PUBLIC HEALTH ASSESSMENT

GENTILE AIR FORCE STATION
(a/k/a US DOD DEFENSE ELECTRONICS SUPPLY CENTER)

KETTERING, MONTGOMERY COUNTY, OHIO

EPA FACILITY ID: OH3971524357

Prepared by:

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

Final Release

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Defense Electronics Supply Center/Gentile Air Force Station
Kettering, Ohio

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

Foreword

The Agency for Toxic Substances and Disease Registry, ATSDR, is an agency of the U.S. Public Health Service. It was established by Congress in 1980 under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), also known as the Superfund law. This law set up a fund to identify and clean up our country's hazardous waste areas. The U.S. Environmental Protection Agency (EPA) and the individual states regulate the investigation and clean up of the areas.

Since 1986, ATSDR has been required by law to conduct a public health assessment at each of the areas 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. (The legal definition of a health assessment is included on the inside front cover.) 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 an area, where it is, and how people might come into contact with it. Generally, ATSDR does not collect its own environmental sampling data. Instead, it 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 then evaluate whether or not there will be any harmful effects from these exposures. The report focuses on public health, or the health impact on the community as a whole, rather than on individual risks. Again, ATSDR generally makes use of existing scientific information, which can include the results of medical, toxicologic, and epidemiologic studies and the data collected in disease registries. The science of environmental health is still developing, and occasionally scientific information on the health effects of certain substances is not available. When this is so, the report will suggest what further research studies are needed.

Conclusions: The report presents conclusions about the level of health threat, if any, posed by an area. In its public health action plan, the report recommends ways to stop or reduce exposure. 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 to warn 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.

Interactive Process: The health assessment is an interactive process. ATSDR solicits and evaluates information from numerous city, state, and federal agencies, the companies responsible for cleaning up the area, and the community. ATSDR then shares its conclusions with them. Agencies are asked to respond to an early version of the report to make sure that the data they provide is accurate and current. When informed of ATSDR's conclusions and recommendations, the agencies sometimes will begin to act on them before the final release of the report.

Community: ATSDR also needs to learn what people in the area know about the area 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 an area, 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 comment. 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, NE (MS E-32), Atlanta, GA 30333.

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List of Abbreviations

AFRPA	Air Force Real Property Agency
AFS	Air Force Station
AST	above ground storage tank
ATSDR	Agency for Toxic Substances and Disease Registry
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COPD	chronic obstructive pulmonary disease
CREG	ATSDR's cancer risk evaluation guide
CRP	community response plan
CVs	comparison value
DCE	dichloroethylene
DESC	Defense Electronics Supply Center
DLA	Defense Logistics Agency
DSMOA	Defense-State Memorandum of Agreement
EMEG	ATSDR's environmental media evaluation guide
EPA	U.S. Environmental Protection Agency
FFA	Federal Facilities Agreement
FS	feasibility study
g	gram
IRP	installation restoration program
MCL	EPA's maximum contaminant level
NFA	no further action
NPL	EPA's National Priorities List
ODH	Ohio Department of Health
o/w	oil/water
PAHs	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
PCE	tetrachloroethylene
PHA	public health assessment
PHAP	Public Health Action Plan
ppb	parts per billion
ppm	parts per million

List of Abbreviations (continued)

RI	remedial investigation
RMEG	ATSDR's reference dose media evaluation guide
ROD	record of decision
SVOCs	semi-volatile organic compounds
TCE	trichloroethylene
USAF	U.S. Air Force
USTs	underground storage tanks VOCs
	volatile organic compounds
WPAFB	Wright-Patterson Air Force Base

I. Summary

Following a request from the Air Force Real Property Agency (AFRPA), the Agency for Toxic Substances and Disease Registry (ATSDR) conducted a public health assessment (PHA) for the Gentile Air Force Station (Gentile AFS). As a part of the PHA process ATSDR reviewed environmental information describing the investigations, sampling results and remediation actions performed at Gentile AFS and scientific literature describing how chemicals used and disposed at Gentile AFS act in the environment. ATSDR also attended an Open House on January 29, 2004, sponsored by the Air Force. The purpose of the open house was to provide the local community with information about the environmental clean up activities performed at Gentile AFS. ATSDR used this opportunity to meet with residents and gather information about the situations where residents may come into contact with Gentile AFS-related chemicals. ATSDR used the environmental information and community exposure concerns to identify potential exposure situations and evaluate if residents could be exposed to contaminants at levels that could affect their health. This report describes our review and evaluation.

