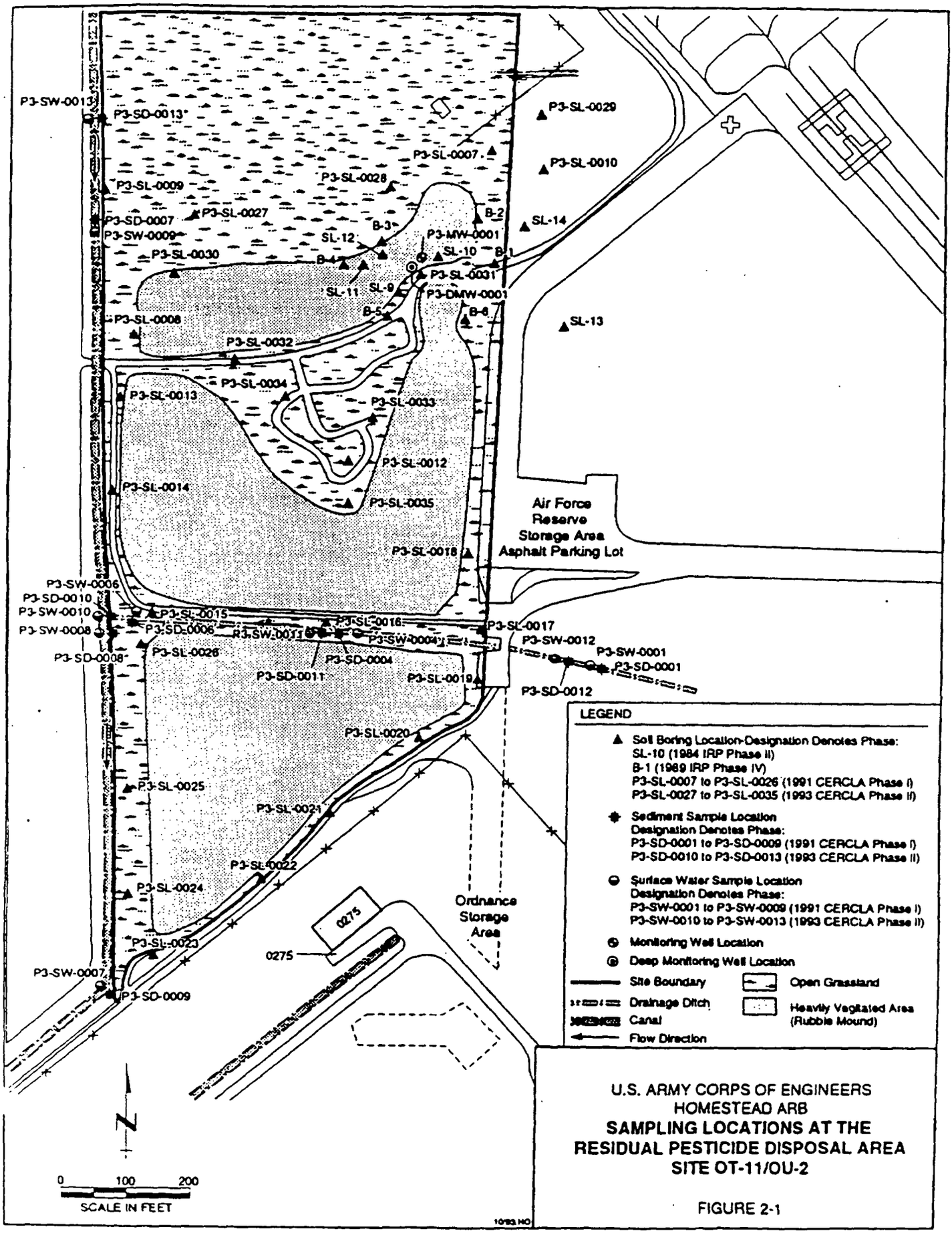
The storage, use, and disposal of pesticides at Homestead ARB has historically been the responsibility of the Entomology Shop. Insecticides have been used heavily for many years. The use of herbicides increased in the late 1970s, when control of the materials was transferred from the Buildings and Grounds Department to the Entomology Shop. Waste pesticides are currently disposed of through the Defense Reutilization and Marketing Office (DRMO).

The northern area of the site served as an asphalt and rubble storage area on an intermittent basis. Asphalt debris collected from around the base was occasionally stored on Site OT-11/OU-2. The asphalt piles were often moved around during site maintenance but were generally located in the northern portion of the site. An asphalt pile was last reported to be near the eastern boundary of the site. The pile was approximately 50 feet long, 6 feet high, and 15 feet wide. The use of this site as an asphalt staging area has been discontinued and access restrictions have been implemented.

The following subsections summarize the nature and extent of the contamination identified at Site OT-11/OU-2 during investigations conducted from 1984 through 1993. The investigations in 1991 and 1993 were conducted in accordance with the approved Facility Remedial Investigation Work Plan (G&M), 1991.

2.6.1 Nature and Extent of Contamination

Four field investigations have been performed at Site OT-11/OU-2. They were performed in 1984, 1988, 1991, and 1993. Soil samples were collected during all four investigations. Groundwater samples were collected during the 1988 and 1993 investigations. Sediments and surface water samples were collected in 1991 and 1993. Figure 2-1 summarizes the various sampling locations. This section presents the results of the investigations for the affected media. All reported data meet data quality objectives as stated in the remedial investigation report (G&M, 1994a).



U.S. ARMY CORPS OF ENGINEERS
HOMESTEAD ARB

SAMPLING LOCATIONS AT THE RESIDUAL PESTICIDE DISPOSAL AREA SITE OT-11/OU-2

FIGURE 2-1

2.6.1.1 Soil Contamination

Six shallow soil/weathered-rock samples were collected at Site OT-11/OU-2 in 1984 during the IRP Phase II investigation and analyzed for chlorinated pesticides. Another six shallow soil/weathered-rock samples (0 to 2 feet below ground surface [bgs]) were collected at Site OT-11/OU-2 in 1988 during the IRP Phase IV investigation. These samples were analyzed for chlorinated pesticides and chlorinated herbicides. A total of 19 shallow soil/weathered-rock samples (0 to 1 foot bgs) were collected from an expanded area around Site OT-11/OU-2 in 1991. These samples were taken around the central and southern rubble piles and were analyzed for chlorinated pesticides. A total of 18 shallow soil/weathered-rock samples were collected from the 0-1 and 1-2 ft bgs interval from nine soil boring locations at Site OT-11/OU-2 in 1993. These 18 samples were analyzed for target compound list (TCL) volatile organic compounds (VOCs), TCL base/neutral-acid extractable organic compounds (BNAs), chlorinated pesticides, and target analyte list (TAL) metals.

Detailed concentrations of analytes for the 1991 and 1993 field investigations are summarized in Tables 2-5 and 2-6. Results of the soil analyses are discussed below for each analytical group (i.e., VOCs, BNAs, etc.).

Volatile Organic Compounds. VOCs were analyzed only in the soil/weathered-rock samples collected during the 1993 field investigation. Analytical results are presented in Table 2-6.

Acetone was the only VOC detected above the practical quantitation limit (PQL) (95% confidence limit that the concentration reported is the actual concentration) in surficial and subsurface-soil/weathered-rock samples, in concentrations ranging from 67 ug/kg dry weight (dw) to 29,000 ug/kg dw, and was recognized as a laboratory artifact. Additionally, acetone concentrations detected may be the result of the oxidation of isopropyl alcohol, which was used during decontamination procedures. Seven other VOCs were detected above the method detection limit but below the PQL, including 1,1-dichloroethene, carbon disulfide, chloroform, 2-butanone, bromodichloromethane, dibromochloromethane, and bromoform as shown on Figure 2-2. Chloroform and 2-butanone are common laboratory artifacts. Potential sources for bromoform, chloroform, bromodichloromethane, and dibromochloromethane could be natural or from treated water.

TAB 5

CONSTITUENTS DETECTED IN SOIL/WEATHERED ROCK SAMPLES COLLECTED IN 1991 AT SITE OT-11/OU-2
RESIDUAL PESTICIDE DISPOSAL AREA
HOMESTEAD AIR RESERVE BASE, FLORIDA

Analyte	Sample Identification / Sampling Date	P3-SL-0007 7/26/91	P3-SL-0008 7/26/91	P3-SL-0009 7/26/91	P3-SL-0010 7/26/91	P3-SL-0012 7/26/91	P3-SL-0013 7/25/91	P3-SL-9013[b] 7/25/91	P3-SL-0014 7/25/91	P3-SL-0015 7/25/91
ORGANOCHLORINE PESTICIDES (µg/kg dw)										
44'-DDD		< 5.0	< 5.1	< 4.8	< 4.5	9.6 Ja	< 4.7	< 5.4	< 4.6	< 4.8
44'-DDE		< 5.0	1.2 J	< 4.8	< 4.5	< 24	< 4.7	1.4 Ja	< 4.6	< 4.8
Dieldrin		< 5.0	< 5.1	< 4.8	< 4.5	10 Ja	< 4.7	< 5.4	< 4.6	< 4.8

Analyte	Sample Identification / Sampling Date	P3-SL-0016 7/25/91	P3-SL-0017 7/25/91	P3-SL-0018 7/25/91	P3-SL-0019 7/25/91	P3-SL-0020 7/25/91	P3-SL-0021 7/25/91	P3-SL-0022 7/25/91	P3-SL-0023 7/25/91	P3-SL-0024 7/25/91
ORGANOCHLORINE PESTICIDES (µg/kg dw)										
44'-DDD		< 4.7	< 4.7	< 5.1	< 4.5	< 4.7	< 22	< 4.6	< 5.8	< 5.0
44'-DDE		3.1 J	< 4.7	< 5.1	< 4.5	< 4.7	< 22	< 4.6	< 5.8	< 5.0
Dieldrin		< 4.7	< 4.7	< 5.1	< 4.5	< 4.7	< 22	< 4.6	< 5.8	< 5.0
Endosulfan II		< 12	< 12	< 13	< 11	< 12	19 Ja	< 12	< 15	< 13

Analyte	Sample Identification / Sampling Date	P3-SL-0025 7/25/91	P3-SL-0026 7/26/91
ORGANOCHLORINE PESTICIDES (µg/kg dw)			
44'-DDD		< 4.7	< 6.3
44'-DDE		< 4.7	< 6.3
Dieldrin		< 4.7	< 6.3

a Result has been classified as qualitative due to error(s) in associated quality control analyses.
b Duplicate analysis for P3-SL-0013.
µg/kg dw micrograms per kilogram dry weight.
< Analyte was not detected. The values given are equal to the practical quantitation limits requested in the RI Work Plan and may vary among samples due to differences in water content, mass analyzed, and dilution factors.
J Value is greater than instrument detection limit but less than practical quantitation limit.

From: Geraghty & [redacted], 1991a

T[redacted]

CONSTITUENTS DETECTED IN SOIL/WEATHERED ROCK SAMPLES COLLECTED IN 1993
AT SITE OT-11/OU-2, RESIDUAL PESTICIDE DISPOSAL AREA
HOMESTEAD AIR RESERVE BASE, FLORIDA
(Page 1 of 5)

Parameter	Boring I.D. Sampling Interval	P3-SL-0027-1 0-1 ft bgs		P3-SL-0027-2 1-2 ft bgs		P3-SL-0028-1 0-1 ft bgs		P3-SL-0028-2 1-2 ft bgs		P3-SL-0029-1 0-1 ft bgs		P3-SL-0029-2 1-2 ft bgs		P3-SL-0030-1 0-1 ft bgs	
Volatile Organic Compounds (µg/kg dw)															
Methylene Chloride		< 1,600		< 14		(220)	UJ+	< 12		(320)	UJ+	< 12		< 1,500	
Acetone		2,100		160	J	5,100	J+	< 12	UJ	19,000	J+	< 12	UJ	14,000	
Carbon Disulfide		< 1,600		< 14		< 1,500	UJ+	< 12		< 1,600	UJ+	< 12		< 1,500	
1,1-Dichloroethene		< 1,600		< 14		< 1,500	UJ+	< 12		< 1,600	UJ+	< 12		< 1,500	
1,1-Dichloroethane		< 1,600		< 14		< 1,500	UJ+	< 12		< 1,600	UJ+	< 12		< 1,500	
Chloroform		< 1,600		< 14		< 1,500	UJ+	< 12		< 1,600	UJ+	< 12		(200)	
2-Butanone (MEK)		(1,300)	U	< 14	UJ	1,200	J+	< 12	UJ	1,200	J+	< 12	UJ	(1,200)	
Bromodichloromethane		< 1,600		< 14		< 1,500	UJ+	< 12		< 1,600	UJ+	< 12		(250)	
Dibromochloromethane		< 1,600		< 14		< 1,500	UJ+	< 12		< 1,600	UJ+	< 12		< 1,500	
Bromoform		< 1,600		< 14		< 1,500	UJ+	< 12		< 1,600	UJ+	(4)	U	< 1,500	
Chlorobenzene		< 1,600		(5)	U	< 1,500	UJ+	(4)	U	< 1,600	UJ+	< 12		< 1,500	
Base/Neutral and Acid Extractable Compounds (µg/kg dw)															
Naphthalene		(38)		< 460		< 390		< 390		< 410		< 390		(390)	
2-Methylnaphthalene		(24)		< 460		< 390		< 390		< 410		< 390		(210)	
Acenaphthylene		< 420		< 460		< 390		< 390		< 410		< 390		(68)	
Acenaphthene		(62)		< 460		(47)		< 390		< 410		< 390		500	
Dibenzofuran		(65)		< 460		(33)		< 390		< 410		< 390		530	
Fluorene		(92)		< 460		(61)		< 390		< 410		< 390		560	
N-Nitrosodiphenylamine/ Diphenylamine		< 420		< 460		< 390		< 390		< 410		< 390		< 400	
Phenanthrene		790		< 460		1,200		(190)		(210)		< 390		8,900	*
Anthracene		(190)		< 460		(330)		(41)		(25)		< 390		1,500	
Carbazole		(91)		< 460		(260)		< 390		(25)		< 390		880	
Di-n-butylphthalate		< 420		< 460		< 390		< 390		< 410		< 390		< 400	
Fluoranthene		1,100		(12)		1,800		400		510		< 390		13,000	*
Pyrene		900		(11)		1,200		(350)		(340)		< 390		12,000	J+
Butylbenzylphthalate		< 420		(14)		(30)		< 390		(36)		< 390		< 400	UJ
Benzo(a)anthracene		580		< 460		810		(190)		(200)		< 390		8,400	J+
Chrysene		590		< 460		820		(230)		(270)		< 390		7,700	J+
bis(2-Ethylhexyl)phthalate		< 420		< 460		< 390		< 390		< 410		< 390		< 400	UJ
Benzo(b)fluoranthene		690		< 460		890		(240)		(290)		(16)		14,000	*
Benzo(k)fluoranthene		(230)		< 460		(320)		(240)		(110)		(7)		2,300	J
Benzo(a)pyrene		530		< 460		630		(220)		(200)		< 390		10,000	J+
Indeno(1,2,3-cd)pyrene		(410)		< 460		460		(52)		(160)		< 390		6,300	J+
Dibenzo(a,h)anthracene		(99)		< 460		(130)		(23)		< 410		< 390		940	J
Benzo(g,h,i)perylene		(360)		< 460		400		(110)		(140)		< 390		6,200	J
Metals (mg/kg dw)															
Aluminum		1,660		339		2,420		1,030		3,750		3,310		2,640	
Antimony		< 12.6		< 13.9		< 11.9		< 12.0		< 12.5		< 11.9		< 12.1	
Barium		< 2.5		< 5.6		< 2.4		< 4.8		(3.3)		< 2.4		(29.7)	J
Cadmium		< 1.3		< 1.4		< 1.2		< 1.2		< 1.2		< 1.2		1.5	
Calcium		321,000		311,000		346,000		350,000		248,000		306,000		285,000	
Chromium		10.9		3.1		9.7		7.8		15.4		9.8		21.1	
Copper		7.0		< 7.0		7.2		4.0		10.1		< 5.9		29.4	
Iron		1,010		126		1,500		630		2,380		2,090		4,520	J
Magnesium		(1,160)		(951)		(1,110)		(1,030)		(904)		(1,020)		1,240	
Manganese		30.2		8.0		53.7		18.7		78.2		40.2		111	J
Silver		< 2.5		< 2.8		< 2.4		< 2.4		< 2.5		< 2.4		11.9	

TABLE 4-6

CONSTITUENTS DETECTED IN SOIL/WEATHERED ROCK SAMPLES COLLECTED IN 1993
AT SITE OT-11/OU-2, RESIDUAL PESTICIDE DISPOSAL AREA
HOMESTEAD AIR RESERVE BASE, FLORIDA
(Page 2 of 5)

Parameter	Boring I.D. / Sampling Interval	P3-SL-0027-1 0-1 ft bgs		P3-SL-0027-2 1-2 ft bgs		P3-SL-0028-1 0-1 ft bgs		P3-SL-0028-2 1-2 ft bgs		P3-SL-0029-1 0-1 ft bgs		P3-SL-0029-2 1-2 ft bgs		P3-SL-0030-1 0-1 ft bgs	
Sodium		(540)	J	(815)	J	(502)	J	(632)	J	(342)	J	(379)	J	(369)	
Vanadium		(3.5)	U	< 2.8		(5.0)		(2.9)		(6.3)		(5.6)		(6.6)	
Zinc		14.7	J	< 5.6		77	J	8.9	J	9.5	J	4.7	J	81.4	
Arsenic		< 2.5	UJ	< 2.8		6.5		5.7		4.1		< 2.4	UJ	11.7	J
Lead		7.9		< 0.84		239.0		627.0		29.7		5.6		86.8	
Mercury		< 0.06		< 0.07		0.05		< 0.06		0.06		< 0.05		0.39	
Organochlorine Pesticides/PCBs (µg/kg dw)															
Heptachlor epoxide		< 2.2		< 2.4		< 2		< 2		< 2.1		< 2	UJ	24	J
4,4'-DDE		5.3		< 4.6		7.1		< 3.9		< 4.1		< 2	UJ	< 40	
4,4'-DDT		14		< 4.6		< 3.9		< 3.9		< 4.1		< 2	UJ	< 40	
alpha-Chlordane		< 2.2		< 2.4		2.4		< 2		< 2.1		< 2	UJ	< 20	
gamma-Chlordane		< 2.2		< 2.4		< 2		< 2		< 2.1		< 2	UJ	< 20	

Parameter	Boring I.D. / Sampling Interval	P3-SL-0030-2 1-2 ft bgs		P3-SL-0031-1 0-1 ft bgs		P3-SL-0031-2 1-2 ft bgs		P3-SL-9031-1 0-1 ft bgs		P3-SL-0032-1 0-1 ft bgs		P3-SL-0032-2 1-2 ft bgs		P3-SL-0033-1 0-1 ft bgs	
Volatile Organic Compounds (µg/kg dw)															
Methylene Chloride		< 1,600		< 11	UJ	< 12		< 12		< 13		< 13		< 3,400	
Acetone		3,700		1,100	a	3,300	Ja	1,400	a	< 13	UJ	230	J	29,000	
Carbon Disulfide		< 1,600		< 11	UJ	< 12		< 12		< 13		< 13		< 3,400	
1,1-Dichloroethene		(230)		< 11	UJ	< 12		< 12		< 13		< 13		< 3,400	
1,1-Dichloroethane		< 1,600		< 11	UJ	< 12		< 12		< 13		< 13		< 3,400	
Chloroform		(340)		< 11	UJ	< 12		< 12		< 13		< 13		(680)	
2-Butanone (MEK)		< 1,600		< 11	UJ	< 12	UJ	< 12	UJ	< 13	UJ	< 13	UJ	< 3,400	
Bromodichloromethane		(320)		< 11	UJ	< 12		< 12		< 13		< 13		(630)	
Dibromochloromethane		(450)		< 11	UJ	< 12		< 12		< 13		< 13		(680)	
Bromoform		(180)		< 11	UJ	< 12		< 12		< 13		< 13		< 3,400	
Chlorobenzene		< 1,600		< 11	UJ	(4)	U	< 12		< 13		(4)	U	< 3,400	
Base/Neutral and Acid Extractable Compounds (µg/kg dw)															
Naphthalene		(28)		< 380		< 410		< 380		< 420		< 420		< 450	
2-Methylnaphthalene		(17)		< 380		< 410		< 380		< 420		< 420		< 450	
Acenaphthylene		(9)		< 380		< 410		< 380		< 420		< 420		< 450	
Acenaphthene		(36)		< 380		< 410		< 380		< 420		< 420		< 450	
Dibenzofuran		(42)		(4)		< 410		< 380		< 420		< 420		< 450	
Fluorene		(43)		< 380		< 410		< 380		< 420		< 420		< 450	
N-Nitrosodiphenylamine/ Diphenylamine		< 420		< 380		< 410		(11)		< 420		< 420		< 450	
Phenanthrene		440		(100)		(130)		(100)		< 420		< 420		< 450	
Anthracene		(110)		(26)		(36)		(20)		< 420		< 420		< 450	
Carbazole		(66)		(25)		(23)		(20)		< 420		< 420		< 450	UJ
Di-n-butylphthalate		< 420		< 380		< 410		< 380		< 420		< 420		450	
Fluoranthene		750		(230)		(340)		(250)		(26)		(10)		< 450	
Pyrene		720		(200)		(320)		(240)		(26)		(11)		< 450	
Butylbenzylphthalate		(34)	U	(21)	U	(23)	U	(30)	U	(24)	U	(30)	U	(17)	U
Benzo(a)anthracene		(410)		(130)		(170)		(130)		< 420		< 420		< 450	
Chrysene		450		(150)		(190)		(150)		(21)		< 420		< 450	

CONSTITUENTS DETECTED IN SOIL/WEATHERED ROCK SAMPLES COLLECTED IN 1993
AT SITE OT-11/OU-2, RESIDUAL PESTICIDE DISPOSAL AREA
HOMESTEAD AIR RESERVE BASE, FLORIDA

Parameter / Boring I.D. / Sampling Interval	P3-SL-0030-2 1-2 ft bgs	P3-SL-0031-1 0-1 ft bgs	P3-SL-0031-2 1-2 ft bgs	P3-SL-9031-1 0-1 ft bgs	P3-SL-0032-1 0-1 ft bgs	P3-SL-0032-2 1-2 ft bgs	P3-SL-0033-1 0-1 ft bgs
bis(2-Ethylhexyl)phthalate	< 420	< 380	< 410	< 380	(14) U	(20) U	< 450
Benzo(b)fluoranthene	760	(230)	(250)	(220)	(34)	< 420	< 450
Benzo(k)fluoranthene	(260)	(87)	(94)	(69)	(14)	< 420	< 450
Benzo(a)pyrene	480	(150)	(150)	(120)	(20)	< 420	< 450
Indeno(1,2,3-cd)pyrene	(290)	(92)	(97)	(95)	< 420	< 420	< 450
Dibenzo(a,h)anthracene	(77)	< 380	< 410	< 380	< 420	< 420	< 450
Benzo(g,h,i)perylene	(270)	(85)	(81)	(92)	< 420	< 420	< 450
Metals (mg/kg dw)							
Aluminum	2,870	2,910	2,720	2,640	498	882	13,200
Antimony	< 12.8	58.1	< 12.5	47.5	< 12.6	< 12.7	< 13.5
Barium	(23.5) J	< 2.3	5 J	< 2.3	< 12.6	< 12.7	(3.5) J
Cadmium	< 1.3	< 1.2	< 1.2	< 1.2	< 1.3	< 1.3	< 1.4
Calcium	312,000	351,000	489,000	360,000	381,000	322,000	299,000
Chromium	16.3	10.8	10.3	14.8	6.6	5.2	39.9
Copper	22.1	9.3	< 6.2	19.4	< 6.3	< 6.3	< 6.8
Iron	2,120 J	1,900 J	1,510 J	1,780 J	291 J	492 J	9,120 J
Magnesium	(1,270)	1,220	(1,190)	(1,070)	(1040)	908	1,550
Manganese	85.8 J	36.6 J	23.6 J	40.3 J	12.1 J	10.1 J	71.8 J
Silver	12.6	< 2.3	< 2.5	< 2.3	< 2.5	< 2.5	< 2.7
Sodium	(407)	(437)	(462)	(443)	(641)	(467)	(463)
Vanadium	(6.7)	(5.5)	(4.7)	(4.7)	(2.7)	(2.8)	20.3
Zinc	58.2	16.5	5.9	22.2	< 5.0	< 5.1	< 5.4
Arsenic	9.6 J	< 2.3 UJ	< 2.5 UJ	< 2.3 UJ	< 2.5 UJ	< 2.5 UJ	< 2.7 UJ
Lead	48.4	6,830	59.0	19,600	1.8	0.9	7.6
Mercury	0.45	< 0.05	< 0.06	< 0.05	< 0.06	< 0.05	< 0.08
Organochlorine Pesticides/PCBs (µg/kg dw)							
Heptachlor epoxide	< 11 UJ	< 2	< 2.1	< 2	< 2.2	< 2.2	< 2.3
4,4'-DDE	< 21 UJ	< 3.9	< 4.1	< 3.8	< 4.2	< 4.2	< 4.5
4,4'-DDT	< 21 UJ	< 3.9	< 4.1	< 3.8	< 4.2	< 4.2	< 4.5
alpha-Chlordane	< 11 UJ	< 2	< 2.1	< 2	< 2.2	< 2.2	< 2.3
gamma-Chlordane	< 11 UJ	< 2	< 2.1	< 2	< 2.2	< 2.2	< 2.3

Parameter / Boring I.D. / Sampling Interval	P3-SL-0033-2 1-2 ft bgs	P3-SL-0034-1 0-1 ft bgs	2P3-SL-0034-2 1-2 ft bgs	P3-SL-0035-1 0-1 ft bgs	P3-SL-0035-2 1-2 ft bgs
Volatile Organic Compounds (µg/kg dw)					
Methylene Chloride	< 13	< 1,700	< 65	< 12	< 14
Acetone	< 13 UJ	2,400	250 J	67 UJ	< 14 UJ
Carbon Disulfide	< 13	< 1,700	< 65	(3)	(11)
1,1-Dichloroethene	< 13	(260)	< 65	< 12	< 14
1,1-Dichloroethane	< 13	< 1,700	< 65	< 12	< 14
Chloroform	< 13	(300)	< 65	< 12	< 14
2-Butanone (MEK)	< 13 UJ	(1,300)	< 65 UJ	< 12 UJ	< 14 UJ
Bromodichloromethane	< 13	(290)	< 65	< 12	< 14

TABLE 2-6

CONSTITUENTS DETECTED IN SOIL/WEATHERED ROCK SAMPLES COLLECTED IN 1993
AT SITE OT-11/OU-2, RESIDUAL PESTICIDE DISPOSAL AREA
HOMESTEAD AIR RESERVE BASE, FLORIDA
(Page 4 of 5)

