Public Health Assessment for

HOMESTEAD AIR FORCE BASE
HOMESTEAD AFB, DADE COUNTY, FLORIDA
CERCLIS NO. FL7570024037
SEPTEMBER 30, 1998

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
Agency for Toxic Substances and Disease Registry

PUBLIC HEALTH ASSESSMENT

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Federal Facilities Assessment Branch
Division of Health Assessment and Consultation
Agency for Toxic Substances and Disease Registry

THE ATSDR PUBLIC HEALTH ASSESSMENT: A NOTE OF EXPLANATION

This Public Health Assessment was prepared by ATSDR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) section 104 (i)(6) (42 U.S.C. 9604 (i)(6)), and in accordance with our implementing regulations (42 C.F.R. Part 90). In preparing this document, ATSDR has collected relevant health data, environmental data, and community health concerns from the Environmental Protection Agency (EPA), state and local health and environmental agencies, the community, and potentially responsible parties, where appropriate.

In addition, this document has previously been provided to EPA and the affected states in an initial release, as required by CERCLA section 104 (i)(6)(H) for their information and review. The revised document was released for a 30-day public comment period. Subsequent to the public comment period, ATSDR addressed all public comments and revised or appended the document as appropriate. The public health assessment has now been reissued. This concludes the public health assessment process for this site, unless additional information is obtained by ATSDR which, in the agency's opinion, indicates a need to revise or append the conclusions previously issued.

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FOREWORD

The Agency for Toxic Substances and Disease Registry, ATSDR, was established by Congress in 1980 under the Comprehensive Environmental Response, Compensation, and Liability Act, also known as the *Superfund* law. This law set up a fund to identify and clean up our country's hazardous waste sites. The Environmental Protection Agency, EPA, and the individual states regulate the investigation and clean up of the sites.

Since 1986, ATSDR has been required by law to conduct a public health assessment at each of the sites on the EPA National Priorities List. The aim of these evaluations is to find out if people are being exposed to hazardous substances and, if so, whether that exposure is harmful and should be stopped or reduced. If appropriate, ATSDR also conducts public health assessments when petitioned by concerned individuals. Public health assessments are carried out by environmental and health scientists from ATSDR and from the states with which ATSDR has cooperative agreements.

Exposure: As the first step in the evaluation, ATSDR scientists review environmental data to see how much contamination is at a site, where it is, and how people might come into contact with it. Generally, ATSDR does not collect its own environmental sampling data but reviews information provided by EPA, other government agencies, businesses, and the public. When there is not enough environmental information available, the report will indicate what further sampling data is needed.

Health Effects: If the review of the environmental data shows that people have or could come into contact with hazardous substances, ATSDR scientists evaluate whether or not these contacts may result in harmful effects. ATSDR recognizes that children, because of their play activities and their growing bodies, may be more vulnerable to these effects. As a policy, unless data are available to suggest otherwise, ATSDR considers children to be more sensitive and vulnerable to hazardous substances. Thus, the health impact to the children is considered first when evaluating the health threat to a community. The health impacts to other high risk groups within the community (such as the elderly, chronically ill, and people engaging in high risk practices) also receive special attention during the evaluation.

ATSDR uses existing scientific information, which can include the results of medical, toxicologic and epidemiologic studies and the data collected in disease registries, to determine the health effects that may result from exposures. The science of environmental health is still developing, and sometimes scientific information on the health effects of certain substances is not available. When this is so, the report will suggest what further public health actions are needed.

Conclusions: The report presents conclusions about the public health threat, if any, posed by a site. When health threats have been determined for high risk groups (such as children, elderly, chronically ill, and people engaging in high risk practices), they will be summarized in the conclusion section of the report. Ways to stop or reduce exposure will then be recommended in the public health action plan.

ATSDR is primarily an advisory agency, so usually these reports identify what actions are appropriate to be undertaken by EPA, other responsible parties, or the research or education divisions of ATSDR. However, if there is an urgent health threat, ATSDR can issue a public health advisory warning people of the danger. ATSDR can also authorize health education or pilot studies of health effects, full-scale epidemiology studies, disease registries, surveillance studies or research on specific hazardous substances.

Community: ATSDR also needs to learn what people in the area know about the site and what concerns they may have about its impact on their health. Consequently, throughout the evaluation process, ATSDR actively gathers information and comments from the people who live or work near a site, including residents of the area, civic leaders, health professionals and community groups. To ensure that the report responds to the community's health concerns, an early version is also distributed to the public for their comments. All the comments received from the public are responded to in the final version of the report.

Comments: If, after reading this report, you have questions or comments, we encourage you to send them to us.

Letters should be addressed as follows:

Attention: Chief, Program Evaluation, Records, and Information Services Branch, Agency for Toxic Substances and Disease Registry, 1600 Clifton Road (E-56), Atlanta, GA 30333.

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LIST OF ABBREVIATIONS

ATSDR	Agency for Toxic Substances and Disease Registry
BNA	base/neutral and acid extractable compound (also known as semi-volatile compound)
BW	body weight
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CPF	cancer potency factor
CREG	ATSDR's cancer risk evaluation guide
CV	comparison value
ED	exposure duration
EF	exposure frequency
EMEG	ATSDR's environmental media evaluation guide
EPA	U.S. Environmental Protection Agency
FDEP	Florida Department of Environmental Protection
FI	fraction ingested
FS	feasibility study
HARP	Health Activities Recommendation Panel
IR	ingestion rate
IRP	Installation Restoration Program
kg	kilogram
MCL	EPA's maximum contaminant level
mg	milligram
mg/L	milligrams per liter
mg/kg/day	milligrams per kilogram per day
MRL	ATSDR's minimal risk level
nd	not detected
NPL	National Priorities List
OU	operable unit
PAH	polycyclic aromatic hydrocarbon
ppb	parts per billion
ppm	parts per million
PCBs	polychlorinated biphenyls
PHAP	Public Health Action Plan
RfD	EPA's reference doses
RI	remedial investigation
RMEG	ATSDR's reference dose media evaluation guide
ROD	record of decision
TEF	toxic equivalency factor
UST	underground storage tank
VOC	volatile organic compound

SUMMARY

Homestead Air Force Base (Homestead AFB) is located approximately 25 miles southwest of Miami and seven miles east of the city of Homestead in Dade County, Florida. The Homestead Army Air Field was activated by the Air Force in September 1942, and used for transport and training. After a severe hurricane in 1945, the base was owned by Dade County Port Authority until the federal government reacquired it in 1953. In 1992, a second severe hurricane, Andrew, destroyed most of Homestead AFB. Currently, the U.S. Air Force Reserve occupies approximately one third of the base for daily operations and training facilities. The remainder of the property is being parceled out for various industrial and commercial uses.

The topography of Homestead AFB is flat and surface drainage is poor. To assist drainage, canals have been constructed throughout Homestead AFB. These canals drain to the Boundary Canal, which surrounds most of the base, then into a stormwater reservoir, and finally into the Outfall Canal. The Outfall Canal flows east two miles from the edge of the base property and empties into the Biscayne Bay.

The Agency for Toxic Substances and Disease Registry (ATSDR) conducted an initial site visit in 1991 and a second site visit in 1997. During these visits, no completed pathways of human exposure were identified. Community concerns regarding Homestead are generally ecological concerns about contaminants in the canal system affecting Biscayne Bay.

ATSDR reviewed on-site groundwater data. Elevated levels of volatile organic compounds (VOCs), base/neutral and acid extractable compounds (BNAs), pesticides, and metals exist in groundwater under Homestead AFB at generally very low quantities. No exposure to contaminated drinking water is occurring currently or will occur in the future. Due to salt water intrusion, the base drinking water has been supplied by off-base wells since 1992. No drinking water wells will be placed on the base in the future. ATSDR suggests placing a ban on future drinking water wells at Homestead AFB. *On the basis of currently available data, ATSDR concludes that contaminants in groundwater do not pose a health hazard because no pathway for exposure appears to exist.*

ATSDR reviewed on-site soil data. Although levels of polycyclic aromatic hydrocarbons (PAHs), pesticides, and metals were detected above comparison values in some samples, detections occurred in areas of limited access (e.g., industrial areas) and were detected sporadically and at levels that do not pose a health hazard. *On the basis of available data, ATSDR concludes that exposure to contaminants in soil does not pose a public health hazard.*

ATSDR performed a detailed review of surface water, sediment, and fish data from the Boundary and Outfall Canals. Surface water samples contain sporadic detections of a few metals. Sediment samples contain PAHs, polychlorinated biphenyls (PCBs), and metals. Limited exposure to contaminants at detected levels in surface water and sediment during recreational activities such

as fishing is not likely to pose a health hazard. *On the basis of available data, ATSDR concludes that exposure to contaminants in surface water and sediment does not pose a public health hazard.* Fish samples contain PCBs, pesticides, and arsenic. Ingestion of contaminants at levels detected in fish from the canal system is not likely to pose a health hazard for individuals who infrequently ingest fish from the canals. However, it is possible (though unlikely) that ingesting large quantities of fish from the canal (such as subsisting on canal fish) may be associated with noncancer health effects. *On the basis of available data, ATSDR concludes that occasionally ingesting fish from the Boundary or Outfall Canals does not pose a public health hazard, but that adverse health effects may be associated with ingesting fish at a subsistence level.*

BACKGROUND

Site Description and History

Homestead Air Force Base (Homestead AFB) is located approximately 25 miles southwest of Miami and seven miles east of the city of Homestead in Dade County, Florida (see Figures 1 and 2). The main installation covers approximately 2,940 acres with easements covering an additional 429 acres (Air Force, 1993; Geraghty & Miller, 1994a).

Pan American Air Ferries originally developed the air field at Homestead AFB and for a few years used the site for pilot training. In September 1942, the Homestead Army Air Field was activated for the Caribbean Wing Headquarters. The base served as a staging facility for the Army Transport Command, which was responsible for maintaining and dispatching aircraft to overseas locations. In 1943, the field mission was changed to train transport pilots and crews for the Second Operational Training Unit (Geraghty & Miller, 1994a).

A severe hurricane caused extensive damage to the air field in September 1945, and the base was placed on inactive status and transferred to Dade County. Dade County Port Authority owned and managed the base for eight years, during which time the runways were used by crop dusters and the buildings housed a few small industrial and commercial operations (Geraghty & Miller, 1994a).

In 1953, the federal government again acquired Homestead AFB, rebuilt it as a Strategic Air Command base, and reactivated it in November 1955 (Geraghty & Miller, 1994a). The base was operated by Air Force strategic and tactical units until August 1992, when Hurricane Andrew rendered 97 percent of the base dysfunctional (Air Force, 1993). The base was placed on the 1993 Base Realignment and Closure list and given a reduced mission (Air Force, 1993).

On April 1, 1994, part of the base officially became Homestead Air Reserve Base. Approximately one-third of the base is currently occupied by the U.S. Air Force Reserve 482 Fighter Wing and used for daily operations and training facilities. The Florida Air National Guard occupies a small parcel of land near the north end of the base's flightline. Most of the remaining two-thirds of the property, or 2,055 acres, is presently under an interim short-term lease to Dade County until final disposition of the property can be carried out (Woodward-Clyde, 1997b). Land transfers have already occurred from the Air Force to the U.S. Department of Labor (41 acres), Dade County Homeless Trust (84 acres), Florida Power and Light, and a bank and credit union. Proposals for the remaining two-thirds of the installation are being considered for Dade County Aviation Department (approximately 1,600 acres), Dade County Parks and Recreation (213 acres), and Dade County Public Schools for industrial use and trade schools (26 acres) (see Figure 3).

Homestead AFB was already engaged in the Installation Restoration Program (IRP) developed by the Department of Defense when it was placed on the U.S. Environmental Protection Agency's

(EPA) National Priorities List on August 30, 1990. To establish a framework and schedule for developing, implementing, and monitoring appropriate remedial actions at the base, a Federal Facility Agreement was signed by Homestead AFB, the EPA, and the Florida Department of Environmental Protection in March 1991.

Through the IRP, 27 sites were identified with known or suspected contamination. Twenty of these sites are being investigated and remediated as needed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Seven other sites are being investigated and remediated as needed under the Florida Department of Environmental Protection Petroleum Contamination Site Cleanup Criteria and one was proposed and accepted for closure under the Resource Conservation and Recovery Act (RCRA) (Air Force, 1993). Several additional sites were identified after Hurricane Andrew damaged the base and are also being investigated and remediated as needed under these programs. The 1994 RCRA Facility Assessment identified 64 potential sites, of these, 37 were recommended for confirmation sampling. As a result of confirmation sampling, 15 sites were recommended for no further action, 9 were transferred to the Florida Fuels Program, and 13 were recommended for further investigations.

Natural Resources and Land Use

Homestead AFB is relatively flat with elevations ranging from approximately five to ten feet above mean sea level. Local variations in relief of the topography at the base are typically the result of construction activities (Geraghty & Miller, 1994a). Because the groundwater table is at or above the ground's surface in south Florida, the landscape is dominated by broad swamps and typically exhibits poor surface drainage. Approximately 100 acres of land at Homestead AFB have been identified as wetlands. Because of the poor drainage, numerous canals have been constructed at Homestead AFB. These canals improve surface water drainage, divert rainfall runoff, and lower the water table in some areas. The hydraulic gradient of the canal system is 0.3 feet per mile. Water in the canals is essentially stagnant and no measurable flow occurs. In response to significant precipitation events, however, a slight hydraulic gradient is induced and some flow occurs in the canals (Woodward-Clyde, 1995).

The Boundary Canal surrounds all but a portion of the base (see Figure 2). A dike was constructed along the outside of the bank of the Boundary Canal to prevent runoff from outside the base from entering the canal (Geraghty & Miller, 1994a). A drainage divide occurs within the base property, running from the northern end toward the center. Water in the Boundary Canal generally flows south and east along the western boundary and south along the eastern boundary, converging at the stormwater reservoir located on the eastern side of the base.

Water flows through water-control structures out of the stormwater reservoir into the Outfall Canal. The Outfall Canal flows east from the base for approximately two miles and empties into Biscayne Bay (Geraghty & Miller, 1994a). The land between Homestead AFB and Biscayne Bay

is composed of farmland, nurseries, woodlands, and forested wetlands. Homestead AFB and these lands are part of the drainage basin for the canal. Biscayne Bay is part of the Biscayne National Park.

Two other surface water bodies are located on Homestead AFB. Mystic Lake is located near a former recreational campground and trailer area. Mystic Lake may have been used in the past for both recreational and fishing purposes (ATSDR, 1997b; ATSDR, 1997c). Phantom Lake is located near a controlled area where access is limited. Recreational fishing may have occurred or may be occurring at Phantom Lake (ATSDR, 1997b; ATSDR, 1997c).

The area adjacent to the Boundary Canal surrounding Homestead AFB to the east, west, and south is primarily composed of farmland and commercial nurseries (Woodward-Clyde, 1997b). Land use adjacent to the northern and western borders of the base includes residential and commercial facilities within the city limits of Homestead. Homestead AFB is surrounded by a fence.

The Biscayne Aquifer is the primary source of drinking water in southern Florida. The aquifer ranges from 80 to 120 feet below land surface around Homestead AFB. It consists of highly permeable limestone, sandstone, and sand. The Biscayne Aquifer is recharged by rainfall and canals in dry periods, but also discharges to canals and coastal seepage. Since the Aquifer has a unique relationship with the canals and Atlantic Ocean, it is subject to saltwater intrusion.

Demographics

Approximately 700 personnel, half military and half civilian, currently work at Homestead AFB. An additional 200 to 300 Reservists are also at the base for training, but are not full-time employees. It has been projected that approximately 1,000 civilian Homestead AFB employees and 2,000 Reservists will be employed at the site in the future (Woodward-Clyde, 1997b). Additional Reservists will be visiting for training for short periods (Woodward-Clyde, 1995). The population of the city of Homestead is approximately 18,700 (Woodward-Clyde, 1997b).

Quality Assurance and Quality Control

In preparing this public health assessment, ATSDR relies on the information provided in the referenced documents and contacts. The agency assumes adequate quality assurance and control measures were followed with regard to chain-of-custody, laboratory procedures, and data reporting. The validity of the analyses and conclusions drawn in this document are determined by the availability and reliability of the referenced information. The limits of these data have been identified in the associated reports.

ENVIRONMENTAL CONTAMINATION AND POTENTIAL PATHWAYS OF EXPOSURE

Introduction

The Agency for Toxic Substances and Disease Registry (ATSDR) performed an Initial Site Scoping visit at Homestead AFB in January 1991 (ATSDR, 1991). At that time, ATSDR toured the base, reviewed documents, and met with representatives from the base, the Florida Department of Health and Rehabilitative Services, the Dade County Department of Public Health, and the Dade County Department of Environmental Resources Management. During the Initial Site Scoping visit, no completed pathways of human exposure were identified and ATSDR concluded that the potential for human exposure was low.

During the January 1991 visit, ATSDR identified potential public health concerns regarding contaminated groundwater, soil contamination at several of the IRP sites, and contact with contaminated surface water in the Outfall Canal (ATSDR, 1991). Groundwater at Homestead AFB is contaminated with generally very low quantities of volatile organic compounds (VOCs), base/neutral and acid extractable compounds (BNAs), pesticides, and metals, but is not currently used as drinking water. Throughout Homestead AFB, there are areas of soil contaminated with polycyclic aromatic hydrocarbons (PAHs), VOCs, metals (including arsenic), and pesticides. Metals have been detected in the Outfall Canal, which is used for fishing about one mile downstream from the base. PAHs, pesticides, polychlorinated biphenyls (PCBs), and metals were also detected in sediment and fish samples from the canal system.

ATSDR again visited Homestead AFB in July 1997 (ATSDR, 1997a). During the 1997 visit, ATSDR toured the base, reviewed documents and maps, met with Homestead AFB's Community Relations Coordinator to discuss community health concerns, and met with representatives from the base and Dade County Department of Environmental Resources Management. The Dade County Department of Environmental Resources Management expressed concerns regarding levels of PAHs and arsenic detected in the soil at Homestead AFB.