In general, many sites on Gentile AFS do have detectable levels of contaminants in the soil, sediments or groundwater. However, there are no public health hazards associated with these sites. The concentrations of the contaminants are below levels known to make people sick. Or people are not exposed to these contaminants long enough or often enough to become sick.

Drinking Water
The homes neighboring Gentile AFS are connected to the municipal water system. This water is unaffected by Gentile AFS-related chemicals and consistently meets or exceeds federal drinking water standards. Anecdotal information suggests that some residents in the neighboring community still use private groundwater wells. Water obtained from local private wells is also unaffected by Gentile AFS-related chemicals.

Little Beaver Creek's Surface Water and Sediment.
Anecdotal information indicates that, in the past, many residents, or their children, played in the creek. While some chemicals were detected in the creek's surface water or sediment, adults and children who played in the creek would not be expected to develop any health problems.

Some contaminants were still detected in sections of the creek bed even after large amounts of contaminated creek sediments were removed. Results of this evaluation indicate that adults and children who play in the creek would not be expected to develop any health problems.

Several residents described how their yards or homes flood during periods of heavy rain when the creek overflows its banks. ATSDR reviewed available information about surface water and sediment transport. Results indicate that neighboring homes and yards would not be affected by Gentile AFS-related contaminants during a flood

Gardening

Anecdotal information indicates that in the past employees were allowed to plant vegetable gardens in the southeastern section of Parcel E. Some citizens were concerned if contaminants in the soil could have been present in, or on, their vegetables and if eating those vegetables could harm their health. Results of this evaluation indicate that gardeners, garden produce consumers, and people who both worked in the garden and ate the produce would not be expected to have any health effects.

II. Introduction

In December 2003, the Agency for Toxic Substances and Disease Registry (ATSDR) was asked by the Air Force Real Property Agency (AFRPA) to review the available information describing the environmental contamination at the Gentile Air Force Station (Gentile AFS) and participate in the Open House sponsored by the U.S. Air Force (USAF) on January 29, 2004. The purpose was to identify and evaluate potential exposure pathways that could cause local residents to contact chemicals used or disposed at Gentile at levels known to cause health effects. This evaluation was conducted to address the concerns voiced by some of the residents in the communities adjacent to Gentile AFS. These residents were concerned that they may have been exposed to Gentile AFS-related chemicals at levels that could cause health problems.

During the Open House, community residents had the opportunity to review summaries of the environmental investigation and remediation work sponsored by the USAF. In addition, public health representatives from the Montgomery County Combined Health District, Ohio Department of Health (ODH), and ATSDR were available to discuss the residents' public health concerns associated with Gentile AFS. In addition to answering questions, ATSDR used this opportunity to identify how neighboring residents may have come into contact with chemicals used or disposed at Gentile AFS.

ATSDR reviewed the available environmental data for Gentile AFS, met with residents to understand their exposure concerns, toured the base, and met with representatives of the Air Force, U.S. Environmental Protection Agency (EPA), Ohio Environmental Protection Agency (Ohio EPA), and City of Kettering. *ATSDR's goal was to identify how local residents would come into contact with Gentile AFS-related chemicals and evaluate if that contact would be expected to cause health problems.* The results of our review and evaluation are presented in this public health assessment (PHA).

III. Background

A. Site Description and Operational History

Gentile Air Force Station (Gentile AFS) is located within the City of Kettering, Montgomery County, Ohio, about 4.5 miles southeast from the center of the City of Dayton (Figure 1). The northern portion of the property was developed with large warehouse buildings, a heating plant, maintenance shops, and other support buildings. Land in the southern portion of the property is largely undeveloped, but contained recreational facilities, including baseball fields, tennis and basketball courts, and a small arms range. Some outdoor storage areas and disposal sites were also located in this area. The Gentile AFS property is completely contained within the City of Kettering and surrounded on the western, southern, and eastern sides by residential housing. Land use to the north and northeast is a mixture of commercial/warehousing and residential uses (URS Greiner 1997a; Gentile AFS 2004).