Parameter	Boring I.D. / Sampling Interval	P3-SL-0033-2 1-2 ft bgs		P3-SL-0034-1 0-1 ft bgs		2P3-SL-0034-2 1-2 ft bgs		P3-SL-0035-1 0-1 ft bgs		P3-SL-0035-2 1-2 ft bgs	
Dibromochloromethane		< 13		(290)		< 65		< 12		< 14	
Bromoform		< 13		< 1,700		< 65		< 12		< 14	
Chlorobenzene		< 13		< 1,700		< 65		< 12		< 14	
Base/Neutral and Acid Extractable Compounds (µg/kg dw)											
Naphthalene		< 420		< 450		< 430	a	(11)		< 450	
2-Methylnaphthalene		< 420		< 450		< 430	a	< 400		< 450	
Acenaphthylene		< 420		< 450		< 430	a	(10)		< 450	
Acenaphthene		< 420		< 450		< 430	a	(13)		< 450	
Dibenzofuran		< 420		< 450		< 430	a	< 400		< 450	
Fluorene		< 420		< 450		< 430	a	(9)		< 450	
N-Nitrosodiphenylamine/ Diphenylamine		< 420		< 450		< 430	a	< 400		< 450	
Phenanthrene		< 420		(13)		< 430	a	(250)		(12)	
Anthracene		< 420		< 450		< 430	a	(52)		< 450	
Carbazole		< 420	UJ	< 450	UJ	< 430	a	(59)		< 450	UJ
Di-n-butylphthalate		< 420		< 450		< 430	a	< 400		(8)	U
Fluoranthene		< 420		(38)		< 430	a	810		(41)	
Pyrene		< 420		(45)		< 430	a	840		(45)	
Butylbenzylphthalate		(16)	U	(26)	U	< 430	a	(32)	U	(23)	U
Benzo(a)anthracene		< 420		< 450		< 430	a	(360)		< 450	
Chrysene		< 420		(25)		< 430	a	460		(27)	
bis(2-Ethylhexyl)phthalate		< 420		< 450		(7)	Ua	(260)	UJ	< 450	
Benzo(b)fluoranthene		< 420		(40)		< 430	a	660		(44)	
Benzo(k)fluoranthene		< 420		(13)		< 430	a	(230)		(18)	
Benzo(a)pyrene		< 420		(20)		< 430	a	(360)		(24)	
Indeno(1,2,3-cd)pyrene		< 420		< 450		< 430	a	(240)		< 450	
Dibenzo(a,h)anthracene		< 420		< 450		< 430	a	< 400		< 450	
Benzo(g,h,i)perylene		< 420		< 450		< 430	a	(230)		< 450	
Metals (mg/kg dw)											
Aluminum		157		3,120		718		699		810	
Antimony		< 12.9		< 13.7		< 12.9		< 12		< 13.7	
Barium		< 5.1		< 5.5		< 12.9		< 4.8		< 5.5	
Cadmium		< 1.3		< 1.4		< 1.3		1.7		< 1.4	
Calcium		337,000		329,000		361,000		341,000		345,000	
Chromium		2.8		11.8		4.8		11.2		4.5	
Copper		< 6.4		< 6.9		< 6.5		< 6.0		< 6.8	
Iron		81.4	J	2,180	J	462	J	1,360	J	454	J
Magnesium		(817)		(1,100)		(1010)		1,370		(1,260)	
Manganese		4.6	J	29.8	J	8.7	J	22.2	J	11.5	J
Silver		< 2.6		< 2.7		< 2.6		< 2.4		< 2.7	
Sodium		(677)		(349)		(346)		(474)		(714)	
Vanadium		< 2.6		(6.2)		(2.7)		(3.1)		< 2.7	
Zinc		< 5.1		< 5.5		< 5.2		23.3		< 5.5	
Arsenic		< 2.6	UJ	< 2.7	UJ	< 2.6	UJ	< 2.4	UJ	< 2.7	UJ
Lead		< 0.77		15.4		0.97		51.0		1.3	
Mercury		< 0.05		< 0.06		< 0.06		< 0.06		< 0.06	
Organochlorine Pesticides/PCBs (µg/kg dw)											
Heptachlor epoxide		< 2.2		< 2.3		< 2.2		< 2		< 23	

TABLE 2-6

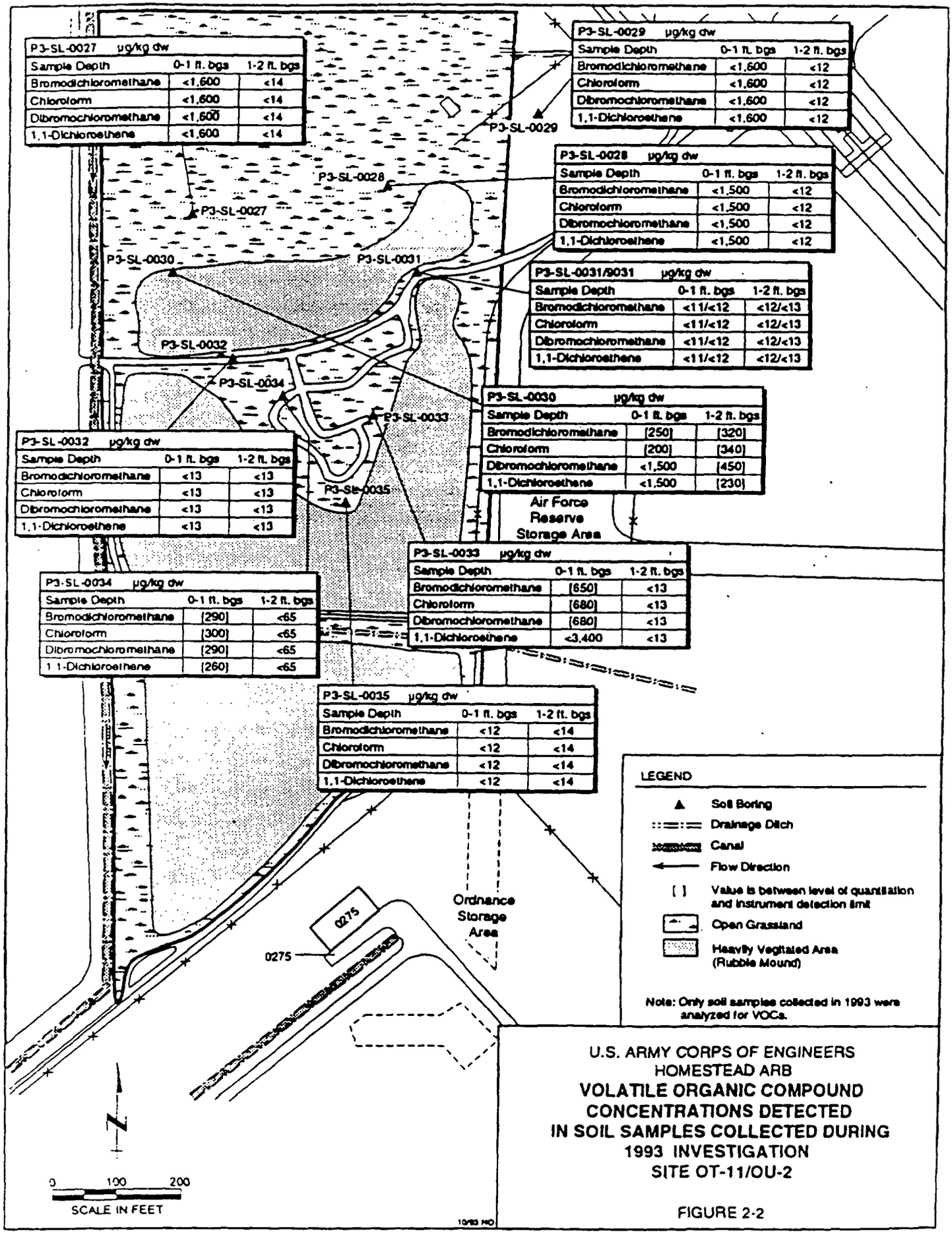
CONSTITUENTS DETECTED IN SOIL/WEATHERED ROCK SAMPLES COLLECTED IN 1993
AT SITE OT-11/OU-2, RESIDUAL PESTICIDE DISPOSAL AREA
HOMESTEAD AIR RESERVE BASE, FLORIDA
(Page 5 of 5)

Parameter	Boring I.D. / Sampling Interval	P3-SL-0033-2 1-2 ft bgs		P3-SL-0034-1 0-1 ft bgs		2P3-SL-0034-2 1-2 ft bgs		P3-SL-0035-1 0-1 ft bgs		P3-SL-0035-2 1-2 ft bgs	
4,4'-DDE		<	4.2	<	4.5	<	4.3	5.2		<	4.5
4,4'-DDT		<	4.2	<	4.5	<	4.3	15	J	<	4.5
alpha-Chlordane		<	2.2	<	2.3	<	2.2	< 2		<	2.3
gamma-Chlordane		<	2.2	<	2.3	<	2.2	3.3	J	<	2.3

Notes:

a	Result from reanalysis of sample.
µg/kg dw	micrograms per kilogram dry weight
mg/kg dw	milligrams per kilogram dry weight
<	Analyte was not detected at or above the indicated concentration. Values may vary among samples due to difference in water content, mass analyzed, and dilution factors.
()	Result is greater than the instrument detection limit by less than the practical quantitation limit.
J	Positive result has been classified as qualitative.
UJ	Analyte was not detected and has been classified as qualitative.
U	Result has been classified as undetected.
[ ]	Concentration above average Homestead AFB background concentration (Table 2-7).

From: Geraghty & Miller, Inc., 1993a



U.S. ARMY CORPS OF ENGINEERS
HOMESTEAD ARB

VOLATILE ORGANIC COMPOUND CONCENTRATIONS DETECTED IN SOIL SAMPLES COLLECTED DURING 1993 INVESTIGATION SITE OT-11/OU-2

FIGURE 2-2

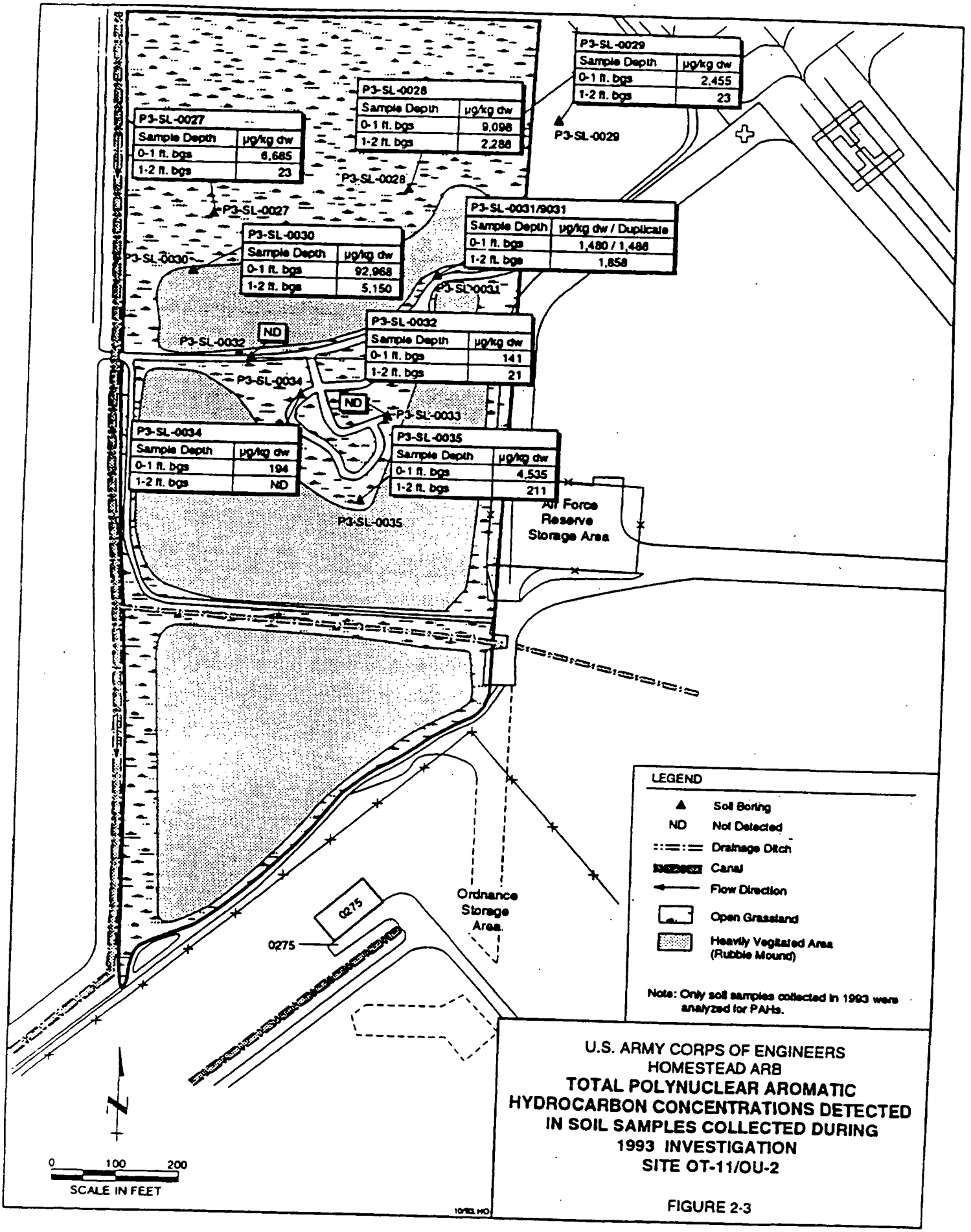
Base/Neutral and Acid Extractable Compounds. BNAs were analyzed only in the soil/weathered-rock samples collected during the 1993 field investigation. Analytical results are presented in Table 2-6.

A total of 21 BNAs (mainly polycyclic aromatic hydrocarbons [PAHs]) were detected in the soil samples from Site OT-11/OU-2. Benzo(a)pyrene was detected in concentrations exceeding the State of Florida Health-Based Soil Target Levels in soil samples P3-SL-0027-1, P3-SL-0028-1, and P3-SL-0030-1. Soil sample P3-SL-0031-1 also had detections of Benzo(a)anthracene, Benzo(b)fluoranthene, and Dibenzo(a,h)anthracene at concentrations exceeding the State of Florida Health-Based Soil Target Levels. In the surficial (0 to 1 foot bgs) soil samples, total PAH concentrations ranged from 141 ug/kg dw (P3-SL-0032-1) to 92,968 ug/kg dw (P3-SL-0030-1) as shown in Figure 2-3. The samples with the highest concentrations of total PAHs (surficial samples P3-SL-0027-1, P3-SL-0028-1, and P3-SL-0030-1) were collected from the original land surface at approximately 4 to 5 feet below the overlying fill material. These concentrations of total PAHs may be the result of the asphalt debris (a hydrocarbon material which contains PAHs) encountered in the fill material. It is recommended that asphalt and other construction debris not be stored at this site in the future.

Total PAH concentrations were lower in the subsurface (1 to 2 feet bgs) soil/weathered rock samples. Total PAH concentrations ranged from below the detection limit (P3-SL-0034-2 and P3-SL-0033-2) to 5,150 ug/kg dw (P3-SL-0030-2). Most of the concentrations detected were below Florida Administrative Code (FAC) Chapter 62-775 Clean Soil Standard for total PAHs of 1,000 ug/kg dw. The lower total PAH concentrations detected in the subsurface soil/rock samples may result from less mixing with the asphalt material from the overlying fill material.

Generally, concentrations of acenaphthylene, acenaphthene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-c,d)pyrene, naphthalene, methylnaphthalene, phenanthrene, and pyrene detected in the soil/weathered rock samples were within the range of Homestead ARB background concentrations (Table 2-7) for surficial soil/weathered rock samples. The PAH concentrations in three samples (P3-SL-0030-1, P3-SL-0028-1, and P3-SL-0027-1), however, exceeded those average background concentrations for surficial samples.

Several non-PAH BNA compounds were also detected in the surficial and subsurface soil/weathered rock samples collected at Site OT-11/OU-2. The phthalic acid ester (PAE)


P3-SL-0027
Sample Depth | µg/kg dw
0-1 ft. bgs | 6,685
1-2 ft. bgs | 23
P3-SL-0028
Sample Depth | µg/kg dw
0-1 ft. bgs | 9,096
1-2 ft. bgs | 2,288
P3-SL-0029
Sample Depth | µg/kg dw
0-1 ft. bgs | 2,455
1-2 ft. bgs | 23
P3-SL-0030
Sample Depth | µg/kg dw
0-1 ft. bgs | 92,968
1-2 ft. bgs | 5,150
P3-SL-0031/9031
Sample Depth | µg/kg dw / Duplicate
0-1 ft. bgs | 1,480 / 1,486
1-2 ft. bgs | 1,858
P3-SL-0032
Sample Depth | µg/kg dw
0-1 ft. bgs | 141
1-2 ft. bgs | 21
P3-SL-0033
Sample Depth | µg/kg dw
0-1 ft. bgs | 4,535
1-2 ft. bgs | 211
P3-SL-0034
Sample Depth | µg/kg dw
0-1 ft. bgs | 194
1-2 ft. bgs | ND
ND
Air Force Reserve Storage Area
Ordnance Storage Area
0275
LEGEND
Soil Boring
ND Not Detected
Drainage Ditch
Canal
Flow Direction
Open Grassland
Heavily Vegitated Area (Rubble Mound)
Note: Only soil samples collected in 1993 were analyzed for PAHs.
0 100 200
SCALE IN FEET
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TOTAL POLYNUCLEAR AROMATIC HYDROCARBON CONCENTRATIONS DETECTED IN SOIL SAMPLES COLLECTED DURING 1993 INVESTIGATION
SITE OT-11/OU-2
FIGURE 2-3

TABLE 2-7

BACKGROUND SOIL CONCENTRATIONS
HOMESTEAD AIR RESERVE BASE, FLORIDA

Compound	Average Carbonate Composition Hem (1989)	Homestead ARB Background Soil[a] 0-2 ft bls	Typical Values for Uncontaminated Soils[b] (mg/kg)	Common Range[c] (mg/kg)	Average[c] (mg/kg)
Volatile Organic Compounds (µg/kg)					
Acetone		119.2			
Chlorobenzene		3.8			
Methylene Chloride		4			
Total PAHs (µg/kg)		738.55	0.01- 1.3 forest[d] 0.01 - 1.01 rural 0.06 - 5.8 urban 8 - 336 road dust		
Base/Neutral and Acid Extractable Organic Compounds (µg/kg/dw)					
Acenaphthene		ND			
Benzo(a)anthracene		67			
Benzo(a)pyrene		66			
Benzo(b)fluoranthene		69			
Benzo(g,h,i)perylene		44			
Benzo(k)fluoranthene		66			
bis(2Ethylhexyl)phthalate		100			
Chrysene		79			
Dibenzofuran		ND			
Fluoranthene		52.4			
Fluorene		ND			
2-Methylnaphthalene		84			
Naphthalene		50			
Phenanthrene		50			
Pyrene		49.15			
1,2-Dichlorobenzene		ND			
1,4-Dichlorobenzene		ND			
Total Phthalates (µg/kg)		126			
Metals (mg/kg)					
Aluminum	8,970	2,400		700 - >10,000	57,000
Antimony	--	<28 - 30	0 - 30	2 - 10[e]	--[f]
Arsenic	1.8	1.6	0 -30	<0.1 - 73	7.4
Barium	30	42.9	0 -500	10 - 1,500	420
Beryllium	--	<2.8 - 2.9	0 - 5	<1 - 7	0.85
Cadmium	0.048	<2.8 - 3.0	0 - 1	0.01 - 0.1[e]	0.06[e]
Calcium	272,000	345,000		10 - 28,000	630
Chromium	>0.1	11.5	0 -100	1 - 1,000	52
Cobalt	0.12	<1.1 - 1.2	7	<0.3 - 70	9.2
Copper	4.4	<2.7 - 3.0	30	<1 - 700	22
Iron	8,190	1,650		10 -10,000	2,500
Lead	16	4.05	0 -500	<10 - 300	17
Magnesium	45,300	1,050	0 -500	5 - 5,000	460
Manganese	842	23	0 -500	<2 - 7,000	640
Mercury	0.046	0.014	0 - 1	<0.01 - 3.4	0.12
Nickel	13	<4.5 - 4.7	15	<5 - 700	18
Potassium	2,390	<110 - 120		5 - 3,700	--[f]
Selenium	--	<5.6 - 5.7	0 - 1	<0.01 - 3.9	0.45
Silver	--	<1.1 - 1.2	0.15	0.01 - 5.0[e]	0.05[e]
Sodium	398	555		<550 - 50,000	7,800
Thallium	--	<1.1 - 5.6		2.2 - 23	8.6
Vanadium	13	<5.7 - 5.9	0 -100	<7 - 300	66
Zinc	16	20	60	<5 - 2,900	52

[a] Source: Based on 5 background samples as reported in Geraghty & Miller, 1992.

[b] Source: Gas Research Institue, 1987.

[c] U.S. Geological Survey Professional Paper 1270, element Concentrations in Soils and Other Surficial Material of the Conterminous United States Page 4, Table 1(unless indicated otherwise).

[d] Source: Menzi, et al., 1992.

[e] Data for these matals were not includeed in the USGS Paper. Concentrations were obained from the USEPA Office of Solid Waste and Emergency Response, Hazardous Waste Land Treatment, SW-874, April 1983, Page 273, Table 6.45.

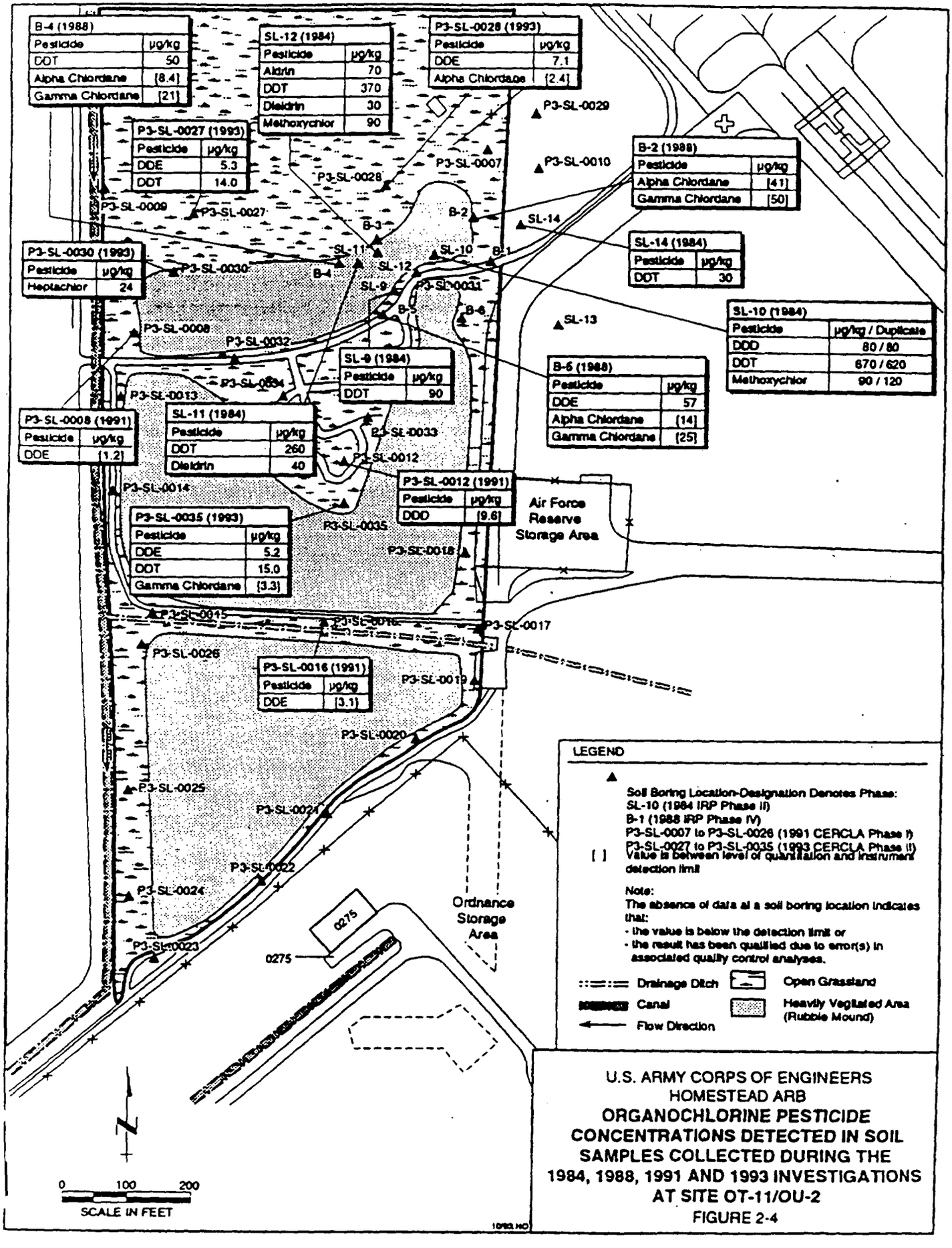
[f] Average not estabisihed.

butylbenzylphthalate was reported in samples P3-SL-0027-1, P3-SL-0027-2, P3-SL-0028-1, P3-SL-0028-2, and P3-SL-0029-1 at concentrations ranging from 14 to 36 ug/kg dw (Table 2-6). PAEs are plasticizers used in the production of various plastics. PAEs have become ubiquitous in the environment because of their general usage, and they also commonly occur as laboratory contaminants. Other BNA compounds detected include dibenzofuran, N-nitrosodiphenylamine, carbazole, and DEHP. Most of these reported values were qualified because the concentrations were less than the PQL (Table 2-6).

Organochlorine Pesticides. Soil samples were analyzed for organochlorine pesticides during all four soil investigations. From all four of the sampling rounds (49 samples), nine pesticides were detected in at least one shallow soil/weathered-rock sample. Chlordane, dieldrin, and methoxychlor were detected in five, three, and two of the 49 samples, respectively. 4,4'-DDD and 4,4'-DDE were detected in two and seven of the 49 soil samples, respectively; and 4,4'-DDT was detected (most frequently) in eight of the 49 samples. Aldrin, endosulfan II, and heptachlor were detected only once. Figure 2-4 summarizes the concentrations of pesticides detected in the soil samples during the various investigations. In 1984, the highest concentration detected in any sample was 670 ug/kg dw of 4,4'-DDT in sample SL-10. In 1988, soil sample B-4 (150 feet to the east of SL-10) contained 50 ug/kg dw of 4,4'-DDT, and sample B-5 contained 57 ug/kg dw of 4,4'-DDE, a DDT degradation product. The concentrations of organochlorine pesticides detected during the 1988 investigation were an order of magnitude lower than those detected during the 1984 investigation. This may indicate that the greatest pesticide concentrations are located within the area of the 1984 soil sampling investigation because the degradation half-lives of pesticides are very long and the lower concentrations detected in 1988 are not likely to indicate degradation of pesticides.

During the 1991 investigation, low levels of organochlorine pesticides, including 4,4'-DDD, 4,4'-DDE, dieldrin, and endosulfan II were reported in four of the 19 samples. However, all of these reported concentrations were qualified, either because the concentrations were less than the practical quantitation limit, or due to errors in associated quality control analyses (Table 2-5). The presence of these pesticides is consistent with other investigations.

During the 1993 investigation, three pesticides, 4,4'-DDE, 4,4'-DDT, and alpha-chlordane, were detected in three surficial (0 to 1 foot bgs) soil/weathered rock samples (P3-SL-0027-1, P3-SL-0028-1, and P3-SL-0035-1). 4,4'-DDE was detected in these soil samples at concentrations of 5.3, 7.1, and 5.2 ug/kg dw, respectively (Table 2-6). Overall, elevated concentrations of organochlorine pesticides were detected in samples collected from the



U.S. ARMY CORPS OF ENGINEERS
HOMESTEAD ARB

ORGANOCHLORINE PESTICIDE CONCENTRATIONS DETECTED IN SOIL SAMPLES COLLECTED DURING THE 1984, 1988, 1991 AND 1993 INVESTIGATIONS AT SITE OT-11/OU-2

FIGURE 2-4

northern and central portion of Site OT-11/OU-2. Pesticide concentrations were typically higher in the surficial soil samples (0 to 1 foot bgs) than in the subsurface soil/rock samples (1 to 2 feet bgs) as illustrated in Figure 2-4.

No chlorinated herbicides were detected in the samples collected during the 1988 investigation; and therefore, the analysis for herbicides was not performed in the subsequent sampling rounds.