ATSDR has gathered and reviewed IRP data for all sites at Homestead AFB (see Table 1). The following sections discuss ATSDR's findings regarding the potential pathways of exposure to contaminated groundwater and soil at Homestead AFB. The potential pathway of exposure to contaminated surface water in the canal system is evaluated in the Community Concerns section, along with an evaluation of sediment and fish contamination.

Tables and figures are provided at the end of this document. Table 1 summarizes site history, investigation results, current status, and evaluation of public health hazards for all sites evaluated during the IRP. Table 2 provides an evaluation of potential and completed exposure pathways. Figure 1 is a location map of Homestead AFB, Figure 2 is a base site plan, Figure 3 is a map

showing land parcels and future use, and Figure 4 provides detail on ATSDR's exposure evaluation process.

Appendix A provides a glossary of environmental and health terms presented in the discussion. In evaluating environmental contamination, ATSDR uses several media-specific comparison values to select environmental contaminants for further evaluation, including environmental media evaluation guides, reference dose media evaluation guides, cancer risk evaluation guides, and EPA's maximum contaminant levels. Appendix B describes the comparison values used in this evaluation. Appendix C provides the estimates of human exposure dose and determination of health effects from potential exposure to contaminated soil at one of the IRP sites, which was formerly located next to a residential and recreational area, and to ingestion of fish from the Boundary and Outfall Canals. Appendix D provides ATSDR's response to comments made during the public comment period for this public health assessment.

Potential Pathway: Groundwater

Conclusions

In evaluating groundwater, ATSDR takes into consideration ingestion, inhalation, and dermal contact pathways. After detailed review of available data, ATSDR has drawn the following conclusions regarding past, present, and future exposures to contaminated groundwater at Homestead AFB:

- Groundwater at Homestead AFB is contaminated with VOCs, BNAs, pesticides, and metals above comparison values. There are several sources of contamination, and the initial date of contamination is unknown.

- Current and future exposure to contaminated drinking water is unlikely because drinking water is supplied from off-base wells and there are no plans for future development of water supply wells on base. Existing wells on base are abandoned.

Discussion

During the IRP investigation, contaminants, including arsenic, lead, beryllium, BNAs, VOCs, and other metals, were detected sporadically and slightly above comparison values in groundwater throughout Homestead AFB (see Table 1).

The Biscayne Aquifer system, comprised of the Miami Oolite and Fort Thompson Formations, covers all of Dade County and is the surficial aquifer in the Homestead AFB area. While it is the sole source of potable water in Dade County, naturally occurring high concentrations of dissolved iron, which commonly exceed the Florida Secondary Drinking Water regulations standard, exist in the Biscayne Aquifer (Geraghty & Miller, 1994a). Within a three-mile radius of Homestead AFB,

over 4,000 area residents obtain drinking water from the Biscayne Aquifer and 18,000 acres of farmland are irrigated from aquifer wells (Montgomery Watson, 1996a).

Under natural conditions, groundwater flows southeast toward the Biscayne Bay, following a hydraulic gradient of 0.3 feet per mile (Geraghty & Miller, 1994a). The water table is generally encountered within five or six feet below the ground's surface but may occur at or near land surface during the rainy season from May to October. All groundwater recharge is derived from local rainfall, which averages approximately 58 inches a year, 70 percent of which occurs during the rainy season (Geraghty & Miller, 1994a). Saline groundwater is present in an area paralleling the coast and extends beneath the southeastern half of the base. Salt-water intrusion apparently occurred as a result of pumping water supply wells in the early 1970s (Geraghty & Miller, 1994a).

A drinking water well field was located in the central portion of the base but was dismantled and abandoned in 1978 due to salt water intrusion (Air Force, 1993). To replace these wells, a water supply well field located along the western border of the facility was used to supply drinking water to the base. This well field is not currently used and will be abandoned and dismantled (Versar Inc., 1997a; ATSDR, 1997b). Since 1992, the base has been supplied with water from a well field maintained by Dade County and located approximately 1.5 miles west of the base. In the near future, water will be supplied from another off-base well field maintained by the city of Homestead (ATSDR, 1997b). There are no plans for the installation of drinking water supply wells on base in the future. Due to salt water intrusion, it is also unlikely that a municipal well field would be located downgradient of the base (Geraghty & Miller, 1994a).

Because groundwater movement under Homestead AFB is slow, contaminated groundwater at IRP sites throughout Homestead AFB is not expected to affect off-base drinking water wells or to have affected the drinking water wells located on base in the past. However, the Environmental Baseline Survey indicates that the drinking water wells used until 1978 were located between Elmendorf Street and St. Lo Boulevard in the east central portion of the base (Air Force, 1993). These drinking water wells were at a depth of 72-feet. This area is also the location for OU-12. Investigation of groundwater at OU-12 during the RI detected levels of tetrachloroethane, pesticides, arsenic, beryllium, and thallium above comparison values for drinking water. The January 1998 Extended Site Investigations (ESI) and Preliminary Risk Evaluation (PRE) show that no contaminants were detected above the comparison values in the groundwater (Air Force, 1998).

OU-4, an oil leak behind the motor pool, is located along the western border of the facility near the water supply wells that were used from 1978 to 1992. These wells were at a depth of 70-feet. However, no contaminants above comparison values were detected in groundwater samples in this area during the 1993 RI.

Because the groundwater under Homestead AFB is no longer used and will not be used in the future as a drinking water source, no current or future exposure pathway to contaminants in groundwater exists.

Potential Pathway: Soil

Conclusions:

- Contaminants detected in soil samples collected at Homestead include PAHs, pesticides, and metals.
- Because areas of contaminated soil are located in inaccessible or low-use areas such as industrial areas, or areas located near the flightline, exposures to contaminants in soil are limited.
- Limited exposures to contaminants at detected levels in soils at Homestead AFB are not expected to be associated with adverse health effects.

Discussion

Soil at sites at Homestead AFB contains contaminants above comparison values but most contaminants are detected sporadically or at levels within an order of magnitude of the comparison values (see Table 1). PAHs, such as benzo(a)pyrene, arsenic, and lead were detected at most sites.

Previous to Hurricane Andrew, Homestead AFB was residential as well as industrial. After Hurricane Andrew destroyed most of the base, the mission was changed and there are no longer any residential sections of Homestead AFB. Approximately one-third of the installation is being retained by the Air Force while the remainder of the base is being parceled off for various other uses. All of the contaminated sites identified through the IRP and after Hurricane Andrew are located on parcels that were historically industrial areas or areas of open space near the flightline. All of these sites will either remain with the Air Force or will be parcelled to the Dade County Aviation Department and will continue to have industrial use (see Table 1 and Figure 3).

Several sites have already been remediated since the investigations referred to in Table 1. Through the IRP program, contaminated soil has been removed or capped at several of the sites. As part of the Base Realignment and Closure plan, the Dade County Department of Environmental Resource Management requires that Homestead AFB remediate arsenic-contaminated soil to a cleanup level of 10 parts per million (ppm) in industrial areas that will be parcelled to other entities, and 15 ppm for industrial areas remaining with the Air Force (ATSDR, 1997d). For sites where arsenic levels exceed these requirements, the Air Force must perform either soil removal or containment.

Containment may include soil capping, paving, or construction of buildings over the contaminated soil. This work is currently ongoing.

Cleanup goals for PAH-contaminated soils are currently under negotiation by the Base Realignment and Closure cleanup team. Once cleanup goals have been determined, soil remediation will occur at sites with PAH contamination. However, since many of the sites that have arsenic contamination also have PAH contamination, it is expected that soil removal or containment to reach arsenic cleanup goals has already reduced PAH levels in soil.

Lead was detected in soil samples in several industrial sites throughout Homestead AFB (see Table 1). Because none of these sites were located in or near residential areas, exposure to lead in soil, if any, would be limited in nature.

Because one IRP site was located near residential and recreational areas before Hurricane Andrew, there is the potential that juveniles may have trespassed this site in the past. The Contractor Storage Area/Former Construction Debris Landfill, OU-18, was used since 1980 for the disposal of crushed asphalt that resulted from the occasional resurfacing of runways. While OU-18 was a restricted area, no fence or other barrier physically restricted access to the site. PAHs, arsenic, aldrin, and heptachlor epoxide were detected above comparison values in surface soil at OU-18. ATSDR evaluated possible noncancer and cancer effects from exposure to the contaminants in soil at OU-18 using very conservative estimates of exposure duration and contaminant levels for a juvenile trespasser scenario (see Appendix C). Based on the results of that evaluation, ATSDR concludes that exposure to contaminated soil at OU-18 at the concentrations detected is not likely to be associated with adverse health effects.

ATSDR performed a detailed, independent review of soil data for each IRP site at Homestead AFB. Because these sites have been and will continue to be used for industrial purposes, exposures to contaminated soils were and will continue to be limited. Furthermore, it is unlikely that sensitive populations, such as children and the elderly, had long-term or frequent access to these industrial sites. Limited exposures to the contaminants at levels detected in soils in the past, present, or future are not expected to be associated with adverse health effects for any of the IRP sites at Homestead AFB. Furthermore, soil at sites with high levels of arsenic or PAHs have been or are being remediated, therefore further decreasing exposure potential for the present and future.

COMMUNITY HEALTH CONCERNS

Introduction

The 1991 Community Relations Plan states that concerns related to Homestead AFB include surface water runoff carrying contaminants to Biscayne Bay, radon in base housing, aircraft noise,

and the occasional jettison of aircraft fuel onto property surrounding the base (Geraghty & Miller, 1991). During the IRP process, environmental and health issues were evaluated. ATSDR has gathered and reviewed IRP data for all sites at Homestead AFB. Table 1 summarizes site history, investigation results, current status, and evaluation of public health hazards for all sites evaluated during the IRP.

No specific public health concerns were voiced to ATSDR during either the January 1991 or the July 1997 visits. During both visits, community members did express concerns about the possible ecological effects of contamination in the Outfall Canal and, in 1991, community members also expressed concern about high noise levels associated with jet aircraft and about Air Force waste management procedures.

The EPA and the Florida Department of Environmental Protection evaluate ecological risks associated with Homestead AFB. The Air Force has a noise control program which is used to evaluate risks and identify flight patterns. The city and state also determine acceptable environmental and residential noise levels.

In order to evaluate potential public health hazards at Homestead AFB, ATSDR gathered and reviewed data for the Boundary Canal and the Outfall Canal. The following section discusses ATSDR's findings regarding surface water, sediment, and fish contamination in the canal system at Homestead AFB from a public health perspective.

Concern: Boundary and Outfall Canals

Conclusions

After detailed review of available data, ATSDR has drawn the following conclusions regarding potential past, present, and future exposures to contaminants in surface water, sediment, and fish of the Boundary and Outfall Canals:

- A few metals were detected sporadically above comparison values in surface water samples from the Boundary and Outfall Canals. Sediment in the Boundary and Outfall Canals is contaminated with PAHs, PCBs, and metals above comparison values. Exposures to contaminants in surface water and sediment is limited and not expected to be associated with adverse health effects.

- Fish in the Boundary and Outfall Canals contain PCBs, pesticides, and arsenic. Occasionally ingesting contaminants at detected levels in fish is unlikely to be associated with either cancer or noncancer health effects. However, it is possible (though unlikely) that ingesting large quantities of fish from the canal system (such as subsisting on canal fish) may be associated with noncancer health effects.

- During the RI, fish sampling was limited to one species (largemouth bass). Because bottom feeding fish (e.g., catfish) may accumulate PCBs and pesticides more easily than largemouth bass, ATSDR recommends that representative bottom feeding fish species be sampled if it is indicated that people might be regularly ingesting this type of fish.

Discussion

Surface Water and Sediment

Surface water samples were collected during the RI from 30 locations and analyzed for VOCs, BNAs, pesticides, PCBs, metals, and cyanide. Surface water samples in the Boundary and Outfall Canals detected antimony, arsenic, beryllium, and lead above comparison values for drinking water, which was used as a conservative screening value (see Table 1). No PCBs were detected; pesticides were detected below comparison values. The surface water in the canals, however, is not used as drinking water.

Sediment samples were collected at 27 locations along the Boundary and Outfall Canals and analyzed for VOCs, BNAs, pesticides, PCBs, metals, and cyanide. Five of the sediment samples were taken in canals or drainage ditches adjacent to IRP sites. Carcinogenic PAHs, PCBs, antimony, arsenic, beryllium, lead, and thallium were detected in sediment samples slightly and sporadically above comparison values (see Table 1). During the RI, problems were encountered collecting sufficient sediment samples. A supplemental investigation of surface water and sediment samples for the Outfall Canal was performed to substantiate findings during the RI. Sediment samples collected during the supplemental investigation were similar to those taken during the RI (see Table 1).

While fishing occurs along much of the canal system, swimming and wading are possible but probably limited. Some areas of the canals on base are inaccessible because of dense overgrowth of trees, weeds, and grass. Accessibility to the Outfall Canal is limited due to the presence of privately owned agricultural land along much of the canal. The sides of the canals are vertical, making access difficult. Furthermore, alligators and snakes inhabit most of the canal system (Woodward-Clyde, 1995).

Dermal contact with contaminants in surface water in the canals may occur during recreational activities such as fishing, but exposure would be limited. Furthermore, the metals detected in the canals do not easily absorb into the skin. Using drinking water standards for comparison is extremely conservative for evaluating dermal absorption. Contact with contaminants at the levels detected in the surface water of the canals during recreational activities is not expected to be associated with adverse health effects.

Dermal contact with contaminants in sediment may occur during recreational activities such as fishing in the canals. Detections of contaminants in sediment were sporadic and at low levels.

Dermal contact with contaminants in sediment at the levels detected are not expected be associated with adverse health effects.

Fish

Largemouth bass were collected from eight locations throughout the Boundary and Outfall Canals and analyzed for VOCs, BNAs, pesticides, PCBs, metals, and cyanide. PCBs, pesticides, and arsenic were detected in fish samples (see Table 1 and Appendix C). A representative bottom feeding fish (the freshwater catfish) was not caught at any of the eight sampling locations. Each fish that was caught was divided into a fillet section and a "remains" section and analyzed both for contaminants in the fillet section and in the whole body. In order to determine background levels, sampling was also performed in Mowry Canal, which is upgradient of Homestead AFB. Findings from all eight locations, including Mowry Canal, were comparable (Woodward-Clyde, 1995).

Because much of the land surrounding Homestead AFB and the Outfall Canal is agricultural, some pesticide contamination in sediment and fish samples in the canal system, especially the Outfall Canal, may be due to agricultural processes, as opposed to activities at Homestead AFB. The Outfall Canal is not owned by the Air Force and access is controlled by the South Florida Water Management District. During the RI, a detailed analysis of the potential for sediment transport through the canals showed that significant movement of sediment either out of the Boundary Canal or out of the stormwater reservoir is unlikely (Woodward-Clyde, 1995). This indicates that contamination in sediments is not migrating off base to the Outfall Canal. Sampling results from the Outfall Canal, therefore, may be due to sources other than or in addition to Homestead AFB. Sampling results from Mowry Canal may suggest that contamination in fish throughout the region exists, unrelated to Homestead AFB.

With the exception of mercury, the Florida Department of Health does not have advisory levels for contaminants in fish. For mercury, the Department of Health issues a limited ingestion advisory for fish containing 0.5 to 1.5 ppm of mercury (ATSDR, 1997f). The highest mercury level detected in fish was 0.46 ppm, which is below the Florida Department of Health's limited ingestion advisory level.

ATSDR performed a review of exposure to contaminants detected in edible fish fillets (with skin removed) collected from the canals (see Appendix C). The occasional ingestion of contaminants in fish is unlikely to be associated with any increased cancer or noncancer health effects. Based on extremely conservative assumptions, however, adverse health effects may be associated with eating several fish meals per month from the canals, for instance, from subsistence fishing. Detected levels of all contaminants in fish varied. *Because the analysis was based on ingesting the highest detected quantity of contaminants for every fish meal, the estimated exposure doses are extremely conservative and highly unlikely for an individual actually catching and ingesting fish from the canal.*

Some of the contaminants detected in the largemouth bass samples from the Boundary and Outfall Canals (e.g., PCBs and pesticides) may accumulate more readily in bottom feeding fish such as catfish. If it is indicated that people might be regularly exposed to this type of fish, ATSDR recommends that sampling be performed for a representative bottom feeding fish (e.g., catfish) in order to more fully characterize contaminant levels and potential health effects.

ATSDR'S CHILD HEALTH INITIATIVE

ATSDR recognizes that infants and children may be more sensitive to environmental exposure than adults in communities faced with contamination of their water, soil, air, or food. This sensitivity is a result of the following factors: (1) children are more likely to be exposed to certain media (e.g., soil or surface water) because they play outdoors; (2) children are shorter than adults, which means that they can breathe dust, soil, and vapors close to the ground; and (3) children are smaller, therefore childhood exposures result in higher doses of chemicals per body weight. Children can sustain permanent damage if these factors lead to toxic exposure during critical growth stages. ATSDR is committed to evaluating their special interests at sites such as Homestead AFB as part of ATSDR's Child Health Initiative.

ATSDR evaluated the likelihood that children living at or near Homestead AFB may have been or may be exposed to contaminants at levels of health concern. ***ATSDR did not identify any situations where children were likely to be or to have been exposed to contaminants at levels which pose a health concern.*** After reviewing the available data, ATSDR based this conclusion on several factors, including:

- No exposure pathway currently exists or will exist in the future to contaminants in groundwater because groundwater is not and will not be used for drinking water.
- No adverse health effects are expected from exposure to contaminants in soil because access to sites with contaminated soil was and is limited and contaminants were not detected at levels that pose a health hazard.
- No adverse health effects are expected from exposure to surface water and sediment because contaminants were not detected at levels that pose a health hazard.
- No adverse health effects are expected from occasional ingestion of contaminants in fish. It is possible (though unlikely), however, that the ingestion of large quantities of fish may be associated with adverse health effects.

CONCLUSIONS

ATSDR has drawn the following conclusions from current environmental data and information on Homestead AFB:

- No exposure pathway currently exists or will exist in the future to contaminants in groundwater because groundwater is not and will not be used for drinking water.