The air station was established in 1944 as the Army's Dayton Signal Corps Supply Agency. At the time, the installation encompassed about 120 acres on partially wooded farmland and the former Johnson Airplane and Supply Company. The original facility included four large warehouses and numerous administrative and support facilities, such as a cafeteria, a base exchange, and a coal-fired heating plant (Earth Tech 1994). The initial mission of the installation was to procure, store, issue, and salvage airborne radio and meteorological equipment and supplies for the U.S. Army and USAF (Earth Tech 1994). In 1951, the air station acquired an additional 49 acres in the eastern portion of the installation and was renamed the Gentile AFS. Additional warehouse and administrative facilities were built as necessary to support the mission (Table 1).

In 1962, the Defense Electronics Supply Center (DESC) was established at Gentile AFS (EBS 1994). DESC operations and support activities were the primary functions of Gentile AFS to the extent that the property is locally known as "DESC." The installation was viewed as the "clearinghouse for all electronics" that the U.S. military used (Ohio EPA 2004). The overall mission did not changed much since the installation's inception, DESC's *primary role* was to "provide effective and reliable electronic spare parts support to all of the U.S. military services and federal civil agencies at the most reasonable cost to the public." In this role, DESC standardized electronic parts and encouraged their use in new designs. Among the items they managed were resistors, connectors, transformers, antennas, crystals, fiber optics, microcircuits, switches, communications equipment and fire control system components, intercoms, audio and video equipment, and a variety of automatic data processing items. In its *support* capacity, DESC served to "manage, control, maintain, and operate assigned facilities; negotiate and implement interservice/interagency support agreements for support services and operating supplies; and perform maintenance and repair of the operating equipment." Because DESC was the major activity at Gentile AFS, the installation was often referred to as "DESC" or "Gentile AFS."

ATSDR uses "Gentile AFS" throughout this document to represent the entire installation and all of its activities.

Gentile AFS was listed for closure in 1993 as a result of the Defense Base Realignment and Closure (BRAC) Act of 1990. The site was officially closed in December 1996, and DESC was relocated to the Defense Supply Centers in Columbus, Ohio (Gentile AFS 2004). At the time of closure, Gentile AFS contained four main buildings and 70 small buildings along with 55 acres of "green space."

B. Remedial and Regulatory History

Past operations at Gentile AFS have resulted in accidental releases or spills of hazardous materials on base (Table 2). The primary source areas where spills or releases occurred are the aboveground and underground storage tanks used for diesel, gasoline, and waste oil; service station and pipelines; oil/water separators used to separate paint or vehicle maintenance waste from water; a silver recovery system for a photographic laboratory; wash racks where equipment was cleaned; pesticide use and storage areas; and the small arms firing and skeet range. Some contaminated wastes were disposed of on base in landfills. Other wastes were poured over the coal storage pile along the western boundary of the base west of the former heating plant, Building 17 (Table 3). These wastes came primarily from cleaning and maintenance operations and included waste oils, paint thinners, and solvents from cleaning operations. The majority of the waste generated before 1978 was disposed of in this manner (URS Greiner 1996, 1997b). Figure 2 shows the locations of the sites.

Contaminants released to the ground surface in certain areas leached through the soil and into the underlying groundwater. Groundwater monitoring results indicate the extent of each plume has been decreasing over time. The USAF identified three main areas of groundwater contamination at Gentile AFS. The discussion below describes each plume and Figure 3 shows the current extent of each plume.

. ***Western VOC plume***. The western plume is located near Layfayette Street along the western boundary of the base (Parcel B). During the remedial investigations, the VOCs tetrachloroethylene (PCE) and trichloroethylene (TCE) were detected at concentrations just above ATSDR's comparison values (CVs) for drinking water. These VOCs are solvents that were likely used in degreasing and cleaning equipment. Carbon tetrachloride, 1,1,1-trichloroethane, and chlorobenzene were also detected, but at lower concentrations (typically within ATSDR's CVs for drinking water). Potential contributors to this plume are waste materials disposed of at the coal storage pile (Site S1) and chemicals used at the Pesticide Storage Area (Site S3). More recent groundwater sampling conducted in November 2003 primarily detected TCE at concentrations still slightly above the EPA drinking water standard.