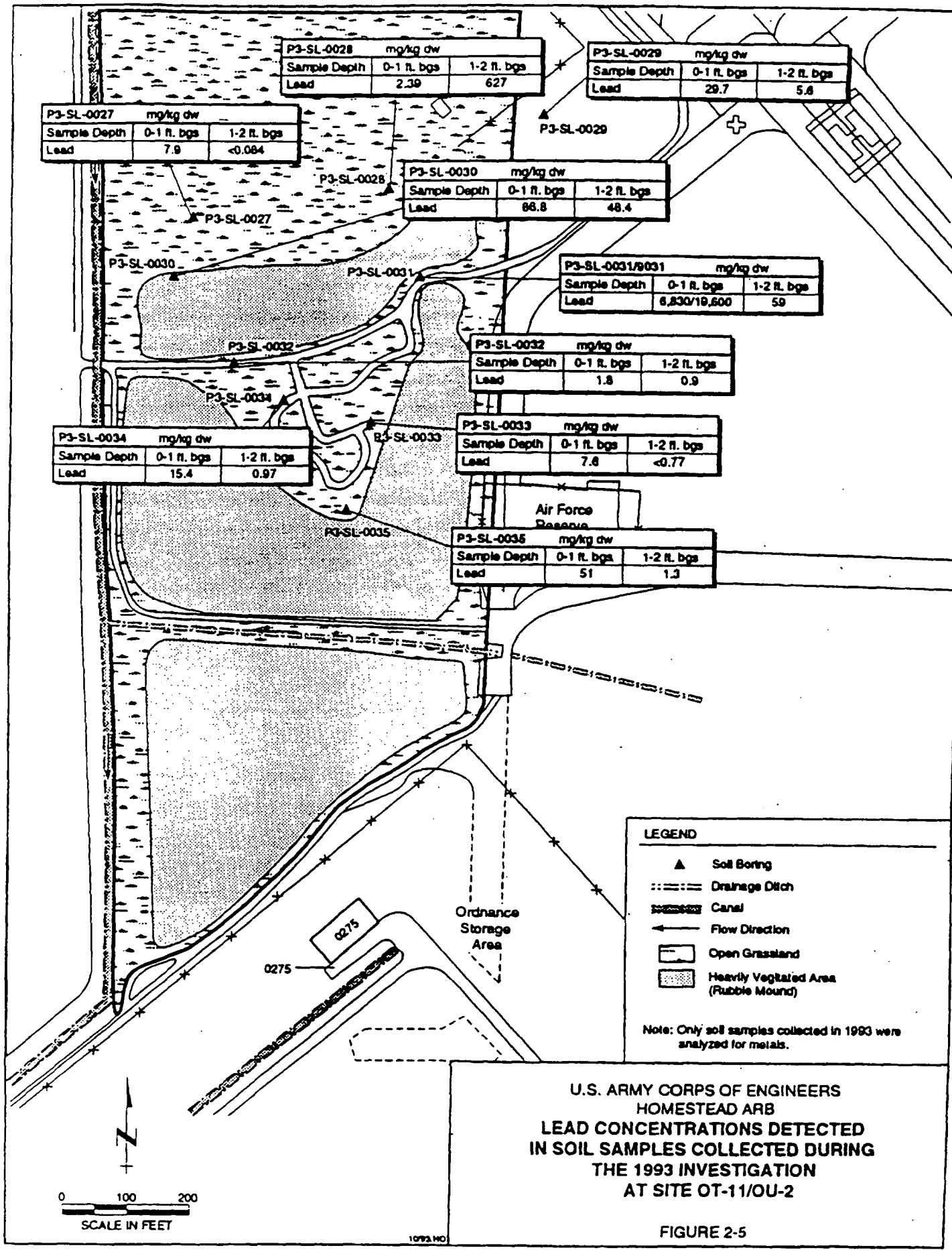
No PCBs were detected in the soil samples at Site OT-11/OU-2.

Inorganic Constituents. Soil/rock samples were analyzed for inorganic constituents only during the 1993 investigation; a total of 17 metals were detected.

Aluminum, calcium, chromium, and iron were detected above the PQL in all soil samples (Table 2-6). Concentrations of aluminum ranged from 157 mg/kg dw to 13,200 mg/kg dw. The concentrations of calcium did not vary as greatly but were significantly higher ranging from 248,000 mg/kg dw to 489,000 mg/kg dw as expected from a sample consisting of weathered Miami Oölite. Chromium was detected in every sample at concentrations ranging from 2.8 mg/kg dw to 39.9 mg/kg dw. Iron concentrations ranged from 81.4 mg/kg dw to 9,120 mg/kg dw. These concentrations are generally within the range of the Homestead ARB background, with aluminum and chromium concentrations slightly higher than the upper limit (Table 2-7).

A few metals were detected in some samples above their respective PQLs. They included antimony, which was detected in one sample (58.1 mg/kg dw); cadmium, which was detected in one sample and its duplicate (1.5 and 1.7 mg/kg dw, respectively); copper, which was detected in five samples at concentrations ranging from 7.0 to 29.4 mg/kg dw; and silver, which was detected in two samples at concentrations of 12.6 and 13.9 mg/kg dw (Table 2-6).

Sodium and vanadium were detected in several soil samples above their respective method detection limit but below their PQLs. Lead was detected in 16 of the 18 soil/weathered-rock samples. Detected concentrations of lead ranged from below the PQL of 0.9 mg/kg dw to 19,600 mg/kg dw (duplicate of P3-SL-0031). The elevated concentration of lead was confined to sample P3-SL-0031. In this sample, the lead concentration levels were 6,830 mg/kg dw for the surficial sample (0 to 1 foot bgs), 19,600 mg/kg dw for its duplicate, and 59 mg/kg dw for the subsurface sample (1 to 2 feet bgs). Remaining lead concentrations did not exceed 627 mg/kg dw as shown on Figure 2-5. The aerial extent of elevated lead levels in



U.S. ARMY CORPS OF ENGINEERS
HOMESTEAD ARB

LEAD CONCENTRATIONS DETECTED IN SOIL SAMPLES COLLECTED DURING THE 1993 INVESTIGATION AT SITE OT-11/OU-2

FIGURE 2-5

the subsurface appears to be confined to the original disposal area in the northern portion of the site. A specific source of lead cannot be ascertained although some of the asphalt materials present on site might be a possible source for lead.

Low levels of arsenic ranging from 4.3 to 11.7 mg/kg dw, and mercury ranging from 0.05 to 0.45 mg/kg dw, were also detected.

2.6.1.2 Groundwater Contamination

Groundwater samples were collected during the 1988 and 1993 investigations. During the 1988 investigation, groundwater samples were collected from each of the soil borings drilled during the soil investigation. The groundwater samples were analyzed for organochlorine pesticides and chlorinated herbicides, which were not detected in any samples. During the 1993 field investigation, samples were collected from two newly constructed wells located in the area of highest soil contamination (Figure 2-6). Monitoring well P3-MW-0001 was screened at approximately 15 feet bgs. Monitoring well P3-DMW-0001, considered a deep monitoring well, was screened at approximately 40 feet bgs. The deep monitoring well was installed next to P3-MW-0001 to identify vertical migration of contaminants, if present, in groundwater at Site OT-11/OU-2. Results of the groundwater analyses are discussed below for each of the analytical groups, and are presented in Table 2-8.

Volatile Organic Compounds. VOCs were analyzed for only in the groundwater samples collected in 1993. No VOCs were detected in the groundwater samples.

Base/Neutral and Acid Extractable Compounds. Eleven BNAs were detected in the two groundwater samples (shallow, shallow duplicate, deep samples) collected in 1993 at concentrations above the method detection limit but below the PQL. Concentrations of total BNAs ranged from 1.2 to 10.8 ug/L and concentrations of PAHs ranged from 0.3 to 8.4 ug/L (Figure 2-6). Four BNAs were detected in all samples (P3-MW-0001, P3-DMW-0001, and duplicate P3-MW-9001): phenanthrene at concentrations ranging from 0.1 to 3 ug/L, fluoranthene at concentrations ranging from 0.1 to 2 ug/L, pyrene at concentrations ranging from 0.1 to 0.4 ug/L, and di-n-octylphthalate at concentrations ranging from 0.07 to 0.1 ug/L. The remaining BNA compounds detected, including naphthalene, acenaphthylene, dibenzofuran, diethylphthalate, fluorene, and carbazole were all detected in P3-DMW-001 at concentrations less than 1.0 ug/L.

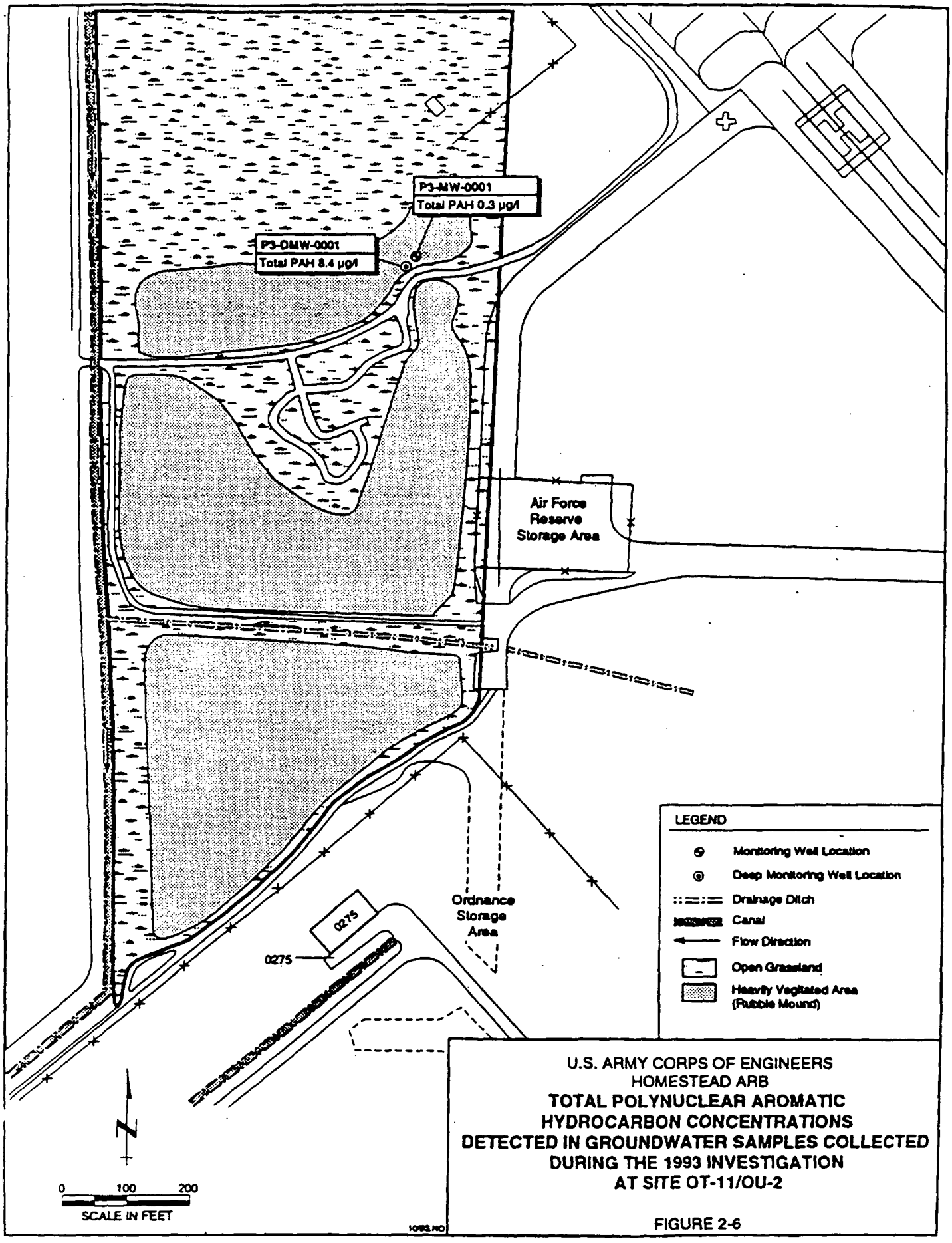

P3-MW-0001
Total PAH 0.3 µg/l
P3-DMW-0001
Total PAH 8.4 µg/l
Air Force
Reserve
Storage Area
Ordnance
Storage
Area
0275
0275
LEGEND
Monitoring Well Location
Deep Monitoring Well Location
Drainage Ditch
Canal
Flow Direction
Open Grassland
Heavily Vegitated Area
(Rubble Mound)
N
0
100
200
SCALE IN FEET
U.S. ARMY CORPS OF ENGINEERS
HOMESTEAD ARB
TOTAL POLYNUCLEAR AROMATIC
HYDROCARBON CONCENTRATIONS
DETECTED IN GROUNDWATER SAMPLES COLLECTED
DURING THE 1993 INVESTIGATION
AT SITE OT-11/OU-2
FIGURE 2-6

TABLE 2-8

SUMMARY OF CONSTITUENTS DETECTED IN GROUNDWATER SAMPLES
COLLECTED IN 1993 AT SITE OT-11/OU-2
RESIDUAL PESTICIDE DISPOSAL AREA
HOMESTEAD AIR RESERVE BASE, FLORIDA

Parameter	Florida Groundwater Guidance Conc.[a]	EPA Drinking Water Standard	EPA Maximum Contaminant Level Goal	Well I.D.	P3-MW-0001		P3-MW-9001			P3-DMW-0001	
Volatile Organic Compounds (µg/L)					ND		ND			ND	
Base/Neutral and Acid Extractable Compounds (µg/L)											
Naphthalene	10	NS	NS		< 10		< 10			(0.3)	
Acenaphthylene	10	NS	NS		< 10		< 10			(0.2)	
Acenaphthene	20	NS	NS		< 10		< 10			(0.4)	
Dibenzofuran	NS	NS	NS		< 10		< 10			(0.4)	
Diethylphthalate	5,600	NS	NS		< 10		< 10			(0.2)	
Fluorene	10	NS	NS		< 10		< 10			(0.6)	
Phenanthrene	10	NS	NS		(0.1)		(0.2)			(3)	
Carbazole	NS	NS	NS		< 10		< 10			(0.9)	
Di-n-butylphthalate	700	NS	NS		(0.2)	U	(0.2)	U	<	10	
Fluoranthene	42	NS	NS		(0.1)		(0.1)			(2)	
Pyrene	10	NS	NS		(0.1)		< 10			(0.4)	
Butylbenzylphthalate	1,400	NS	NS		(0.2)	U	(0.4)	U		(0.3)	U
bis(2-Ethylhexyl)phthalate	14	4[e]	0[e]		(0.5)	U	(0.6)	U		(2)	U
Di-n-octylphthalate	10	NS	NS		< 10		(0.07)			(0.1)	
Organochlorine Pesticides/PCBs (µg/L)					ND		ND			ND	
Metals (µg/L)											
Barium	1,000[b]	2,000[d,f]	2,000[d]		< 10		(10)		<	10	
Calcium	NS	NS	NS		103,000		101,000			100,000	
Chromium	50[b]	100[d,f]	100[d]		46.1		46.9		<	10	
Iron	300[b]	300[g]	NS		< 50		< 50			(55)	
Magnesium	NS	NS	NS		(3,490)		(3,460)			(3,460)	
Potassium	NS	NS	NS		12,900		13,000			7,850	
Sodium	160,000[b]	NS	NS		16,400		16,500			13,800	
Cyanide (µg/L)	154	200[i]	200[i]		< 10		< 10		<	10	
Total Dissolved Solids (mg/L)	500[b]	500[g]	NS		380		340			380	

Notes:

[a] Florida Groundwater Guidance Concentrations for Minimum Criteria Requirements (Rule 17-3.402, FAC), Florida Department of Environmental Protection, February 1989.
[b] Florida Primary Drinking Water Standard.
[c] Numbers represent EPA's Final MCL (Maximum Contaminant Levels).
[d] Numbers represent EPA's Final MCL effective July 1992, Federal Register, January 30, 1991.
[e] Numbers represent EPA's Proposed Primary MCL, Federal Register, Vol. 55, No. 143, July 1990.
[f] Numbers represent EPA's Primary MCL for Inorganics.
[g] Florida Secondary Drinking Water Standard.

ND Not detected, none of the compounds in this analyte group were detected above the detection limit.
NS No standard applicable
ug/L micrograms per liter
mg/L milligrams per liter
< Analyte was not detected at or above the indicated concentrations. Values given are equal to the requested quantitation
J 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 or has been classified as undetected, with further classification.
U Classified or undetected.

From: Geraghty & Miller, Inc., 1993a

Organochlorine Pesticides/PCBs. No pesticides/PCBs were detected in the groundwater samples collected during the 1988 and 1993 investigations.

Inorganic Constituents. Calcium, magnesium, potassium, and sodium were detected in all three groundwater samples (P3-MW-0001, P3-DMW-0001, and duplicate P3-MW-9001) collected in 1993, as shown on Table 2-8. However, there are no Federal or State Primary Drinking Water Standards for these constituents. Barium, chromium, and iron were detected in some of the groundwater samples at maximum concentrations of 10 ug/L, 48.9 ug/L, and 55 ug/L, respectively. These concentrations are well below their respective Federal and State Primary Drinking Water Standards (Table 2-8).

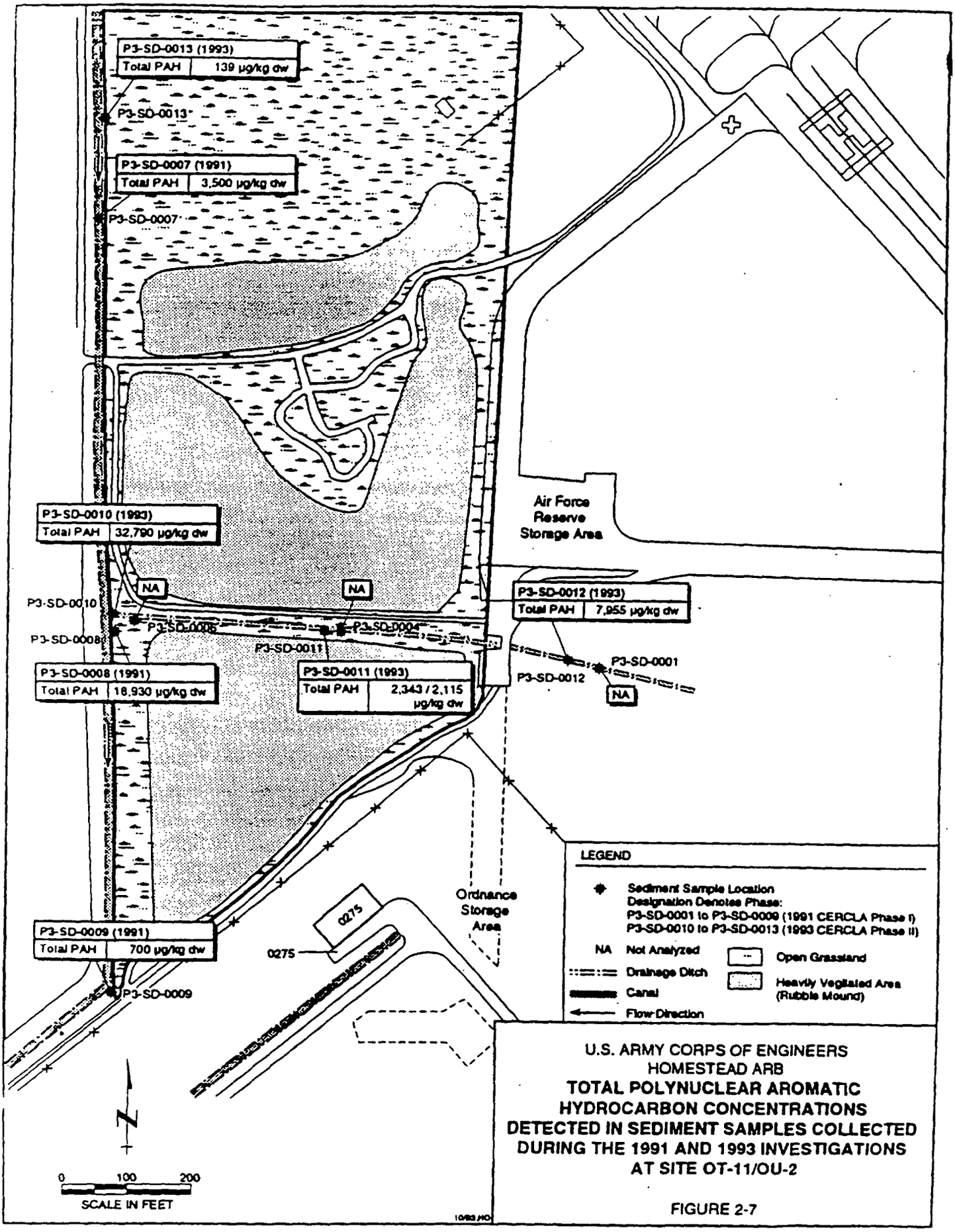
2.6.1.3 Sediment Contamination

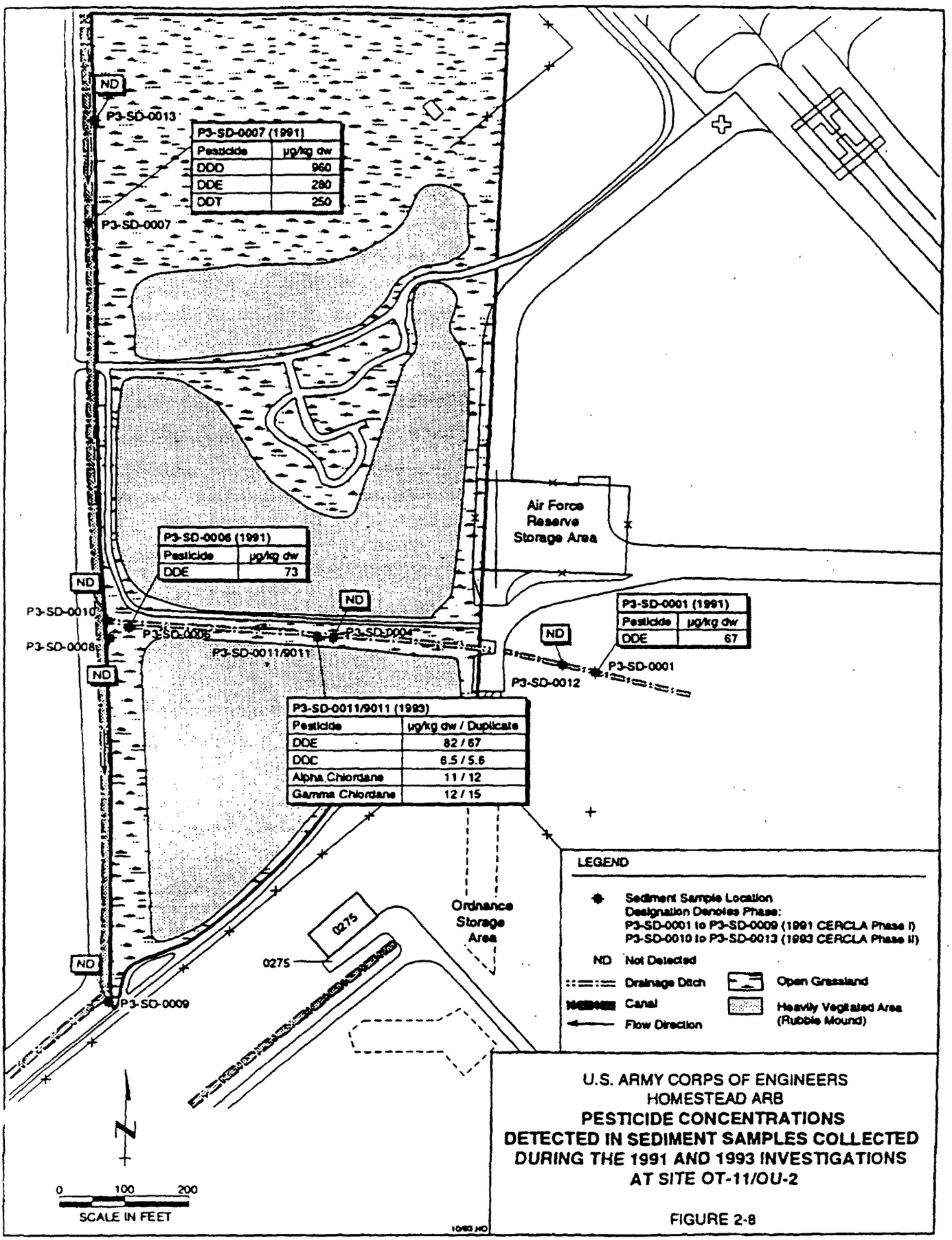
Sediment samples were collected during the 1991 and 1993 field investigations. A total of six sediment samples were collected in 1991; three sediment samples (P3-SD-0001, P3-SD-0004, and P3-SD-0006) were collected from the ditch system which transects Site OT-11/OU-2, and the remaining three sediment samples (P3-SD-0007 through P3-SD-0012) were collected from Boundary Canal. In 1993, three sediment samples (P3-SD-0010 through P3-SD-0012) were collected from the ditch system; and one sample (P3-SD-0014) was collected from the Boundary Canal upgradient of Site OT-11/OU-2.

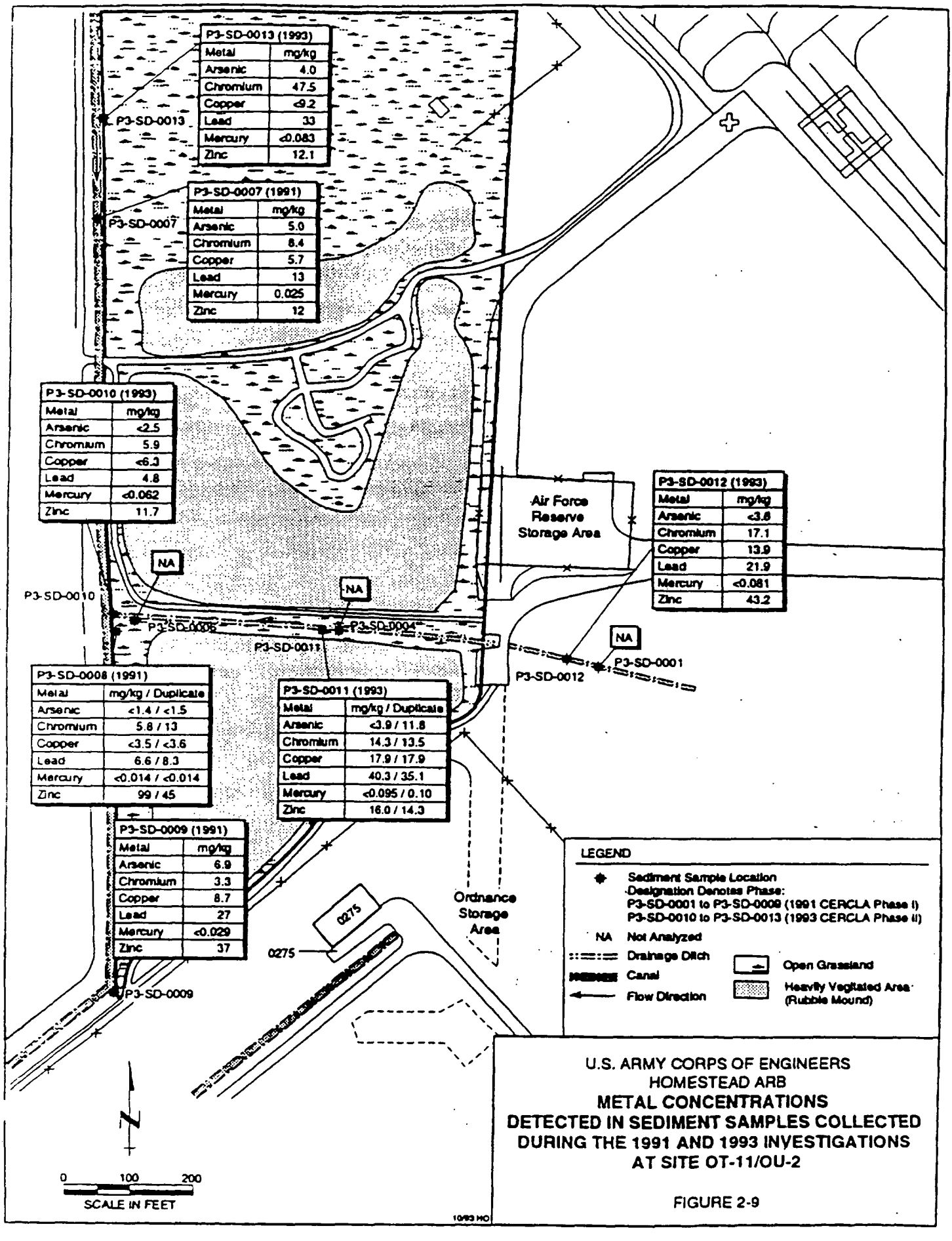
A summary of the analytical results for sediments is presented in Tables 2-9 and 2-10 and Figures 2-7 to 2-9. The analytical results are discussed below for each analyte group. The potential impacts to sediments in the Boundary Canal (OU-9) are addressed in the Remedial Investigation/Baseline Risk Assessment Reports for OU-9.

Volatile Organic Compounds. The only VOCs detected during the 1991 and 1993 field investigations were acetone and methylene chloride. Both acetone and methylene chloride are common laboratory artifacts and, at the concentrations detected, are not believed to be representative of site contamination.