- Exposure to soil contamination is not likely to result in adverse human health effects because access to areas where contamination was detected was and is limited; furthermore, contaminants were detected at levels that do not pose a health hazard.

- Exposure to surface water and sediment in the Boundary and Outfall Canals is not likely to result in adverse human health effects because contamination is at levels that do not pose a health hazard.

- Occasional ingestion of contaminants in fish from the canal system is not likely to result in adverse human health effects. However, it is possible (though unlikely) that the ingestion of large quantities of fish (such as subsisting on canal fish) may be associated with adverse human health effects.

- If it is indicated that people might be regularly exposed to bottom feeding fish such as catfish, additional sampling should be performed to collect and analyze one species of bottom feeding fish to more fully characterize contaminants in fish in the Boundary and Outfall Canals.

- On the basis of information available on contaminants in groundwater, soil, surface water, sediment, and fish, ATSDR concludes that the Homestead AFB poses no apparent public health hazard.

PUBLIC HEALTH ACTION PLAN

The public health action plan (PHAP) for Homestead AFB contains a description of actions to be taken by ATSDR and/or other governmental agencies at and in the vicinity of the site subsequent to the completion of this public health assessment. The purpose of PHAP is to ensure that this public health assessment not only identifies public health hazards, but provides a plan of action designed to prevent adverse health effects that would result from any exposure to hazardous substances in the environment.

Ongoing Actions

1. The Dade County Department of Environmental Resource Management requires Homestead AFB to clean arsenic-contaminated soil to 15 ppm for industrial areas remaining with the Air Force and 10 ppm in industrial areas that will be parceled to other entities. Areas which exceed these requirements must have soil removal or containment.

Planned Actions

1. The findings of this public health assessment have been reviewed by the other Divisions of ATSDR to determine if any follow-up activities are recommended for Homestead AFB. The Division of Health Education and Promotion will determine if any health education activities are needed.

2. ATSDR recommends that no future drinking water wells are constructed in the east central portion of the base, where groundwater contamination was detected.

3. ATSDR recommends that representative bottom feeding fish species be sampled if it is indicated that people might be regularly ingesting this type of fish.

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REFERENCES

Air Force. *See* Department of the Air Force.

ATSDR. 1991. Initial site scoping visit of Homestead Air Force Base. January 1991.

ATSDR. 1997a. Site summary of Homestead Air Force Base. July 1997.

ATSDR. 1997b. ATSDR record of activity for telephone communication with John Mitchell, Environmental Flight Chief, Homestead Air Reserve Base, regarding water well usage and Mystic and Phantom Lake recreational usage. November 24, 1997.

ATSDR. 1997c. ATSDR record of activity for telephone communication with Tom Bartol, Base Realignment and Closure Environmental Coordinator, Homestead Air Reserve Base, regarding Mystic and Phantom Lake recreational usage. November 24, 1997.

ATSDR. 1997d. ATSDR record of activity for telephone communication with James Carter, Engineer II, Metropolitan Dade County Environmental Resources Management, regarding arsenic and PAH cleanup goals for Homestead. December 9, 1997.

ATSDR. 1997e. ATSDR record of activity for telephone communication with John Mitchell, Environmental Flight Chief, Homestead Air Reserve Base, regarding water well usage. December 17, 1997.

ATSDR. 1997f. ATSDR record of activity for telephone communication with Joe Sekerke and Randy Merchant at the Florida Department of Health regarding ingestion advisories for contaminants in fish. December 18, 1997.

Department of the Air Force. 1993. Basewide environmental baseline survey, Homestead Air Force Base, Florida. December 1993.

Department of the Air Force. 1998. Comments received from John B. Mitchell, January 23, 1998.

Geraghty & Miller, Inc. 1991. Final community relations plan, Homestead Air Force Base, Florida. September 1991.

Geraghty & Miller, Inc. 1994a. Draft final remedial investigation report addendum for Site FT-5, Fire Protection Training Area No. 2 (Former Site FPTA-2), Homestead AFB, Florida. Volume I of XIV. March 1994.

Geraghty & Miller. 1994b. Draft final remedial investigation report addendum for Site OT-11, Residual Pesticide Disposal Area (Former Site P-3), Homestead AFT, Florida. April 1994.

Montgomery Watson. 1993. Draft remedial investigation report addendum for Site SS-13, PCB Spill Area, Civil Engineering Storage Compound, Homestead Air Force Base, Florida. Metairie, Louisiana. August 1993.

Montgomery Watson. 1994a. Draft final remedial investigation report addendum for Site SS-8, Motor Pool Oil Leak Area, Homestead Air Force Base, Florida. Metairie, Louisiana. April 1994.
Montgomery Watson. 1994b. Draft final remedial investigation report addendum for Site SS-3, Aircraft Washrack, Homestead Air Force Base, Florida. Metairie, Louisiana. March 1994.

Montgomery Watson. 1996a. Final remedial investigation report addendum for Operable Unit 8/Site FT-4, Fire Protection Training Area No. 3, Homestead Air Reserve Base, Florida. St. Rose, Louisiana. May 1996.

Montgomery Watson. 1996b. Final risk assessment report for Operable Unit 8/Site FT-4, Fire Protection Training Area No. 3, Homestead Air Reserve Base, Florida. St. Rose, Louisiana. May 1996.

Montgomery Watson. 1996c. Final remedial investigation report addendum for Operable Unit 7/Site SS-7, Entomology Storage Area, Homestead Air Reserve Base, Florida. St. Rose, Louisiana. May 1996.

Montgomery Watson. 1996d. Final risk assessment report for Operable Unit 7/Site SS-7, Entomology Storage Area, Homestead Air Reserve Base, Florida. St. Rose, Louisiana. May 1996.

Montgomery Watson. 1996e. Final remedial investigation report addendum for Operable Unit 5/Site WP-1, Electroplating Waste Disposal Area, Homestead Air Reserve Base, Florida. St. Rose, Louisiana. October 1996.

Montgomery Watson. 1996f. Final risk assessment report for Operable Unit 5/Site WP-1, Electroplating Waste Disposal Area, Homestead Air Reserve Base, Florida. St. Rose, Louisiana. October 1996.

Montgomery Watson. 1996g. Draft final extended site investigation and preliminary risk evaluation report for Sites OU 10, OU 11, OU 12, OU 13, and OU 14, Homestead Air Reserve Base, Florida. St. Rose, Louisiana. December 1996.

OHM Remediation Services Corp. 1996. Site SS-15b Flightline Pumphouses contamination assessment addendum and IRA report, Homestead Air Reserve Base, Dade County, Florida. Volumes I and II. AFCEE Contract No. F41624-94-D-8106, Delivery Order No. 0008, FDEP No. 138521996. May 1996.

Versar, Inc. 1996. Unites States Air Force Installation Restoration Program (IRP) final preliminary assessment/site investigation, Building 153 Site (Operable Unit 15). Miami, Florida. October 1996.

Versar, Inc. 1997a. Final Homestead Air Reserve Base Installation Restoration Program (IRP) technical report, preliminary assessment/site investigation, Structure 898 Site (Operable Unit 16). Miami, Florida. July 1997.

Versar, Inc. 1997b. Final Homestead Air Reserve Base Installation Restoration Program (IRP) technical report, preliminary assessment/site investigation, Building 793 Site (Operable Unit 17). Miami, Florida. July 1997.

Woodward-Clyde. 1995. Final OU-9 remedial investigation, Homestead Air Reserve Base, Florida. November 1995.

Woodward-Clyde. 1996. Supplemental investigation of the Outfall Canal, Homestead Air Reserve Base, Florida. March 1996.

Woodward-Clyde. 1997a. Draft final site investigation: AOC 1, AOC 3, AOC 5, OU 19, OUs 20/21, OU 25, and O/WS 206, Homestead Air Force Base, Florida. January 1997.

Woodward-Clyde 1997b. Draft remedial investigation/baseline risk assessment: OU 18, OU 22, OU 26, OU 27, OU 28, OU 29, Homestead Air Force Base, Florida. Volumes I and II of V. February 1997.

TABLES

TABLE 1: EVALUATION OF POTENTIAL PUBLIC HEALTH HAZARDS

Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Corrective Activities and/or Current Status	Evaluation of Public Health Hazard
OU-1 Fire Protection Training Area #2 (FT-05; Former Site FPTA-2)	Fire training area was used from 1955 to 1972; materials burned included JP-4, aviation gas, various contaminated fuels, and waste liquids from base shops (oils, lubricants, solvents, etc.); extinguishing agents included water, carbon dioxide, aqueous film forming foam, and protein foam. Beginning in 1972, construction debris was disposed. The site is currently used as rubble fill area.	*1994 Draft Final Remedial Investigation (RI):* **Soil**: Polycyclic aromatic hydrocarbons (PAHs) (e.g., benzo(a)pyrene: not detected [nd]-150 parts per million [ppm]), arsenic (nd-29 ppm), and lead (nd-1,100 ppm) were detected sporadically above comparisou values (CVs). **Sediment**: Arsenic (nd-11.7 ppm) was detected above the CV. PAHs were detected slightly and sporadically above CVs. **Groundwater**: Arsenic (nd-12.1 parts per billion [ppb]) was detected sporadically above the CV. Benzene and bis(2-ethylhexyl)phthalate were detected sporadically and slightly above CVs. **Surface water**: Methylene chloride and bis(2-ethylhexyl)phthalate were detected slightly and sporadically above CVs.	This site is located in open space near the flight line; the parcel will be retained by the Air Force for industrial use. Hot spot soil removal occurred at this site. Further remedial action includes a requirement for no further rubble disposal, deed restrictions, change in practice (i.e., no walking), restrictions prohibiting the installation of drinking water wells, and continued groundwater monitoring.	Based on available data, no public health hazards appear to exist. PAHs, arsenic, and lead were detected above CVs in soil and sediment. Under past, current, and proposed future use, sporadic exposures to contaminants at detected levels are not expected to be associated with adverse health effects. Contaminants were detected above CVs in groundwater and surface water. Because neither groundwater nor surface water are used for drinking water, no exposures, and therefore no health hazards, exist.

TABLE 1: EVALUATION OF POTENTIAL PUBLIC HEALTH HAZARDS

Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Corrective Activities and/or Current Status	Evaluation of Public Health Hazard
OU-2 Residual Pesticide Disposal Area (OT-11)	From 1977 to 1982, the site was used for disposal of excess or waste pesticides, and pesticide-contaminated rinses from equipment cleaning. Wastes were sprayed or dumped; chlorine bleach and ammonia were applied to accelerate decomposition. A drainage ditch transects the site and is interconnected with the Boundary Canal.	*1994 Draft Final RI:* **Soil**: PAHs (e.g., benzo(a)pyrene: nd-10 ppm), arsenic (nd-11.7 ppm), and lead (nd-19,600 ppm) were detected sporadically above CVs. No other contaminants, including pesticides, were detected above CVs. **Sediment**: PAHs (e.g., benzo(a)pyrene: nd-2.3 ppm) and arsenic (nd-11.8 ppm) were detected sporadically above CVs. No other contaminants, including pesticides, were detected above CVs. **Groundwater**: No contaminants, including pesticides, were detected above CVs. **Surface Water**: Lead (nd-4.9 ppb) was detected sporadically above the CV. Bromodichloromethane was detected slightly and sporadically above the CV. No other contaminants, including pesticides, were detected above CVs.	This site is located in open space; the parcel will be retained by the Air Force for industrial use. Remedial action at this site includes excavatiou of lead- and PAH-contaminated soil, site fencing, restrictions prohibiting the installation of drinking water wells, and continued groundwater monitoring.	Based on available data, no public health hazards appear to exist. PAHs, arsenic, and lead were detected above CVs in soil and sediment. Under past, current, and proposed future use, sporadic exposures to contaminants at detected levels are not expected to be associated with adverse health effects. Contaminants were detected above CVs in surface water. Because surface water is not used for drinking water, no exposures, and therefore no health hazards, exist.

TABLE 1: EVALUATION OF POTENTIAL PUBLIC HEALTH HAZARDS

Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Corrective Activities and/or Current Status	Evaluation of Public Health Hazard
OU-3 Civil Engineering Storage Compound/ PCB Spill Area (SS-13)	Beginning in the late 1960s or early 1970s, miscellaneous materials such as lumber, piping, air handlers, cable, conduit, transformers, non-PCB transformers, jeeps, solar water heating equipment, dumpsters, and razor wire were stored. In 1981, there was a spill of less than 100 gallons of PCB-contaminated transformer fluid . A drainage canal borders the site to the west.	*1993 Draft RI:* **Soil**: Arsenic (109-123 ppm) was detected above the CV. No other contaminants, including polychlorinated biphenyls (PCBs), were detected above CVs. **Groundwater**: Arsenic (nd-21.3 ppb) was detected sporadically above the CV. No other contaminants, including PCBs, were detected above CVs.	This site is located in an industrial area; the parcel will be retained by the Air Force for industrial use. PCB-contaminated soil was removed after the 1981 spill. The ROD calls for no further action.	Based on available data, no public health hazards appear to exist. Arsenic was detected above the CV in soil. Under past, current, and proposed future use, sporadic exposures to arsenic at detected levels are not expected to be associated with adverse health effects. Arsenic was detected above CVs in groundwater. Because groundwater is not used for drinking water, no exposures, and therefore no health hazards, exist.

TABLE 1: EVALUATION OF POTENTIAL PUBLIC HEALTH HAZARDS

Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Corrective Activities and/or Current Status	Evaluation of Public Health Hazard
OU-4 Oil Leakage Behind the Motor Pool (SS-08)	The motor pool has been used from 1960 to the present; several leaks associated with oil spills from two 550 gallon above ground storage tanks and spills from used batteries that were stored on site have occurred. The site is almost entirely paved and used as a motor pool for cleaning, servicing, and repairing utility vehicles.	*1994 Draft Final RI:* **Soil**: PAHs (e.g., benzo(a)pyrene: nd-5.5 ppm) and arsenic (nd-3 ppm) were detected sporadically above CVs. Beryllium was detected slightly and sporadically above the CV. No other contaminants were detected above CVs. **Sediment**: PAHs (e.g., benzo(a)pyrene: 0.081-13 ppm), arsenic (2.6-64 ppm), and lead (42.1-1,600 ppm) were detected above CVs. Beryllium was detected slightly and sporadically above CVs. No other contaminants were detected above CVs. **Groundwater**: No contaminants were detected above CVs. **Surface water**: No contaminants were detected above CVs.	This site is located in an industrial area; the parcel will be retained by the Air Force for industrial use. Remedial action for this site includes deed restriction, site fencing, and groundwater monitoring.	Based on available data, no public health hazards appear to exist. Contaminants were detected above CVs in soil and sediment. Under past, current, and proposed future use, sporadic exposures to contaminants at detected levels are not expected to be associated with adverse health effects. No contaminants were detected above CVs in groundwater or surface water; therefore no health hazards exist.

TABLE 1: EVALUATION OF POTENTIAL PUBLIC HEALTH HAZARDS

Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Corrective Activities and/or Current Status	Evaluation of Public Health Hazard
OU-5 Electroplating Waste Disposal Area (WP-01)	Between 1946 and 1953, spent plating baths and rinses containing chromium, nickel, copper, and sulfuric and hydrochloric acid were poured on the ground. Wastes were generated at a rate of approximately 250 gallons per month, and the electroplating operation continued for about 2 years.	*1996 Final RI:* **Surface soil**: Arsenic (nd–9.7 ppm) was detected above the CV. Benzo(a)pyrene (nd-0.24 ppm) was detected slightly and sporadically above the CV. No other contaminants were detected above CVs. **Groundwater**: Arsenic (3.9–92 ppb) and lead (nd–30 ppb) were detected above CVs. Bis(2-ethylhexyl)phthalate and other metals were detected sporadically and slightly above CVs.	This site is located in an industrial area; the parcel will be retained by the Air Force for industrial use. In 1995, contaminated soils and sediments were excavated.	Based on available data, no public health hazards appear to exist. PAHs and arsenic were detected above CVs in soil. Under past, current, and proposed future use, sporadic exposures to contaminants at detected levels are not expected to be associated with adverse health effects. Contaminants were detected above CVs in groundwater. Because groundwater is not used for drinking water, no exposures, and therefore no health hazards, exist.

TABLE 1: EVALUATION OF POTENTIAL PUBLIC HEALTH HAZARDS

Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Corrective Activities and/or Current Status	Evaluation of Public Health Hazard
OU-6 Aircraft Washrack Area (SS-03)	Prior to Hurricane Andrew, the site consisted of a covered, concrete and asphalt aircraft washrack structure, a utility building and building 723. Two aboveground storage tanks stored contaminated oils, hydraulic fluids, spent solvents, and other liquid wastes. From 1970 to 1980, frequent spills and overflows onto the ground occurred.	*1994 RI:* **Soil**: PAHs (e.g., benzo(a)pyrene: 0.16-0.29 ppm) and arsenic (nd-1.1 ppm) slightly above CVs. **Sediment**: PAHs (e.g., benzo(a)pyrene: 1.2-3.1 ppm), arsenic (12.4-30.4 ppm), and lead (93.5-446 ppm) were detected above CVs. 4,4-DDD and 4,4-DDE were detected slightly and sporadically above CVs. **Groundwater**: Benzene, bis(2-ethylhexyl)phthalate, 2-methylnaphthalene, naphthalene, and lead detected sporadically above CVs. **Surface water**: Arsenic (15.8-25.5 ppb) detected above the CV.	This site is located in an industrial area; the parcel will be deeded to the Dade County Aviation Department for industrial use. In 1980, aboveground storage tanks and contaminated soil were removed. The ROD calls for remedial action.	Based on available data, no public health hazards appear to exist. Contaminants were detected above CVs in soil and sediment. Under past, current, and proposed future use, sporadic exposures to contaminants at detected levels are not expected to be associated with adverse health effects. Contaminants were detected above CVs in groundwater and surface water. Because neither groundwater nor surface water are used for drinking water, no exposures, and therefore no health hazards, exist.