- ***Southern VOC plume***. This plume likely formed from contaminants migrating from Sites D1 and C7 (Parcel E). These sites were used for disposal of hazardous materials during the 1950s. Contaminants discovered in the plume are the solvent trichloroethylene (TCE) and its degradation products, and minor amounts of petroleum constituents. During the November 2003 sampling, vinyl chloride and *cis*-1,2-DCE were detected in this plume at levels above ATSDR's CVs for drinking water. TCE associated with the plume, however, was detected well below ATSDR's CV for drinking water.

- ***Site R2 plume***. This plume extends from an area near an infiltration pit that is located at Site R2, east of building 84 (Parcel A). The primary contaminant is the VOC *cis*-1,2-dichloroethylene (DCE). Concentrations have decreased over time.

Figure 3 shows the current boundary of each plume as determined by groundwater monitoring data gathered in November 2003. The plume boundaries shown on the map illustrate the amount of area estimated to contain groundwater with contaminant concentrations above federal drinking water standards. The groundwater flow directions vary significantly for different areas of the base. In the vicinity of the western plume, the groundwater flow direction is predominantly southwest. Near the southern plume it is predominantly towards the east. In both locations the groundwater flow direction is towards the base boundary; however neither plume is migrating off-base. The actual amount of the plume migration from the contaminant source area causing the plume will depend on the flow rate of the groundwater, the amount of chemical that is leaching into the groundwater from the source in the overlying soil, and the chemical degradation that is occurring within the plume. At Gentile AFS the groundwater flow rates are very low, the contaminant sources of the plumes have been removed, and chemical degradation is occurring within the plume. As a result the plumes are not migrating off-base; in fact the groundwater monitoring data indicates the size of each plume is getting smaller.

In addition to entering the groundwater, some contaminants which were on the surface of the ground or materials stored outdoors could have been washed away during periods of rainfall into the storm drains or neighboring ditches, eventually reaching the West Branch of Little Beaver Creek. The creek flows to the east through the southern portion of the site. The upgradient portion of the creek, west of the base, is a storm water drainage system that primarily drains roads and parking lots in the residential and commercial areas west of the base. Currently within the Gentile AFS property, the creek primarily receives storm water runoff released into one of three storm water ditches. The western storm water ditch no longer exists, but it used to drain the former coal storage (Site S1) and the pesticide storage areas (Site S3), among other areas. The middle and eastern ditches still exist and carry storm water from the southern and northern portions of the base, respectively.

To ensure that contamination is cleaned from the site, the Department of Defense implemented the Installation Restoration Program (IRP) at Gentile AFS. This program is designed to identify potentially contaminated sites, conduct the necessary environmental investigations, and perform the necessary remedial actions. Under the IRP, the USAF began a preliminary assessment

records search in November 1982 to identify and evaluate the history of material use and disposal at the installation. This initial records search identified six sites where chemicals may have spilled, leaked, or were stored or disposed of: Disposal Area No. 1 (Site Dl), two Low-Level Radioactive Waste Disposal Sites (Sites D4 and D5, formerly known as Sites RD1 and RD2), the Hydrofluoric Acid Neutralization and Settling Basin (Site Tl), and two Coal Storage Areas (S1 and S2).

The USAF established the **IRP** to identify, characterize, and remediate contamination. The program is designed to evaluate past disposal sites, control the migration of contaminants, and control potential hazards to human health and the environment. Gentile AFS has participated in this program since 1982.

Gentile AFS was closed in 1996, and the USAF accepted the City of Kettering's application to acquire the property. As part of the transfer process, the property was required to undergo rigorous investigations to determine if potentially contaminated areas were safe for reuse. A cleanup plan was developed that outlines a "comprehensive strategy for implementing response actions necessary to protect human health…." This strategy combines efforts performed under the IRP with those of other compliance programs to ensure full restoration of the land (URS Greiner 1997a). Oversight of the investigation, evaluation and remediation of Gentile AFS was provided by the EPA and the Ohio EPA.

Following the records search, Gentile AFS conducted a Phase I remedial investigation (RI) in 1994 and 1995 to identify the nature and extent of contamination at the installation. As soil and groundwater samples were collected and analyzed, Gentile AFS determined that some of the sites required further investigation and in early 1997 made recommendations for Phase II field investigations. Due to the low levels of environmental contamination, EPA has not proposed Gentile AFS for listing on the NPL[1]. The Ohio EPA has been the primary regulatory agency responsible for the completion of the environmental investigation and remediation activities for Gentile AFS. The Ohio EPA provides technical support to ensure compliance with all state environmental protection laws, regulations, and policies. EPA also provides technical support and oversight to ensure that the investigation and remediation activities are protective of public health and the environment (Table 4).