Base/Neutral and Acid Extractable Compounds. A number of BNA compounds were detected in the samples, as shown in Tables 2-9 and 2-10, and Figure 2-7, all of which were PAHs. During the 1991 investigation, all of the PAHs reported in samples P3-SD-0007 and P3-SD-0009 were detected above the detection limit but below the PQL. Ten PAH compounds were detected in sample P3-SD-0008 at concentrations above the PQL including


P3-SD-0013 (1993)
Total PAH 139 µg/kg dw
P3-SD-0013
P3-SD-0007 (1991)
Total PAH 3,500 µg/kg dw
P3-SD-0007
Air Force Reserve Storage Area
P3-SD-0010 (1993)
Total PAH 32,790 µg/kg dw
NA
NA
P3-SD-0010
P3-SD-0008
P3-SD-0005
P3-SD-0004
P3-SD-0011
P3-SD-0012 (1993)
Total PAH 7,955 µg/kg dw
P3-SD-0001
P3-SD-0012
NA
P3-SD-0008 (1991)
Total PAH 18,930 µg/kg dw
P3-SD-0011 (1993)
Total PAH 2,343 / 2,115 µg/kg dw
Ordnance Storage Area
0275
0275
P3-SD-0009 (1991)
Total PAH 700 µg/kg dw
P3-SD-0009
LEGEND
Sediment Sample Location
Designation Denotes Phase:
P3-SD-0001 to P3-SD-0009 (1991 CERCLA Phase I)
P3-SD-0010 to P3-SD-0013 (1993 CERCLA Phase II)
NA Not Analyzed
Drainage Ditch
Canal
Flow Direction
Open Grassland
Heavily Vegitated Area (Rubble Mound)
N
0 100 200
SCALE IN FEET
U.S. ARMY CORPS OF ENGINEERS
HOMESTEAD ARB
TOTAL POLYNUCLEAR AROMATIC HYDROCARBON CONCENTRATIONS DETECTED IN SEDIMENT SAMPLES COLLECTED DURING THE 1991 AND 1993 INVESTIGATIONS AT SITE OT-11/OU-2
FIGURE 2-7


ND
P3-SD-0013
P3-SD-0007 (1991)
Pesticide | µg/kg dw
DDD | 960
DDE | 280
DDT | 250
P3-SD-0007
P3-SD-0006 (1991)
Pesticide | µg/kg dw
DDE | 73
ND
P3-SD-0010
P3-SD-0008
P3-SD-0005
P3-SD-0004
P3-SD-0011/9011
ND
ND
P3-SD-0001 (1991)
Pesticide | µg/kg dw
DDE | 67
P3-SD-0001
P3-SD-0012
Air Force Reserve Storage Area
P3-SD-0011/9011 (1993)
Pesticide | µg/kg dw / Duplicate
DDE | 82 / 67
DDC | 6.5 / 5.6
Alpha Chlordane | 11 / 12
Gamma Chlordane | 12 / 15
Ordnance Storage Area
0275
0275
ND
P3-SD-0009
LEGEND
Sediment Sample Location
Designation Denotes Phase:
P3-SD-0001 to P3-SD-0009 (1991 CERCLA Phase I)
P3-SD-0010 to P3-SD-0013 (1993 CERCLA Phase II)
ND Not Detected
Drainage Ditch
Canal
Flow Direction
Open Grassland
Heavily Vegitated Area (Rubble Mound)
N
0 100 200
SCALE IN FEET
U.S. ARMY CORPS OF ENGINEERS
HOMESTEAD ARB
PESTICIDE CONCENTRATIONS
DETECTED IN SEDIMENT SAMPLES COLLECTED
DURING THE 1991 AND 1993 INVESTIGATIONS
AT SITE OT-11/OU-2
FIGURE 2-8



U.S. ARMY CORPS OF ENGINEERS
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METAL CONCENTRATIONS DETECTED IN SEDIMENT SAMPLES COLLECTED DURING THE 1991 AND 1993 INVESTIGATIONS AT SITE OT-11/OU-2

FIGURE 2-9

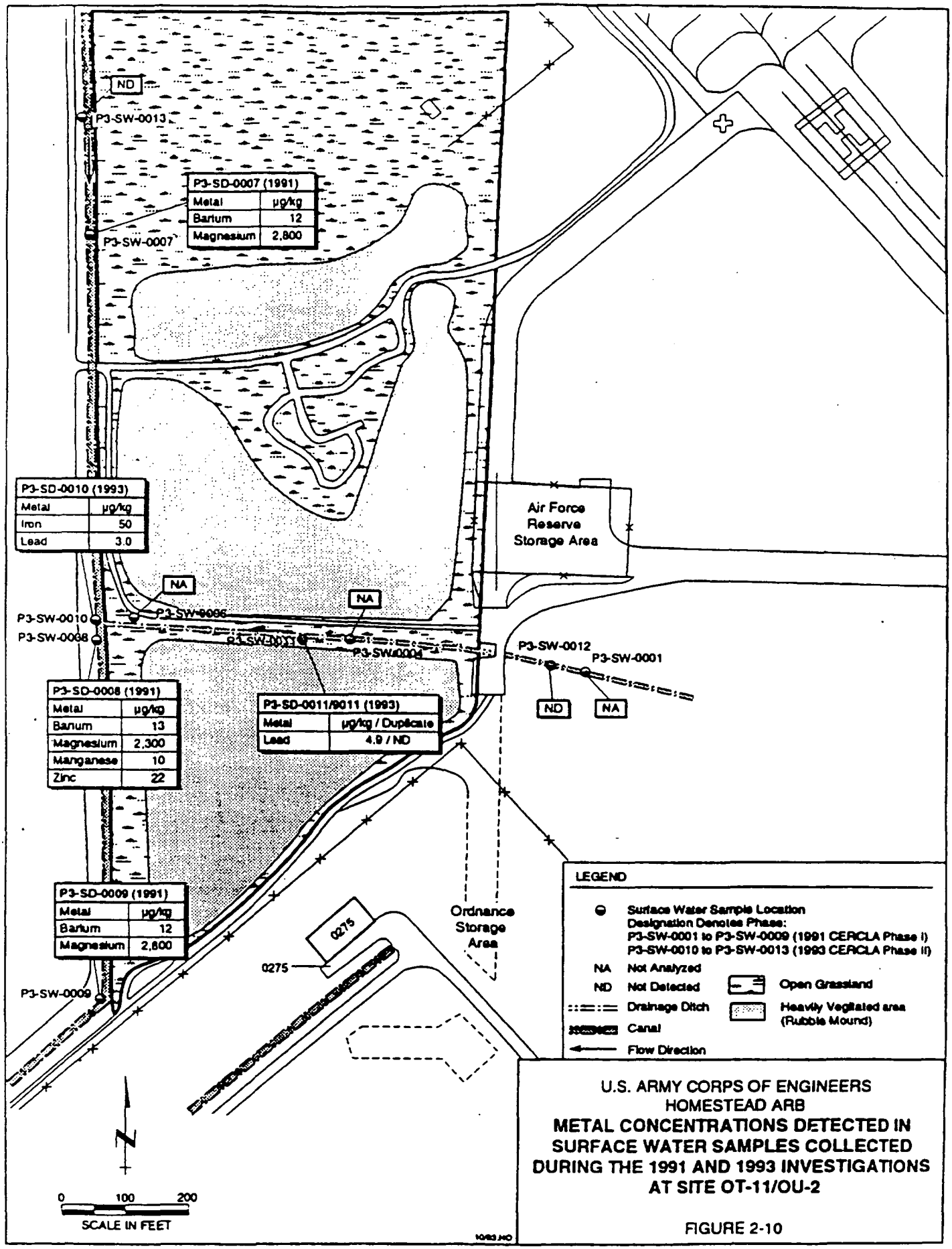

ND
P3-SW-0013
P3-SD-0007 (1991)
Metal | µg/kg
Barium | 12
Magnesium | 2,800
P3-SW-0007
P3-SD-0010 (1993)
Metal | µg/kg
Iron | 50
Lead | 3.0
Air Force Reserve Storage Area
NA
NA
P3-SW-0010
P3-SW-0006
P3-SW-0008
P3-SW-0005
P3-SW-0004
P3-SW-0012
P3-SW-0001
P3-SD-0008 (1991)
Metal | µg/kg
Barium | 13
Magnesium | 2,300
Manganese | 10
Zinc | 22
P3-SD-0011/9011 (1993)
Metal | µg/kg / Duplicate
Lead | 4.9 / ND
ND
NA
P3-SD-0009 (1991)
Metal | µg/kg
Barium | 12
Magnesium | 2,800
P3-SW-0009
0275
0275
Ordnance Storage Area
LEGEND
Surface Water Sample Location
Designation Denotes Phase:
P3-SW-0001 to P3-SW-0009 (1991 CERCLA Phase I)
P3-SW-0010 to P3-SW-0013 (1993 CERCLA Phase II)
NA Not Analyzed
ND Not Detected
Drainage Ditch
Canal
Flow Direction
Open Grassland
Heavily Vegitated area (Rubble Mound)
N
0 100 200
SCALE IN FEET
U.S. ARMY CORPS OF ENGINEERS
HOMESTEAD ARB
METAL CONCENTRATIONS DETECTED IN SURFACE WATER SAMPLES COLLECTED DURING THE 1991 AND 1993 INVESTIGATIONS AT SITE OT-11/OU-2
FIGURE 2-10

TABLE 2-9

CONSTITUENTS DETECTED IN SEDIMENT SAMPLES COLLECTED IN 1991 AT SITE OT-11/OU-2
RESIDUAL PESTICIDE DISPOSAL AREA
HOMESTEAD AIR RESERVE BASE, FLORIDA

Analyte	Sample Identification / Sampling Date	P3-SD-0001 8/23/91	P3-SD-0004 8/24/91	P3-SD-0006 8/24/91	P3-SD-0007 10/3/91	P3-SD-0008 10/3/91	P3-SD-9008 10/3/91	P3-SD-0009 10/3/91
Volatile Organic Compounds (µg/kg dw)								
Acetone		NA	NA	NA	23 J	19 J	45	64 J
Methylene Chloride		NA	NA	NA	5.3 J	5.3 J	3.3 J	9.9 J
Metals (mg/kg dw)								
Aluminum		NA	NA	NA	2,100	1,100	1,200	1,500
Arsenic		NA	NA	NA	5.0	< 1.4	< 1.5	6.9
Barium		NA	NA	NA	7.9	6.4	6.9	10
Calcium		NA	NA	NA	310,000	270,000	370,000	310,000
Chromium		NA	NA	NA	8.4	5.8	13	3.3
Cobalt		NA	NA	NA	< 1.5	< 1.4	< 1.4	3.3
Copper		NA	NA	NA	5.7	< 3.5	< 3.6	8.7
Iron		NA	NA	NA	900	570	640	1,400
Lead		NA	NA	NA	13	6.6	8.3	27
Magnesium		NA	NA	NA	880	690	1,100	700
Manganese		NA	NA	NA	17	13	17	23
Mercury		NA	NA	NA	0.025	< 0.014	< 0.014	< 0.029
Sodium		NA	NA	NA	460	510	640	< 500
Vanadium		NA	NA	NA	4.8	2.9	3.7	7.3
Zinc		NA	NA	NA	12	99	45	37
Base/Neutral-Acid Extractable Compounds (µg/kg dw)								
Anthracene		NA	NA	NA	< 850	290 J	NA	< 1,100
Benzo(a)anthracene		NA	NA	NA	< 850	1,700	NA	< 1,100
Benzo(a)pyrene		NA	NA	NA	340 J	1,800	NA	120 J
Benzo(b)fluoranthene		NA	NA	NA	350 J	2,200	NA	130 J
Benzo(g,h,i) perylene		NA	NA	NA	250 J	1,200	NA	< 1,100
Benzo(k)fluoranthene		NA	NA	NA	340 J	420 J	NA	110 J
Bis(2-Ethylhexyl)phthalate		NA	NA	NA	< 850	1,300[a]	NA	140 J[a]
Chrysene		NA	NA	NA	390 J	1,900	NA	< 1,100
Dibenzo(a,h)anthracene		NA	NA	NA	< 850	520 J	NA	< 1,100
Fluoranthene		NA	NA	NA	790 J	3,400	NA	190 J
Indeno(1,2,3-cd)pyrene		NA	NA	NA	240 J	1,100	NA	< 1,100
Phenanthrene		NA	NA	NA	280 J	1,200	NA	< 1,100
Pyrene		NA	NA	NA	520 J	3,200	NA	150 J
Chlorinated Pesticides (µg/kg dw)								
4,4'-DDD		< 140	< 160	< 71	960	< 60	< 60	< 120
4,4'-DDE		67 J	< 160	73	280	< 60	< 60	< 120
4,4'-DDT		< 360	< 390	< 180	250	< 150	< 150	< 290

[a] Result has been classified as qualitative due to error(s) in associated quality control analyses.
µg/kg dw Micrograms per kolgram dry weight.
mg/kg dw Milligrams per kilogram dry weight.
< Analyte was not detected. Values given are equal to the practical quantitation limits requested in the RI Work Plan and may vary among samples due to differences in water content, mass analyzed, and dilution factors.
NA Sample was not analyzed for the indicated analytes.
J Value is greater than instrument detection limit but less than practical quantitation limit..

From: Geraghty & Miller, Inc., 1991a

TABLE 2-10

**CONSTITUENTS DETECTED IN SEDIMENT SAMPLES COLLECTED IN 1993
AT SITE OT-11/OU-2, RESIDUAL PESTICIDE DISPOSAL AREA
HOMESTEAD AIR RESERVE BASE, FLORIDA
(Page 1 of 2)**

Parameter	NOAA ER-L[a] Value	NOAA ER-M[b] Value	Interim SQC (µg/kg OC)[c]	P3-SD-0010		P3-SD-0011		(Duplicate) P3-SD-9011		P3-SD-0012		P3-SD-0013	
Volatile Organic Compounds (µg/kg dw)													
Methylene Chloride	N	N	NS	(6)	U	< 20		< 18		< 91		< 19	
Acetone	N	N	NS	44	J	< 20	UJ	< 18	UJ	750	J	< 19	UJ
Base/Neutral and Acid Extractable Compounds (µg/kg dw)													
Acenaphthene	85	960	NS	(110)		< 650		< 580		< 600		< 610	
Fluorene	35	640	NS	(130)		< 650		< 580		(35)		< 610	
Phenanthrene	225	1,380	139,000[d]	4,200	b	(83)		(97)		(480)		< 610	
Anthracene	85	960	NS	550		< 650		< 580		(80)		< 610	
Carbazole	N	N	NS	450		< 650		< 580		(48)		< 610	UJ
Fluoranthene	600	3,600	1,883,000[d]	7,200	b	(340)		(340)		1,400		(50)	
Pyrene	350	2,200	1,311,000[d]	5,600	b	(340)		(280)		1,900		(43)	
Benzo(a)anthracene	230	1,600	1,317,000[d]	2,900		(140)		(130)		(540)		< 610	
Chrysene	400	2,800	NS	3,200		(260)		(230)		770		< 610	
bis(2-Ethylhexyl)phthalate	N	N	NS	< 410		< 650		(50)		< 600		< 610	UJ
Di-n-octylphthalate	N	N	NS	< 410		< 650		< 580		(72)		< 610	UJ
Benzo(b)fluoranthene	N	N	NS	2,800	J	(340)		(360)		680		(46)	
Benzo(k)fluoranthene	N	N	NS	2,000	J	(270)		(110)		(580)		< 610	
Benzo(a)pyrene	400	2,500	1,063,000[d]	2,300	J	(230)		(190)		(550)		< 610	
Indeno (1,2,3-cd)pyrene	N	N	NS	1,800	J	(170)		(170)		(440)		< 610	
Dibenz(a,h)anthracene	60	260	NS	< 410	UJ	< 650		(38)		< 600		< 610	
Benzo(g,h,i)perylene	N	N	NS	< 410	UJ	(170)		(170)		(500)		< 610	
Dibenzofuran	N	N	NS	(130)		< 650		< 580		< 600		< 610	
Organochlorine Pesticides/PCBs (µg/kg dw)													
4,4'-DDE	2	15	NS	< 4.1		82		67		< 6.0		< 6.1	
4,4'-DDD	2	20	NS	< 4.1		6.5	J	(5.6)		< 6.0		< 6.1	
alpha-Chlordane	0.5[e]	6[e]	NS	< 2.1		11		12		< 3.1		< 3.1	
gamma-Chlordane	0.5[e]	6[e]	NS	< 2.1		12		13		< 3.1		< 3.1	
Metals (mg/kg dw)													
Aluminum	N	N	NS	758	J	2,660	J	2,110	J	3,220	J	8,450	J
Barium	N	N	NS	< 12.5		(10.7)		(11.0)		(14.0)		(10.5)	
Calcium	N	N	NS	412,000		304,000		311,000		223,000		143,000	
Chromium	80	145	NS	5.9		14.3		13.5		17.1		47.5	
Copper	70	390	NS	< 6.3		17.9		17.9		13.9		< 9.2	
Iron	N	N	NS	514		2,170		1,790		2,930		9,190	
Magnesium	N	N	NS	(952)		(1,160)		1,110	J	(936)		(734)	
Manganese	N	N	NS	11.8		65.4		65.2		58.1		37.5	
Sodium	N	N	NS	(663)		(447)		(444)		(433)		(274)	
Vanadium	N	N	NS	(3.4)		(5.7)		(5.4)		(8.0)		30.6	
Zinc	120	278	NS	11.7		16.0		14.3		43.2		12.1	
Lead	35	110	NS	4.8		40.3		35.1		21.9		33.0	
Arsenic	33	85	NS	< 2.5	UJ	< 3.9	UJ	11.8	J	< 3.6	UJ	4.0	J
Mercury	0.15	1.3	NS	< 0.062		< 0.095		0.10		< 0.081		< 0.083	

TABLE 2-10

CONSTITUENTS DETECTED IN SEDIMENT SAMPLES COLLECTED IN 1993
AT SITE OT-11/OU-2, RESIDUAL PESTICIDE DISPOSAL AREA
HOMESTEAD AIR RESERVE BASE, FLORIDA
(Page 2 of 2)

Parameter	NOAA ER-L[a] Value	NOAA ER-M[b] Value	Interim SQC (µg/kg OC)[c]	P3-SD-0010	P3-SD-0011	(Duplicate) P3-SD-9011	P3-SD-0012	P3-SD-0013
Cyanide (mg/kg dw)	N	N	NS	< 0.31	< 0.49	0.44	< 0.45	< 0.46
Total Organic Carbon (mg/kg dw)	-	-	-	2,500	24,000	21,000	33,000	34,000
AVS Extractable Metals (mg/kg dw)								
Copper	-	-	-	< 2.3	27.3	6.5	< 3.3	< 3.3
Zinc	-	-	-	11.6	8.9	10.4	36.7	8.3
Lead	-	-	-	< 4.5	21.1	20.8	12.5	9.6
Acid Volatile Sulfide (mg/kg dw)	-	-	-	< 13	31	29	210	19

[a] National Oceanic and Atmospheric Administration.
Effects Range - Low values are concentrations equivalent to the lower 10 percentile of available data screened by NOAA and indicate the low end of the range of concentrations in specific sediments at which adverse biological effects were observed or predicted in sensitive species and/or sensitive life stages.
[b] Effects Range - Median values are concentrations based on the NOAA journal data equivalent to the midpoint (50th percentile) of the range of available data screened by NOAA.
[c] OC is Organic Carbon. Before comparing Interim Sediment Quality Criteria (SQC) with the concentrations of constituents detected in a sample, the detected sediment concentrations must be normalized to the average percent combustible matter assumed to be organic carbon.
[d] Fresh Water Final Chronic Value (FCV) Sediment Quality Criteria.
[f] The sediment quality criteria (SQC) cannot be directly compared with the Boundary Canal and drainage ditch data because the SQC are presented as normalized to organic carbon (i.e., presented on a per organic carbon weight basis). To allow a direct comparison between Boundary Canal and drainage ditch data and SQC, the SQC for the average carbon content, 2.3% OC, in Boundary Canal and drainage ditch sediments were calculated. The SQC (µg/kg) at 2.3% OC were derived by multiplying the SQC (µg/kg OC) by the average OC content of 2.3% (.023 kg of OC/kg of sediment).
[g] NOAA ER-L & ER-M values for total Chlordane.
[h] Result from reanalysis of sample

NS No Standard Available
N No NOAA ER-L or ER-M value available.
µg/kg dw micrograms per kilogram dry weight
mg/kg dw milligrams per kilogram dry weight
< Analyte was not detected at or above the indicated concentration.
J Positive result has been classified as qualitative due to deficiencies in one or more quality control measures.
() Result is greater than instrument detection limit but less than practical quantitation limit.
UJ Analyte was not detected or has been classified as undetected, with further classification as qualitative.
U Classified as undetected.
☐ Concentration above NOAA or Sediment Quality Criterion To-Be-Considered Guidelines.

From: Geraghty & Miller, 1993a

benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, fluoranthene, indeno(1,2,3-c,d)pyrene, phenanthrene, and pyrene (Table 2-9).

During the 1993 field investigation, a total of 18 BNA compounds were detected as shown on Table 2-10, all of which were PAHs. Total PAH concentrations ranged from 139 to 32,790 ug/kg dw (Figure 2-7). All of the PAHs reported in sample P3-SD-0011 and duplicate P3-SD-9011 were detected above the detection limit but below the quantitation limit. Eleven PAHs (including acenaphthene, phenanthrene, fluoranthene, pyrene, benzo(a)anthracene, benzo(a)pyrene) were detected in sample P3-SD-0010 at concentrations above the practical quantitation limit (Table 2-10). The highest levels of PAHs in sediment occurred at the confluence of the drainage ditch and the Boundary Canal. No PAH sources are present on site at that location. In the canal, at the northern area of the site (by the rubble pile), none of the PAHs exceed NOAA ER-M values. The area is heavily overgrown at the location of the elevated PAH concentrations in the soil; and runoff is unlikely at that location. Due to the abundant vegetation at the site, surface water runoff during normal rain events is expected to be minimal. However, under heavy rain storms, surface water runoff to the drainage ditch and the Boundary Canal is possible. The canal system at Site OT-11/OU-2 has been evaluated under OU-9 -Boundary Canal.

Organochlorine Pesticides. During the 1991 field investigation, only 4,4'-DDE was detected in sediment samples collected from the ditch, at a concentration of 67 µg/kg (P3-SD-0001) and 73 µg/kg (P3-SD-0006) as shown in Figure 2-8. In the sediment samples collected from the Boundary Canal, three organochlorine pesticides were detected in sample P3-SD-0007: 4,4'-DDD, at a concentration of 960 µg/kg; 4,4'-DDE, at a concentration of 280 µg/kg; and 4,4'-DDT, at a concentration of 250 µg/kg. Figure 2-8 depicts the areal distribution of pesticides detected in the sediments at Site OT-11/OU-2. During the 1993 investigation, four pesticides were detected in sediment samples P3-SD-0011 and duplicate P3-SD-9011: 4,4'-DDD at concentrations of 6.5 and 5.6 µg/kg, respectively; 4,4'-DDE at concentrations of 82 and 67 µg/kg, respectively; alpha-chlordane at concentrations of 11 and 12 µg/kg, respectively; and gamma-chlordane at concentrations of 12 and 15 µg/kg, respectively (Table 2-10). No other pesticides were detected in the OT-11/OU-2 sediment samples. Forty-nine soil samples were collected at Site OT-11/OU-2, and only three had pesticide levels slightly higher than the maximum concentrations detected in the sediment samples. No pesticides were detected in the groundwater wells located in the immediate vicinity of these soil samples. The dense vegetation and distance (approximately 500 feet) to the canal makes stormwater runoff entering the canal unlikely. However, during heavy rain storms, surface water runoff to the drainage ditch and Boundary Canal is possible. Pesticides

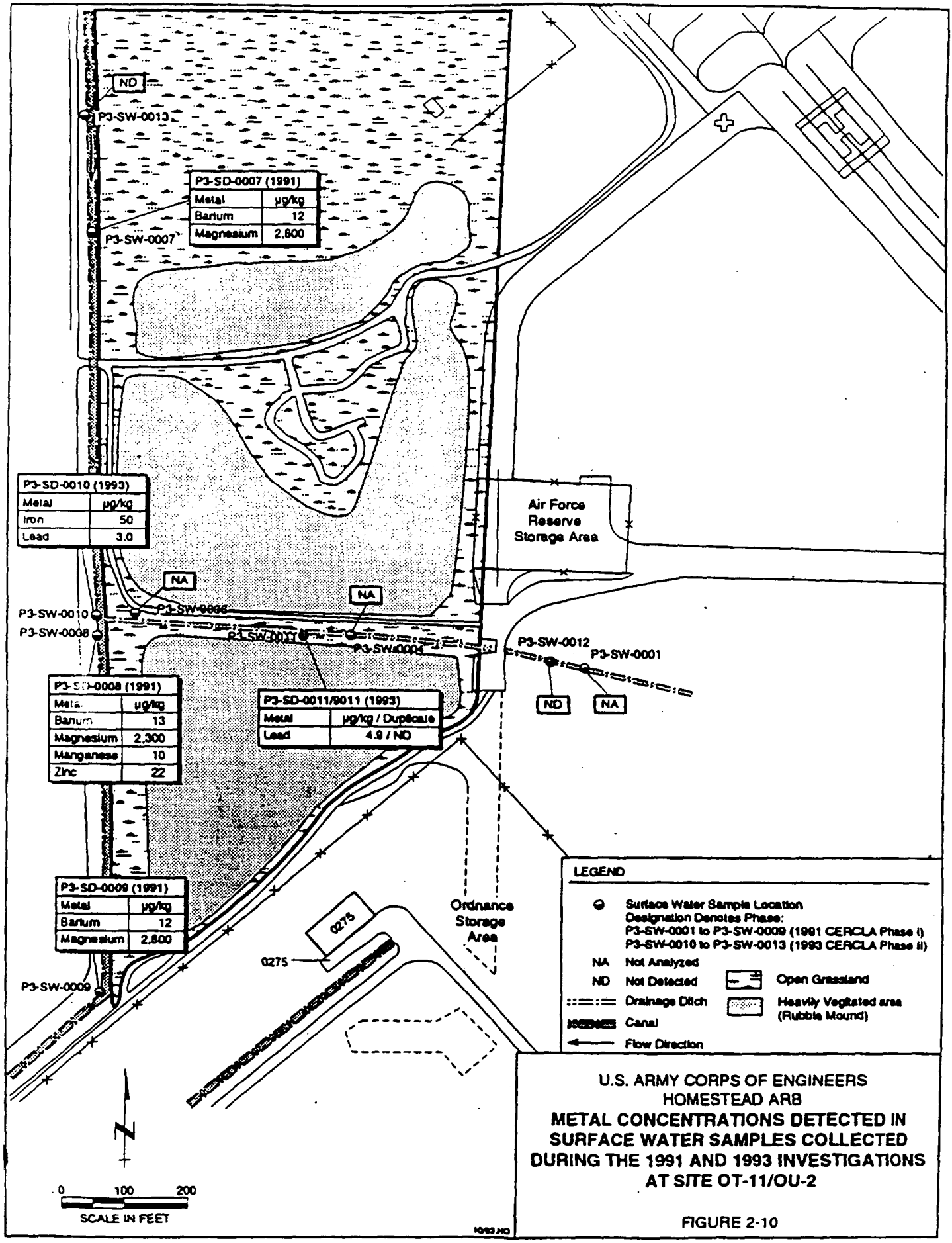
were not detected in Boundary Canal sediment samples collected downstream of the confluence of Boundary Canal and the OT-11/OU-2 drainage ditch in the vicinity of Site OT-11/OU-2. The canal system at Site OT-11/OU-2 has been evaluated under OU-9 - Boundary Canal.

Inorganic Constituents. During the 1991 and 1993 sampling rounds, 15 metals were detected in sediment samples collected from the drainage ditch and the Boundary Canal, as shown in Table 2-9 and 2-10. The metals with the highest concentrations in the sediment samples were calcium, aluminum, magnesium, iron, and sodium. The remaining metals, including arsenic, barium, chromium, cobalt, lead, mercury, and vanadium, occurred in trace concentrations. The concentrations of metals detected in the Site OT-11/OU-2 sediment samples appear to be typical of sediments having a carbonate bedrock source and were representative of background soils (Table 2-7). Figure 2-9 depicts the areal distribution of metals of concern.