TABLE 1: EVALUATION OF POTENTIAL PUBLIC HEALTH HAZARDS

Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Corrective Activities and/or Current Status	Evaluation of Public Health Hazard
OU-7 Entomology Storage Area (Civil Engineering) (SS-07)	In the 1960s, bulk quantities of pesticides were stored. Diesel fuel may have been stored on a portion of the site. A PCB spill area (OU-3) was included in the investigation. A canal borders the site, but a concrete wall diverts surface water away from the canal.	*1996 Final RI:* **Soil**: Arsenic (nd-28.9 ppm) was detected sporadically above the CV. Chrysene was detected slightly and sporadically above the CV. **Groundwater**: Arsenic (nd-0.632 ppb) was detected slightly and sporadically above the CV. Pesticides, volatile organic compounds (VOCs), and cadmium were detected slightly and sporadically above CVs.	This site is located in an industrial area; the parcel will be retained by the Air Force for industrial use. In 1994, arsenic- and pesticide-contaminated soil was removed.	Based on available data, no public health hazards appear to exist. Arsenic and chrysene were detected above CVs in soil. Under past, current, and proposed future use, sporadic exposures to contaminants at detected levels are not expected to be associated with adverse health effects. Contaminants were detected above CVs in groundwater. Because groundwater is not used for drinking water, no exposures, and therefore no health hazards, exist.

TABLE 1: EVALUATION OF POTENTIAL PUBLIC HEALTH HAZARDS

Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Corrective Activities and/or Current Status	Evaluation of Public Health Hazard
OU-8 Fire Protection Training Area #3 (FT-04; Former Site FPTA-3)	Two bermed and unlined burning pits (Burn Pits 2 and 3) were used for fire protection training from 1972 to 1985. A third bermed and unlined burning pit (Burn Pit 1) was used since 1985; the date of last use is undetermined. Materials reportedly burned as often as once a week in these pits include JP-4, diesel fuel, and other fuels and waste materials (oils, lubricants, and solvents); the main extinguishing agents were water and aqueous film forming foam. Approximately 5,500 gallons of ethyl ether were burned over a 10-hour period in 1984.	*1996 Final RI:* **Soil**: Arsenic (nd-2.5) and beryllium were detected slightly and sporadically above CVs. No other contaminants were detected above CVs. **Groundwater**: Arsenic (nd-8 ppb) and lead (nd-83 ppb) were detected sporadically above CVs. VOCs, base/neutral and acid extractable compounds (BNAs), and other metals were detected slightly and sporadically above CVs.	This site is located in open space; the parcel will be retained by the Air Force for industrial use. In 1994, contaminated soil was removed. In 1995, buried fuel distribution lines and petroleum-contaminated soil were removed. The ROD calls for no further action.	Based on available data, no public health hazards appear to exist. Arsenic and beryllium were detected above CVs in soil. Under past, current, and proposed future use, sporadic exposures to contaminants at detected levels are not expected to be associated with adverse health effects. Contaminants were detected above CVs in groundwater. Because groundwater is not used for drinking water, no exposures, and therefore no health hazards, exist.

TABLE 1: EVALUATION OF POTENTIAL PUBLIC HEALTH HAZARDS

Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Corrective Activities and/or Current Status	Evaluation of Public Health Hazard
OU-9 Boundary Canal/ Military Canal (ST-27)	Since 1942, the Boundary Canal has surrounded the base.	*1995 Final RI (includes Outfall Canal sampling):* **Sediment**: VOCs: PAHs (e.g., benzo(a)pyrene: 0.13-18 ppm), arsenic (0.81-31.6 ppm), and lead (4-380 ppm) were detected above CVs. Other metals were detected slightly and sporadically above CVs. Aroclor-1260 was detected once above the CV. Pesticides were detected below CVs. **Surface water**: Arsenic (0.6-6 ppm) and lead (1.1-6.4 ppb) were detected above CVs. No other contaminants, including VOCs, BNAs, or pesticides, were detected above CVs. No PCBs were detected. **Fish fillet samples**: Pesticides and PCBs, including Aroclor-1260, 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT were detected sporadically above CVs. Arsenic, beryllium, and mercury were detected sporadically above CVs. No BNAs, including PAHs, were detected.	The Boundary Canal system surrounds the property. The RI for the Boundary and Outfall Canals recommends no further action.	Based on available data, no public health hazards appear to exist. Contaminants were detected above CVs in sediment and surface water. Exposures to contaminants at detected levels during recreational use of the canal system are limited and not expected to be associated with adverse health effects. PCBs, pesticides, and metals were detected sporadically above CVs in fish fillet samples. Occasional ingestion of fish from the canals is not expected to be associated with adverse health effects. While unlikely, it is possible that ingesting large quantities of fish (such as subsisting on canal fish) may be associated with noncancer health effects.

TABLE 1: EVALUATION OF POTENTIAL PUBLIC HEALTH HAZARDS

Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Corrective Activities and/or Current Status	Evaluation of Public Health Hazard
Outfall Canal	The Boundary Canal (OU-9) empties to the Outfall Canal at the Wastewater Treatment Plant (OU-11). Water in the Outfall Canal flows 2 miles before emptying into Biscayne Bay.	*1996 Supplemental Investigation:* **Sediment**: Arsenic (3.6-7.5 ppm) was detected above the CV. Beryllium was detected slightly and sporadically above the CV. No other contaminants, including VOCs, BNAs, or pesticides, were detected above CVs. No PCBs were detected. **Surface water**: Arsenic (0.8–1.6 ppb) was detected above CVs. Heptachlor epoxide, lead, and beryllium were detected slightly and sporadically above CVs. No pesticides were detected above CVs. No PCBs were detected.	The Outfall Canal flows east from the base property to the Biscayne Bay. The RI for the Boundary and Outfall Canals and the Supplemental Investigation of the Outfall Canal recommend no further action.	Based on available data, no public health hazards appear to exist. Contaminants were detected above CVs in sediment and surface water. Exposures to contaminants at detected levels during recreational use of the canal system are limited and not expected to be associated with adverse health effects.

TABLE 1: EVALUATION OF POTENTIAL PUBLIC HEALTH HAZARDS

Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Corrective Activities and/or Current Status	Evaluation of Public Health Hazard
OU-10 Landfill #1 (LF-12)	Prior to 1943, Pan American Ferries used this site for an open dump. From 1943 to 1946, general refuse was disposed. After the hurricane in 1946, the waste disposal history is unknown, bnt wastes may have been disposed until 1955, when the Air Force began disposing of wastes off site.	*1996 Draft Final Expanded Site Investigation (ESI):* **Soil**: Arsenic (1.8-8.8 ppm) was detected above the CV. PAHs (e.g., benzo(a)pyrene: 0.022–1.2 ppm) and beryllium were detected slightly and sporadically above CVs. **Sediment**: No contaminants were detected above CVs. **Groundwater**: Beryllium, iron, and antimony were detected slightly and sporadically above the CVs. No other contaminants were detected above CVs. **Surface water**: Bis(2-ethylhexyl)phthalate was detected slightly and sporadically above the CV. No other contaminants were detected above CVs.	This site is located in open space; the parcel will be deeded to the Dade County Aviation Department for industrial use. The (1990) ROD calls for no further action. The 1996 ESI recommends no further action.	Based on available data, no public health hazards appear to exist. PAHs and arsenic were detected above CVs in soil. Under past, current, and proposed future use, sporadic exposures to contaminants at detected levels are not expected to be associated with adverse health effects. Contaminants were detected above CVs in groundwater and surface water. Because neither groundwater nor surface water are used for drinking water, no exposures, and therefore no health hazards, exist.

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Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Corrective Activities and/or Current Status	Evaluation of Public Health Hazard
OU-11 Incinerator Ash and Sewage Treatment Plant Sludge Disposal Areas (LF-19 and WP-23)	From the mid-1950s until possibly the early 1960s, solid wastes generated at the base were incinerated. Ash was reportedly disposed of along the eastern boundary of the site. From the 1950s to early 1983, the sewage treatment plant treated all domestic and industrial wastewater generated on the base. The process utilized primary clarification, trickling filters, secondary clarification, anaerobic sludge digestion, and sludge drying beds. Sludge was reportedly spread on ground surrounding plant.	*1996 Draft Final ESI:* **Soil**: PAHs (e.g., benzo(a)pyrene 0.015-1.3 ppm) and lead (0.42-14,600 ppm) were detected sporadically above CVs. Beryllium and antimony were detected slightly and sporadically above CVs. **Sediment**: No contaminants were detected above CVs. **Groundwater**: Arsenic (4.2-63.3 ppb) was detected above CVs. VOCs and beryllium were detected slightly and sporadically above CVS. **Surface water**: No contaminants were detected above CVs.	This site is an industrial area located in open space; the parcel will be deeded to the Dade County Aviation Department for industrial use. The site will undergo an RI.	Based on available data, no public health hazards appear to exist. Contaminants were detected above CVs in soil. Under past, current, and proposed future use, sporadic exposures to contaminants at detected levels are not expected to be associated with adverse health effects. Contaminants were detected above CVs in groundwater. Because groundwater is not used for drinking water, no exposures, and therefore no health hazards, exist.

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Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Corrective Activities and/or Current Status	Evaluation of Public Health Hazard
OU-12 Entomology Storage Shop, Building 371 (OT-25)	From the 1940s through the mid-1980s, a wide variety of organochlorine pesticides stored in a wooden building with a concrete floor, reportedly only small quantities of non-volatile and relatively non-toxic chemicals. Building was also used for water treatment, chemical storage, and small equipment storage.	*1996 Draft Final ESI:* **Soil**: PAHs (e.g., benzo(a)pyrene: 0.029–6.1 ppm) and arsenic (0.71–44 ppm) were detected above CVs. Pesticides and beryllium were detected slightly and sporadically above CVs. **Groundwater**: Arsenic (nd-7 ppb) was detected sporadically above the CV. VOCs, pesticides and other metals were detected slightly and sporadically above CVs.	This site is located in an industrial area; the parcel will retained by the Air Force for industrial use. The site will undergo an RI.	Based on available data, no public health hazards appear to exist. Contaminants were detected above CVs in soil. Under past, current, and proposed future use, sporadic exposures to contaminants at detected levels are not expected to be associated with adverse health effects. Contaminants were detected above CVs in groundwater. Because groundwater is not used for drinking water, no exposures, and therefore no health hazards, exist.

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Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Corrective Activities and/or Current Status	Evaluation of Public Health Hazard
OU-13 Hardfill Storage Area No. 3 (Landfill SS-22)	From 1945 to the 1950s, construction and demolition debris, including concrete, asphalt, wood, and excavated earth, were disposed. Debris was possibly burned here and ashes disposed.	*1996 Draft Final ESI:* **Soil**: PAHs (e.g., benzo(a)pyrene: 0.012–22 ppm) and arsenic (0.77–6.9 ppm) were detected above CVs. Beryllium was detected slightly and sporadically above the CV. **Groundwater**: Arsenic (3.2-9.1 ppb) and beryllium (0.17–0.3 ppb) were detected above CVs. No other contaminants were detected above CVs.	This site is located in open space; the parcel will be retained by the Air Force for industrial use. The (1990) ROD calls for no further action. The 1996 ESI recommends no further action.	Based on available data, no public health hazards appear to exist. PAHs, arsenic, and beryllium were detected above CVs in soil. Under past, current, and proposed future use, sporadic exposures to contaminants at detected levels are not expected to be associated with adverse health effects. Contaminants were detected above CVs in groundwater. Because groundwater is not used for drinking water, no exposures, and therefore no health hazards, exist.

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Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Corrective Activities and/or Current Status	Evaluation of Public Health Hazard
OU-14 Drum Storage Area, Building 720 (SS-26)	Former drum storage area for paint and solvent-related wastes from the early 1980s through 1985. The site is covered with concrete and asphalt. No significant spills are indicated.	*1996 Draft Final ESI:* **Soil**: PAHs (e.g., benzo(a)pyrene: 0.031–2.8 ppm) and arsenic (nd-20 ppm) were detected sporadically above CVs. No other contaminants were detected above CVs. **Groundwater**: Arsenic (nd-20 ppb) was detected sporadically above the CV.	This site is located in an industrial area; the parcel will be deeded to the Dade County Aviation Department for industrial use. The (1990) ROD calls for no further action. The 1996 ESI recommends no further action.	Based on available data, no public health hazards appear to exist. PAHs and arsenic were detected above CVs in soil. Under past, current, and proposed future use, sporadic exposures to contaminants at detected levels are not expected to be associated with adverse health effects. Arsenic was detected above CVs in groundwater. Because groundwater is not used for drinking water, no exposures, and therefore no health hazards, exist.

TABLE 1: EVALUATION OF POTENTIAL PUBLIC HEALTH HAZARDS

Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Corrective Activities and/or Current Status	Evaluation of Public Health Hazard
OU-15 Building 153: Hazardous Waste Storage (SS-30)	From 1973 to 1976, Building 153 was used as a hazardous material storage area for small containers of chemicals, including battery electrolytes, paint thinners, hydraulic fluids, and motor oils. Expired chemicals were routinely dumped from the loading dock onto the ground next to the building.	*1996 Preliminary Assessment/Site Investigation (PA/SI):* **Soil**: PAHs (e.g., benzo(a)pyrene: 0.74-6.7 ppm) and arsenic (11-120 ppm) were detected above CVs. No other contaminants were detected above CVs. **Groundwater**: Arsenic (nd-130 ppb) was detected sporadically above the CV. Other metals were detected slightly and sporadically above CVs.	This site is located in an industrial area; the parcel will be retained by the Air Force for industrial use. The site will undergo an ESI.	Based on available data, no public health hazards appear to exist. PAHs and arsenic were detected above CVs in soil. Under past, current, and proposed future use, sporadic exposures to contaminants at detected levels are not expected to be associated with adverse health effects. Arsenic was detected above CVs in groundwater. Because groundwater is not used for drinking water, no exposures, and therefore no health hazards, exist.

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Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Corrective Activities and/or Current Status	Evaluation of Public Health Hazard
OU-16 Structure 898: Missile Battery (SS-31)	During the early to mid 1970s, site was surrounded by earthen berm walls and used as a missile battery area. After deactivation of the site as a missile pad, 55-gallon drums of contaminants such as paint thinners, pesticides, motor oils, and hydraulic oils were stored here; open dumping occurred between 1973 and 1978. During the 1980s, the area was paved and used as a parking compound.	*1997 PA/SI:* **Soil**: Arsenic (2.4-11.8 ppm) was detected above the CV. No other contaminants were detected above CVs. **Sediment**: Arsenic (nd-13 ppm) was detected sporadically above the CV. No other contaminants were detected above CVs. **Groundwater**: Antimony was detected slightly and sporadically above the CV. No other contaminants were detected above CVs.	This site is located in open space; the parcel will be deeded to the Dade County Aviation Department for industrial use. The 1997 PA/SI recommends no further action.	Based on available data, no public health hazards appear to exist. Arsenic was detected above the CV in soil and sediment. Under past, current, and proposed future use, sporadic exposures to contaminants at detected levels are not expected to be associated with adverse health effects. Antimony was detected above CVs in groundwater. Because groundwater is not used for drinking water, no exposures, and therefore no health hazards, exist.

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Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Corrective Activities and/or Current Status	Evaluation of Public Health Hazard
OU-17 Hangar 793: Fuel Release (SS-32)	Building 793 was used as a C-130 maintenance hangar. During Hurricane Andrew the building was destroyed and a parked C-130 was torn apart, resulting in a release of JP-4 fuel; approximately 2,000 gallons of fuel were in the wing when the spill occurred.	*1997 PA/SI:* **Soil**: PAHs (e.g., benzo(a)pyrene: nd-1.6 ppm) and arsenic (3.2-10.7 ppm) were detected above CVs. No other contaminants were detected above CVs. **Groundwater**: No contaminants were detected above CVs.	This site is located in an industrial area; the parcel will be deeded to the Dade County Aviation Department for industrial use. The 1997 PA/SI recommends no further action.	Based on available data, no public health hazards appear to exist. PAHs and arsenic were detected above CVs in soil. Under past, current, and proposed future use, sporadic exposures to contaminants at detected levels are not expected to be associated with adverse health effects.

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Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Corrective Activities and/or Current Status	Evaluation of Public Health Hazard
OU-18 Contractor Storage Area/Former Construction Debris Landfill [Post-Andrew Site]	The Contractor Storage Area has been used since the 1980s to store various materials, including pipes, equipment, cans of paints, empty containers, and tools. Housekeeping was reportedly poor, although no spills are known to have occurred. The Former Construction Debris Landfill was used for disposal of crushed asphalt, most likely generated from the occasional resurfacing of runways. Oil staining and paint spillage were noted in 1993. The site is composed of 2.5 acres and is bordered by canals.	*1994 Confirmation Sampling and 1997 Draft RI:* **Surface soil**: PAHs (e.g., benzo(a)pyrene: 14–120 ppm) and arsenic (2.5-10 ppm) were detected above CVs. Pesticides were detected slightly and sporadically above CVs. **Sediment**: PAHs (e.g., benzo(a)pyrene: 0.32-4.9 ppm) and arsenic (2.7-21.4 ppm) were detected above CVs. Antimony and beryllium were detected slightly and sporadically above CVs. **Groundwater**: PAHs (e.g., benzo(a)pyrene: nd-2 ppb) arsenic (1.2-48.6 ppb), and pesticides were detected above CVs. Other metals were detected slightly and sporadically above CVs. **Surface water**: Arsenic (1.1-6.3 ppb) was detected above the CV. No other contaminants were detected above CVs.	This site is currently located in remote open space but, prior to Hurricane Andrew, was located near a residential area, and the former Base Family Campground borders it to the west; the parcel will be deeded to the Dade County Aviation Department for industrial use. The 1996 RI recommends a Feasibility Study (FS).	Contaminants were detected above CVs in soil and sediment. Under past, current, and proposed future use, sporadic exposures to contaminants at detected levels are not expected to be associated with adverse health effects. Contaminants were detected above CVs in groundwater and surface water. Because neither groundwater nor surface water are used for drinking water, no exposures, and therefore no health hazards, exist.