Since the IRP began at Gentile AFS, site investigations have identified 40 sites as being contaminated or having the potential to be contaminated. EPA and the Ohio EPA approved 35 of those sites for no further action because there was no evidence of contamination, or the initial removal and cleanup actions at the sources (such as a storage area, oil/water separators, a tank, drain lines) were enough to prevent any impact to the environment. The remaining five sites required additional measures.

These sites included Site C1 (the creek); Site D1 (disposal area no. 1); Site R2 (the floor drain to infiltration pit); Site S1 (source of the Western Plume); and the Commander's Yard (URS Greiner 1997b). Currently, remedial actions have been completed at all sites and they are

[1] The National Priorities List (NPL) is part of EPA's Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly known as "Superfund".

ready for transfer. As a condition of transfer, the USAF will continue long-term groundwater monitoring (LTM) at Sites R2, S1, and D1 (as well as C7) until contaminant concentrations meet EPA's drinking water standards, and maintain warning signs along the creek (Site C1) (Ohio EPA 2004b). Figure 2 shows the locations of all IRP sites at Gentile AFS.

As part of the cleanup efforts to ready the property for transfer, the USAF has:

- Excavated contaminated soil from several areas, including Site S3 (Pesticide Storage area) in Parcel B and Sites D1 (Disposal Area) and C7 (Old Salvage Yard) in Parcel E.
- Dredged the entire on-base section of the creek at Gentile AFS (Site C1).
- Removed contaminated equipment, such as the oil/water separators at O1, O2, and O3.
- Installed groundwater monitoring wells to ensure that the groundwater plumes were not migrating off base.

In addition, the USAF identified 14 underground storage tanks (USTs) and 20 above-ground storage tanks (ASTs). The USTs were removed in 1995 and the surrounding soil was tested and removed if necessary (URS Greiner 1997b). All of the ASTs were removed by 1997.

The Air Force sub-divided Gentile AFS property into Parcels A through F. Parcels A, B, C, D, and F north of the creek were transferred to the city, and is now the home of the Kettering Business Park. This land was remediated and is appropriate for commercial and industrial use. Another 26 acres in the southern portion of the base (Parcel E), south of the creek, have been cleaned and will be transferred to the city for redevelopment as a neighborhood park and residential area.

Parcel	Date of Transfer	Condition of Transfer	Current/ Future Use
A	May 1997	LTM and groundwater use restrictions	Commercial/ Industrial
B	2001	Same as Parcel A	Commercial/ Industrial
C	1997		Commercial/ Industrial
D	1998		Commercial/ Industrial
E	Pending	Signs posted at the creek	Recreation/ Residential
F	1998	Same as Parcel A	Commercial/ Industrial

The USAF continues to monitor groundwater at four sites: R2 (Parcel A), S1 (Parcel B), and C7 and D1 (Parcel E). Groundwater use restrictions are in place for these sites (Ohio EPA 2004b). These restrictions prevent the owners from legally drilling wells to use the groundwater. These restrictions will not adversely affect the future owners because all businesses and residential buildings are required by existing local regulations to be connected to the municipal water supply.

C. Quality Assurance and Quality Control

In preparing this PHA, ATSDR reviewed and evaluated information provided in the referenced documents. EPA and Ohio EPA set the standards the USAF followed for all sample gathering, analysis and reporting activities. Documents prepared to describe the environmental investigation, evaluation and remediation activities must meet these standards. The environmental data presented in this PHA come from USAF and OEPA prepared documents. ATSDR has determined that the data's quality is adequate for making public health decisions.

IV. Potential Exposure Pathways

A. Overview of the Exposure Evaluation Process

Identifying Exposure

ATSDR's evaluation is designed to identify if community members could come into contact with Gentile AFS-related chemicals at levels that could cause health problems. The evaluation is driven by the exposure (or contact) the community has with the chemicals. People who work or live in area of an environmental release can only be exposed to a contaminant if they come in contact with it. Exposure might occur by breathing, eating, or drinking a substance containing the contaminant or by skin contact with a substance containing the contaminant. Therefore, *a release does not always result in exposure*.