2.6.1.4 Surface Water Contamination

The surface-water quality at Site OT-11/OU-2 was evaluated during both the 1991 and 1993 investigations. In 1991, six surface-water samples were collected from the same locations as the sediment samples: three samples (P3-SW-0001, P3-SW-0004, and P3-SW-0006) from the ditch system which transects Site OT-11/OU-2, and three samples (P3-SW-0007 through P3-SW-0009) from Boundary Canal. All six samples were analyzed for chlorinated pesticides. In addition, three of these samples (from the Boundary Canal), including the upgradient sample, were analyzed for TCL VOCs, TCL BNAs, and TAL metals. In 1993, three surface water samples (P3-SW-0010, P3-SW-0011, and P3-SW-0012) and one background sample (P3-SW-0013) were collected from Site OT-11/OU-2 and analyzed for TCL VOCs, TCL BNAs, pesticides, and TAL metals. A summary of the analytical results is presented in Tables 2-11 and 2-12 and Figure 2-10. Results of the analyses are discussed below for each analyte group (i.e., VOCs, BNAs, etc.). Surface water impacts to the canals are addressed in the OU-9 Boundary Canal RI/BRA Reports

Volatile Organic Compounds. Only one VOC was detected in the surface water samples. Bromodichloromethane was detected in sample P3-SW-0010 at a concentration of 1.0 µg/L and was also detected in the background sample, P3-SW-0013, at the same concentration. The practical quantitation limit for bromodichloromethane is 10 µg/L, which is substantially greater than the detected concentration. Bromodichloromethane, a disinfection by-product, is a trihalomethane commonly found in drinking water.



U.S. ARMY CORPS OF ENGINEERS
HOMESTEAD ARB

METAL CONCENTRATIONS DETECTED IN SURFACE WATER SAMPLES COLLECTED DURING THE 1991 AND 1993 INVESTIGATIONS AT SITE OT-11/OU-2

FIGURE 2-10

TABLE 2-11

CONSTITUENTS DETECTED IN SURFACE WATER SAMPLES COLLECTED IN 1991 AT SITE OT-11/OU-2
RESIDUAL PESTICIDE DISPOSAL AREA
HOMESTEAD AIR RESERVE BASE, FLORIDA

Analyte	Sample Identification / Sampling Date	P3-SW-0001 8/23/91	P3-SW-0004 8/24/91	P3-SW-0006 8/24/91	P3-SW-9006 8/24/91	P3-SW-0007 10/3/91	P3-SW-0008 10/3/91	P3-SW-9008[a] 10/3/91	P3-SW-0009 10/3/91
METALS (µg/L)									
Barium		NA	NA	NA	NA	12	13	13	12
Calcium		NA	NA	NA	NA	99,000	87,000	88,000	98,000
Copper		NA	NA	NA	NA	< 2.0	< 2.0	< 2.0	< 2.0
Magnesium		NA	NA	NA	NA	2,800	2,300	2,300	2,800
Manganese		NA	NA	NA	NA	< 10	10	10	< 10
Potassium		NA	NA	NA	NA	6,700	4,300	4,400	6,900
Sodium		NA	NA	NA	NA	12,000	10,000	9,800	1,200
Zinc		NA	NA	NA	NA	< 20	22	< 20	< 20
BASE/NEUTRAL-ACID EXTRACTABLE COMPOUNDS (µg/L)									
Bis(2-Ethylhexyl)phthalate		NA	NA	NA	NA	7.2 Jb	< 5.0	4.9 Jb	11b
ORGANOCHLORINATED PESTICIDES (µg/L)									
gamma-BHC (Lindane)		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	0.011

b Result has been classified as qualitative due to error(s) in associated quality control analyses.
a Duplicate analysis for P3-SW-0008.

µg/L micrograms per liter.
NA Not analyzed
< Analyte was not detected. Values given are equal to the practical quantitation limits requested in the RI Work Plan and may vary among samples due to differences in water content, mass analyzed, and dilution factors.
J Value is greater than instrument detection limit but less than practical quantitation limit.

From: Geraghty & Miller, 1991a

TABLE 2-12

CONSTITUENTS DETECTED IN SURFACE WATER SAMPLES COLLECTED IN 1993
AT SITE OT-11/OU-2, RESIDUAL PESTICIDE DISPOSAL AREA
HOMESTEAD AIR RESERVE BASE, FLORIDA

Parameter	Florida Surface-Water Quality Standards[a]	Federal Water Quality Criterion[b]	P3-SW-0010	P3-SW-0011	P3-SW-9011	P3-SW-0012	(Background) P3-SW-0013
Volatile Organic Compounds (µg/L)							
Bromodichloromethane	NS	NS	(1)	< 10	< 10	< 10	(1)
Base/Neutral and Acid Extractable Compounds (µg/L)							
Butylbenzylphthalate	NS	NS	< 10 UJ	(0.2) UJ	< 10 UJ	< 10 UJ	(0.2) UJ
bis(2-Ethylhexyl)phthalate	NS	NS	(0.5) UJ	(0.8) UJ	< 10 UJ	(2) UJ	(0.3) UJ
Organochlorine Pesticides/PCBs (µg/L)			ND	ND	ND	ND	ND
Metals (µg/L)							
Calcium	NS	NS	93,100	107,000	89,300	50,500	95,500
Iron	1,000	1,000	50.0	(94.5)	< 50.0	< 50.0	< 50.0
Magnesium	NS	NS	(3,060)	(3,110)	(3,080)	(2,180)	(3,110)
Potassium	NS	NS	8,140	8,040	7,990	5,070	8,130
Sodium	NS	NS	13,600	13,900	13,800	11,400	13,500
Lead	30	8.8[c]	3.0	4.9	< 3.0	< 3.0	< 3.0
Cyanide (µg/L)	<5	5.2	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Hardness(mg/L)	NS	NS	245	280	236	135	251

Notes:
[a] Florida Surface Water Quality Standard for Class III fresh surface waters (Rule 17-302.560 and 17-302.510, FAC).
[b] Continuous Federal Water Quality Criterion except where otherwise noted.
[c] Federal Water Quality Criterion calculated using an average hardness value of 222 mg/L.
µg/L micrograms per liter
mg/L milligrams per liter
< Analyte was not detected at or above the indicated concentrations. Values given are equal to the requested quantitation limits and may vary among samples due to dilution factors.
() Value is greater than instrument detection limit but less than practical quantitation limit.
ND Not detected, none of the compounds in this analyte group were detected above the detection limit.
J Positive result has been classified as qualitative.
UJ Analyte was not detected or has been classified as undetected, with further classification as qualitative.
U Classified as undetected.

From: Geraghty & Miller, Inc., 1993a

Base/Neutral and Acid Extractable Compounds. The only BNA compound detected was bis(2-ethylhexyl)phthalate, reported in surface water samples P3-SW-0007, P3-SW-9008, and P3-SW-0009 at a maximum concentration of 11 µg/L (Table 2-11). Bis(2-ethylhexyl)phthalate is a common laboratory artifact. The low levels of bis(2-ethylhexyl)phthalate detected in surface water samples from this site are likely due to laboratory contamination. No other BNA compounds were detected in the surface water samples at Site OT-11/OU-2.

Organochlorine Pesticides. Only one organochlorine pesticide was reported in one surface-water sample: lindane (gamma-BHC) was reported at a concentration of 0.011 µg/L in sample P3-SW-0009. Lindane was not detected in other soil or sediment samples collected from the site. No other pesticides were detected in any of the surface water samples.

Inorganic Constituents. In both sampling rounds, calcium, magnesium, potassium, and sodium were detected in all the surface water samples; however, no water quality standards or guidelines exist for these metals. Barium was detected at concentrations ranging from 12 µg/L to 13 µg/L in all samples collected in the 1991 investigation. Manganese was detected in sample P3-SW-0008 and the duplicate sample P3-SW-9008 at a concentration of 10 µg/L. Zinc was detected at a concentration of 22 µg/L (P3-SW-0008), but was not detected in the associated duplicate (P3-SW-9008). Iron was detected at a concentration of 94.5 µg/L (P3-SW-0011), but was not detected in the associated duplicate (P3-SW-9011). Lead was detected at a concentration of 4.9 µg/L (P3-SW-0011), but was not detected in the associated duplicate (P3-SW-9011). None of the detections in surface water samples exceeded Federal Water Quality Criterion or Florida Surface Water Standards. Figure 2-10 depicts the areal distribution of the metals detected in surface water samples at Site OT-11/OU-2.

2.6.2 Summary

Concentrations of pesticides (e.g., DDT, DDD, DDE, aldrin, dieldrin, methoxychlor, and chlordane) have been detected in shallow soil samples collected at Site OT-11/OU-2 below the State of Florida Health-Based Soil Target Levels. The samples collected in 1984 were also analyzed for chlorinated herbicides. Since none of the samples indicated the presence of herbicides, this analysis was not performed in the subsequent sampling rounds. Soil samples were also analyzed for VOCs, BNAs, and metals during the 1993 investigation. Eight VOCs were detected in the soil samples; however, acetone was the only VOC detected at a concentration above its PQL, and was believed to be a laboratory artifact. A total of 21 BNAs (mainly PAHs) were detected in the soil samples. Total PAH concentrations ranged

from 141 to 92,968 ug/kg dw. The elevated concentrations of total PAHs are likely from the asphalt debris (which contains PAHs) in the overlying fill material. A total of 19 metals were detected in the soil samples, most within the range of Homestead ARB background. Lead was detected at concentrations greater than twice the average Homestead ARB background concentration for soil. Lead concentrations ranged from below 1 to 19,600 mg/kg dw. Of the eighteen soil samples collected during the 1993 investigation, one surficial soil sample and its duplicate contained lead concentrations that exceed the FDEP Health-Based Soil Target Level of 1,000 mg/kg.

Groundwater samples were collected in 1988 and 1993 and analyzed for organochlorine pesticides, chlorinated herbicides, VOCs, BNAs, and metals. No VOCs, chlorinated pesticides/PCBs, or herbicides were detected in the samples. Eleven BNAs were detected at concentrations above their detection limit but below their practical quantitation limit. Seven metals were detected; however, none of the metals were detected at concentrations above Federal or State Primary Drinking Water Standards.

Sediment samples were collected in 1991 and 1993 from the drainage swale that transects the site and from Boundary Canal. Low levels of pesticides (i.e., DDT, DDE, DDD, and chlordane) were found in four of the samples (three from the swale and one from Boundary Canal). Metals were detected in four samples from Boundary Canal and six samples from the drainage swale at total concentrations within background levels. BNAs were detected in four sediment samples collected from Boundary Canal at total concentrations ranging from less than 1 mg/kg dw (P3-SD-0009) to 18.93 mg/kg dw (P3-SD-0008), and in three sediment samples collected from the drainage swale at total concentrations ranging from 2.1 (P3-SD-0011) to 32.79 (P3-SD-0010) mg/kg dw.

Surface water samples were collected in 1991 and 1993 from the same locations as the sediment samples. Samples collected from Boundary Canal and from the swale were analyzed for organochlorine pesticides, BNAs, VOCs, and metals. No VOCs were detected in any of the samples. One pesticide, lindane, was detected in one surface sample. This pesticide was not believed to be prevalent at the site. Several metals were detected in the surface water samples collected from Boundary Canal. None of the detections in surface water samples exceeded Federal Water Quality Criterion or Florida Surface Water Standards.

In summary, the environmental media of concern include the soil and sediment at Site OT-11/OU-2.

2.7 SUMMARY OF SITE RISKS

In order to evaluate whether existing or future exposure to contaminated media at Site OT-11/OU-2 could pose a risk to human health and the environment, the USAF completed a Baseline Risk Assessment (BRA) in July 1994, with USEPA oversight of the process. In evaluating potential site risk, the USAF assumed no further action would be taken to address contamination at the site. This evaluation then served as a baseline for determining whether cleanup of each site media was necessary. In the BRA, the USAF evaluated site risk for several environmental media. This ROD addresses the risks attributable to chemicals in the soil, groundwater, sediment, and surface water at Site OT-11/OU-2. The BRA included the following major components: selection of chemicals of potential concern (COPC), exposure assessment, toxicity assessment, risk characterization, development of remedial goal options, ecological risk and uncertainties.

2.8 SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Chemicals are included in the BRA as COPCs if the results of an initial screening indicate the chemical might pose a current or future risk above levels deemed protective of human health and the environment by the USEPA. COPCs at Site OT-11/OU-2 were based on the twice background criteria for inorganic chemicals, elimination of lab contaminants and detection frequency for organic chemical and essential nutrient elimination.

COPCs for soil, groundwater, surface water, and sediment are shown in Table 2-13.

2.9 EXPOSURE ASSESSMENT

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

TABLE 2-13

CONSTITUENTS OF POTENTIAL CONCERN
AT SITE OT-11/OU-2
RESIDUAL PESTICIDE DISPOSAL AREA
HOMESTEAD AIR RESERVE BASE, FLORIDA
(Page 1 of 3)

Constituent	Groundwater	Soils/ Weathered Rock	Surface Water	Sediment	Cancer Potential Class[d]
VOCS					
Acetone		X[a]		X[a]	D
Bromodichloromethane		X[b]	X[b]		B2
2-Butanone		X[a,b]			D
Carbon Disulfide		X[b]			D
Chloroform		X[b]			B2
Dibromochloromethane		X[b]			C
1,1-Dichloroethene		X[b]			C
BNAs					
Acenaphthene	X[b]	X		X	D
Acenaphthylene	X[b]	X			D
Anthracene		X		X[b]	D
Benzo(a)anthracene		X		X	B2
Benzo(b)fluoranthene		X		X	B2
Benzo(k)fluoranthene		X		X[b]	B2
Benzo(g,h,i)perylene		X		X	D
Benzo(a)pyrene		X		X	B2
Bis(2-ethylhexyl)phthalate			X[a]	X[a]	B2
Butylbenzylphthalate		X[a]	X[a]		C
Carbazole	X[b]	X[b]		X	B2
Chrysene		X		X	B2
Dibenzo(a,h)anthracene		X		X[b]	B2
Dibenzofuran	X[b]	X		X[b]	D
Diethylphthalate	X[b]				D
Di-n-octylphthalate	X[b]			X[b]	D

TABLE 2-13

CONSTITUENTS OF POTENTIAL CONCERN
AT SITE OT-11/OU-2
RESIDUAL PESTICIDE DISPOSAL AREA
HOMESTEAD AIR RESERVE BASE, FLORIDA
(Page 2 of 3)

Constituent	Groundwater	Soils/ Weathered Rock	Surface Water	Sediment	Cancer Potential Class[d]
Fluoranthene	X[b]	X		X	D
Fluorene	X[b]	X		X[b]	D
Indeno(1,2,3-c,d)pyrene		X		X[b]	B2
2-Methylnaphthalene		X			D
Naphthalene	X[b]	X			D
Phenanthrene	X[b]	X		X	D
Pyrene	X[b]	X		X	D
Pesticides					
Aldrin		X			B2
Chlordane (alpha and gamma)		X		X	B2
4,4'-DDD		X		X	B2
4,4'-DDE		X		X	B2
4,4'-DDT		X			B2
Dieldrin		X[b]			B2
Endosulfan II		X			D
Heptachlor epoxide		X			B2
Methoxychlor		X			D
Metals					
Aluminum		X			NA
Arsenic		X		X[c]	A
Barium	X[b]		X		D
Cadmium		X			B1
Chromium	X	X			A
Cobalt				X	NA

TABLE 2-13

CONSTITUENTS OF POTENTIAL CONCERN
AT SITE OT-11/OU-2
RESIDUAL PESTICIDE DISPOSAL AREA
HOMESTEAD AIR RESERVE BASE, FLORIDA

Constituent	Groundwater	Soils/ Weathered Rock	Surface Water	Sediment	Cancer Potential Class[d]
Copper		X		X	D
Iron	X[b]	X	X		D
Lead		X	X		B2
Manganese		X	X		D
Mercury		X		X	D
Silver		X			D
Vanadium		X[b]			D
Zinc		X	X	X	D

[a] Common laboratory contaminant
[b] Analytical results are above the method detection limit but below the practical quantitation limit
[c] Result classified as undetected
[d] Class A: Known human carcinogen
Class B: Probable human carcinogen
B1: Limited human data are available
B2: Sufficient evidence in animals but inadequate human data
Class C: Possible human carcinogen
Class D: Inadequate evidence of carcinogenicity
NA: Not Available/Applicable (not considered carcinogens)

Adapted From: Geraghty & Miller, 1994b

2.9.1 Exposure Point Concentration

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

$$UCL = e\left(\bar{y} + \frac{Sy^2}{2} + \frac{Sy \times H}{\sqrt{n-1}}\right)$$

where: $\bar{y}$ = 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_{95} is higher than the maximum detected concentration. If so, the maximum concentration detected was used as the exposure point concentration rather than the UCL_{95}.

2.9.2 Land Use

Hypothetical future use of the site for residential purposes is unlikely. However, for the purposes of the BRA, the hypothetical future risks were evaluated for the possibility of future residential development of the site and installation of a potable well.

2.9.3 Exposure Scenarios

Potential current risks at the site were evaluated based on a base worker, accessing the site for cutting the grass, who could ingest soil, have skin contact with soil, or inhale dust from soil. Future populations at risk consisted of hypothetical adults and children. Exposure to contaminated groundwater and soil was evaluated for hypothetical 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 2-14 through 2-16. Based on the exposure point concentrations derived from site data for the chemicals shown in Table 2-13 and using the exposure assumptions identified in Tables 2-14 through 2-16, USEPA estimated the chronic daily intake (CDI) associated with each exposure pathway and population combination. The formulas used to calculate the CDI for each pathway are also provided in Tables 2-14 through 2-16.

TABLE 2-14
EQUATIONS AND SAMPLE CALCULATIONS FOR HYPOTHETICAL FUTURE GROUNDWATER EXPOSURE, SITE OT-11/OU-2, RESIDUAL PESTICIDE DISPOSAL AREA
Homestead Air Reserve Base, Florida

Equation Definitions

$$GWE \times D_o = \frac{EPC_{gw} \times IR \times EF \times ED}{BW \times AP}$$

$$GWE \times D_d = \frac{EPC_{gw} \times SSA \times PC \times ET \times EF \times ED}{BW \times AP \times UCF}$$

$$HI = \frac{GWE \times D_o}{RfD_o} + \frac{GWE \times D_d}{RfD_d}$$

$$ELCR = (GWE \times D_o \times CSF_o) + (GWE \times D_d \times CSF_d)$$

where:

AP	Averaging period (equal to ED x 365 days/year for non-cancer effects; 25,550 days [365 days/yr for 70 years] for carcinogenic effects (USEPA, 1989a).
BW	Body weight (70-kg for an adult: 15 kg for a child [aged 0 to 6])) (USEPA, 1991a).
CSF	Cancer slope factor for oral (CSF_o) or dermal (CSF_d) intake $(mg/kg/day)^{-1}$.
ELCR	Excess lifetime cancer risk.
EF	Exposure frequency (350 days/year) (USEPA, 1991a).
ET	Exposure time while bathing/showering (hours) (15 minutes = 0.25 hour) (Foster and Chrostowski, 1987).
ED	Exposure duration (30 years for an adult resident; 6 years for a child resident [aged 0 to 6]).
EPC_{gw}	Exposure point concentration in groundwater (mg/L) (Table 3.1).
GWE x D	Potable groundwater exposure dose for oral (GWE x D_o) or dermal (GWE x D_d) intake (mg/kg/day).
HI	Hazard index.
IR	Ingestion rate of drinking water (2 liters/day for an adult; 1 liter/day for a child [aged 0 to 6]) (USEPA, 1991a; 1989d).
PC	Permeability constant (cm/hour) (Table 3.11).
RfD	Reference dose for oral (RfD_o) or dermal (RfD_d) intake (mg/kg/day).
SSA	Exposed skin surface area while bathing/showering (18,150 cm for an adult; 5,150 cm for a child [aged 0 to 6]) (USEPA, 1989d).
UCF	Unit conversion factor (1,000 cm /L).

TABLE 2-14
EQUATIONS AND SAMPLE CALCULATIONS FOR HYPOTHETICAL FUTURE GROUNDWATER EXPOSURE,
SITE OT-11/OU-2, RESIDUAL PESTICIDE DISPOSAL AREA
Homestead Air Reserve Base, Florida
(Continued)

Example Calculation: Cancer Effects of Carbazole (Adult Resident)

$$GWE \times D_o = \frac{(0.00090\ mg/L)(2\ L/day)(350\ days/year)(30\ years)}{(70\ kg)(25{,}550\ days)}$$

$$= 1.06E\text{-}05\ mg/kg/day$$

$$GWE \times D_d = \frac{(0.00090\ mg/L)(18{,}150\ cm^2)(0.04\ cm/hour)(0.25\ hour)(350\ days/year)(30\ years)}{(70\ kg)(25{,}550\ days)(1{,}000\ cm^3/L)}$$

$$= 9.59E\text{-}07\ mg/kg/day$$

$$ELCR = [(1.06E\text{-}5\ mg/kg/day)(0.020\ kg\text{-}day/mg)] + [(9.59E\text{-}7\ mg/kg/day)(0.020\ kg\text{-}day/m$$

$$= 2.3E\text{-}07$$

Non-Cancer Effects of Pyrene (Child Resident)

$$GWE \times D_o = \frac{(0.00040\ mg/L)(1\ L/day)(350\ days/year)(6\ years)}{(15\ kg)(2{,}190\ days)}$$

$$= 2.6E\text{-}05\ mg/kg/day$$

$$GWE \times D_d = \frac{(0.00040\ mg/L)(5{,}150\ cm^2)(0.67\ cm/hour)(0.25\ hour)(350\ days/year)(6\ years)}{(15\ kg)(2{,}190\ days)(1{,}000\ cm^3/L)}$$

$$= 2.2E\text{-}05\ mg/kg/day$$

$$HI = \frac{2.6E\text{-}05\ mg/kg/day}{3E\text{-}02\ mg/kg/day} + \frac{2.2E\text{-}05\ mg/kg/day}{3E\text{-}02\ mg/kg/day}$$

$$= 1.6E\text{-}03$$

Source: Geraghty & Miller, 1994b

TABLE 2-15
-EQUATIONS AND SAMPLE CALCULATIONS FOR SOIL EXPOSURE, SITE OT-11/OU-2, RESIDUAL PESTICIDE DISPOSAL AREA
Homestead Air Reserve Base, Florida

Equation Definitions:

$$SExD_o = \frac{EPC_o \times IR \times EF \times ED \times UC_1}{BW \times AP} \quad [\text{mg/kg/day}]$$

$$SExD_d = \frac{EPC_s \times SSA \times SAR \times ABS \times EF \times ED \times UC_1}{BW \times AP} \quad [\text{mg/kg/day}]$$

$$SExD_i = \frac{EPC_s \times BR \times (1/VF + 1/PEF) \times ET \times EF \times ED}{BW \times AP} \quad [\text{mg/kg/day}]$$

$$VF = Q/C \times \frac{(3.1416 \times \sigma \times T)^{1/2}}{2 \times Dei \times Pa \times Kas} \times UC_2' \quad [\text{m}^3/\text{kg}]$$

$$PEF = Q/C \times \frac{UC_3}{0.036 \times (1-G) \times (Um/Ut)^3 \times F} \quad [\text{m}^3/\text{kg}]$$

$$Q/C = \left(\exp[(0.1004 \times \ln(A)) - 5.3466 + (2.92 \times sY)]\right)^{-1} \quad [(\text{g/m}^2/\text{sec})/(\text{kg/m}^3)]$$

$$sY = 0.02685 \times \left[0.25 + \frac{[\ln(A) - 11.0509]^2}{26.3608}\right] \quad [\text{unitless}]$$

$$\sigma = \frac{Dei \times Pa}{Pa + [\rho s \times (1 - Pa/Kas)]} \quad [\text{cm}^2/\text{sec}]$$

$$Dei = Di \times (Pa^{3.33}/Pt^2) \quad [\text{cm}^2/\text{sec}]$$

$$ELCR = [(SExD_o \times CSF_o) + (SExD_d \times CSF_o) + (SExD_i \times CSF_i)] \times TEF \quad [\text{unitless}]$$

$$HI = \frac{SExD_o}{RfD_o} + \frac{SExD_d}{RfD_o} + \frac{SExD_i}{RfD_i} \quad [\text{unitless}]$$

where:

Contiguous area of contamination (m^2); 4 acres (16,000 m^2).

.S Dermal absorption efficiency, constituent-specific (Table 3.11).

AP Averaging period (25,550 days [70 years x 365 days/year] for cancer effects; ED x 365 days/year for non-cancer effects for a base worker and residents; ED x 7 days/week for an excavation worker) (USEPA, 1989a).

TABLE 2-15
EQUATIONS AND SAMPLE CALCULATIONS FOR SOIL EXPOSURE, SITE OT-11/OU-2, RESIDUAL PESTICIDE DISPOSAL AREA
Homestead Air Reserve Base, Florida

BR	Breathing rate (0.83 m^3/hour [20 m^3/day] for residents; 2.5 m^3/hour [20 m^3/8-hour day] for workers) (USEPA, 1991a).
BW	Body weight (70 kg for an adult; 15 kg for a child (aged 0 to 6) [USEPA, 1991a]).
CSF	Cancer slope factor for oral (CSF_o), dermal (CSF_d), or inhalation (CSF_i) intake (mg/kg/day)$^{-1}$ (Table 3.10).
Dei	Effective diffusivity (cm^2/sec).
Di	Diffusivity in air (cm^2/sec) (Table 3.7).
ED	Exposure duration (years or weeks) (25 years for a base worker [USEPA, 1991a]; 12 weeks for an excavation worker; 30 years for an adult resident [USEPA, 1989a]; 6 years for a child resident (aged 0 to 6)).
EF	Exposure frequency (days/year or days/week) (350 days/year for residents [USEPA, 1991a]; 12 days/year for a base worker; 6 days/week for an excavation worker).
ELCR	Excess lifetime cancer risk (unitless).
EPC,	Constituent exposure point concentration in the soil (mg/kg) (Table 3.2).
ET	Exposure time (2 hours/day for a base worker; 8 hours/day for an excavation worker; 24 hours/day for residents).
F	Function of Ut/Um (0.0126) (unitless); $F = 0.18 [8x^3 + 12x \times \exp(-x^2)]$, where $x = 0.886$ (Ut/Um).
Foc	Fraction organic carbon in soil (0.02).
G	Fraction of vegetative cover (unitless); conservatively assumed as zero.
H	Henry's Law Constant (atm-m^3/mol) (Table 3.7).
HI	Hazard index (unitless).
IR	Incidental ingestion rate for soil (50 mg/day for a base worker; 480 mg/day for an excavation worker; 100 mg/day for an adult resident; 200 mg/day for a child resident (aged 0 to 6)) (USEPA, 1991a).
Kas	Soil-air partition coefficient (g soil/cm^3 air); calculated as (41 mol/atm/m^3) × H / (Koc × Foc).
Koc	Organic carbon partition coefficient (cm^3/g or mL/g) (Table 3.7).
Pa	Air-filled soil porosity (0.06) (unitless).
PEF	Particulate emission factor (site-specific) (2.02×10^{10} m^3/kg).
Pt	Total soil porosity (0.43) (unitless).
Ps	True soil or particle density (2.65 g/cm^3).
RfD	Reference dose for oral (RfD_o), dermal (RfD_d), or inhalation (RfD_i) intake (mg/kg/day) (Table 3.9).
SAR	Soil adherence rate (1 mg/cm^2/day) (USEPA, 1992b).
SExD	Soil exposure dose from oral ($SExD_o$), dermal ($SExD_d$), or inhalation ($SExD_i$) exposure (mg/kg/day).
SSA	Exposed skin surface area (3,160 cm^2 for workers [USEPA, 1992b]; 4,650 cm^2 for an adult resident; 3,220 cm^2 for a child resident (aged 0 to 6) [USEPA, 1989d]).
T	Exposure interval (sec) (7.9×10^8 sec [25 years] for a base worker; 7.3×10^6 sec [12 weeks] for an excavation worker; and 9.5×10^8 sec [30 years] for residents).
TEF	Toxicity equivalency factor for carcinogenic polynuclear aromatic hydrocarbons (PAHs); not applicable for other constituents (Table 3.10).
UC,	Unit conversion (10^{-6} kg/mg).
UC_2	Unit conversion 2 (10^{-4} m^2/cm^2).
UC_3	Unit conversion 3 (3,600 sec/hour).
Um	Wind speed (4 m/sec [NOAA, 1974]).
Ut	Equivalent threshold value of windspeed at 10 meters (12.8 m/sec).
VF	Volatilization factor (site- and constituent-specific) (m^3/kg).