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Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Corrective Activities and/or Current Status	Evaluation of Public Health Hazard
OU-19 Building 208: Aerospace Ground Equipment/ Aircraft Operations and Maintenance Facility [Post-Andrew Site]	The building was used for aerospace ground equipment maintenance and repair since 1950; bulk oils, virgin oils, and lubricants were contained in 55-gallon steel drums. Oil stains were noted near an oil/water separator and an associated waste oil underground storage tank.	*1997 Draft Final Site Investigation (SI)*: **Surface soil**: Arsenic (10–11.3 ppm) and lead (303–1,200 ppm) were detected above CVs. No VOCs or BNAs were sampled for because none were detected in previous investigations.	This site is located in an industrial area; the parcel will be retained by the Air Force for industrial use. In 1994, the oil/water separator and underground storage tank were excavated. Six aboveground storage tanks and soils containing organic vapor concentrations (288 ppm) were removed in 1994. Lead-contaminated soil was removed in 1994. The 1997 SI recommends further limited sampling.	Based on available data, no public health hazards appear to exist. Arsenic and lead were detected above CVs in soil. Under past, current, and proposed future use, sporadic exposures to contaminants at detected levels are not expected to be associated with adverse health effects.

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Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Corrective Activities and/or Current Status	Evaluation of Public Health Hazard
AOC 1 New Contractor Storage/Parking Area by Building 767 [Post-Andrew Site]	This site is a parking area where steel 55-gallon drums containing fuel oil and hydraulic fluid, aboveground storage tanks, construction machinery, mobile fuel tanks, scrap metal, and miscellaneous debris were located in 1994. The site was used as a decontamination water treatment facility in 1996.	*1997 Draft Final SI:* **Surface soil**: PAHs (e.g., benzo(a)pyrene: 0.33–65 ppm), arsenic (1.6–35.5 ppm), and lead (30.5–945 ppm) were detected above CVs. Beryllium was detected slightly and sporadically above the CV. **Groundwater**: Arsenic (1.8 –391 ppb) was detected above the CV. No other contaminants were detected above CVs.	This site is located in an industrial area; the parcel will be deeded to the Dade County Aviation Department for industrial use. Two underground storage tanks were excavated in 1994; one was replaced with an aboveground storage tank. The 1997 SI recommends an RI.	Based on available data, no public health hazards appear to exist. Contaminants were detected above CVs in soil. Under past, current, and proposed future use, sporadic exposures to contaminants at detected levels are not expected to be associated with adverse health effects. Arsenic was detected above CVs in groundwater. Because groundwater is not used for drinking water, no exposures, and therefore no health hazards, exist.

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Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Corrective Activities and/or Current Status	Evaluation of Public Health Hazard
AOC 3 Munitions Storage Area [Post-Andrew Site]	This area used for munitions storage and painting, and light maintenance of munitions trailers since 1950. In 1993, staining and dead vegetation were observed around an emergency generator that was used during Hurricane Andrew; the area has underground storage tanks. Waste oils, waste paints, and thinners were reportedly contained on uncovered concrete pad; a release of mineral spirits reportedly occurred in 1988.	*1997 Draft Final SI:* **Surface soil**: Arsenic (4.9–12 ppm) was detected above the CV. PAHs (e.g., benzo(a)pyrene: nd-0.26 ppm) were detected slightly and sporadically above CVs. **Groundwater**: No contaminants were detected above CVs.	This site is located in secure open space; the parcel will be retained by the Air Force for industrial use. Two oil/water separators, an aboveground storage tank containment pad, and one underground storage tank have been excavated. The 1997 SI recommends further surface soil sampling in support of future removal/risk management decisions.	Based on available data, no public health hazards appear to exist. PAHs and arsenic were detected above CVs in soil. Under past, current, and proposed future use, sporadic exposures to contaminants at detected levels are not expected to be associated with adverse health effects. No contaminants were detected above CVs in groundwater; therefore no health hazards exist.

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Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Corrective Activities and/or Current Status	Evaluation of Public Health Hazard
AOC 5 Building 755, Non-Destructive Inspection Laboratory [Post-Andrew Site]	This building contained garage, x-ray room, dark room, offices, furnace room, and mechanical room; it was destroyed by Hurricane Andrew. The building was used for x-ray inspection of aircraft parts, analysis of aircraft engine oil, and dye penetrant/magnetic particle inspection of aircraft and support equipment. Stressed vegetation around the building was observed in 1993.	*1997 Draft Final SI:* **Surface soil**: Arsenic (21.6–25 ppm) was detected above the CV. PAHs (e.g., benzo(a)pyrene: nd-0.98 ppm) and beryllium were detected slightly and sporadically above CVs. **Groundwater**: No contaminants were detected above CVs.	This site is located in an industrial area; the parcel will be deeded to the Dade County Aviation Department for industrial use. An underground storage tank was excavated. A former concrete transformer pad and arsenic contaminated soils were removed in 1996. The 1997 SI recommends further sampling.	Based on available data, no public health hazards appear to exist. PAHs, arsenic, and beryllium were detected above CVs in soil. Under past, current, and proposed future use, sporadic exposures to contaminants at detected levels are not expected to be associated with adverse health effects. No contaminants were detected above CVs in groundwater; therefore no health hazards exist.

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Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Corrective Activities and/or Current Status	Evaluation of Public Health Hazard
Flight Line Pumphouses (SS-15b)	JP-4 jet fuel leaked along the flight line. This site is being investigated and monitored under the state petroleum program.	*1996 Contamination Assessment:* **Soil**: PAHs (e.g., benzo(a)pyrene: nd-5.12 ppm) and arsenic detected sporadically above CVs. **Groundwater**: Benzene detected slightly and sporadically above CVs.	This site is located along the flight line; the parcel will be deeded to the Dade County Aviation Department for industrial use. Hot spot soil removal occurred in 1995. Groundwater monitoring is ongoing. The Contamination Assessment recommends further soil remediation involving in-situ technology.	Based on available data, no public health hazards appear to exist. PAHs and arsenic were detected above CVs in soil. Under past, current, and proposed future use, sporadic exposures to contaminants at detected levels are not expected to be associated with adverse health effects. Benzene was detected above CVs in groundwater. Because groundwater is not used for drinking water, no exposures, and therefore no health hazards, exist.

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Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Corrective Activities and/or Current Status	Evaluation of Public Health Hazard
OU-20 Buildings 618 and 619 Parking Lot/Outdoor Staging Area (also see OU-21) [Post-Andrew Site]	14,000 square feet of paved parking lot were used as a staging area for hazardous wastes collected since Hurricane Andrew. Drums labeled "Tar and Gravel" were observed in 1993; aboveground storage tanks were placed in the lot; staining was observed in 1993.	*1997 Draft Final SI:* **Surface soil**: Arsenic (0.44–31.2 ppm) was detected above the CV. Beryllium was detected slightly and sporadically above CVs. No other contaminants were detected above CVs. **Groundwater**: Arsenic (nd-300 ppb) was detected sporadically above the CV. No other contaminants were detected above CVs.	This site is located in an industrial area; the parcel will be deeded to the Dade County Aviation Department for industrial use. An underground storage tank was excavated in 1994. Arsenic contaminated surface soil was excavated in 1996. The 1997 SI recommends further investigation.	Based on available data, no public health hazards appear to exist. Arsenic and beryllium were detected above CVs in soil. Under past, current, and proposed future use, sporadic exposures to contaminants at detected levels are not expected to be associated with adverse health effects. Arsenic was detected above CVs in groundwater. Because groundwater is not used for drinking water, no exposures, and therefore no health hazards, exist.

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Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Corrective Activities and/or Current Status	Evaluation of Public Health Hazard
OU-21 #32, Building 619 Parking Lot/Base Supply Hazardous Materials Storage Facility (also see OU-20) [Post-Andrew Site]	The building was used to store flammables and acids before and hazardous waste after Hurricane Andrew; the site encompasses 2,400 square feet.	*1997 Draft Final ESI:* **Surface soil**: Arsenic (0.44–31.2 ppm) was detected above the CV. Beryllium was detected slightly and sporadically above the CV. No other contaminants were detected above CVs. **Groundwater**: Arsenic (nd-300 ppb) was detected sporadically above the CV. No other contaminants were detected above CVs.	This site is located in an industrial area; the parcel will be deeded to the Dade County Aviation Department for industrial use. Arsenic contaminated surface soil was excavated in 1996. The 1997 ESI recommends further investigation.	Based on available data, no public health hazards appear to exist. Arsenic and beryllium were detected above CVs in soil. Under past, current, and proposed future use, sporadic exposures to contaminants at detected levels are not expected to be associated with adverse health effects. Arsenic was detected above CVs in groundwater. Because groundwater is not used for drinking water, no exposures, and therefore no health hazards, exist.

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Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Corrective Activities and/or Current Status	Evaluation of Public Health Hazard
OU-22 Buildings 761 and 764, Aerospace Ground Equipment Maintenance (Paint Booth) [Post-Andrew Site]	Oil staining and dead vegetation were observed in 1993. Three aboveground storage tanks were formerly located on site.	*1994 Confirmation Sampling and 1997 Draft RI:* **Surface soil**: PAHs (e.g., benzo(a)pyrene (nd–30 ppm), arsenic (1.3–11.4 ppm), and lead (36.4–805 ppm) were detected sporadically above CVs. Pesticides and beryllium were detected slightly and sporadically above CVs. **Groundwater**: Arsenic (2.4–9.1 ppb) was detected above the CV. Benzene (nd–370 ppb) and toluene (nd–1,700 ppb) were detected sporadically above the CV. BNAs and other VOCs and metals were detected slightly and sporadically above the CVs.	This site is located in an industrial area (now open space); the parcel will be deeded to the Dade County Aviation Department for industrial use. In 1996, aboveground storage tanks and contaminated soils were excavated. The 1997 RI recommends no further action.	Based on available data, no public health hazards appear to exist. Contaminants were detected above CVs in soil. Under past, current, and proposed future use, sporadic exposures to contaminants at detected levels are not expected to be associated with adverse health effects. Contaminants were detected above CVs in groundwater. Because groundwater is not used for drinking water, no exposures, and therefore no health hazards, exist.

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Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Corrective Activities and/or Current Status	Evaluation of Public Health Hazard
OU-25 Hardstand Pad Near Building 814, Empty Hazardous Waste Container Staging [Post-Andrew Site]	A square concrete slab was used to secure aircraft for engine testing prior to construction of "hush houses" in mid-1980s; after Hurricane Andrew, this was used as a staging area for material and wastes, including pesticides, herbicides, paints, thinners, waste and lube oils, and contaminated soils.	*1997 Draft Final SI:* **Surface soil**: PAHs (e.g., benzo(a)pyrene: nd-1.4 ppm), arsenic (2–21.5 ppm), and lead (88.5–647 ppm) were detected above CVs. Beryllium was detected slightly and sporadically above CVs. **Groundwater**: VOCs and BNAs were detected slightly and sporadically above the CVs.	This site is located in an open area near the flight line; the parcel will be retained by the Air Force for industrial use. Lead contaminated soils were excavated in 1996. The 1997 SI recommends further sampling in support of removal/risk management decisions.	Based on available data, no public health hazards appear to exist. Contaminants were detected above CVs in soil. Under past, current, and proposed future use, sporadic exposures to contaminants at detected levels are not expected to be associated with adverse health effects. Contaminants were detected above CVs in groundwater. Because groundwater is not used for drinking water, no exposures, and therefore no health hazards, exist.

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Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Corrective Activities and/or Current Status	Evaluation of Public Health Hazard
OU-26 Building 745, Aircraft Fabrication (Metal Working) Facility [Post-Andrew Site]	The building was used for maintenance of aircraft skin and hydraulics; wastes generated at the facility included PD-680 and hydraulic fluid; floor drains collect to an underground drain line that discharges to the canal. The fence that surrounds the transformers on the side of the building fell on them during the hurricane; no leaks were reported. A battery shop with floor staining was observed in 1993.	*1994 Confirmation Sampling and 1997 Draft RI:* **Surface soil**: PAHs (e.g., benzo(a)pyrene: 0.14–1.9 ppm), arsenic (1.5–40.4 ppm), and lead (18.8–551 ppm) were detected above CVs. **Sediment**: PAHs (e.g., benzo(a)pyrene: 3-36 ppm), arsenic (4.8-5.7 ppm), and lead (308-1,640 ppm) were detected above CVs. Beryllium and cadmium were detected slightly and sporadically above CVs. **Groundwater**: VOCs, pesticides, and metals were detected slightly and sporadically above CVs. **Surface water**: Arsenic (1.1-82.3 ppb) and lead (2.7-44.7 ppb) were detected above CVs.	This site is located in an industrial area; the parcel will be deeded to Dade County Aviation Department for industrial use. In 1994, two underground storage tanks were excavated. In another area, lead-contaminated soil was excavated. The 1997 RI recommends an FS.	Based on available data, no public health hazards appear to exist. Contaminants were detected above CVs in soil and sediment. Under past, current, and proposed future use, sporadic exposures to contaminants at detected levels are not expected to be associated with adverse health effects. Contaminants were detected above CVs in groundwater and surface water. Because neither groundwater nor surface water are used for drinking water, no exposures, and therefore no health hazards, exist.

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Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Corrective Activities and/or Current Status	Evaluation of Public Health Hazard
OU-27 Buildings 268 and 268A, Jet Engine Test Cell Facility [Post-Andrew Site]	From the early 1970s to the mid-1980s, the Jet Engine Test Cell was used to conduct jet engine testing. An aboveground fuel tank was observed on the site in 1993, but has been since removed. A water well and pump were situated adjacent to a water tank, but use of the well is uncertain; it has been inactive since the mid-1980s. An oil/water separator received coolant/noise suppression water prior to discharge in the Boundary Canal.	*1994 Confirmation Sampling and 1997 Draft RI:* **Surface soil**: PAHs (e.g., benzo(a)pyrene: nd–12 ppm), arsenic (0.36–14.5 ppm), and lead (3.4–1,050 ppm) were detected above CVs. Other metals were detected slightly and sporadically above CVs. **Groundwater**: Antimony was detected slightly and sporadically above CVs. No other contaminants were detected above CVs.	This site is in a remote industrial area; the parcel will be retained by the Air Force for industrial use. In 1994, the oil/water separator was excavated and the aboveground storage tanks were removed. The 1997 RI recommends no further action.	Based on available data, no public health hazards appear to exist. Contaminants were detected above CVs in soil. Under past, current, and proposed future use, sporadic exposures to contaminants at detected levels are not expected to be associated with adverse health effects. Antimony was detected above CVs in groundwater. Because groundwater is not used for drinking water, no exposures, and therefore no health hazards, exist.

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Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Corrective Activities and/or Current Status	Evaluation of Public Health Hazard
OU-28 Building 750, Propulsion (Engine) Maintenance Facility [Post-Andrew Site]	Building 750 was used for jet engine teardown, rebuilding, inspection, and repair sinee approximately 1950. Waste oils were previously collected in an aboveground storage tank; an oil/water separator and sump and five underground storage tanks associated with electroplating operations were located at this site.	*1997 Draft RI:* **Surface soil**: PAHs (e.g., benzo(a)pyrene: nd–26 ppm), arsenic (2–23.6 ppm), and lead (15.4–20,200 ppm) were detected above CVs. Other metals were detected slightly and sporadically above CVs. **Groundwater**: VOCs and beryllium were detected slightly and sporadically above CVs.	This site is located in an industrial area; the parcel will be deeded to the Dade County Aviation Department for industrial use. In 1993 and 1994, the oil/water separator and sump and five electroplating underground storage tanks were excavated. The 1997 RI recommends an FS.	Based on available data, no public health hazards appear to exist. Contaminants were detected above CVs in soil. Under past, current, and proposed future use, sporadic exposures to contaminants at detected levels are not expected to be associated with adverse health effects. Contaminants were detected above CVs in groundwater. Because groundwater is not used for drinking water, no exposures, and therefore no health hazards, exist.

TABLE 1: EVALUATION OF POTENTIAL PUBLIC HEALTH HAZARDS

Site	Site Description/ Waste Disposal History	Investigation Results/ Environmental Monitoring Results	Corrective Activities and/or Current Status	Evaluation of Public Health Hazard
OU-29 Building 760 [Post-Andrew Site]	Building 760 was used as an Avionics Aerospace Ground Equipment shop, a Tactical Electronic Warfare System shop, and housed various associated testing shops. The building was heavily damaged during Hurricane Andrew. An oil/water separator was located by the building and effluent was discharged to the sewer; an underground storage tank was used to store diesel fuel for a generator in the building.	*1997 Draft RI:* **Surface soil**: PAHs (e.g., benzo(a)pyrene: (0.24–12 ppm), arsenic (0.82–26.6 ppm), and lead (4.5–760 ppm) were detected above CVs. No other contaminants were detected above CVs. **Groundwater**: VOCs were detected slightly and sporadically above CVs. No other contaminants were detected above CVs.	This site is located in an industrial area; the parcel will be deeded to the Dade County Aviation Department for industrial use. In 1994, the oil/water separator and the underground storage tank were excavated. The 1997 RI recommends no further action.	Based on available data, no public health hazards appear to exist. PAHs, arsenic, and lead were detected above CVs in soil. Under past, current, and proposed future use, sporadic exposures to contaminants at detected levels are not expected to be associated with adverse health effects. Contaminants were detected above CVs in groundwater. Because groundwater is not used for drinking water, no exposures, and therefore no health hazards, exist.

TABLE 2. EXPOSURE PATHWAYS

Pathway Name	Exposure Pathway Elements						Comments
	Source of Contamination	Environmental Medium	Point of Exposure	Route of Exposure	Time of Exposure	Exposed Population	
POTENTIAL EXPOSURE PATHWAYS							
Groundwater	Industrial and aviation activities at Homestead AFB.	Groundwater	Drinking water wells.	Ingestion	**Past**: Contaminants were detected in groundwater. A drinking water well field located in the central part of the base was used until 1978; a second well field was located on the western border of the base and used from 1978 until 1992. **Present and Future**: Contaminants still exist in groundwater; however, water is and will continue to be supplied from off-base wells.	**Past**: Residents and employees at Homestead AFB. **Present and Future**: No exposed population; drinking water is supplied from off-base supply.	Drinking water has not been supplied from wells on base since 1992 and no plans exist for drinking water wells to be located on the base in the future.