ATSDR evaluates site conditions to evaluate if people could have been, are, or could be exposed to site-related contaminants. When evaluating exposure pathways, ATSDR evaluates if people could be exposed to contaminated media (soil, water, air, waste, or biota) by ingestion, dermal (skin) contact, or inhalation. ATSDR identifies an exposure pathway as *completed* or *potential*, or *eliminates the pathway from further evaluation*. Completed exposure pathways exist if all elements of a human exposure are present. (See "Exposure Pathway" in Appendix A for a description of the elements of a completed exposure pathway.) A potential pathway is one that ATSDR cannot rule out, because one or more of the pathway elements cannot be definitely proved or disproved. A pathway is eliminated if one or more of the elements are definitely absent.

More information about the ATSDR evaluation process can be found in ATSDR's Public Health Assessment Guidance Manual at http://www.atsdr.cdc.gov/HAC/HAGM/ or by contacting ATSDR at 1-888-42ATSDR.

Exposure and Health Effects

People who have a significant exposure to chemical contaminants disposed of or released into the environment may develop adverse health effects. The type and severity of health effects that occur in an individual from contact with a contaminant depend on the exposure concentration (how much), the frequency and duration of exposure (how long), the route or pathway of exposure (breathing, eating, drinking, or skin contact), and the toxicology of the contaminant. Other characteristics such as age, sex, nutritional status, genetics, lifestyle, and health status of the exposed individual influence how the individual absorbs, distributes, metabolizes, and excretes the contaminant. Together, these factors and characteristics influence the health effects that might occur as a result of exposure to a contaminant in the environment.

ATSDR selects contaminants for further evaluation by comparing the concentration of each contaminant measured in the environment at Gentile AFS to its health-based comparison value

(CV). CVs are chemical specific. They are developed by ATSDR based on the available scientific literature that describes the potential for health effects following an exposure to the chemical. CVs are derived for each of the different environmental media (air, water, and soil) and reflect an estimated contaminant concentration that is *not expected* to cause adverse health effects for a given chemical, assuming a standard daily contact rate (e.g., amount of water or soil consumed or amount of air breathed) and body weight. In order to be conservative and protective of public health, ATSDR CVs are generally based on contaminant concentrations *many times lower than levels at which no effects were observed* in experimental animals or human epidemiologic studies. ATSDR's CVs are not used to predict the occurrence of adverse health effects, but serve as a protective screen and first step in evaluation of public health implications.

Some of the CVs used include ATSDR's environmental media evaluation guides (EMEGs), reference dose media evaluation guides (RMEGs), and cancer risk evaluation guides (CREGs). EMEGs, RMEGs, and CREGs are non-enforceable, health-based CVs developed by ATSDR for screening environmental contamination for further evaluation. In addition, ATSDR uses EPA's maximum contaminant levels (MCLs). MCLs are enforceable drinking water regulations developed to protect public health. (See Appendix B for a description of the CVs.)
If contaminant concentrations are above CVs, ATSDR further analyzes the exposure variables (for example, duration and frequency), the toxicology of the contaminant, other epidemiology studies, and the weight of evidence for possible health effects. Figure 4 provides an overview of ATSDR's exposure evaluation process.

B. Major Exposure Issues/Concerns for the Gentile AFS Community

ATSDR reviewed data for Gentile AFS's 40 IRP Sites to determine if they are associated with past, current, or future public health hazards. When evaluating these areas, ATSDR assessed the level of contamination present, the extent to which individuals come into contact with the contamination, and whether this contact would result in a public health hazard. Our review indicated that the sites at Gentile are not associated with any known public health hazards because: (1) site-related contaminants are not present, (2) contaminant concentrations detected are too low to pose a health hazard, or (3) the amount, type and frequency of the past and current exposures for the community are below levels known to cause health effects (Table 2).

ATSDR also used the site information to address specific exposure concerns identified by community members. The majority of exposure concerns brought to ATSDR's attention are related to the following topics:

- Possible exposure to contaminants in the drinking water.
- Possible exposure to contaminants in Little Beaver Creek's surface water and sediment.
- Possible exposure to contaminants in soil while gardening.

These exposure concerns are evaluated in detail in the following discussion and summarized in Table 5 of this PHA.