Sample Calculation: Cancer Effects of Chrysene (excavation worker)

$$xD_o = \frac{(1.6\ mg/kg) \times (480\ mg/d) \times (6\ d/wk) \times (12\ wks) \times (10^{-6}\ kg/mg)}{(70\ kg) \times (25{,}550\ d)}$$

$$= 3.1 \times 10^{-6}\ mg/kg/d$$

TABLE 2-15
EQUATIONS AND SAMPLE CALCULATIONS
FOR SOIL EXPOSURE,
SITE OT-11/OU-2, RESIDUAL PESTICIDE DISPOSAL AREA
Homestead Air Reserve Base, Florida

$$SExD_a = \frac{(1.6\ mg/kg) \times (3{,}160\ cm^2) \times (1\ mg/cm^2/d) \times (0.03) \times (6\ d/wk) \times (12\ wks) \times (10^{-6}\ kg/mg)}{(70\ kg) \times (25{,}550\ d)}$$

$$= 6.1 \times 10^{-6}\ mg/kg/d$$

$$Dei = (0.04531\ cm^2/sec) \times (0.06^{2.32}/0.43^2) = 2.09 \times 10^{-5}\ cm^2/sec$$

$$Kas = \frac{(41\ mol/atm/m^3) \times (3.15 \times 10^{-7}\ atm\text{-}m^3/mol)}{(240{,}000\ cm^3/g) \times (0.02)} = 2.69 \times 10^{-8}\ g/cm^3$$

$$\alpha = \frac{(2.09 \times 10^{-5}\ cm^2/sec) \times 0.06}{0.06 + [(2.65\ g/cm^3) \times (1 - 0.06)/(2.69 \times 10^{-8}\ g/cm^3)]} = 1.36 \times 10^{-15}\ cm^2/sec$$

$$sY = 0.02685 \times \left[0.25 + \frac{[\ln(16{,}000\ m^2) - 11.0509]^2}{26.3608}\right] = 0.008626$$

$$Q/C = \left(\exp[(0.1004 \times \ln[16{,}000\ m^2]) - 5.3466 + (2.92 \times 0.008626)]\right)^{-1}$$

$$= 77.44\ (g/m^2/sec)/(kg/m^3)$$

$$VF = \left[77.44\ \frac{g/m^2/sec}{kg/m^3}\right] \times \frac{[3.1416 \times (1.36 \times 10^{-15}\ cm^2/sec) \times (7.3 \times 10^8\ sec)]^{1/2}}{2 \times (2.09 \times 10^{-5}\ cm^2/sec) \times 0.06 \times (2.69 \times 10^{-8}\ g/cm^3)} \times (10^{-4}\ m^2/cm^2)$$

$$= 2.02 \times 10^6\ m^3/kg$$

$$PEF = \left[77.44\ \frac{g/m^2/sec}{kg/m^3}\right] \times \frac{3{,}600\ sec/hour}{(0.036\ g/m^2/hr) \times (1 - 0) \times [(4\ m/sec)/(12.8\ m/sec)]^3 \times 0.01257}$$

$$= 2.02 \times 10^{10}\ m^3/kg$$

$$SExD_i = \frac{(1.6\ mg/kg) \times (2.5\ m^3/hr) \times [(1/2.02 \times 10^6\ m^3/kg) + (1/2.02 \times 10^{10}\ m^3/kg)] \times (8\ hr/d) \times (6\ d/wk) \times (12\ wks)}{(70\ kg) \times (25{,}550\ d)}$$

$$= 6.4 \times 10^{-12}\ mg/kg/d$$

$$ELCR = \{[(3.1 \times 10^{-6}\ mg/kg/d) \times (7.3\ kg\text{-}d/mg)] + [(6.4 \times 10^{-12}\ mg/kg/d) \times (6.1\ kg\text{-}d/mg)]\} \times 0.01$$

$$= 2.3 \times 10^{-8}$$

(CSF_o is not available for chrysene; therefore, dermal exposure is not included in the ELCR calculation.)

TABLE 2-15
EQUATIONS AND SAMPLE CALCULATIONS FOR SOIL EXPOSURE, SITE OT-11/OU-2, RESIDUAL PESTICIDE DISPOSAL AREA
Homestead Air Reserve Base, Florida

Sample Calculation: Non-Cancer Effects of Mercury (adult resident)

$$SExD_o = \frac{(0.10\ mg/kg) \times (100\ mg/d) \times (350\ d/yr) \times (30\ yrs) \times (10^{-6}\ kg/mg)}{(70\ kg) \times (10{,}950\ d)}$$

$$= 1.4 \times 10^{-7}\ mg/kg/d$$

$$SExD_d = \frac{(0.10\ mg/kg) \times (4{,}650\ cm^2) \times (1\ mg/cm^2/d) \times 0.026 \times (350\ d/yr) \times (30\ yrs) \times (10^{-6}\ kg/mg)}{(70\ kg) \times (10{,}950\ d)}$$

$$= 1.7 \times 10^{-7}\ mg/kg/d$$

$$SExD_i = \frac{(0.10\ mg/kg) \times [0 + (1/2.02 \times 10^{10}\ m^3/kg)] \times (0.83\ m^3/hr) \times (24\ hr/d) \times (350\ d/yr) \times (30\ yrs)}{(70\ kg) \times (10{,}950\ d)}$$

$$= 1.4 \times 10^{-12}\ mg/kg/d$$

$$HI = \frac{1.4 \times 10^{-7}\ mg/kg/d}{3 \times 10^{-4}\ mg/kg/d} + \frac{1.7 \times 10^{-7}\ mg/kg/d}{5 \times 10^{-5}\ mg/kg/d} + \frac{1.4 \times 10^{-12}\ mg/kg/d}{9 \times 10^{-5}\ mg/kg/d}$$

$$= 0.0038$$

Source: Geraghty & Miller, 1994b

TABLE 2-16
EQUATIONS AND SAMPLE CALCULATIONS FOR WADING EXPOSURE AT SITE OT-11/OU-2, RESIDUAL PESTICIDE DISPOSAL AREA
Homestead Air Reserve Base, Florida

Equation Definitions:

$$WE \times D_o = \frac{EPC_{sw} \times IR_{sw} \times ED \times EF \times ET}{BW \times AP} + \frac{EPC_{sd} \times IR_{sd} \times ED \times EF}{BW \times AP \times UC_1}$$

$$WE \times D_d = \frac{EPC_{sw} \times SSA \times PC \times UC_2 \times ED \times EF \times ET}{BW \times AP} + \frac{EPC_{sd} \times SSA \times SAR \times ABS \times ED \times EF}{BW \times AP \times UC_1}$$

$$ELCR = [(WExD_o \times CSF_o) + (WExD_d \times CSF_d)] \times TEF$$

$$HI = (WExD_o/RfD_o) + (WExD_d/RfD_d)$$

where:

ABS	Dermal absorption efficiency (unitless) (Table 3.11).
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, 1991a).
BW	Body weight (70 kg for an adult; 38 kg for an older child [aged 6 to 15 years]) (USEPA, 1991a; USEPA, 1986b).
CSF	Cancer slope factor for oral (CSF_o) or dermal (CSF_d) exposure $(mg/kg\text{-}day)^{-1}$ (Table 3.10).
ED	Exposure duration (25 years for a base worker; 9 years for an older child [aged 6 to 15]).
EF	Exposure frequency (12 days/year).
ELCR	Excess lifetime cancer risk (unitless).
EPC_{sd}	Constituent exposure point concentration in the sediment (mg/kg) (Table 3.4).
EPC_{sw}	Constituent exposure point concentration in the surface water (mg/L) Table 3.3).
ET	Exposure time (8 hours/day for a base worker; 2.6 hours/day for an older child).
HI	Hazard index (unitless).
IR_{sd}	Incidental ingestion rate of sediment while wading (5 mg/day).
IR_{sw}	Incidental ingestion rate of surface water while wading (0.005 liters/hour).
PC	Permeability constant (cm/hour) (Table 3.11).
RfD	Reference dose for oral (RfD_o) or dermal (RfD_d) exposure (mg/kg-day) (from Table 3.9).
SAR	Sediment adherence rate (1 $mg/cm^2/day$) (recommended value for soil exposure [USEPA, 1992b]).
SSA	Exposed skin surface area (3,120 cm^2 for a base worker; 3,715 cm^2 for an older child [aged 6 to 15 years]) (USEPA, 1991a; 1989d).
TEF	Toxicity equvalency factor for carcinogenic polynuclear aromatic hydrocarbons (PAHs); not applicable for other constituents (Table 3.10).
UC_1	Unit conversion 1 (10^6 mg/kg).
UC_2	Unit conversion 2 (10^{-3} L/cm^3).
WExD	Wading exposure dose from incidental ingestion ($WExD_o$) or dermal contact ($WExD_d$) (mg/kg-day).

TABLE 2-16
EQUATIONS AND SAMPLE CALCULATIONS FOR
WADING EXPOSURE AT
SITE OT-11/OU-2, RESIDUAL PESTICIDE AREA
Homestead Air Reserve Base, Florida
(Continued)

Sample calculation - Bromodichloromethane, cancer effects, base worker:

$$WExD_o = \frac{(0.0010\ mg/L) \times (0.005\ L/hr) \times (25\ yrs) \times (12\ days/yr) \times (8\ hrs/day)}{(70\ kg) \times (25{,}550\ days)}$$

$$= 6.7E\text{-}09\ mg/kg/day$$

$$WExD_d = \frac{(0.0010\ mg/L) \times (3{,}120\ cm^2) \times (5.8E\text{-}03\ cm/hr) \times (1E\text{-}03\ L/cm^3) \times (25\ yrs) \times (12\ days/yr) \times (8\ hrs/day)}{(70\ kg) \times (25{,}550\ days)}$$

$$= 2.4E\text{-}08\ mg/kg/day$$

$$ELCR = [(6.7E\text{-}09\ mg/kg/day) \times (0.062\ kg\text{-}day/mg)] + [(2.4E\text{-}08\ mg/kg/day) \times (0.062\ kg\text{-}day/mg)]$$

$$= 1.9E\text{-}09$$

Sample Calculations - phenanthrene, non-cancer effects, child resident:

$$WExD_o = \frac{(4.2\ mg/kg) \times (5\ mg/day) \times (9\ yrs) \times (12\ days/yr)}{(38\ kg) \times (3{,}285\ days) \times (1E{+}06\ mg/kg)}$$

$$= 1.8E\text{-}08\ mg/kg/day$$

$$WExD_o = \frac{(4.2\ mg/kg) \times (3{,}715\ cm^2) \times (1\ mg/cm^2/day) \times (0.03) \times (9\ yrs) \times (12\ days/yr)}{(38\ kg) \times (3{,}285\ days) \times (1E{+}06\ mg/kg)}$$

$$= 4.0E\text{-}07\ mg/kg/day$$

$$HI = \frac{1.8E\text{-}08\ mg/kg/day}{3.0E\text{-}02\ mg/kg/day} + \frac{4.0E\text{-}07\ mg/kg/day}{3.0E\text{-}2\ mg/kg/day}$$

$$= 1.4E\text{-}05$$

Source: Geraghty & Miller, 1994b

2.9.4 Toxicity Assessment

The toxicity assessment evaluated possible harmful effects of exposure to each COPC. A number of chemicals found at the site, including VOCs, PAHs, pesticides, arsenic, cadmium, chromium, and lead have the potential to cause cancer (carcinogenic). Cancer slope factors (CSFs) have been developed by EPA's Carcinogenic Assessment Group for estimating lifetime cancer risks associated with exposure to potentially carcinogenic compounds. These CSFs, which are expressed in units of $(mg/kg\text{-}day)^{-1}$ 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 for the CSF. 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 CSFs for the carcinogenic contaminants of concern are contained in Table 2-17.

As an interim procedure until more definitive Agency guidance is established, Region IV has adopted a toxicity equivalency factor (TEF) methodology for evaluating the carcinogenic risks from PAHs. This methodology relates the relative potency of each individual carcinogenic PAH to the potency of benzo(a)pyrene, the most carcinogenic PAH. The TEFs for the PAHs are also presented in Table 2-17.

Additionally, COPCs including VOCs, PAHs, pesticides, and metals, 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 some contaminants exhibiting non-carcinogenic effects. RfDs, which are expressed in units of $(mg/kg\text{-}day)^{-1}$, 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 effects of COPCs are provided in Table 2-18.

TABLE 2-17
CANCER SLOPE FACTORS, TUMOR SITES AND USEPA CANCER CLASSIFICATIONS FOR CHEMICALS OF CONCERN AT
SITE OT-11/OU-2, RESIDUAL PESTICIDE DISPOSAL AREA
Homestead Air Reserve Base, Florida

Constituent	CSF (mg/kg/day)-1			TEF	Tumor site		USEPA Classification
	Oral	Adjusted [a]	Inhalation		Oral	Inhalation	
VOCs							
Bromodichloromethane	6.2E-02	6.2E-02	NA	–	lg. intestin, kidney	NA	B2
Chloroform	6.1E-03	6.1E-03	8.1E-02	–	kidney	liver	B2
Dibromochloromethane	8.4E-02	8.4E-02	NA	–	liver	NA	C
1,1-Dichloroethane	6.0E-01	6.0E-01	1.2E+00	–	adrenal gland	kidney	C
BNAs							
Benzo(a)anthracene*	7.3E+00	IAP	6.1E+00**	0.1	NA	NA	B2
Benzo(b)fluoranthene*	7.3E+00	IAP	6.1E+00**	0.1	NA	NA	B2
Benzo(k)fluoranthene*	7.3E+00	IAP	6.1E+00**	0.1	NA	NA	B2
Benzo(a)pyrene	7.3E+00	IAP	6.1E+00**	1	stomach	respiratory tract	B2
Bis(2-ethylhexyl)phthalate	1.4E-02	1.4E-02	NA	–	liver	NA	B2
Butylbenzylphthalate	NA	NA	NA	–	NA	NA	B2
Carbazole	2.0E-02	2.0E-02	NA	–	liver	NA	C
Chrysene*	7.3E+00	IAP	6.1E+00**	0.01	NA	NA	B2
Dibenzo(a,h)anthracene*	7.3E+00	IAP	6.1E+00**	1	NA	NA	B2
Indeno(1,2,3-c,d)pyrene*	7.3E+00	IAP	6.1E+00**	0.1	NA	NA	B2
Pesticides							
Aldrin	1.7E+01	1.7E+01	1.7E+01	–	liver	liver	B2
Chlordane	1.3E+00	2.6E+00	1.3E+00	–	liver	liver	B2
4,4'-DDD	2.4E-01	2.7E-01	NA	–	liver	NA	B2
4,4'-DDE	3.4E-01	3.8E-01	NA	–	liver	NA	B2
4,4'-DDT	3.4E-01	3.8E-01	3.4E-01	–	liver	liver	B2
Dieldrin	1.6E+01	1.6E+01	1.6E+01	–	liver	liver	B2
Heptachlor epoxide	9.1E+00	1.5E+01	9.1E+00	–	liver	liver	B2

TABLE 2-17
CANCER SLOPE FACTORS, TUMOR SITES AND USEPA CANCER CLASSIFICATIONS FOR CHEMICALS OF CONCERN AT SITE OT-11/OU-2, RESIDUAL PESTICIDE DISPOSAL AREA
Homestead Air Reserve Base, Florida
(Continued)

Constituent	CSF (mg/kg/day)-1 Oral	Adjusted [a]	Inhalation	TEF	Tumor site Oral	Inhalation	USEPA Classification
Metals							
Arsenic	1.75E+00	1.8E+01	5.0E+01	–	skin	respiratory tract	A
Cadmium	NAP	NAP	6.3E+00	–	NA	respiratory tract	B1
Chromium VI	NAP	NAP	4.1E+01	–	NA	lung	A
Lead	NA	NA	NA	–	NA	NA	B2

References: IRIS, 1994; USEPA, 1993a; USEPA,1992a.
[a] The CSF adjusted to an absorbed dose was used to assess dermal exposure. The adjusted CSF was derived according to USEPA (1989a) methodology by dividing the oral CSF by the constituent-specific oral absorption efficiency (Table 3.11).
* The oral and inhalation CSFs for benzo(a)pyrene are used with the appropriate benzo(a)pyrene toxicity equivalency factor (TEF) values (USEPA, 1992a).
** The inhalation CSF for benzo(a)pyrene has been withdrawn from HEAST; this value is referenced to a previous issue of HEAST (USEPA, 1992d).
– Not applicable; the TEF is relevant only for the carcinogenic PAHs.
IAP Inappropriate to adjust the oral CSF for carcinogenic PAHs to evaluate dermal exposure (USEPA, 1989a).
mg/kg/day Milligrams per kilogram per day.
NA Not available.
NAP Not applicable since it is carcinogenic by inhalation only.
PAHs Polynuclear aromatic hydrocarbons
TEF Toxicity equvalency factor for carcinogenic PAHs.

Source: Geraghty & Miller, 1994b

TABLE 2-18
REFERENCE DOSES FOR CHEMICALS OF POTENTIAL CONCERN,
SITE OT-11/OU-2, RESIDUAL PESTICIDE DISPOSAL AREA
Homestead Air Reserve Base, Florida

Constituent	Oral RfDo (mg/kg/day)		Adjusted RfDa (mg/kg/day) [a]		Inhalation RfDi (mg/kg/day)	
	Subchronic	Chronic	Subchronic	Chronic	Subchronic	Chronic
VOCs						
Acetone	1.0E+00	1.0E-01	1.0E+00	1.0E-01	NA	NA
Bromodichloromethane	2.0E-01	2.0E-02	2.0E-01	2.0E-02	NA	NA
2-Butanone	2.0E-01	6.0E-01	2.0E-01	6.0E-01	3.0E+00	3.0E-01
Carbon disulfide	1.0E-01	1.0E-01	1.0E-01	1.0E-01	3.0E-03	3.0E-03
Chloroform	1.0E-02	1.0E-02	1.0E-02	1.0E-02	NA	NA
Dibromochloromethane	2.0E-01	2.0E-01	2.0E-01	2.0E-02	NA	NA
1,1-Dichloroethene	9.0E-03	9.0E-03	9.0E-03	9.0E-03	NA	NA
PAHs						
Acenapthene	6.0E-01	6.0E-02	5.0E-01	5.0E-02	NA	NA
Acenapthylene [b]	3.0E-01	3.0E-02	3.0E-01	3.0E-02	NA	NA
Anthracene	3.0E+00	3.0E-01	3.0E+00	3.0E-01	NA	NA
Benzo(g,h,i)perylene [b]	3.0E-01	3.0E-02	3.0E-01	3.0E-02	NA	NA
Bis(2-ethylhexyl)phthalate	2.0E-02	2.0E-02	2.0E-02	2.0E-02	NA	NA
Butylbenzylphthalate	2.0E+00	2.0E-01	2.0E+00	2.0E-01	NA	NA
Carbazole	NA	NA	NA	NA	NA	NA
Dibenzofuran [b]	3.0E-01	3.0E-02	3.0E-01	3.0E-02	NA	NA
Diethylphthalate	8.0E+00	8.0E-01	8.0E+00	8.0E-01	NA	NA
Di-n-octylphthalate	2.0E-02	2.0E-02	2.0E-02	2.0E-02	NA	NA
Fluoranthene	4.0E-01	4.0E-02	3.0E-01	3.0E-02	NA	NA
Fluorene	4.0E-01	4.0E-02	3.0E-01	3.0E-02	NA	NA
2-Methylnapthalene [c]	4.0E-02	4.0E-02	3.0E-02	3.0E-02	3.7E-04*	3.7E-04
Napthalene	4.0E-02	4.0E-02	3.0E-02	3.0E-02	3.7E-04*	3.7E-04
Phenanthrene [b]	3.0E-01	3.0E-02	3.0E-01	3.0E-02	NA	NA
Pyrene	3.0E-01	3.0E-02	3.0E-01	3.0E-02	NA	NA

TABLE 2-18
REFERENCE DOSES FOR CHEMICALS OF POTENTIAL CONCERN,
SITE OT-11/OU-2, RESIDUAL PESTICIDE DISPOSAL AREA
Homestead Air Reserve Base, Florida
(Continued)

Constituent	Oral RfDo (mg/kg/day)		Adjusted RfDa (mg/kg/day) [a]		Inhalation RfDi (mg/kg/day)	
	Subchronic	Chronic	Subchronic	Chronic	Subchronic	Chronic
Pesticides						
Aldrin	3.0E-05	3.0E-05	3.0E-05	3.0E-05	NA	NA
Chlordane	6.0E-05	6.0E-05	3.0E-05	3.0E-05	NA	NA
4,4'-DDD	3.0E-03*	3.0E-03	3.0E-03*	3.0E-03	NA	NA
4,4'-DDE	7.0E-04*	7.0E-04	6.0E-04*	6.0E-04	NA	NA
4,4'-DDT	5.0E-04	5.0E-04	5.0E-04	5.0E-04	NA	NA
Dieldrin	5.0E-05	5.0E-05	5.0E-05	5.0E-05	NA	NA
Endosulfan	NA	NA	NA	NA	NA	NA
Heptachlor epoxide	1.3E-05	1.3E-05	7.8E-06	7.8E-06	NA	NA
Methoxychlor	5.0E-03	5.0E-03	5.0E-03	5.0E-03	NA	NA
Metals						
Aluminum	NA	NA	NA	NA	NA	NA
Arsenic	3.00E-04	3.00E-04	3.00E-04	3.00E-04	NA	NA
Barium	7.00E-02	7.00E-02	5.00E-03	5.00E-03	1.0E-03	1.0E-04
Cadmium (food) [d]	1.0E-04*	1.00E-03	2.0E-05*	2.00E-05	NA	NA
Cadmium (water)	5.0E-04*	5.00E-04	1.0E-05*	1.00E-05	NA	NA
Chromium VI	2.0E-02	5.0E-03	4.0E-04	1.0E-04	NA	NA
Cobalt	6.0E-02*	6.0E-02	2.0E-02*	2.0E-02	NA	NA
Copper [e]	3.0E-02	3.0E-02	2.0E-02	2.0E-02	NA	NA
Iron	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA
Manganese (food) [d]	1.4E-01	1.4E-01	7.0E-03	7.0E-03	1.0E-05	1.0E-05
Manganese (water)	5.0E-03	5.0E-03	3.0E-04	3.0E-04	1.0E-05	1.0E-05
Mercury	3.0E-04	3.0E-04	5.0E-05	5.0E-05	9.0E-05	9.0E-05
Silver	5.0E-03	5.0E-03	1.0E-03	1.0E-03	NA	NA
Vanadium	7.0E-03	7.0E-03	7.0E-05	7.0E-05	NA	NA
Zinc	3.0E-01	3.0E-01	9.0E-02	9.0E-02	NA	NA

TABLE 2-18
REFERENCE DOSES FOR CHEMICALS OF POTENTIAL CONCERN,
SITE OT-11/OU-2, RESIDUAL PESTICIDE DISPOSAL AREA
Homestead Air Reserve Base, Florida
(Continued)

References: IRIS (1994); USEPA (1993a); USEPA (undated [b,c,d]).

*	No subchronic value available. Chronic value used as a surrogate.
[a]	The RfD adjusted to an absorbed dose was used to assess dermal exposure. The adjusted RfD was derived according to USEPA (1989a) methodology by multiplying the oral RfD by the constituent-specific oral absorption efficiency (Table 3.11).
[b]	No RfD available; pyrene used as a surrogate.
[c]	No RfD available; napthalene used as a surrogate.
[d]	The RfD for food is used to assess soil exposure.
[e]	Based on current Florida Department of Environmental Protection (FDEP) drinking-water standard (1 mg/L).
NA	Not available.

Source: Geraghty & Miller, 1994b

2.9.5 Risk Characterization

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

In summary, the results of the BRA indicate that human health risks associated with potential future land use scenarios at Site OT-11/OU-2 exceed FDEP's target risk range for protection of human health.

2.9.5.1 Carcinogenic Risk. For cancer causing compounds, risk is a probability that is expressed in scientific notation. For example, an excess lifetime cancer risk (ELCR) 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 $1x10^{-6}$. However, the state of Florida's target risk is $1x10^{-6}$.

The formula used for calculating cancer risk is shown below:

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

where:

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

For current base workers exposed to site soils, the ELCR is 3×10^{-7}. The ELCR for a base worker exposed to the surface water and sediments while wading is 6×10^{-8}. The ELCR for a hypothetical base worker exposed to site soil is 6×10^{-7}. The calculated ELCRs for current and future base workers do not exceed the EPA or FDEP acceptance range risk level.

The ELCRs for a hypothetical future adult and child resident exposed to site soils are 2×10^{-5} and 3×10^{-5}, respectively. The ELCRs for a hypothetical future adult and child resident exposed to groundwater are 2×10^{-7} and 1×10^{-7}, respectively. The ELCR for a hypothetical older child resident exposed to surface water and sediment while wading is 3×10^{-8}. The calculated ELCRs for the hypothetical future adult and child resident exposed to groundwater, surface water, or sediments do not exceed the EPA or FDEP acceptable range risk level. The only unacceptable risk associated with Site OT-11/OU-2 were to hypothetical

future adult and child residents exposed to site soils. The soils at Site OT-11/OU-2 are less than 6 inches thick and are not continuous across the site. The ELCRs for the hypothetical future adult and child residents fall within the EPA target risk range of 10^{-4} to 10^{-6} but exceed the FDEP acceptable risk level of 10^{-6}.

2.9.5.2 Non-carcinogenic Risk. 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:

Non-cancer HQ = CDI/RfD

where: CDI = chronic daily intake
RfD = reference dose

CDI and RfD are expressed in the same units $(mg/kg\text{-}day)^{-1}$ 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 an HI of 1.0 to be the maximum acceptable hazard.

For current base workers exposed to site soils the HI is 0.0004. The HI for a base worker exposed to surface water and sediments while wading is 0.0003. The HI for a hypothetical base worker exposed to site soils is 0.03. The calculated HI's for current and future base workers do not exceed the EPA or FDEP acceptable risk level.

The HI for a hypothetical future adult and child resident exposed to site soils are 0.02 and 0.09, respectively. The HI for a hypothetical future adult and child resident exposed to groundwater are 0.3 and 0.7, respectively. The HI for a hypothetical older child resident exposed to surface water and sediment while wading is 0.0002.

The calculated HIs for the hypothetical future adult and child residents exposed to soil, groundwater, surface water, or sediments do not exceed the EPA or FDEP acceptable risk level.

2.9.5.3 Total Risk. The total site risk for current base workers was obtained by adding the calculated risk for soil and wading (surface water and sediment) exposures. The total site ELCR and HI for current base workers were calculated as 3×10^{-7} and 0.0006, respectively. The total site risk for current base workers do not exceed the EPA or FDEP acceptable range risk levels. The future base worker was exposed to soils only, so the total site risk is an ELCR of 6×10^{-7} and an HI of 0.03. The total site risk for future base workers do not exceed the EPA or FDEP acceptable range risk levels.

Total site risks for hypothetical future residents were obtained by adding the calculated risks for the adult (groundwater and soil) and for the child (groundwater, soil, and wading). The total site ELCR for hypothetical future adult resident exposure was calculated as 2×10^{-5}, and the total site HI was calculated as 0.3. For the hypothetical future child resident, the total site ELCR and HI were 3×10^{-5} and 0.8 respectively. The total site ELCRs for the future hypothetical residents are greater than 10^{-6} but less than 10^{-4}, and the total site HIs do not exceed the level of acceptable non-cancer risk of 1. The total site risk for hypothetical future adult residents exposed to soil and groundwater and child residents exposed to soil and wading fall within the EPA acceptable range but exceed the FDEP range of 10^{-6}.

2.9.5.4 Risk from Lead Exposure. Lead exposure was evaluated using the EPA's LEAD5 uptake/biokinethic model designed to assess chronic non-carcinogenic effects from diet, inhalation, and ingestion of soil, dust, and water. The predicted blood level in the hypothetical child receptor using an EPC of 390 mg/kg is 3.63 micrograms per deciliter (µg/dL). The concentration is below the 10 µg/dL acceptable blood lead level. LEAD5 predicts that 99.82 percent of the hypothetically exposed population of children aged 0 to 6 years would have blood-lead levels below the 10 ug/dL level of concern. The results of the lead exposure scenario for Site OT-11/OU-2 indicate low levels of concern for lead exposure.

2.9.6 Chemicals of Concern and Remedial Goal Option

COCs contribute significantly to a use scenario for a receptor that (a) exceeds a 10^{-4} total carcinogenic risk, (b) exceeds an HI of 1, or (c) exceeds a state or federal chemical specific ARAR. Chemicals need not be included if their individual carcinogenic risk contribution is

less than $1x10^{-6}$ or their non-carcinogenic HQ is less than 1. For this site, the relevant Remedial Goal Options (RGOs) are for PAHs and metals.

RGOs are risk-based cleanup levels: they are developed by combining the intake levels to each chemical 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 for soil based on a 10^{-4}, 10^{-5}, and 10^{-6} HI and a 0.1, 1, and 10 HQ have been developed for this site for each COC, medium, land use, and receptor type. A summary of the risk-based RGOs are presented in Tables 2-19 through 2-20.