TABLE 2. EXPOSURE PATHWAYS

Pathway Name	Exposure Pathway Elements						Comments
	Source of Contamination	Environmental Medium	Point of Exposure	Route of Exposure	Time of Exposure	Exposed Population	
POTENTIAL EXPOSURE PATHWAYS, continued							
Soil	Industrial and aviation activities at Homestead AFB at certain IRP sites.	Surface soil	Various sites throughout Homestead AFB.	Ingestion Skin contact	**Past, Present, and Future**: Contaminants were detected sporadically and at low levels at several sites.	**Past**: Residents and employees at Homestead AFB; trespassers at restricted sites. **Present and Future**: Employees at Homestead AFB.	Based on industrial use of the Homestead AFB property, contaminants were not detected at levels that are likely to pose a health hazard.

TABLE 2. EXPOSURE PATHWAYS

Pathway Name	Exposure Pathway Elements						Comments
	Source of Contamination	Environmental Medium	Point of Exposure	Route of Exposure	Time of Exposure	Exposed Population	
POTENTIAL EXPOSURE PATHWAYS, continued							
Surface Water in Canals	Industrial and aviation activities at Homestead AFB. Agricultural activities around Homestead AFB.	Surface water	Canals throughout and surrounding Homestead AFB, and the Outfall Canal from Homestead AFB to the Biscayne Bay.	Skin contact	**Past, Present, and Future**: Contaminants were detected sporadically in surface water samples throughout the canal system.	**Past, Present, and Future**: Residents (past only) and employees at Homestead AFB and residents of Homestead and surrounding communities that fish, swim, or wade in the canal system.	Swimming and wading in the canals are possible but unlikely due to heavy vegetation, steep slopes, and the presence of alligators and snakes. Based on infrequent exposures, contaminants were not detected at levels that are likely to pose a health hazard.

TABLE 2. EXPOSURE PATHWAYS

Pathway Name	Exposure Pathway Elements						Comments
	Source of Contamination	Environmental Medium	Point of Exposure	Route of Exposure	Time of Exposure	Exposed Population	
POTENTIAL EXPOSURE PATHWAYS, continued							
Sediment in Canals	Industrial and aviation activities at Homestead AFB. Agricultural activities around Homestead AFB.	Sediment	Canals throughout and surrounding Homestead AFB, and the Outfall Canal from Homestead AFB to the Biscayne Bay.	Ingestion Dermal	**Past, Present, and Future**: Contaminants were detected sporadically and at low levels in sediment samples throughout the canal system.	**Past, Present, and Future**: Residents (past only) and employees at Homestead AFB and residents of Homestead and surrounding communities that fish, swim, or wade in the canal system.	Swimming and wading in the canals are possible but unlikely due to heavy vegetation, steep slopes, and the presence of alligators and snakes. Based on infrequent exposures, contaminants are not detected at levels that are likely to pose a health hazard.

TABLE 2. EXPOSURE PATHWAYS

Pathway Name	Exposure Pathway Elements						Comments
	Source of Contamination	Environmental Medium	Point of Exposure	Route of Exposure	Time of Exposure	Exposed Population	
COMPLETED EXPOSURE PATHWAYS							
Fish in Canals	Industrial and aviation activities at Homestead AFB. Agricultural activities around Homestead AFB.	Fish	Canals throughout and surrounding Homestead AFB, and the Outfall Canal from Homestead AFB to the Biscayne Bay.	Ingestion	**Past, Present, and Future**: Contaminants were detected in fish samples from the canal system.	**Past, Present, and Future**: Residents (past only) and employees at Homestead AFB and residents of Homestead and surrounding communities that ingest fish caught in the canal system.	Occasional ingestion of contaminants in fish from the canals is not likely to be associated with health effects. It is possible (though unlikely) that ingesting large quantities of fish from the canals (such as subsisting on canal fish) may be associated with noncancer health effects.

FIGURES

Figure 1: Location Map

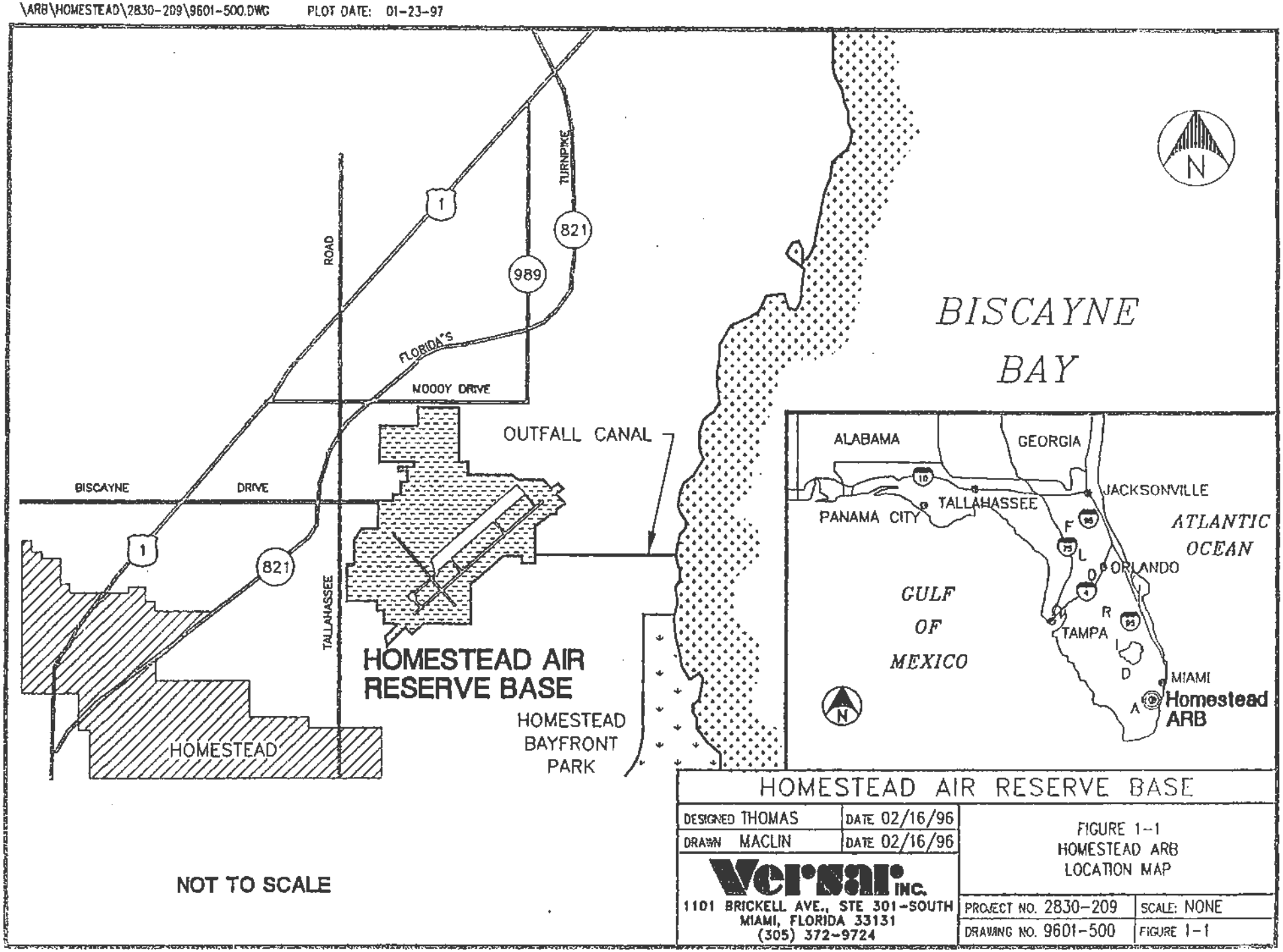
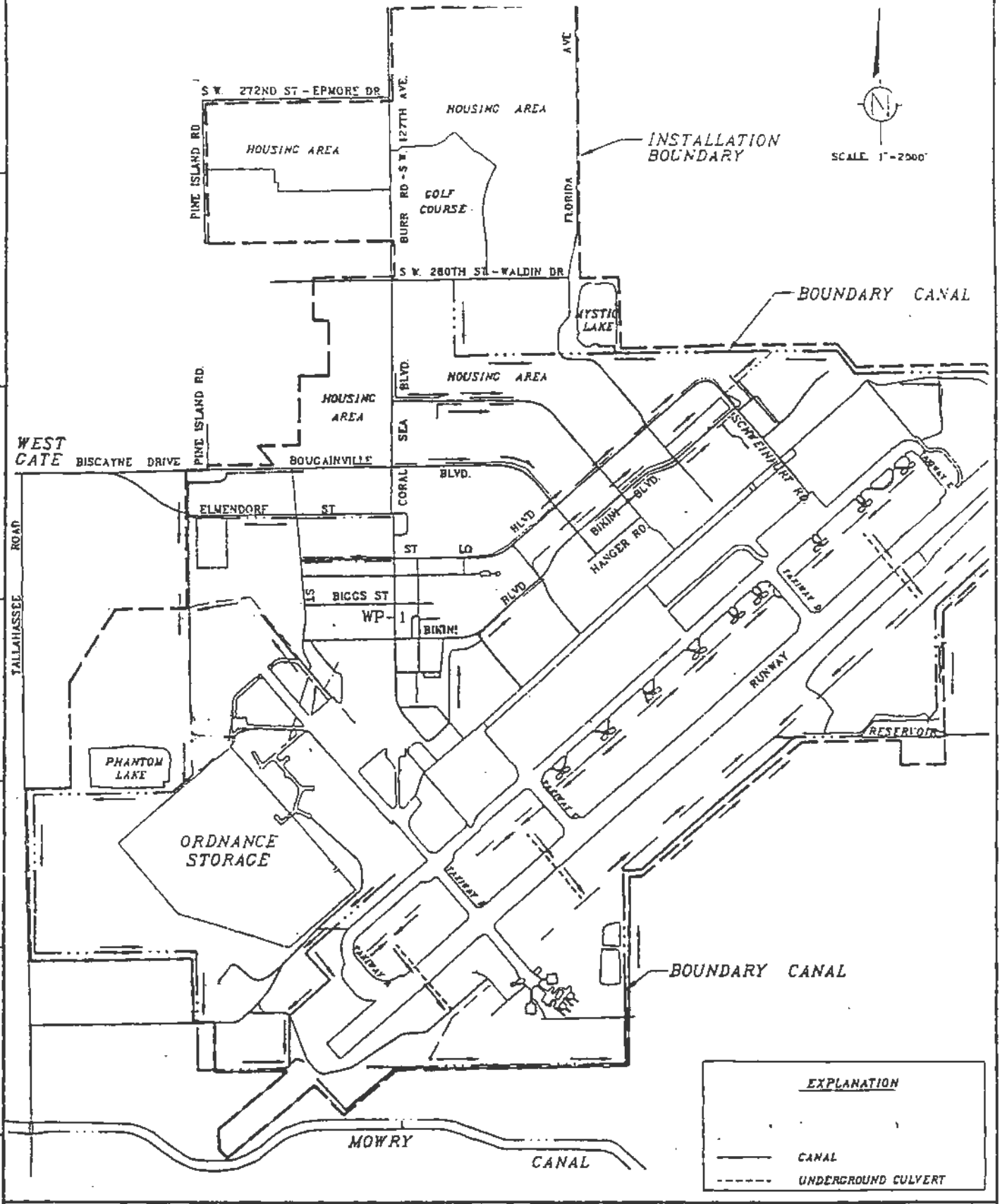


Figure 2: Site Plan



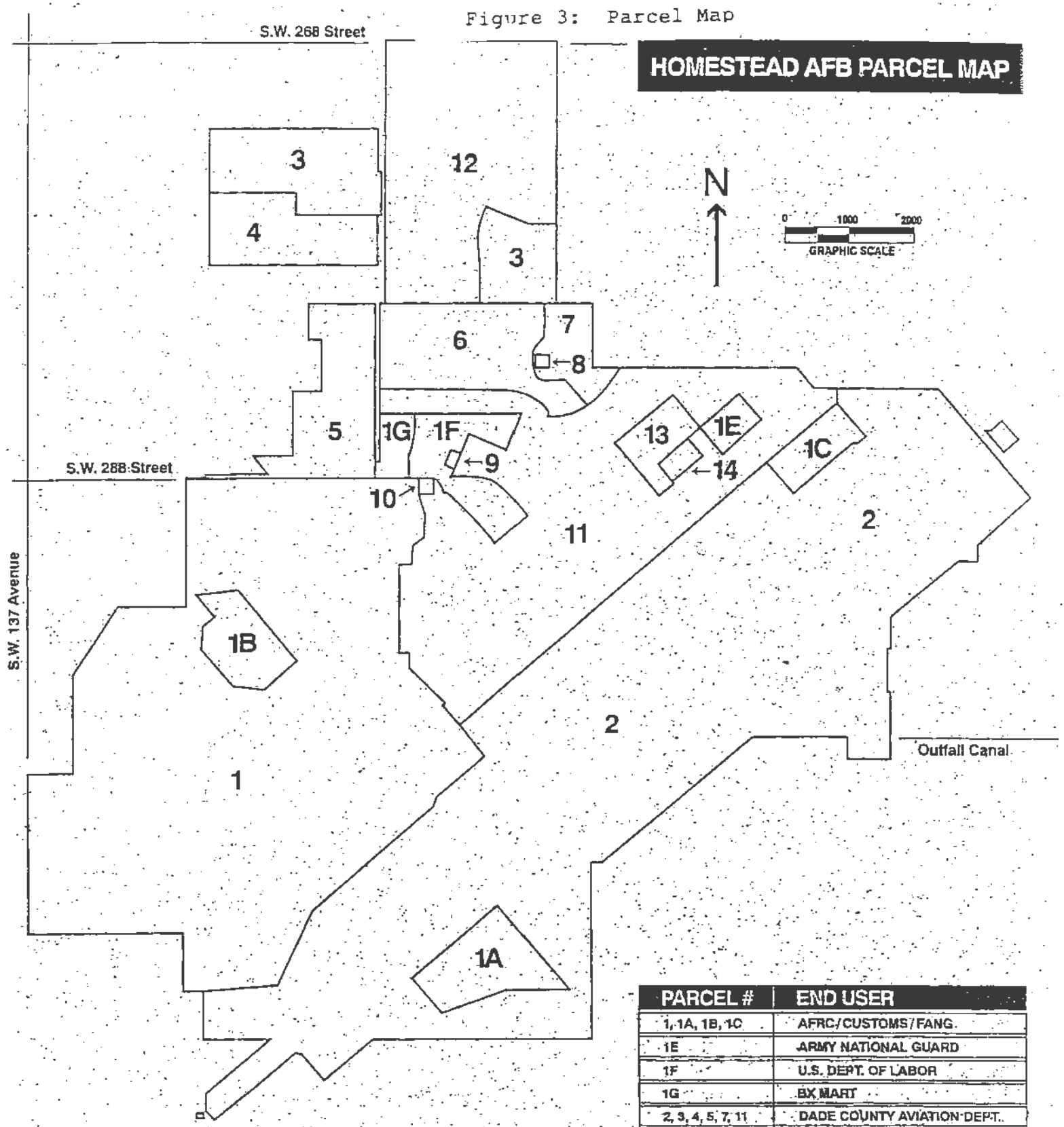
DRAFTER: DAN T.
APPROVED: K.T.
CHECKED: K.T.
DRAWING: A
FILE NO.: HOMES31.AU
PROJECT NO.: TF0704.004
07-30-93
DWG

GERAGHTY & MILLER, INC.
Environmental Services

HOMESTEAD AIR FORCE BASE SITE PLAN

HOMESTEAD A.F.B., FLORIDA

Figure 3: Parcel Map



PARCEL #	END USER
1, 1A, 1B, 1C	AFRC/CUSTOMS/FANG
1E	ARMY NATIONAL GUARD
1F	U.S. DEPT. OF LABOR
1G	BX MART
2, 3, 4, 5, 7, 11	DADE COUNTY AVIATION DEPT.
6	COUNTY HOMELESS TRUST
8	FP&L
9	CREDIT UNION
10	BANK
12	DADE COUNTY PARKS DEPT.
13	MDCC (projected)
14	DCPS (projected)

April, 1997

Figure 4: ATSDR's Exposure Evaluation Process

ATSDR's Exposure Evaluation Process

REMEMBER: For a public health threat to exist, the following three conditions must all be met:

- People must come into contact with areas that have potential contamination
- Contaminants must exist in the environment
- The amount of contamination must be sufficient to affect people's health

Are People Exposed To Areas With Potentially Contaminated Media?

For exposure to occur, contaminants must be in locations where people can contact them.

People may contact contaminants by any of the following three exposure routes:

Inhalation
Ingestion
Dermal absorption

Are the Environmental Media Contaminated?

ATSDR considers:

Soil
Ground water
Surface water and sediment
Air
Food sources

For Each Completed Exposure Pathway, Will the Contamination Affect Public Health?

ATSDR will evaluate existing data on contaminant concentration and exposure duration and frequency.

ATSDR will also consider individual characteristics (such as age, gender, and lifestyle) of the exposed population that may influence the public health effects of contamination.

APPENDIX A: Glossary

Analyte

A chemical component of a sample to be determined or measured. For example, if the *analyte* is mercury, the laboratory test will determine the amount of mercury in the sample.

Background level

A typical or average level of a chemical in the environment. *Background* often refers to naturally occurring or uncontaminated levels.

Base/Neutral and Acid Extractable Compounds (BNAs)

Compounds amenable to analysis by extraction of the sample with an organic solvent. Polycyclic aromatic hydrocarbons, such as naphthalene, phenanthrene, benzo(a)pyrene, and chrysene, comprise one category of *BNAs*. The term *BNAs* is used synonymously with semi-volatile organic compounds.

Carcinogen

Any substance that may produce cancer.

CERCLA

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980, also known as Superfund. This is the legislation that created ATSDR.