To acquaint the reader with terminology and methods used in this PHA, Appendix A provides a glossary of environmental and health terms presented in the discussion, and Appendix B describes the CVs ATSDR used in screening contaminants for further evaluation.

V. Public Health Evaluation of the Potential Exposure Pathways

A. Potential Exposure to Contaminants in Drinking Water Supplies

Municipal Water

Kettering residents began obtaining municipal drinking water in the 1960s, when their homes were connected to the Dayton Municipal Water Supply (URS Greiner 1996). Since 1986, Kettering residents have received their drinking from Dayton via Montgomery County. The county purchases its water from the City of Dayton, and distributes the drinking water to a 65-square-mile area that encompasses the communities of Kettering, Vandalia, Riverside, Trotwood, Brookville, the Dayton International Airport, and customers in Greene County.

The primary source of water for the Dayton Municipal Water Supply is groundwater from the Great Miami Buried Valley aquifer. This aquifer is made up of "interconnected buried valley and upland streams." Most of the groundwater is drawn from the buried valley, which is a large underground area of water-bearing sand and gravel deposits with a thin layer of soil cover (Montgomery County 1999, 2004; Ohio State 2004).

The City of Dayton operates two well fields. The Great Miami and the Mad River well fields span 6,280 acres and support about 100 production wells (City of Dayton 2004, EPA 2004). Groundwater in the well fields is not affected by Gentile AFS-related contaminants. The production wells are more than 8 miles north of the Gentile AFS property (URS Greiner 1996) and groundwater contaminant at Gentile AFS have not traveled beyond the base boundaries. In addition, the City of Dayton operates a network of about 160 monitoring wells that surround the production wells. These monitoring wells ensure that the contaminants, from any source, are identified before they reach the well field. The monitoring wells ensure that the municipal water supply is safe to drink. Furthermore, the water from the Great Miami Valley Buried Aquifer is pumped to the Miami and the Ottawa Water Treatment Plants, where it is treated before distribution to homes and businesses. The Dayton Water Department tests the water that enters and leaves the treatment plant regularly for approximately 100 contaminants regulated by the U.S. EPA (Montgomery County 2004). Drinking water supplied to Kettering residents has met the federal standards since 1993, the earliest date for which this information is available (Montgomery County 2004; City of Dayton 2004).

The City of Dayton has instituted several programs that help prevent groundwater, and therefore drinking water, contamination. For example, the department uses a zoning overlay that restricts the amount of chemicals and types of land development that may occur in the well field area. In addition, businesses within the well field are required to submit chemical inventories every 2 years. The water department then oversees any cleanup efforts at facilities in the well field area. Similar program are in place at the five other jurisdictions that are on top of the well field area:

Huber Heights, Riverside and Vandalia, Harrison Township, and Wright-Patterson Air Force Base (Montgomery County 2004).

The City of Oakwood draws its drinking water from three well fields located about 3,500 feet northwest of the air station (URS Grenier 1996). The well fields encompass eight wells that range in depth from 80 to 122 feet below ground surface. Like Dayton, the City of Oakwood has developed a wellhead protection plan for its eight wells. These wells are not impacted by contaminants from Gentile AFS because groundwater elevations at the air station indicate that groundwater does not flow toward the City of Oakwood well fields.

All of the well fields used to supply drinking water to the community surrounding Gentile AFS are not impacted by any of the chemicals used or disposed of at Gentile. *Community residents who are connected to the municipal drinking water system receive clean water that meets all state and federal standards for drinking water.*

Private Wells

It is expected that all residents are currently connected to the municipal water supply. Old records of applications for private sewage disposal systems show that some residences had private wells in the 1940s and 1950s. Anecdotal information suggests that some residents might still be connected to private groundwater wells to irrigate their lawn or garden or possibly for drinking water. The local health district, however, is not aware of any private wells currently in use in the residential community surrounding Gentle AFS, nor did ATSDR identify any sampling data for potential private wells. While it is not certain if neighboring residents have or use private groundwater wells, results of the environmental investigations and groundwater sampling indicate groundwater contaminants are not migrating off base or to the creek. *Private wells are not affected by Gentile AFS-related contaminants.*