2.9.7 Uncertainties in the Risk Assessment

The risk estimates presented in the BRA are conservative estimates of the risks associated with current and hypothetical future exposure to media at the site. Actual risks are almost certainly lower than those presented. Further, there is considerable uncertainty inherent in the risk assessment process. Sources of uncertainty can be summarized as follows:

Environmental sampling may not fully identify constituent distribution.

Exposure doses calculated for hypothetical future scenarios do not take into account natural attenuation processes that will reduce constituent concentrations and the likelihood of exposure.

Toxicity values and other toxicologic information used to calculate risks are associated with significant uncertainty; most information has been developed using laboratory animals exposed to high doses.

Sufficient toxicological data may not be available for all detected constituents. As a result, surrogate compounds were used to evaluate PAHs.

Non-carcinogenic risks associated with potential lead exposure were evaluated differently from other COCs in the risk assessment.

TABLE 19
RISK-BASED REMEDIAL GOAL OPTIONS FOR SOIL
BASED ON HYPOTHETICAL FUTURE ADULT RESIDENT EXPOSURE
SITE OT-11/OU-2, RESIDUAL PESTICIDE DISPOSAL AREA
HOMESTEAD AIR RESERVE BASE, FLORIDA
(Page 1 of 2)

Constituents	EPCs	Non-Cancer Risk-Based RGOs			Cancer Risk-Based RGOs		
	THI:	0.1	1	10	TCR:	1E-06	1E-05	1E-04
VOCs							
Acetone	29	5.0E+03	5.0E+04	5.0E+05		–	–	–
Bromodichloromethane	0.65	–	–	–		1.9E+01	1.9E+02	1.9E+03
2-Butanone	1.5	1.6E+04	1.6E+05	1.6E+06		–	–	–
Carbon disulfide	0.010	2.7E+02	2.7E+03	2.7E+04		–	–	–
Chloroform	0.68	–	–	–		2.1E+01	2.1E+02	2.1E+03
Dibromochloromethane	0.68	–	–	–		1.4E+01	1.4E+02	1.4E+03
1,1-Dichloroethene	0.26	–	–	–		5.8E-01	5.8E+00	5.8E+01
BNAs								
Acenaphthene	0.37	1.6E+03	1.6E+04	1.6E+05		–	–	–
Acenaphthylene	0.068	9.1E+02	9.1E+03	9.1E+04		–	–	–
Anthracene	0.48	9.1E+03	9.1E+04	9.1E+05		–	–	–
Benzo(a)anthracene	0.85	–	–	–		2.3E+00	2.3E+01	2.3E+02
Benzo(b)fluoranthene	2.7	–	–	–		2.3E+00	2.3E+01	2.3E+02
Benzo(k)fluoranthene	1.1	–	–	–		2.3E+00	2.3E+01	2.3E+02
Benzo(g,h,i)perylene	0.63	9.1E+02	9.1E+03	9.1E+04		–	–	–
Benzo(a)pyrene	1.7	–	–	–		2.3E-01	2.3E+00	2.3E+01
Butylbenzylphthalate	0.033	–	–	–		–	–	–
Carbazole	0.40	–	–	–		5.8E+01	5.8E+02	5.8E+03
Chrysene	1.6	–	–	–		2.3E+01	2.3E+02	2.3E+03
Dibenzo(a,h)anthracene	0.34	–	–	–		2.3E-01	2.3E+00	2.3E+01
Dibenzofuran	0.53	9.1E+02	9.1E+03	9.1E+04		–	–	–
Fluoranthene	7.1	1.0E+03	1.0E+04	1.0E+05		–	–	–
Fluorene	0.45	1.0E+03	1.0E+04	1.0E+05		–	–	–
Indeno(1,2,3-c,d)pyrene	0.69	–	–	–		2.3E+00	2.3E+01	2.3E+02
2-Methylnaphthalene	0.21	6.1E+02	6.1E+03	6.1E+04		–	–	–
Naphthalene	0.39	3.5E+02	3.5E+03	3.5E+04		–	–	–
Phenanthrene	2.1	9.1E+02	9.1E+03	9.1E+04		–	–	–
Pyrene	5.1	9.1E+02	9.1E+03	9.1E+04		–	–	–

TABLE 2-19
RISK-BASED REMEDIAL GOAL OPTIONS FOR SOIL
BASED ON HYPOTHETICAL FUTURE ADULT RESIDENT EXPOSURE
SITE OT-11/OU-2, RESIDUAL PESTICIDE DISPOSAL AREA
HOMESTEAD AIR RESERVE BASE, FLORIDA
(Page 2 of 2)

Constituents	EPCs	Non-Cancer Risk-Based RGOs			Cancer Risk-Based RGOs		
	THI:	0.1	1	10	TCR:	1E-06	1E-05	1E-04
Pesticides								
Aldrin	0.0050	–	–	–		2.1E-02	2.1E-01	2.1E+00
Chlordane	0.033	–	–	–		2.7E-01	2.7E+00	2.7E+01
4,4'-DDD	0.0064	–	–	–		2.6E+00	2.6E+01	2.6E+02
4,4'-DDE	0.0060	–	–	–		1.8E+00	1.8E+01	1.8E+02
4,4'-DDT	0.034	–	–	–		1.8E+00	1.8E+01	1.8E+02
Dieldrin	0.0064	–	–	–		2.3E-02	2.3E-01	2.3E+00
Endosulfan II	0.0072	–	–	–		–	–	–
Heptachlor epoxide	0.0040	–	–	–		2.2E-02	2.2E-01	2.2E+00
Methoxychlor	0.085	3.5E+01	3.5E+02	3.5E+03		–	–	–
Metals								
Aluminum	5,200	–	–	–		–	–	–
Arsenic	4.6	–	–	–		9.3E-01	9.3E+00	9.3E+01
Cadmium	0.85	–	–	–		2.7E+04	2.7E+05	2.7E+06
Chromium	17	–	–	–		4.2E+03	4.2E+04	4.2E+05
Copper	12	2.0E+03	2.0E+04	2.0E+05		–	–	–
Iron	4,900	–	–	–		–	–	–
Lead	20,000	–	–	–		–	–	–
Manganese	69	4.9E+03	4.9E+04	4.9E+05		–	–	–
Mercury	0.10	2.7E+00	2.7E+01	2.7E+02		–	–	–
Silver	3.4	3.0E+02	3.0E+03	3.0E+04		–	–	–
Vanadium	7.1	9.0E+01	9.0E+02	9.0E+03		–	–	–
Zinc	29	1.9E+04	1.9E+05	1.9E+06		–	–	–

Concentrations are given in milligrams per kilogram (mg/kg)
Risk-based RGOs which are less than the current EPCs are indicated with a cell border
– RGO not available or not applicable
* n-Hexane is a surrogate for petrolem hydrocarbons
EPCs Exposure point concentration in soil (Table 3.2)
RGO Remedial goal option
TCR Target cancer risk
THI Target hazard index
Source: Geraghty and Miller, 1994b

TABL[redacted]0
RISK-BASED REMEDIAL GOAL OPTIONS FOR SOIL
BASED ON HYPOTHETICAL FUTURE CHILD RESIDENT EXPOSURE
SITE OT-11/OU-2, RESIDUAL PESTICIDE DISPOSAL AREA
HOMESTEAD AIR RESERVE BASE, FLORIDA
(Page 1 of 2)

Constituents	EPCs	Non-Cancer Risk-Based RGOs			Cancer Risk-Based RGOs		
	THI:	0.1	1	10	TCR: 1E-06	1E-05	1E-04
VOCs							
Acetone	29	6.7E+02	6.7E+03	6.7E+04	–	–	–
Bromodichloromethane	0.65	–	–	–	1.3E+01	1.3E+02	1.3E+03
2-Butanone	1.5	2.6E+03	2.6E+04	2.6E+05	–	–	–
Carbon disulfide	0.010	5.7E+01	5.7E+02	5.7E+03	–	–	–
Chloroform	0.68	–	–	–	2.1E+01	2.1E+02	2.1E+03
Dibromochloromethane	0.68	–	–	–	9.4E+00	9.4E+01	9.4E+02
1,1-Dichloroethene	0.26	–	–	–	5.3E-01	5.3E+00	5.3E+01
BNAs							
Acenaphthene	0.37	3.0E+02	3.0E+03	3.0E+04	–	–	–
Acenaphthylene	0.068	1.6E+02	1.6E+03	1.6E+04	–	–	–
Anthracene	0.48	1.6E+03	1.6E+04	1.6E+05	–	–	–
Benzo(a)anthracene	0.85	–	–	–	1.2E+00	1.2E+01	1.2E+02
Benzo(b)fluoranthene	2.7	–	–	–	1.2E+00	1.2E+01	1.2E+02
Benzo(k)fluoranthene	1.1	–	–	–	1.2E+00	1.2E+01	1.2E+02
Benzo(g,h,i)perylene	0.63	1.6E+02	1.6E+03	1.6E+04	–	–	–
Benzo(a)pyrene	1.7	–	–	–	1.2E-01	1.2E+00	1.2E+01
Butylbenzylphthalate	0.033	–	–	–	–	–	–
Carbazole	0.40	–	–	–	3.9E+01	3.9E+02	3.9E+03
Chrysene	1.6	–	–	–	1.2E+01	1.2E+02	1.2E+03
Dibenzo(a,h)anthracene	0.34	–	–	–	1.2E-01	1.2E+00	1.2E+01
Dibenzofuran	0.53	1.6E+02	1.6E+03	1.6E+04	–	–	–
Fluoranthene	7.1	1.9E+02	1.9E+03	1.9E+04	–	–	–
Fluorene	0.45	1.9E+02	1.9E+03	1.9E+04	–	–	–
Indeno(1,2,3-c,d)pyrene	0.69	–	–	–	1.2E+00	1.2E+01	1.2E+02
2-Methylnaphthalene	0.21	1.2E+02	1.2E+03	1.2E+04	–	–	–
Naphthalene	0.39	7.2E+01	7.2E+02	7.2E+03	–	–	–
Phenanthrene	2.1	1.6E+02	1.6E+03	1.6E+04	–	–	–
Pyrene	5.1	1.6E+02	1.6E+03	1.6E+04	–	–	–

TABLE 2-20
RISK-BASED REMEDIAL GOAL OPTIONS FOR SOIL
BASED ON HYPOTHETICAL FUTURE CHILD RESIDENT EXPOSURE
SITE OT-11/OU-2, RESIDUAL PESTICIDE DISPOSAL AREA
HOMESTEAD AIR RESERVE BASE, FLORIDA
(Page 2 of 2)

Constituents	EPCs	Non-Cancer Risk-Based RGOs			Cancer Risk-Based RGOs		
		THI: 0.1	1	10	TCR: 1E-06	1E-05	1E-04
Pesticides							
Aldrin	0.0050	–	–	–	2.3E-02	2.3E-01	2.3E+00
Chlordane	0.033	–	–	–	3.0E-01	3.0E+00	3.0E+01
4,4'-DDD	0.0064	–	–	–	2.4E+00	2.4E+01	2.4E+02
4,4'-DDE	0.0060	–	–	–	1.7E+00	1.7E+01	1.7E+02
4,4'-DDT	0.034	–	–	–	1.7E+00	1.7E+01	1.7E+02
Dieldrin	0.0064	–	–	–	2.5E-02	2.5E-01	2.5E+00
Endosulfan II	0.0072	–	–	–	–	–	–
Heptachlor epoxide	0.0040	–	–	–	2.7E-02	2.7E-01	2.7E+00
Methoxychlor	0.085	9.3E+00	9.3E+01	9.3E+02	–	–	–
Metals							
Aluminum	5,200	–	–	–	–	–	–
Arsenic	4.6	–	–	–	5.1E-01	5.1E+00	5.1E+01
Cadmium	0.85	–	–	–	2.9E+04	2.9E+05	2.9E+06
Chromium	17	–	–	–	4.5E+03	4.5E+04	4.5E+05
Copper	12	2.3E+02	2.3E+03	2.3E+04	–	–	–
Iron	4,900	–	–	–	–	–	–
Lead	20,000	–	–	–	–	–	–
Manganese	69	7.9E+02	7.9E+03	7.9E+04	–	–	–
Mercury	0.10	6.7E-01	6.7E+00	6.7E+01	–	–	–
Silver	3.4	3.6E+01	3.6E+02	3.6E+03	–	–	–
Vanadium	7.1	2.1E+01	2.1E+02	2.1E+03	–	–	–
Zinc	29	2.2E+03	2.2E+04	2.2E+05	–	–	–

Concentrations are given in milligrams per kilogram (mg/kg)
Risk-based RGOs which are less than the current EPCs are indicated with a cell border
– RGO not available or not applicable
EPCs Exposure point concentration in soil (Table 3.2)
RGO Remedial goal option
TCR Target cancer risk
THI Target hazard index
Source: Geraghty and Miller, 1994b

There is considerable uncertainty associated with the toxicity of mixtures. The risk assessment assumes that toxicity is additive; the mixture of constituents present has neither synergistic nor antagonistic interaction; and all of the constituents have the same mechanism of action in the same target organ to produce the same toxic endpoints.

The use of conservative assumptions and models and the conservatism built into the RfDs and CSFs are believed to result in an overestimate of risk. Therefore, actual risk may be much lower than the estimates presented in the BRA but are unlikely to be greater.

2.9.7.1 Ecological Risks. Conditions at Site OT-11/OU-2 provide little usable or preferred habitat for terrestrial species. Flightline activity near OT-11/OU-2 likely inhibits the activities of animals. While avian species may visit the site, it is highly unlikely that they would derive a significant portion of their diet from the limited resources available. Animals potentially present in the vicinity of Homestead ARB are more likely to inhabit and utilize less active surrounding areas such as Everglades and Biscayne National Parks, located near the Base. Constituents detected at OT-11/OU-2 may represent potential ecotoxicological effects; however, it is highly unlikely that terrestrial biota would inhabit or frequent the site due to the Flightline activity and limited natural resources. The potential water hazards to aquatic life from groundwater contaminants being transported and discharged to surface water bodies (i.e., the OU-2 drainage canal or the Boundary Canal) are considered low due to dilution and mixing. The limited distribution of contaminants in the canal sediments also indicated a low potential for ecological effects to aquatic organisms.

2.10 DESCRIPTION OF ALTERNATIVES

The USAF initially considered four alternatives in the Feasibility Study (FS) to address the soil contamination identified at OU-2. The four alternatives were screened based on the criteria of effectiveness, implementability, and cost. The three most promising alternatives were carried forward through complete evaluation. These three alternatives were then evaluated against the nine CERCLA criteria requirements for selecting a remedial alternative. These nine criteria include effectiveness, implementability, cost, state acceptance, community acceptance, long-term effectiveness and permanence, reduction of mobility, toxicity, or volume through treatment, compliance with ARARs, short term effectiveness, and overall protection of human health and environment. A summary of the four alternatives described in the Feasibility Study are presented below while each is discussed in greater detail in the FS.

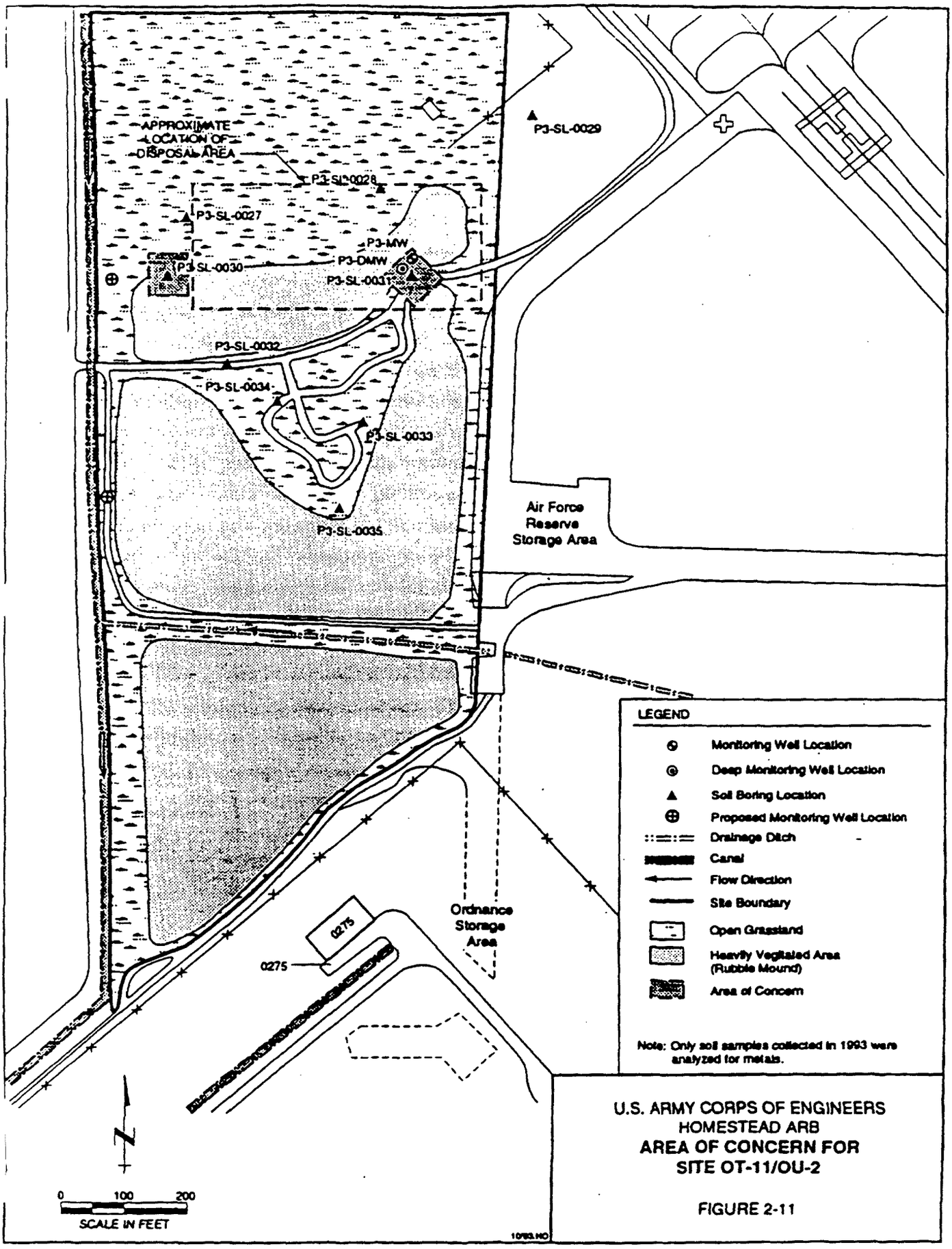
2.10.1 Alternative 1 - No-Action

The No-Action Alternative is evaluated as required by the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), the regulation implementing CERCLA, for comparison with other alternatives. The No-Action Alternative includes two 5-year site reviews involving literature searches, site walks, interviews, and minimal sampling. The no-action alternative is protective of human health under current land use conditions, but is slightly above FDEP criteria for risk (1×10^{-6}) for the hypothetical future residential land use scenario. This alternative does not control exposure to potentially contaminated soil; however, the contaminants which strongly adsorb to soil particles are considered relatively immobile and are not expected to migrate off site.

A present worth analysis is used to evaluate expenditures that occur over different time periods by discounting all future cost to a common base year, usually the current year. This allows the cost of remedial action alternatives to be compared on the basis of a single figure representing the amount of money that, if invested in the base year and disbursed as needed, would be sufficient to cover all costs associated with the remedial action over its planned life. The present-worth cost of this alternative is estimated at $43,300. This cost consists of two 5 years site reviews with an estimated cost of $29,500 each. The cost of the 5 years site reviews have been discounted to present value using a 5% discount rate.

2.10.2 Alternative 2 - Access and Use Restriction for Soil, Access Restriction for Groundwater, and Groundwater Monitoring

This alternative includes use and access restrictions for soils in the form of deed restrictions and/or fencing around the area of concern and the installation of two new groundwater monitoring wells. These two wells (see Figure 2-11 for proposed well locations), and also the existing deep and shallow wells will be sampled annually for pesticides, PAHs, and priority pollutant metals for 5 years to monitor for any future migration of COPCs into the groundwater. The installation of two new monitoring wells is to ensure protectiveness through the monitoring of shallow groundwater with respect to potential discharge to the boundary canal in the event that all areas of contamination have not been identified. This alternative also includes access restrictions that would prevent placement of a potable well in the groundwater beneath Site OT-11/OU-2. Two 5-year site reviews are included which involve literature searches, site walks, interviews, soil sampling, and a groundwater sampling review to determine the effectiveness of the remedy. This alternative is protective of human health and the environment under the current and probable future land use conditions and



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HOMESTEAD ARB
AREA OF CONCERN FOR SITE OT-11/OU-2

FIGURE 2-11

relies on institutional controls to prevent exposure for the hypothetical future residential land-use scenario. This alternative does not actively reduce the toxicity, mobility or volume of the potential contaminants in the soil, and relies on control measures to prevent access or exposure to contaminated areas at Site OT-11/OU-2

The present-worth cost of this alternative is estimated at $226,400. This cost consists of an estimated initial capital cost of $68,500, five annual operation and maintenance (O&M) reviews with an estimated cost of $25,200 each, and two 5 years site reviews with an estimated cost of $29,500 each. The cost of the annual O&M reviews and the 5 years site reviews have been discounted to present value using a 5% discount rate.

2.10.3 Alternative 3 - Institutional Controls, Capping, and Groundwater Monitoring

This alternative consists of the placement of a 2-ft thick soil cap over a 20-ft by 20-ft area to prevent exposure to soil contaminants. Approximately 250 cubic yards of clean imported fill material would be required to cap the site. The soil cap, once in place, would be packed, scarified, and hydroseeded to promote revegitation and reduce erosion. Institutional controls would be enacted to prevent residential development and child care facilities at the site. Deed restrictions would be developed and enforced by the current landowner, the U.S. Air Force. If the base is deactivated and a transfer of ownership occurs, the new landowner would be responsible for enforcing these restrictions. Monitoring well installation and sampling as described in Alternative 2 would be performed to determine the effectiveness of the remedy. This alternative does not actively reduce the toxicity, mobility, or volume of contaminants in the soil, and relies on control measures to prevent access or exposure to contamination on site.

The present value of this alternative is estimated at $236,200. This cost consists of an estimated initial capital cost, ten years of annual operation and maintenance costs, and two five year site reviews.

This alternative was not carried forward into the detailed analysis phase of the FS because it is more difficult to implement than Alternative 2 and does not provide increased effectiveness.

2.10.4 Alternative 4 - Excavation, Off-Site Disposal of Soils, Access Restriction for Groundwater, and Groundwater Monitoring

This alternative consists of excavating the areas with elevated concentrations of lead and PAHs to levels below the State of Florida Health-Based Soil Target Levels and transporting the soil to an off-site permitted RCRA landfill for disposal. If required, stabilization of the soil could be performed either on or off site prior to disposal. Additionally, this alternative includes the installation of two shallow monitoring wells (see Figure 2-11, proposed well location) which would be sampled annually for 5 years along with the existing deep and shallow wells to monitor for any future migration of COPCs into the groundwater. The installation of two new monitoring wells is to ensure protectiveness through the monitoring of shallow groundwater with respect to potential discharge to the boundary canal in the event that all areas of contamination have not been identified. This alternative also includes access restriction in the form of site fencing around the perimeter of the 20 acre site and deed restrictions that would prevent the placement of a potable well in the groundwater beneath site OT-11/OU-2. An estimated 60 cubic yards or 90 tons of material would be excavated for disposal off-site. Testing of the soil is also included to determine if the material is a RCRA hazardous waste and/or to determine if it meets land disposal regulations. If the standards are not met, soils would be stabilized in order to meet the land disposal regulations treatment standards. If the excavated soils, after adequate testing, are determined to be RCRA hazardous waste, the contaminated soil will be disposed of at an approved RCRA Subtitle C facility. Because contaminated soils would be removed from the site, this alternative permanently reduces risk to base personnel and potential future residents to an acceptable level and provides adequate protection of the environment.

The present-worth cost of this alternative is estimated at $265,500*. The present-worth cost with stabilization of the soil is $289,300*. This cost consists of an estimated initial capital cost of $150,950* and five annual O&M reviews with an estimated cost of $25,200 each. The cost of the annual O&M reviews have been discounted to present value using a 5% discount rate. *(These costs reflect an increase of $60,000 over the costs given in the FS and $50,000 over the costs provided in the Proposed Plan. The additional costs represent $10,000 due to the EPA requirement to include groundwater access restriction and $50,000 to provide for a perimeter fence around the approximate 20 acre site.)

2.11 SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

An evaluation and comparison of the alternatives is presented in Table 2-21. 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 USEPA. The nine criteria are as follows:

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

2.11.1 Overall Protection of Human Health and Environment

The estimated excess cancer and noncancer risks to humans under current conditions are within acceptable guidelines set by USEPA. The excess cancer risk for the worst-case scenario, a future hypothetical resident exposed to soils, is estimated at $3x10^{-5}$. The noncancer risk is estimated at 0.09. The excess cancer risk range considered acceptable by USEPA is 10^{-4} to 10^{-6}. The noncancer limit considered acceptable by USEPA is 1. Predicted blood lead level for a hypothetical future child resident was estimated at 3.63 µg/dL, which is below the USEPA guideline of 10 µg/dL, and indicates a low level of concern for lead exposure if the site were re-developed for future land use.

All of the alternatives are within the USEPA acceptable risk range of 10^{-4} to 10^{-6} under current and potential future land use conditions but are slightly above the FDEP benchmark for acceptable risk of 1×10^{-6} based on the site-specific risk assessment performed for Site OT-11/OU-2. However, the no-action alternative and Alternative 2 may not be protective of the environment. Constituents detected at Site OT-11/OU-2 may represent potential ecotoxicological effects; however, it is highly unlikely that terrestrial biota would inhabit or

TABL[redacted]-21

COMPARATIVE ANALYSIS OF FINAL ALTERNATIVES FOR SITE OT-11/OU-2
RESIDUAL PESTICIDE DISPOSAL AREA
HOMESTEAD AIR RESERVE BASE, FLORIDA
(Page 1 of 4)

Criteria	Alternative 1 No Action	Alternative 2 Access and Use Restriction For Soil, Access Restriction For Groundwater, and Groundwater Monitoring	Alternative 4 Excavation, Off-Site Disposal of Soils, Access Restriction For Groundwater, and Groundwater Monitoring
Overall Protectiveness			
Human Health Protection - Dermal Contact/ Ingestion/Inhalation	Only current completed exposure pathway is that of base worker cutting the grass. Excess cancer risk is conservatively estimated at $3x10^{-7}$. Potential future cancer risk may be as high as $3x10^{-5}$. Predicted blood lead level for a hypothetical child receptor is acceptable at 3.63 µg/dl.	Same as Alternative 1.	Permanently reduces risks by removing contaminants from site.
Environmental Protection	Potential for constituents detected at Site OT-11 to cause ecotoxicological effects. However, unlikely that terrestrial biota would spend a great deal of time at the site.	Same as Alternative 1.	Permanently reduces potential for surficial exposure to contaminants.
Compliance with ARARs			
Chemical-Specific	This alternative meets chemical-specific ARARs	Same as Alternative 1.	Same as Alternative 1.
Location-Specific	There are no location-specific ARARs	Same as Alternative 1.	Same as Alternative 1.
Action-Specific	There are no action-specific ARARs associated with this alternative.	Same as Alternative 1.	LDRs may be applicable. Soil must meet LDRs prior to disposal.
Other Criteria and Guidance	Does not address the TBCs (e.g., FDEP soil cleanup guidelines) applicable to soil contamination at Site OT-11.	Same as Alternative 1.	Alternative removes contaminants from Site OT-11.