Comparison Values

Estimated contaminant concentrations in specific media that are not likely to cause adverse health effects, given a standard daily ingestion rate and standard body weight. The *comparison values* are calculated from the scientific literature available on exposure and health effects.

Concentration

The amount of one substance dissolved or contained in a given amount of another. For example, sea water contains a higher *concentration* of salt than fresh water.

Contaminant

Any substance or material that enters a system (the environment, human body, food, etc.) where it is not normally found.

Dermal

Referring to the skin. *Dermal* absorption means absorption through the skin.

Dose

The amount of substance to which a person is exposed. *Dose* often takes body weight into account.

Environmental contamination

The presence of hazardous substances in the environment. From the public health perspective, *environmental contamination* is addressed when it potentially affects the health and quality of life of people living and working near the contamination.

Exposure

Contact with a chemical by swallowing, by breathing, or by direct contact (such as through the skin or eyes). *Exposure* may be short term (acute) or long term (chronic).

Hazard

A source of risk that does not necessarily imply potential for occurrence. A *hazard* produces risk only if an exposure pathway exists and if exposures create the possibility of adverse consequences.

Ingestion

Swallowing (such as eating or drinking). Chemicals can get in or on food, drink, utensils, cigarettes, or hands where they can be ingested. After *ingestion*, chemicals can be absorbed into the blood and distributed throughout the body.

Inhalation

Breathing. Exposure may occur from inhaling contaminants because they can be deposited in the lungs, taken into the blood, or both.

Media

Soil, water, air, plants, animals, or any other parts of the environment that can contain contaminants.

Minimal Risk Level (MRL)

An *MRL* is defined as an estimate of daily human exposure to a substance that is likely to be without an appreciable risk of adverse effects (noncancer) over a specified duration of exposure. *MRLs* are derived when reliable and sufficient data exist to identify the target organ(s) of effect or the most sensitive health effects(s) for a specific duration via a given route of exposure. *MRLs* are based on noncancer health effects only. *MRLs* can be derived for acute, intermediate, and chronic duration exposures by the inhalation and oral routes.

National Priorities List (NPL)

The Environmental Protection Agency (EPA) list of sites that have undergone preliminary assessment and site inspection to determine which locations pose immediate threat to persons living or working near the release. These sites are most in need of cleanup.

No Apparent Public Health Hazard

Sites where human exposure to contaminated media is occurring or has occurred in the past, but the exposure is below a level of health hazard.

Plume

An area of chemicals in a particular medium, such as air or groundwater, moving away from its source in a long band or column. A *plume* can be a column of smoke from a chimney or chemicals moving with groundwater.

Polycyclic Aromatic Hydrocarbons (PAHs)

PAHs comprise one category of base/neutral acid or extractable compounds and are a group of chemicals that are formed during the burning of coal, oil, gas, wood, or other organic substance. Some *PAHs* are contained in asphalt used for paving roads or runways. There are more than 100 different *PAH* compounds and they are found throughout the environment in air, water, and soil. Most *PAHs* do not appear alone in the environment but, rather, in complex mixtures of many individual *PAHs*, which may be carcinogenic or noncarcinogenic.

Potentially Exposed

The condition where valid information, usually analytical environmental data, indicates the presence of contaminant(s) of a public health concern in one or more environmental media contacting humans (i.e., air, drinking water, soil, food chain, surface water), and there is evidence that some of those persons may have an identified route(s) of exposure (i.e., drinking contaminated water, breathing contaminated air, having contact with contaminated soil, or eating contaminated food).

Public Health Assessment

The evaluation of data and information on the release of hazardous substances into the environment in order to assess any current or future impact on public health, develop health advisories or other recommendations, and identify studies or action needed to evaluate and mitigate or prevent human health effects; also the document resulting from that evaluation.

Public Health Hazard

Sites that pose a *public health hazard* as the result of long-term exposures to hazardous substances.

Risk

In risk assessment, the probability that something will cause injury, combined with the potential severity of that injury.

Route of Exposure

The way in which a person may contact a chemical substance. For example, drinking (ingestion) and bathing (skin contact) are two different *routes of exposure* to contaminants that may be found in water.

Superfund

Another name for the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), which created ATSDR.

Superfund Amendments and Reauthorization Act (SARA)

The 1986 legislation that broadened ATSDR's responsibilities in the areas of public health assessments, establishment and maintenance of toxicologic databases, information dissemination, and medical education.

Volatile organic compounds (VOCs)

Substances containing carbon and different proportions of other elements such as hydrogen, oxygen, fluorine, chlorine, bromine, sulfur, or nitrogen; these substances easily become vapors or gases. A significant number of the *VOCs* are commonly used as solvents (paint thinners, lacquer thinner, degreasers, and dry-cleaning fluids).

APPENDIX B: Comparison Values

The conclusion that a contaminant exceeds the comparison value does not mean that it will cause adverse health effects. Comparison values represent media-specific contaminant concentrations that are used to select contaminants for further evaluation to determine the possibility of adverse public health effects.

Cancer Risk Evaluation Guides (CREGs)

CREGs are estimated contaminant concentrations that would be expected to cause no more than one excess cancer in a million (10^{-6}) persons exposed over lifetime. ATSDR's CREGs are calculated from EPA's cancer potency factors.

Environmental Media Evaluation Guides (EMEGs)

EMEGs are based on ATSDR minimal risk levels (MRLs) and factors in body weight and ingestion rates. An EMEG is an estimate of daily human exposure to a chemical (in mg/kg/day) that is likely to be without noncarcinogenic health effects over a specified duration of exposure.

Maximum Contaminant Level (MCL)

The MCL is the drinking water standard established by EPA. It is the maximum permissible level of a contaminant in water that is delivered to the free-flowing outlet. MCLs are considered protective of public health over a lifetime (70 years) for people consuming two liters of water per day.

Reference Media Evaluation Guides (RMEGs)

ATSDR derives RMEGs from EPA's oral reference doses. The RMEG represents the concentration in water or soil at which daily human exposure is unlikely to result in adverse noncarcinogenic effects.

EPA Region III Risk-Based Concentrations

EPA combines reference doses and carcinogenic potency slopes with "standard" exposure scenarios to calculate risk-based concentrations, which are chemical concentrations corresponding to fixed levels of risk (i.e., a hazard quotient of 1, or lifetime cancer risk of 10^{-6}, whichever occurs at a lower concentration) in water, air, fish tissue, and soil.

APPENDIX C: Evaluation of Estimated Exposure Doses and Health Effects from Contact with OU-18 Soil and Ingestion of Fish from the Boundary and Outfall Canals.

Deriving Exposure Doses

ATSDR estimated the human exposure doses for trespassers from dermal contact with or incidental ingestion of on-site soil at OU-18, and for nearby residents from ingestion of fish from the Boundary and Outfall Canals. Deriving exposure doses requires evaluating the concentrations of the contaminants to which people may have been exposed and how often and for how long exposure to those contaminants occurred. Health effects are also related to individual characteristics such as age, gender, and nutritional status that influence how a chemical might be absorbed, metabolized, and eliminated by the body. Together, these factors help influence the individual's physiological response to chemical contaminant exposure and potential noncancer (noncarcinogenic) or cancer (carcinogenic) outcomes. In the absence of exposure-specific information, ATSDR applied several conservative exposure assumptions to define site-specific exposures as accurately as possible for trespassers at the OU-18 site and residents near the canals.

Evaluating Potential Health Hazards

The estimated exposure doses are used to evaluate potential noncancer and cancer effects associated with chemicals of concern. When evaluating *noncancer* effects, ATSDR uses standard health guidelines, including ATSDR's Minimal Risk Levels (MRLs) and EPA's Reference Doses (RfDs), to evaluate whether adverse effects may occur. The chronic MRLs and RfDs are estimates of daily human exposure to a substance that are unlikely to result in adverse noncancer effects over a specified duration. ATSDR compared estimated exposure doses associated with OU-18 soil exposure and fish ingestion scenarios to conservative health guidelines such as MRLs or RfDs for each contaminant. If the exposure dose is greater than the MRL or RfD, then a possibility exists that noncancer effects will occur. However, because comparison values do not represent thresholds of toxicity, exposure to chemical concentrations above comparison values does not necessarily produce health effects.

To evaluate *cancer* effects, ATSDR uses Cancer Potency Factors (CPFs) that define the relationship between oral exposure doses and the increased likelihood of developing cancer over a lifetime. The CPFs are developed using data from animal or human studies and often require extrapolation from high exposure doses administered in animal studies to the lower exposure levels typical of human exposure to environmental contaminants. The CPF represents the upper-bound estimate of the probability of developing cancer at a defined level of exposure; therefore, they tend to be very conservative (i.e., overestimate the actual risk) in order to account for a number of uncertainties in the data used in the extrapolation.

ATSDR estimated the potential for cancer to occur using the following equation. The estimated exposure doses and CPF values for the contaminants of concern are incorporated into the equation:

Lifetime Cancer Risk = Estimated exposure dose (mg/kg/day) x CPF $(mg/kg/day)^{-1}$

Although no risk of cancer is considered acceptable, it is impossible to achieve a zero cancer risk. Consequently, ATSDR often uses a range of 10^{-4} to 10^{-6} estimated lifetime cancer risk (or 1 new case in 10,000 to 1,000,000 exposed persons), based on conservative assumptions about exposure, to determine whether a concern regarding cancer effects is valid. This range is consistent with values adopted by EPA for evaluating the need for cleanup at hazardous waste sites. Some of the chemicals of concern detected in soil at the OU-18 site and in the fish from the Boundary and Outfall Canals are considered to be human carcinogens or probable human carcinogens.

OU-18: Soil

Benzo(a)pyrene Toxic Equivalents

When estimating exposure doses for carcinogenic effects of polycyclic aromatic hydrocarbons (PAHs), ATSDR uses a Toxic Equivalency Factor (TEF) approach (EPA, 1993) to account for the fact that toxicity values are not available for all the PAHs detected in soil at the site. The benzo(a)pyrene toxic equivalent is a weighted concentration of carcinogenicity of PAHs in a mixture that compensates for the differences in toxicity among the different PAHs. A TEF has been assigned to 17 individual PAH compounds based on laboratory evidence of carcinogenicity and on their prevalence at hazardous waste sites. Although the TEF approach assumes that the carcinogenic activity of PAH mixtures depends primarily on the carcinogenic PAHs, noncarcinogenic PAHs are included because they may increase the potency of the carcinogenic PAHs (Nisbet and LaGoy, 1992).

The relative weight is 1 for benzo(a)pyrene; 5 for dibenzo(a,h)anthracene; 0.1 for benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, and indeno(1,2,3-cd)pyrene; 0.001 for anthracene, benzo(g,h,i)perylene, and chrysene; and 0.0001 for acenaphthene, acenaphthylene, fluoranthene, fluorene, 2-methylnaphthalene, naphthalene, phenanthrene, and pyrene. ATSDR used the benzo(a)pyrene equivalent to evaluate the likelihood for cancer effects to occur from contact with or incidental ingestion of soil at the OU-18 site.

ATSDR used the maximum PAH values for samples collected on site to estimate exposure doses for noncancer effects. The total PAH value is the sum of the concentrations of the individual noncarcinogenic PAHs.

Table C-1: Maximum Contaminant Concentrations in On-Site Surface Soil at OU-18

Contaminant	Maximum Concentration (mg/kg)	Comparison Value	
		Concentration (mg/kg)	Reference
PAHs Benzo(a)pyrene equivalents	2,526 438.36	no value 0.1	 CREG
Arsenic	10	20 0.5	RMEG CREG
Aldrin	0.53	0.04	CREG
Heptachlor Epoxide	2.2	0.08	CREG

Dermal Contact With Soil at OU-18

ATSDR used the following equation to estimate human exposure doses for dermal (skin) contact with soil at the OU-18 site:

$$\textit{Estimated Exposure Dose} = \frac{\text{Conc.} \times \text{CF} \times \text{SA} \times \text{ABS} \times \text{AF} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT}}$$

where:

Conc. = Maximum contaminant concentration in on-site soil (mg/kg)
CF = Conversion factor: 10^{-6} kg/mg
SA = Skin surface area available for contact (cm^2/event):
trespasser: 6,170 cm^2 (hands, arms, legs, and feet) (EPA, 1989)
ABS = Absorption Factor (unitless) for dermal exposure
AF = Skin to soil adherence factor = 0.6 mg/cm^2-event (EPA, 1992)
EF = Exposure frequency, or number of exposure events per year of exposure:
trespasser = 2 days/week x 50 weeks = 100 times per year
ED = Exposure duration, or the duration over which exposure occurs: trespasser = 7 years
BW = Body weight (kg): trespasser (age 7-14) = 50 kg
AT = Averaging time, or the time period over which cumulative exposures are averaged (ED x 365 days/year for noncancer effects; 70 years x 365 days/year for cancer effects)

Assumptions for Estimating Human Exposure Dose:

- The skin surface area (SA) available for contact per exposure event was assumed to be 10% of the 95th percentile values for the whole body of a juvenile trespasser (hands, arms, legs, and feet) (EPA, 1992). Although estimates of exposed skin are fairly realistic, it is likely that less than the estimated area of exposed skin actually becomes covered with soil.

- Assessing exposure to contaminants from dermal contact involves determining the amount of contaminant actually absorbed into the body rather than the amount that comes into contact with the outer skin. Therefore, exposures that occur through dermal contact were calculated as absorbed doses. A dermal absorption factor (ABS-dermal) was used to approximate how much of the contaminant contacting the body is actually absorbed. The ABS-dermal values for the chemicals of concern represent the percentage of the contaminant concentration contacted. The ABS-dermal factor is 10 percent for PAHs and the benzo(a)pyrene equivalent (Ryan and Hawkins, et al., 1987), 3.2 percent for arsenic (West and Maibach, et al., 1993), and 10 percent for heptachlor epoxide (Feldman and Maibach, 1974). Because no ABS-dermal factor is known for aldrin, ATSDR assumed 100 percent.

- The amount of soil adherence to skin (the adherence factor [AF]) per exposure event was assumed to be 0.6 mg/cm^2, the midpoint of the range recommended by EPA for dermal exposure to soil (EPA, 1992). Measurements of soil adherence for workers, however, reportedly approach only 0.2 mg/cm^2 for hands and approximately 0.02 mg/cm^2 for other exposed parts of the body (Kissel et al., 1995).

- The exposure frequency (EF), or number of exposure events per year, was assumed to be 100 days per year for juvenile trespassers. This assumes that a juvenile might have spent two days a week at OU-18 almost every week of the year (50 weeks). This site was a landfill; although nearby residents may have accessed the site, there is no indication that it was a frequently visited site or meeting place for juveniles. ATSDR believes that this assumption overestimates exposure.

- The duration of exposure (ED) was assumed to have occurred over seven years for a juvenile trespasser, for instance, from the age of nine through the age of 16.

- The averaging time (AT) for noncancer effects was assumed to be seven years for 365 days/year, and 70 years for 365 days/years (or 25,550 days) for cancer effects.

- No health guidelines for carcinogenic and noncarcinogenic effects are available for the dermal route of exposure. Therefore, the values available for the oral route of exposure were adjusted to account for exposure occurring through the skin rather than from ingestion.

Likelihood of Health Effects for a Trespasser from Dermal Contact with On-Site Soil at OU-18

Noncancer Effects: Estimated exposure doses for a juvenile trespasser (7 to 14 years) exposed to the maximum detected concentration of PAHs, arsenic, aldrin, or heptachlor epoxide two days per week for 50 weeks over seven years are below health guidelines and therefore do not pose a public health hazard.

Cancer Effects: Based on detected levels and intermittent exposures, PAHs, arsenic, aldrin, and heptachlor epoxide in soil are not likely to be associated with excess cancers.

Incidental Ingestion of Soil at OU-18

$$\textit{Estimated Exposure Dose} = \frac{\text{Conc. x IR x CF x EF x ED}}{\text{BW x AT}}$$

where:

Conc. = Maximum contaminant concentration in OU-18 site soil (mg/kg)
IR = Ingestion Rate (mg/day): 100 mg/day for trespassers.
CF = Conversion factor (10^{-6} kg/mg)
EF = Exposure frequency, or number of exposure events per year of exposure: trespasser = two days/week x 50 weeks.
ED = Exposure duration, or the duration over which exposure occurs: trespasser = 7 years
BW = Body weight (kg): trespasser (age 7-14) = 50 kg
AT = Averaging time, or the time period over which cumulative exposures are averaged (ED x 365 days/year for noncancer effects; 70 years x 365 days/year for cancer effects)

Assumptions for Estimating Human Exposure Dose:

- A soil ingestion rate (IR) of 100 mg/day was based on an assumption that soil on the hands is incidentally ingested while eating or playing, and that soil adheres to the palms of the hands. A more typical value for ingestion over an entire day is probably less than 50 mg/day. The soil ingestion rate also assumes that the contaminant in soil is bioavailable as the pure chemical, whereas the actual bioavailability may be substantially less.

- The exposure frequency (EF), or number of exposure events per year, was assumed to be 100 days per year for juvenile trespassers. This assumes that a juvenile might have spent two days a week at OU-18 almost every week of the year (50 weeks). This site was a landfill; although nearby residents may have accessed the site, there is no indication that it was a frequently visited site or meeting place for juveniles. ATSDR believes that this assumption overestimates exposure.

- The duration of exposure (ED) was assumed to have occurred over seven years for a juvenile trespasser, for instance, from the age of nine through the age of 16.

- The averaging time (AT) for noncancer effects was assumed to be seven years for 365 days/year and 70 years for 365 days/years (or 25,550 days) for cancer effects.

Likelihood of Health Effects From Incidental Ingestion of Soil at OU-18

Noncancer Effects: The estimated exposure doses for a juvenile trespasser (7 to 14 years) who is exposed to the maximum concentration of PAHs, arsenic, aldrin, or heptachlor epoxide two days per week for 50 weeks over seven years are lower than health guideline values and therefore do not pose a public health hazard.

Cancer Effects: No increased likelihood of developing cancer is associated with incidental exposures to soil contaminants at OU-18, even using conservative assumptions.

Boundary and Outfall Canals: Fish

Table C-2: Summary of Contaminants that Exceeded EPA Region III Risk-Based Concentrations in Fish Fillet Samples from the Boundary and Outfall Canals.

Contaminant	Contaminant Concentration (mg/kg)				EPA Region III Risk-Based Concentration[1] (mg/kg)
	Minimum	Maximum	Frequency of Detections/ Total Samples	Number of Detections greater than the EPA Region III Value	
Polychlorinated Biphenyls (PCBs)/Pesticides					
Aroclor-1260	0.018	0.054	5/24	5	0.0016
4,4'-DDD	0.026	0.067	3/24	3	0.013
4,4'-DDE	0.0027	0.17	20/24	14	0.0093
4,4'-DDT	0.0062	0.0171	2/24	1	0.0093
Metals/Inorganics					
Arsenic	0.05	0.26	13/24	13	0.0021
Mercury	0.02	0.46	24/24	1	0.5[2]

[1] Revised April 15, 1998. Listed values are based on cancer effects.
[2] The Florida Department of Health's limited ingestion advisory for mercury in fish (0.5 to 1.5 mg/kg).

Ingestion of Contaminated Fish from the Boundary and Outfall Canals

ATSDR used the following equation to estimate human exposure doses for ingestion of fish from the Boundary and Outfall Canals:

$$\textit{Estimated Exposure Dose} = \frac{\text{Conc.} \times \text{IR} \times \text{FI} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT}}$$

where:

Conc. = Maximum contaminant concentration detected in fish (mg/kg)
IR = Ingestion rate (kg/day):
0.014 kg/day daily intake averaged over a year (EPA, 1998)
[approximately 1.5, 0.2 kg fish meals per month]
0.051 kg/day daily intake averaged over a year for Florida residents ingesting freshwater predator fish (Portier et al., 1995)
[approximately 5, 0.2 kg fish meals per month]
0.132 kg/day upper bound value of fin fish ingestion (Pao et al., 1982)
[approximately 14, 0.2 kg fish meals per month]
FI = Fraction ingested from the canals (assumed to be 100 percent)
EF = Exposure frequency, or number of exposure events: 365 days/year
ED = Exposure duration, or the duration over which exposure occurs: 30 years for adults, 6 years for children
BW = Body weight (kg): 70 kg for adult, 10 kg for children (aged 0-6)
AT = Averaging time, or the time period over which cumulative exposures are averaged: noncancer effects: ED x 365 days/year; cancer effects: 70 years x 365 days/year

Assumptions for Estimating Human Exposure Dose:

- Tables C-3 and C-4 show estimated daily doses of contaminants using common assumptions about daily intake. Estimated daily intakes are heavily dependent on assumed ingestion rates of recreationally caught fish. The fish ingestion rates that ATSDR used ranged from 1.5 to 14 fish meals per month. The smallest ingestion rate scenario is based on EPA's estimation of the average daily intake of fish in the U.S. The mid-range scenario is based on a study evaluating fish consumption in Florida. The largest value is used for evaluating the possible ingestion rate of subsistence fishermen. The fish ingestion rate also assumes the highest concentration of the contaminant detected was consumed for each fish meal. These very conservative assumptions will most likely overestimate exposure. The same ingestion rate was used for children, who tend to eat smaller serving sizes than adults. Therefore, a greater number of smaller sized meals would have to be consumed for each ingestion scenario.

- The fraction ingested (FI) was conservatively assumed to be 100 percent, meaning that all fish consumed were caught in the Boundary or Outfall Canals.

- The duration of exposure (ED) was assumed to have occurred over 30 years for an adult and 6 years for a child.

- The averaging time (AT) was assumed to be 30 years for 365 days/year for noncancer effects and 70 years for 365 days/years (or 25,550 days) for cancer effects.

Likelihood of Health Effects From Ingestion of Fish from the Boundary and Outfall Canals

Adult Exposure

Noncancer Effects: With few exceptions, estimated adult exposure doses, based on three different ingestion rate scenarios, are below health guidelines for PCBs, pesticides, and metals and therefore do not pose a public health hazard. The estimated exposure doses for an adult exposed to the maximum detected concentrations of Aroclor-1260 and arsenic, however, are above health guidelines and may therefore be a health concern.

Table C-3. Estimated Exposure Doses for Noncancer Effects for an Adult Exposed to the Maximum Detected Concentration in Fish Fillets over 30 Years for Three Ingestion Rate Scenarios. (Bold values indicate a dose in excess of the MRL/RfD value.)

Contaminant	Dose from approximately 1.5, 0.02 kg fish meals/month (mg/kg/day)	Dose from approximately 5, 0.2 kg fish meals/month (mg/kg/day)	Dose from approximately 14, 0.2 kg fish meals/month (mg/kg/day)	MRL/RfD (mg/kg/day)
Aroclor-1260	0.000011	**0.000039**	**0.0001**	0.00002
Arsenic	0.000053	0.00019	**0.00049**	0.0003

Cancer Effects: Based on the highest detected concentration of arsenic, the cancer risk estimate is slightly elevated (3.2×10^{-4}) for an adult ingesting 14 fish meals per month from the canal system. No increased likelihood of developing cancer is associated with ingestion of detected levels of PCBs, pesticides, or other metals in fish, even using the most conservative ingestion rate scenario.

Child Exposure

Noncancer Effects: The bolded estimated exposure doses presented in Table C-4 for a child exposed to the maximum detected concentration of the contaminants listed are above health guidelines and may therefore be a health concern. All other estimated exposure doses, even for the most conservative ingestion rate, are lower than health guideline values and therefore do not pose a public health hazard.

Table C-4. Estimated Exposure Doses for Noncancer Effects for a Child Exposed to the Maximum Detected Concentration in Fish Fillets over Six Years for Three Ingestion Rate Scenarios. (Bold values indicate a dose in excess of the MRL/RfD value.)

Contaminant	Dose from approximately 1.5, 0.2 kg fish meals/month (mg/kg/day)	Dose from approximately 5, 0.2 kg fish meals/month (mg/kg/day)	Dose from approximately 14, 0.2 kg fish meals/month (mg/kg/day)	MRL/RfD (mg/kg/day)
Aroclor-1260	**0.000077**	**0.00028**	**0.00071**	0.00002
4,4'-DDD	0.000096	0.00034	**0.00088**	0.0005
4,4'-DDE	0.00024	**0.00087**	**0.00224**	0.0005
Arsenic	**0.00037**	**0.00133**	**0.00343**	0.0003
Mercury	0.00066	**0.00235**	**0.00607**	0.002

Cancer Effects: ATSDR does not routinely evaluate cancer for children primarily because of the uncertainty stemming from limited understanding of mechanisms of carcinogenicity in children. In addition, CPFs are generally derived from lifetime studies (i.e., 70 years), and children have experienced much less than a lifetime exposure.

Discussion

Estimated doses from ingesting fish exceeded the MRL or RfD for a few contaminants, most notably PCBs (Aroclor-1260), pesticides (4,4'-DDD and 4,4'-DDE), arsenic, and mercury. Exceeding an MRL or RfD, however, does not necessarily mean that an adverse health effect will be seen. These values are very conservative and do not represent thresholds of toxicity. Most of the estimated doses in this analysis exceeded the MRL or RfD only slightly.

The analysis that ATSDR performed assumed that all the fish consumed by an individual contains the highest detected levels of a given contaminant. It is important to note, however, that all fish in the canal do not contain the highest detected levels of all of the contaminants (see Table C-2). For instance, arsenic was detected in only half of the fish samples. Similarly, Aroclor-1260 was detected in only 5 of 24 samples, and 4,4'-DDD was detected in only 3 of 24 samples. While 4,4'-DDE was detected in 20 of the 24 samples, only 14 of those detections were at levels above the EPA Region III Risk-Based Concentration of 0.0093 mg/kg. It is highly unlikely that an individual would be exposed to the highest concentration of a contaminant detected in every fish he or she caught in the canal and ate.

It is very important to understand that ATSDR based this analysis on the consumption of fish meals **from the canal only**. The three different fish ingestion rate scenarios are based on studies

for the U.S. population and do not necessarily represent what residents near Homestead AFB might catch and eat from the canals. For instance, the Statistical Analysis of Florida Per Capita Fish and Shellfish Consumption Data report (Portier et al., 1995) performed telephone surveys and determined that Floridians eat an average of 370.85 grams of freshwater predator fish (such as the largemouth bass caught in the canal) in their home per month (this is equivalent to approximately five fish meals). ATSDR used this number as a guideline for what residents in the area of Homestead might consume, and extrapolated that they might eat all of those meals from fish caught in the canals, as opposed to store-bought fish.

Estimated exposure doses for ingestion are also highly dependent on what people actually eat. People have been seen fishing along the Outfall Canal; how much fishing is done recreationally and how much fish caught in the canals is ingested is not known. This analysis indicates that the infrequent ingestion of fish from the canal system (for instance, one or two fish meals per month) is not likely to be associated with either cancer on noncancer effects. However, there is a possibility that ingestion of fish from the canals at a subsistence level (eating 14 fish meals per month) may be associated with health effects. It is unknown if subsistence fishing in the canals occurs or whether the Boundary and Outfall Canals are even capable of providing enough fish to make subsistence fishing possible.

ATSDR analyzed contaminant concentrations in fish fillets based on the assumption that people usually eat the fillet section of the fish. It should be noted, however, that the skin, fatty tissues, and organs of fish accumulate PCBs and pesticides more readily than the fillet section. Whole body fish samples from the canals contained greater concentrations of PCBs and pesticides than the fillet samples. Therefore, people who consume other parts of the fish, in addition to the fillet section, will be exposed to higher quantities of contaminants. It should also be noted that all of the fish samples used for this analysis were taken from largemouth bass. No bottom feeding fish, such as catfish, were sampled. Bottom feeding fish tend to accumulate contaminants such as PCBs and pesticides more readily than predator fish such as largemouth bass. Therefore, ingesting catfish or a similar type fish from the canal system may also expose individuals to higher quantities of contaminants.

REFERENCES

EPA. *See* U.S. Environmental Protection Agency.

Feldman, R.J. and H.I. Maibach. 1975. Percutaneous penetration of some pesticides and herbicides in man. Toxicol. Appl. Pharmacol. 28:126-132.

Kissel, J., Richter, K., Duff, R. et al. 1995. Dermal soil exposure: Investigation of soil contact and skin coverage. Office of Health and Environmental Assessment. (Review Draft). June 1995.

Nisbet, I.C., and P.K. LaGoy. 1992. Toxic equivalency factors (TEFs) for polycyclic aromatic hydrocarbons (PAHs). Regul. Toxicol. Pharm. 16:290-300.

Pao, E.M., Fleming, K.H., Guether, P.M., and Mickie, S.J. 1982. Food commonly eaten by individuals: Amounts per day and per eating occasion. U.S. Department of Agriculture.

Portier, Kenneth M., Um, Yonghwan, Degner, Robert L., Mack, Stephanie K., and Adams, Charles M. 1995. Statistical analysis of Florida per capita fish and shellfish consumption data. University of Florida, Institute of Food and Agricultural Sciences. Florida Agricultural Market Research Center Industry Report 95-1. December 1995.

Ryan, E., E. Hawkins, et al. 1987 Assessing risk from dermal exposure at hazardous waste sites. In: Superfund '87 Proceedings of the Eighth National Conference. Bennet, G. and J. Bennet, eds. November 16-18, 1987. Washington, D.C. The Hazardous Material Control Research Institute.

U.S. Environmental Protection Agency. 1989. Exposure Factors Handbook. EPA/600/8-89/043.

U.S. Environmental Protection Agency. 1992. Dermal Exposure Assessment: Principles and Applications. Interim Report. Office of Research and Development. EPA/600/8-91/001B.

U.S. Environmental Protection Agency. 1993. EPA, Office of Research and Development, Washington, DC. Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons. EPA/600/R-93/089.

West R., R. Maibach, et al. 1993. In vivo and in vitro percutaneous absorption and skin decontamination of arsenic from water and soil. Fundamental and Applied Toxicology.20:336-340.

APPENDIX D: Responses to Public Comments

The Homestead Air Force Base Public Health Assessment was released for public comment on July 6, 1998. The comment period ended on August 16, 1998.

1. **Comment:** Fish Pathway: Based on the surface water and sediment results (Page 12 and Table 1, Page 31), it appears that if the Boundary and Outfall Canals contributed to the current fish PCB and pesticide contamination, the levels of PCBs and pesticides should decrease in the future.

   Response: Because levels of PCBs and pesticides in surface water and sediment are relatively low, it is possible levels of PCBs and pesticides in fish that are attributable to the Boundary and Outfall Canals may decrease in the future. See also Comment 3 below.

2. **Comment:** Will ATSDR consider adding some statements that the Air Force not only conducted an investigation of the fish in the Boundary Canal and Outfall Canal, but sampled a canal off the installation unaffected by Air Force activities (Mowry Canal)? The point of this addition is that organic contamination in fish in South Florida is a regional issue. Please see the following table:

Range of Contaminants from OU-9 Boundary Canal Remedial Investigation (ug/kg) in Fish Tissue

Contaminant	Outfall Canal		Mowry Canal (unaffected by Homestead AFB)	
	Fillet	Residual	Fillet	Residual
PCB (Aroclor 1260)	19-130	ND-250	ND	51-130
DDD	ND-12	ND-15	ND-26	15-310
DDE	24-180	19-400	58-170	340-7,795
DDT	ND-2.9	ND-7.2	ND-17.1	ND-19.5

The above table shows that organic contamination is prevalent in the region and that any fish advisories recommended by ATSDR or other health officials need to be put into context. For example, DDE contamination in fish tissue in Mowry Canal was an order of magnitude higher than in the Outfall Canal. The risk to subsistence level fishermen from eating fish from Outfall Canal may be overshadowed by the risk fishermen face from other canals. To the best of our knowledge, the Air Force remedial investigation of OU-9 is the only study of organics in fish tissue in South Florida. There have been other studies which address mercury contamination in fish tissue in the area.

Response: ATSDR noted in the discussion of *Fish* under **Concern: Boundary and Outfall Canals** that pesticide contamination in the Outfall Canal "may be due to agricultural processes, as opposed to activities at Homestead AFB." Text was added to note that background samples taken in Mowry Canal during the remedial investigation also contained elevated levels of pesticides and PCBs.

3. **Comment:** Page 12-15. These sections discuss surface, sediment, and fish sampling that occurred in the boundary canals. The fish sampling results, when evaluated for the unlikely subsistence scenario, indicated that PCBs and arsenic were the risk drivers followed by pesticides.

   Since surface and sediment sampling results are likely to predict future chemical concentrations in fish, these results should be discussed further. Surface and sediment samples were collected and analyzed for various contaminants including PCBs, arsenic, and pesticides.

   No surface water pesticide sampling results exceeded their conservative drinking water screening values. In addition, the sediment samples analyzed for pesticides resulted in non-detects. This suggests that future generations of fish will not be contaminated by pesticides from the boundary canals.

   Sediment sampling results for arsenic were slightly above the comparison values for human incidental ingestion exposures (Table 1, Page 31) at 3.6 ppm to 7.5 ppm. The arsenic analyses from surface water sampling also indicated that arsenic was above incidental ingestion for this route at 0.8 ppb to 1.6 ppb.

   PCBs were either not detected in the surface water samples and/or above the comparison values for drinking water (Page 12 Para 2). Sediment sampling PCB results were reported to be slightly above ATSDR's human health comparison values based on Boundary and Outfall Canals RI results (Page 12 Para 3), but were not mentioned in Table 1, Page 31, Evaluation of Potential Public Health Hazards (Supplemental Investigation, 1996).

   Response: In both the remedial investigation and the supplemental investigation, surface water sampling for the Boundary and Outfall Canals did not detect any PCBs; pesticides were detected below comparison values. Sediment sampling detected PCBs (Aroclor-1260) above the comparison values once in the remedial investigation; no PCBs were detected in the supplemental investigation. Sediment sampling detected pesticides below comparison values in both the remedial investigation and the supplemental investigation. ATSDR made changes to the text and tables in order to clarify this information.

   ATSDR did not evaluate past levels of PCBs and pesticides in surface water and sediment. Because levels of PCBs and pesticides in surface water and sediment are relatively low,

however, levels of PCBs and pesticides in fish that are attributable to the Boundary and Outfall Canals may decrease in the future.

4. **Comment:** Does subsistence fishing occur in the canals? We suggest that an objective study be conducted of anglers and fish consumption practices at the canals at Homestead AFB to ascertain whether any fish consumers were experiencing unacceptable risk.

   Response: It is unknown whether subsistence fishing occurs in the canals or even if the fish population is substantial enough to support subsistence fishing. It is beyond the scope of this report to perform the kind of study needed to determine the answer to this question. ATSDR spoke with various groups about the possibility of subsistence fishing in canals. Some groups thought the canals were too isolated and did not contain enough fish to support subsistence fishing, while others thought the local residents would subsistence fish from the canals. Therefore, in order to be conservative in our approach to this public health assessment, ATSDR evaluated exposure dose estimates for subsistence fishing in the canals. No adverse health effects are expected from occasional ingestion of contaminants in fish. It is possible (though unlikely), however, that the ingestion of large quantities of fish may be associated with adverse health effects.

5. **Comment:** We suggest that the rewritten version of the Exposure Factors Handbook (EPA/600/P95/002Fb) be used in lieu of the 1989 version.

   Response: ATSDR revised the analysis and used an estimate for fish consumption from the 1998 Final Exposure Factors Handbook. The reader is referred to Appendix C.

6. **Comment:** We suggest that a Florida fish consumption survey be used rather than a national study, Statistical Analysis of Florida Per Capita Fish and Shellfish Consumption Data, Florida Agricultural Market Research Center Industry Report 95-1 prepared by the University of Florida Institute of Food and Agricultural Sciences.

   Response: ATSDR revised the analysis and used an estimate for fish consumption from the above-referenced document. This estimate was used in addition to the estimate referred to in Comment 5. The reader is referred to Appendix C.