TABLE 2-21

COMPARATIVE ANALYSIS OF FINAL ALTERNATIVES FOR SITE OT-11/OU-2
RESIDUAL PESTICIDE DISPOSAL AREA
HOMESTEAD AIR RESERVE BASE, FLORIDA

Criteria	Alternative 1 No Action	Alternative 2 Access and Use Restriction For Soil, Access Restriction For Groundwater, and Groundwater Monitoring	Alternative 4 Excavation, Off-Site Disposal of Soils, Access Restriction For Groundwater, and Groundwater Monitoring
Long-Term Effectiveness and Permanence			
Magnitude of Residual Risk	Contamination in soil above FDEP Health-Based Soil Target Levels.	Same as Alternative 1.	Eliminates residual risk because contaminants are removed.
Adequacy and Reliability of Controls	No controls over contamination. No reliability.	Relies on use restrictions to prevent future exposure to workers and potential residents.	Relies on access restrictions to prevent potable wells from being placed on site. Fencing will be placed around the perimeter to restrict access to vehicle and foot traffic for unauthorized entry.
Need for 5-Year Review	Review would be required to verify contamination at site is not above health-based levels of concern.	Same as Alternative 1.	The 5 year site review will be required because of concern that potential sources of contamination in areas adjacent to OU-2 may exist since the area has not been fully characterized.
Reduction of Toxicity, Mobility, or Volume through Treatment			
Treatment Process Used	None.	None.	None
Amount Destroyed or Treated	None.	None.	None
Reduction of Toxicity, Mobility, or Volume	None.	None.	Contaminants that cause adverse health risk removed from site.

TABLE 2-21

COMPARATIVE ANALYSIS OF FINAL ALTERNATIVES FOR SITE OT-11/OU-2
RESIDUAL PESTICIDE DISPOSAL AREA
HOMESTEAD AIR RESERVE BASE, FLORIDA
(Page 3 of 4)

Criteria	Alternative 1 No Action	Alternative 2 Access and Use Restriction For Soil, Access Restriction For Groundwater, and Groundwater Monitoring	Alternative 4 Excavation, Off-Site Disposal of Soils, Access Restriction For Groundwater, and Groundwater Monitoring
Short-Term Effectiveness			
Community Protection	No risk to community.	Same as Alternative 1.	Same as Alternative 1.
Worker Protection	No risk to workers.	Same as Alternative 1.	Workers could potentially be exposed to contaminants during excavation. Protective clothing would reduce potential risk.
Environmental Impacts	None	None	None
Time to Complete Action	Not applicable	Not applicable	Excavation and disposal of soil could be completed within 6 months.
Implementability			
Ability to Construct and Operate	Not applicable.	Access and use restrictions require cooperation of the base and local regulatory agencies. Installation and sampling of monitoring wells is easily implemented.	Excavation and disposal of soils is easily implementable.
Flexibility of Action	Not applicable.	Not applicable.	The volume and type of soil excavated is easily changed.
Ability to Monitor Effectiveness	None required.	None required.	None required.
Ability to Obtain Approvals	No approvals necessary.	Same as Alternative 1.	Same as Alternative 1.

TABLE 2-21

COMPARATIVE ANALYSIS OF FINAL ALTERNATIVES FOR SITE OT-11/OU-2
RESIDUAL PESTICIDE DISPOSAL AREA
HOMESTEAD AIR RESERVE BASE, FLORIDA
(Page 4 of 4)

Criteria	Alternative 1 No Action	Alternative 2 Access and Use Restriction For Soil, Access Restriction For Groundwater, and Groundwater Monitoring	Alternative 4 Excavation, Off-Site Disposal of Soils, Access Restriction For Groundwater, and Groundwater Monitoring
Availability of Services, Equipment, and Materials	No special services, equipment, or materials required.	Conventional drilling equipment and contractors readily available.	Conventional excavation and transportation equipment and contractors readily available.
Availability of Technologies	None required.	None required.	Stabilization easily implementable, if required
Capital Cost	$0	$68,500	$150,950* to $174,750*
Annual O&M Costs Five-Year O&M Costs	$0 $29,500 (every 5 years)	$25,200 (for 5 years) and $29,500 (every 5 years)	$25,200 (for 5 years)
Present Worth	$43,300	$226,400	$265,500* to $289,300*

Notes: *Including perimeter fencing of the entire 20 acre site.

frequent the site. Alternative 4 is protective of the environment because it reduces potential for surficial exposure to contaminants by removal of soils with elevated concentrations of PAHs and lead concentrations exceeding FDEP Health-Based Target Levels.

2.11.2 Compliance with ARARs

All alternatives meet ARARs. The chemicals detected in groundwater and surface water are below federal and state promulgated standards and there are no ARARs for soils and sediments. Alternative 4, only, meets TBC guidelines for soil cleanup levels (FDEP Health-Based Soil Target Levels and DERM Clean Soil Criteria).

2.11.3 Long-term Effectiveness and Permanence

Alternatives 1 and 2 do not provide permanent solutions to the remedial action objectives. Alternative 4 permanently reduces the risks from both inhalation and ingestion by removing the contaminated soils from Site OT-11/OU-2.

2.11.4 Reduction of Mobility, Toxicity, or Volume Through Treatment

Alternatives 1 and 2 do not involve treatment. Alternative 4 reduces the mobility of contaminants but does not reduce the volume or toxicity of contaminants. Alternative 4 will involve treatment if excavated soil is determined to be a RCRA hazardous waste.

2.11.5 Short-Term Effectiveness

Alternatives 1 and 2 are not expected to pose significant risk to the community or workers during implementation. Under Alternative 4, excavation and disposal might cause some risk to the workers but protection measures can be easily implemented. There are no anticipated adverse environmental impacts from any of the alternatives.

2.11.6 Implementability

Alternatives 1, 2, and 4 are easily implementable.

2.11.7 Cost

Alternative 1 provides protection to human health and the environment and has a 10-year present worth of $43,300. Alternative 2 uses institutional controls to limit access to the contaminated soils and would cost approximately $226,400. Alternative 4 eliminates all risks at the site associated with the contaminated soils and costs approximately $265,500 if stabilization is not required and $289,300 if stabilization is required.

2.12 SELECTED REMEDY

Based upon consideration of the requirements of CERCLA, the detailed evaluation of the alternatives and public comments, the U.S. Air Force, in concurrence with the USEPA and the State of Florida, has determined that Alternative 4 - Excavation, Off-Site Disposal of Soils, Access Restriction for Groundwater, Site Fencing, and Groundwater Monitoring is the most appropriate course of action for Site OT-11/OU-2.

This alternative is protective of human health and the environment under the current and unlimited future land use conditions because it removes the contaminated soils from the site. The groundwater will be monitored annually for 5 years to monitor any future migration of contaminants in areas within and adjacent to OU-2 that may not have been fully characterized, such as the southern vegetation and fill areas. After the five year monitoring period, EPA, FDEP, and the USAF will evaluate the effectiveness of the remedy and the need for continued groundwater access restrictions. This alternative would be protective, cost effective, and complies with all Federal and State ARARs. The selected remedy has been accepted by the State and community concerns have been addressed in the Responsiveness Summary of this ROD.

A five year review will be conducted to determine whether the remedy remains protective of human health and the environment and to evaluate the need for continued groundwater access restrictions.

2.13 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. The selected remedy reduces and controls the existing risk from exposure to soil by excavation of contaminated soils. The selected remedy reduces and controls potential risk from exposure to groundwater by use of access restrictions to groundwater. 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 statutory waiver is justified. Since the applicable MCLs are already being met, the selected remedy satisfies all Federal and State ARARs. The selected remedy also must be cost-effective and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. The selected remedy has been determined to be cost-effective and utilizes permanent solutions by excavation of contaminated soils. Finally, the statute includes a preference for remedies that permanently and significantly reduce the volume, toxicity, or mobility of hazardous wastes as their principal element. The selected remedy will only satisfy this preference in the event that the excavated soils need treatment pursuant to Subtitle C of RCRA.

2.14 DOCUMENTATION OF SIGNIFICANT CHANGES

The PP was released for public comment on September 18, 1995. The PP identified Alternative 4 - Excavation, Off-Site Disposal of Soils, Access Restriction for Groundwater, and Groundwater Monitoring as the preferred alternative for remedial action at Site OT-11/OU-2.

The selected alternative has been modified from the March 1995 Feasibility Study due to the added EPA requirement to include groundwater access restriction to the selected alternative. This modification increased the cost of the alternative by $10,000. This change was reflected in the September 1995 Proposed Plan.

Perimeter Fencing, as presented in this ROD for the selected alternative, was added based on public concerns expressed during the public meeting. Site fencing was not included as part of Alternative 4 in the March Feasibility Study or the September Proposed Plan. Inclusion of site fencing increased the cost of the selected alternative by $50,000.

Responses to comments received during the September-October 1995 public comment period are presented in the attached Responsiveness Summary.

Homestead Air Reserve Base, Florida
Operable Unit No. 2
Site OT-11, Residual Pesticide Disposal Area

Responsiveness Summary for the Record of Decision

RESPONSIVENESS SUMMARY

FOR THE

RECORD OF DECISION

The responsiveness summary serves three purposes. First, it provides regulators with information about the community preferences regarding both the remedial alternatives and general concerns about Operable Unit No. 2, Homestead ARB. 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 ARB Site OT-11/OU-2 were released to the public in July 1994 and September 1995, 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.

The public comment period was held from September 18, 1995 to November 2, 1995, as part of the community relations plan of Operable Unit 2. Additionally, a public meeting was held on Monday, September 18, 1995, at 7:00 PM at South Dade High School. A public notice was published on September 6, 1995 in the South Dade News Leader and on September 7, 1995 in the Miami Herald to announce the purpose, location, date, and time of the public meeting. At this meeting, the USAF, in coordination with EPA Region IV, FDEP, and DERM discussed the investigation, results of the Baseline Risk Assessment, and Preferred Alternative described in the Proposed Plan.

Summary of Public Comments Received During the Public Comment Period

Comments received during the September 18, 1995 public meeting and the September 18 through November 3, 1995 public comment period are summarized on the following pages.

Originator: South Florida Water Management District

Comment: Although we do not have any specific comments on the clean-up of Operable Unit 2, the Residual Pesticide Disposal Area, we remain interested in the activities on the Homestead Air Reserve Base and any associated Base Reuse Plans.

In General, these concerns remain:

1. Any contaminated groundwater or soil clean-up plans must be considered when proposing revisions in surface water management facilities or changes in land use in general.

2. The relationship between all entities with an interest in long term operation and maintenance of the existing and proposed water management system must be established.

3. Continued coordination with Metro-Dade County, FDEP, and the District on specific construction activities as plans are developed.

Response: The USAF, in conjunction with the Base Closure Team (BCT) will continue to take the steps necessary to insure protectiveness to human health and the environment. The USAF understands the concerns of the community and many of the interested parties associated with the redevelopment of the base, they will continue to act under their current policy of stewardship and good housekeeping. The USAF will continue to coordinate with the BCT and solicit comments and concerns regarding cleanup and redevelopment of the base. These comments are carefully reviewed by the BCT, comprised of representatives from the USEPA, FDEP, DERM, and the USACE. The USAF encourages public input through organizations such as the Restoration Advisory Board (RAB) and public meetings.

Originator: L. Anthony

Comment: Reference Proposed Plan for Restoration of Operable Unit 2, Site OT-11 as part of the Installation Restoration Program at Homestead Air Reserve Base by the Department of the Air Force.

By separate comments, dated September 13, 1995, I, Leonard S. Anthony, 14820 Naranja Lakes Boulevard, Homestead, Florida, submitted comments concerning the Proposed Plan.

Subsequent to that submission, I have had the opportunity with the assistance of Base staff, Mr. Robert Courtright, Remedial Project Manager and Judith C. Gretsch, W.P.I. Inc., to visit the project site. Although not traversing the entire site on foot, I was able to determine that area undocumented with test points, are indeed wooded and overgrown with vegetation. They are essentially overgrown to the extent that they were inaccessible by vehicle or on foot and therefore revealed no added information.

Ms. Gretsch also made available certain documentation.

One document, Engineering-Science, August 1983, Installation Restoration Program, Phase I-Records Search is Atlanta Georgia AR/1R3 395, on page 4-11 states in part, "The practice was to spray the waste over a wide area, after which chlorine bleach and ammonia were applied as neutralizing agents." There is no indication in this paragraph that this wide area was confined to roadways or pathways but rather a "wide area" however undefined.

Page 5-6 of this same document states, "The disposal practice involved spraying the wastes on the ground over a twenty acre area, followed by applications of chlorine bleach and ammonia to help break down the chemicals. While the wastes were not applied in concentrated form on a localized area, the extremely permeable nature of the surface soils and underlying rock in the area make the site a potential source of groundwater contamination." This reference certainly discounts any localized patterns of disposal, emphasizing that the disposal was over twenty acres of land, possibly.

Page 2-18 of "Science Application International Corporation, March 1986, Installation Restoration Program Phase II - Confirmation/Quantification Stage 1, Final Report. SAIC: McLean, VA AR/IR #466 states in part, "Waste pesticides....were disposed of in an open area..... The disposal practice involved pouring and spraying the wastes on the ground over a 20-acre area,...." Here it is noted that the area was "open" and a 20-acre area was used. This disposal period covered five (5) years from 1977 to 1982. There is no mention of pattern disposal, only that the open 20 acres were used.

The Draft Final Report (April 1994), "Remedial Investigation Report for Site OT-11, Residual Pesticide Disposal Area, Volume 1 of XIV, AR/IR #1326 HAFB, FL, "on page XVII of the executive summary notes that the northern portion of the site was significantly altered, physically, since the last investigation. The vegetation and rubble fill had been removed and a large mound of what appeared to be excess road (asphaltic) and fill dirt was present." The paragraph later notes that the PAH's and high levels of lead were detected in

soil samples - possibly due to these rubble piles. It is unknown when the last investigation referred to was performed, but there is an obvious change of the topography of the site over time from earlier 1983 and 1986 documented on page 1-5 of this same document, and 1993 (CERCLA Field Investigation Time). If the site were totally accessible and used in the 1977-1982 period and subsequent piles of rubble were stored there and moved, there may still be some residuals still there in the overgrown and wooded areas, possibly under the piles where no test points have been documented. Given that high levels of lead were found in the north area, there may be a different type contamination here than just pesticides of a level to warrant further investigation.

The site history of documents "Montgomery Watson, March 1995, Feasibility study for OT-11 - Residual Pesticide Disposal Area, Final Report, Montgomery Watson; Walnut Creek CA AR/IR #1342, further notes that intermittent use of the site for the storage of asphaltic materials, although generally confined to the northern area.

The essential concern is that there is a clear lack of documentation at testpoints randomly conducted throughout the site.

1. There may be contaminants of concern under the debris piles given the changing conditions on the site over time.

2. Remediation of the contaminants in the soil has been selectively addressed, that is identified and scheduled for removal etc. The entire twenty acre site is not included nor has testing been accomplished.

3. If this alternative is accepted and implemented, there can be no assurance of what lies under/in the untested areas. Yet remediation will have been assumed to have been accomplished and the entire site, all twenty acres will have been assumed completed.

4. The suggested site remediation alternative includes the provision of wells for continued multi-year testing. However, the hallmark contaminant is for now water soluble pesticides that are bound in the soil. The use of wells to monitor future pesticide contamination seems inconsistent. Other contaminants such as metals, BNAs (PAHs), will not necessarily be detected in those well points because they may be trapped in the piles.

Response: The southern vegetation and fill areas were generated as a result of construction and demolition debris from the construction of the expanded runway in the early 1950s. Residual pesticide disposal occurred from 1972 to 1982. As the Base began investigating potential areas of concern, activities associated with the Residual Pesticides Disposal Area were reviewed. During the IRP Phase II and Phase IV investigations, emphasis focused on soil and groundwater in the northern portion of the site. Then during the 1991 remedial investigation, the area was expanded to include the southern fill/vegetation areas. The perimeters of the fill/vegetation were sampled with the presumption that pesticide disposal would have more readily occurred along the roadways which surround these areas because they were more readily accessible. Sediment and surface water samples were collected from the canals adjacent to the fill/vegetation areas to assess potential impacts from runoff and seepage into the adjacent canals. Soil, sediment, and surface water samples collected during this event were analyzed for pesticide. The results from these analyses indicate that there were no significant impact to soil, surface water, or sediments as a result of pesticide disposal operations. In 1993, a Boundary Canal Remedial Investigation was completed which included the collection of additional sediment and surface water samples for an expanded parameters list in the canals adjacent to the site. The results from these analysis also indicated that there were no significant impacts to the canals as a result of past operations.

Due to the absence of significant pesticide contamination around the southern fill/vegetation area, the investigations returned to the north were the positive detections were observed. The 1993 expanded remedial investigation for this site included the collection of groundwater, soil, sediment, and surface water with an expanded perimeter list. The results from this investigation reported elevated levels of lead and PAH compounds. These findings are reported to be associated with the rubble piles. The sampling and analyses performed to date do not indicate impacts as a result of residual pesticide disposal activities. However, because the USAF recognizes the potential for impact to the site through leaching of COPCs, annual monitoring will be conducted followed by a 5-year site review. The annual groundwater monitoring will consist of analyzing groundwater from the existing monitoring wells plus two new wells. The collected samples will be analyzed for parameters consistent with the potential site contaminants and will include pesticides, PAHs, and priority pollutant metals.

Originator: G. Sweitzer

Comment: I have lingering doubts concerning the "Operable Unit 2 - Site OT-11 proposed plan." The "rubble piles" found in the area should be more closely examined to determine IF pesticide containers are hidden beneath the obvious concrete and asphalt debris.

These containers MAY NOT HAVE LEAKED as of the studies date. In respect I echo the statement made by Mr. Len Anthony. The effort should be made to dissect at least some of these rubble piles and determine if a threat exists. Failure to do so, despite contrary indications of contamination (wells etc.) will leave doubt in the publics mind that enough was done to make sure no threat exists.

Response: As was discovered during the investigation of this site, the southern rubble piles were generated in the early 1950's during the expansion of the runway, approximately 20 years prior to the area being utilized as a residual pesticide disposal area. Residual pesticide disposal began in this area in 1972. Once the area was identified as a potential source of contamination, it was systematically investigated to determine the nature and extent of potential contaminants. This approach included a site review, record search, and multiple multi-media sampling and analysis events. Results of these efforts indicated the absence of significant pesticide contamination around the southern rubble piles. Evaluation of the site with regard to risks to human health and the environment indicate the only unacceptable risk would be to a hypothetical future adult and child resident exposed to site soils. These levels are due primarily to the levels of lead and PAH compounds. The selected alternative was chosen because it was determined to be protective to human health and the environment. The USAF, in conjunction with the USEPA and the FDEP will utilize the annual groundwater monitoring information to evaluate the effectiveness of the remedy. Should the conditions change, the USAF will take the steps necessary to insure protectiveness to human health and the environment.

Public Comment Summary

The United States Air Force has reviewed and analyzed all of the public comments, and has elected to proceed with the Selected Remedial Alternative outlined within the Feasibility Study and as announced with the Public Notice Proposed Plan.

Homestead Air Reserve Base, Florida
Operable Unit No. 2
Site OT-11, Residual Pesticide Disposal Area

Declaration for the Record of Decision

DECLARATION STATEMENT

FOR THE

RECORD OF DECISION FOR OPERABLE UNIT NO. 2

SITE NAME AND LOCATION

Homestead Air Reserve Base
Homestead, Dade County, Florida
Operable Unit No. 2 - Site OT-11
Residual Pesticide Disposal Area (Former Site P-3)

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the Residual Pesticide Disposal Area (Site OT-11), Operable Unit No. 2 (OU-2), at Homestead Air Reserve Base, in Homestead, Florida. The selected remedial action is chosen in accordance with CERCLA, as amended by SARA, and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision document explains the basis for selecting the remedial alternative for this Operable Unit. The information that forms the basis for this remedial action is contained in the administrative record for Site OT-11/OU-2.

The selected alternative for OU-2 is excavation, off-site disposal of soils, installation of perimeter fence for access restriction, institutional controls for groundwater restrictions, and monitoring for any future migration of compounds of potential concern (COPC) into the groundwater. 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). OK

ASSESSMENT OF THE SITE

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

DESCRIPTION OF THE SELECTED REMEDY

The operable unit represents the only unit for the site. This response action addresses the principal threat at the site by removing contaminated soils. It also requires access restriction, deed restriction for groundwater use, and groundwater monitoring.

The major components of the selected remedy include:

- Excavation of approximately 60 cubic yards of contaminated soil. The soil is slated for disposal at a RCRA permitted facility. Based on testing of the soil, it may require treatment to comply with requirements of Subtitle C of RCRA such as land disposal restrictions.

- Installation of two shallow monitoring wells and annual groundwater monitoring for 5 years. The groundwater samples will be analyzed for pesticides, PAHs, and priority pollutant metals.

- Institutional controls to restrict the placement of potable water wells into the groundwater beneath the site.

- Five year review to determine whether the remedy remains protective of human health and the environment and to evaluate the need for continued groundwater access restrictions.

- Installation of a perimeter fence to restrict site access (vehicular and foot traffic).

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to remedial action, and is cost effective. This remedy utilizes permanent solutions and alternative treatment technologies, and satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element, only if the excavated soils need treatment pursuant to Subtitle C of RCRA.

Although this remedy will reduce the concentrations of hazardous substances, pollutants, or other contaminants remaining on site to below Health-Based Levels, a review of the remedial action will be conducted 5 years after its commencement. The 5 year review is conducted because there is concern that potential sources of contamination in areas adjacent to OU-2 may exist since the area has not been fully characterized.

UNITED STATES AIR FORCE
HOMESTEAD AIR RESERVE BASE

By:_____ Date:_____

RESPONSE TO COMMENTS
RECORD OF DECISION
OPERABLE UNIT NO. 2 SITE OT-11
RESIDUAL PESTICIDE DISPOSAL AREA
HOMESTEAD AIR RESERVE BASE, FLORIDA

The following are written responses to comments from Mr. Earl L. Bozeman, Jr. of the USEPA, received via fax on April 18, 1996 regarding review of the Draft Final Record of Decision for Operable Unit No. 2 Site OT-11, Residual Pesticide Disposal Area at Homestead ARB, FL.

Ref. No.	Item No.	A/E	Comment/Response
Page ii, First Bullet	1		Comment: Add the sentence "Based on testing of the soil, it may require treatment to comply with requirements of Subtitle C of RCRA such as land disposal restrictions."
		[A]	*Response: The text change has been made as requested.*
Page ii, Second Bullet	2		Comment: Please indicate the parameters for which the groundwater will be monitored.
		[A]	*Response: The text has been modified to include the groundwater sampling parameters.*
Page ii, Third Bullet	3		Comment: Please insert the words "Institutional controls to" at the beginning of this sentence.
		[A]	*Response: The text change has been made as requested.*
Page ii, Fourth Bullet	4		Comment: Change the word "site" to "remedy".
		[A]	*Response: The text change has been made as requested.*
Page ii, First Paragraph of Statutory Determinations	5		Comment: Add the phrase ",only if the excavated soils need treatment pursuant to Subtitle C of RCRA." to the last sentence of this paragraph.

Ref. No.	Item No.	A/E	Comment/Response
		[A]	*Response: The text change has been made as requested.*
Page ii, Last Paragraph	6		Comment: Change the first part of the sentence to read "Although this remedy will reduce the concentrations of hazardous substances, pollutants, or other contaminants remaining on site to below health-based levels, a review of the remedial action will be conducted 5 years after its commencement." Also, add the following sentence to this paragraph: "The 5 year review is conducted because there is concern that potential sources of contamination in areas adjacent to OU-2 may exist since the area has not been fully characterized."
		[A]	*Response: The text change has been made as requested.*
Page 10, First Full Paragraph, Second Sentence	7		Comment: Please indicate if the levels of organochlorine pesticides detected in 5 of the 6 soil samples were above or below health-based benchmarks. In the fourth sentence of this paragraph, insert "a" before "high", change "affinities" to "affinity", insert "an" before "extremely" and change "solubility's" to "solubility".
		[A]	*Response: Text has been added to indicate these pesticide concentrations were below the State of Florida Health-Based Soil Target Levels. Additional text changes have been made as requested.*
Page 11, Second Full Paragraph	8		Comment: Please indicate if the concentrations of organochlorine pesticides detected in soil samples during the 1988 investigation were above or below health-based benchmarks.
		[A]	*Response: Text has been added to indicate these pesticide concentrations were below the State of Florida Health-Based Soil Target Levels*
Page 14, Last Paragraph, Second Sentence	9		Comment: Please define the acronym "bgs" if not previously defined in the text.

Ref. No.	Item No.	A/E	Comment/Response
		[A]	*Response: The acronym "bgs" has been defined in the text as requested.*
Page 15, Last Paragraph	10		Comment: Please indicate if BNAs detected in soil samples were above or below health-based benchmarks. Also, in the last line on this page, please indicate a reference point for the "...elevated concentrations of total PAHs ..." (i.e., background, health -based benchmarks, etc.).
		[A]	*Response: Text has been added to indicate which BNA detection exceed the State of Florida Health-Based Soil Target Levels. The term elevated as it refers to concentration of total PAHs in samples P3-SL-0027-1, P3-SL-0028-1, and P3-SL-0030-1 has been removed from the text.*
Page 27, Second Full Paragraph, Second Sentence	11		Comment: Insert "some" before "contaminants" and delete "of concern".
		[A]	*Response: The text changes have been made as requested.*
Page 28, Second Full Paragraph, Fourth Sentence	12		Comment: Change "of" to "or" between EPA and FDEP. Same page, last paragraph, first sentence, dose is misspelled.
		[A]	*Response: These typographical errors have been corrected.*
Page 30, Last Paragraph of Section 2.9.6	13		Comment: Why are RGOs presented for the HQ level of 10? Also, the first sentence of this paragraph is confusing. Please reword.
		[A]	*Response: The risk assessment was prepared by another A.E., however previous guidance evaluated the HQ an order of magnitude above and below 1, i.e., 0.1, and 10. Current guidance calls for RGOs for the HQ at 0.1, 1, and 3.*
Page 32, Section 2.10.1, First Paragraph, Third Sentence	14		Comment: This statement is contradicted by the statement made in the first sentence of the first full paragraph on page 36.

Ref. No.	Item No.	A/E	Comment/Response
		[A]	*Response: The No Action alternative is below the USEPA range of 10^{-4} to 10^{-6} but above the FDEP benchmark of 10^{-6} for the future land use scenario. The text on page 36 has been revised.*
Page 34, Section 2.10.1, First Sentence	15		Comment: Reference is made to excavation of areas with elevated concentrations of PAHs and lead to " ...levels deemed protective to FDEP ...". Please indicate the levels. In the same paragraph, seventh sentence, insert "is a RCRA hazardous waste and/or to determine if it" between "material" and "meets". In the same paragraph, page 35, first line, change "eliminates" to "reduces" and insert "to an acceptable level" between "residents" and "and".
		[A]	*Response: Reference has been made to the State of Florida Health-Based Soil Target Levels. The remaining text changes have been made as specified.*
Page 36, First Paragraph, First Sentence	16		Comment: See comment 14.
		[A]	*Response: See Response to comment No. 14.*
Page 36, Section 2.11.4	17		Comment: Please insert "Alternative 4 will involve treatment if excavated soil is determined to be a RCRA hazardous waste" at the end of this Section.
		[A]	*Response: The text change has been made as requested.*
Page 37, Last Paragraph, Second Sentence	18		Comment: Please indicate from where future migration of contaminants may occur.
		[A]	*Response: Additional text has been provided consistent with the information presented in comment No. 6.*

Ref. No.	Item No.	A/E	Comment/Response
Page 38, Last Paragraph of Section 2.12	19		Comment: It is stated that the selected remedy includes a five year review of the site, however, on the second page of Table 2-12 under Alternative 4, it is stated that the five year review is not required. Please clarify.
		[A]	*Response: Table 2-21 has been revised to indicate that "the 5 year site review will be required because of concern that potential sources of contamination in areas adjacent to OU-2 may exist since the area has not been fully characterized.*
Page 38, Section 2.13		20	Comment: Insert "Since the applicable MCLs are already being met," at the beginning of the sixth sentence. In the next to last sentence of this Section, delete "that employ treatment". Also, change the last sentence of this Section to read "The selected remedy will only satisfy this preference in the event that the excavated soils need treatment pursuant to Subtitle C of RCRA."
		[A]	*Response: The text changes have been made as requested.*
Table 2-21, Page 2	21		Comment: Under Alternative 4, across from Treatment Process Used and Amount Destroyed or Treated, please change the entries to "None", since off site disposal is not the same as treatment.
		[A]	*Response: The text changes have been made as requested.*
Table 2-21, Page 4	22		Comment: The cost information for all three alternatives in this table as well as in the text on pages 32, 33, and 35 is very confusing. Please explain in greater detail in the text and ensure the accuracy of the computations in the table.
		[A]	*Response: The cost information has been developed in accordance with "Remedial Action Costing Procedures Manual", USEPA, 1985. Additional information has been provided which discusses the fact that future expenditures, such as five year site reviews and operation and maintenance costs have been discounted 5 percent over the specified life of the alternative in order to determine the present day cost for performance of the alternative.*