B. Potential Exposure to Contaminants in Little Beaver Creek

Description of the West Branch of Little Beaver Creek

A portion of the West Branch of Little Beaver Creek flows east through the southern portion of Gentile AFS. The creek is about 1,650 feet long and, on average, about 15 feet wide. The water in the creek is primarily a combination of storm water runoff from Gentile AFS and other local commercial or residential areas. The upgradient portion of the creek, west of the base, receives storm water from roads, parking lots, and other impermeable surfaces of the residential and commercial areas. To the east of Gentile AFS, the creek exits the base through a culvert and empties into a residential neighborhood where it continues to receive storm water runoff from primarily roads and residential neighborhoods. On base, the creek forms the northern boundary of Parcel E and it primarily receives storm water runoff from roofs of buildings and parking lots collected in one of thre major ditches that empty into the creek. The

"Storm water runoff" is the term used to describe rainwater that either accumulates on the ground surface or travels over the ground surface (Dunn and Leopold 1978). Storm water from Gentile AFS discharges into the West Branch of Little Creek.

middle and eastern ditches carry storm water from the southern and northern portions of the base, respectively. The western ditch no longer exists, but used to drain the pesticide storage area and the coal storage area, among other areas on the western side of the base north of the creek (URS Greiner 1997b). The creek contains water year-round, but demonstrates relatively low flow except during and after storms. If the rain is heavy enough or lasts long enough, the water level of the creek will eventually rise above the creek banks. However, not all water in neighboring property that becomes flooded after these heavy rain events comes directly from the creek. The water in flooded yards and homes is a combination of water from different sources. These sources might include water that fell directly on the property, water that moved downhill from higher neighboring property, and water possibly from the creek.

Contaminants from Gentile AFS and the upgradient residential and commercial neighborhoods west of the base have entered the creek. Contaminants include metals, pesticides and polycyclic aromatic hydrocarbons (PAHs). Of greatest concern are the PAHs. Total PAHs in the creek sediment were highest near the former coal pile, where they reached 500 parts per million (ppm). The coal storage pile was located along the western boundary of the base west of the former heating plant (Building 17). Coal was initially stored on the ground, but by the 1980s the coal was stored on a concrete pad constructed over the original storage location. Prior to 1978, waste oils, paint thinners, and solvents from paint cleaning operations were poured on the coal pile. It is expected that some of the chemicals from the coal, waste oil, and solvents infiltrated into the soil or were washed away during periods of rainfall into the storm drains or neighboring ditch, eventually arriving in the West Branch of Little Beaver Creek. Prior to the base closing, the western ditch also known as the "coal pile drainage ditch" ran south from the coal pile toward the West Branch of Little Beaver Creek, along the east side of Lafayette Street. The ditch was removed in 1997 (URS Greiner 1996; Ohio EPA 2004a).

From January through March 2000, the USAF dredged sediment contaminated at levels above cleanup goals from the entire on-base section of the creek at Gentile AFS. The USAF removed sediment to different depths in different parts of the creek, reaching 6 feet in some locations. After excavation, the creek bed was re-sampled and then backfilled with clean silty soil provided by the Phillips borrow area in Xenia, Ohio. At the City of Kettering's request to achieve the normal creek flow condition, the creek was restored to a grade of -0.10%, or a difference in elevation of 1.57 feet between the western property boundary (921.27 feet) and the eastern property boundary (919.70 feet) (Jacobs Engineering 2000; URS Consultants 2002).

The post-excavation sampling that was performed before the clean fill was added over the creek bed revealed that although PAHs were still present in the creek sediments, the concentrations were greatly reduced (from an average concentration of 121 ppm to 21 ppm for total PAHs). Only one of the 16 sediment samples obtained prior to the addition of clean sediment had PAH concentrations above the regulatory cleanup goals. All of the other samples were within the cleanup goals. The sample with the high concentration of total PAHs was collected from the eastern drainage ditch, approximately 100 feet from a freshly paved parking lot (Jacobs Engineering 2000). This sample is believed to represent the effects of parking lot drainage, not

that of an uncontrolled spill or disposal site. The PAH concentrations remaining in the main section of the creek were believed to have been from ongoing asphalt parking lot runoff (including some parking lots added since Gentile AFS closed) and upstream sources of contaminants common to urban environments (Ohio EPA 2004b; URS Consultants 2002). Contamination attributable to USAF activities (i.e., the coal pile and other industrial activities) was considered removed. Additional sediment removal was deemed impracticable (URS Consultants 2002). However, there would be little exposure to the sediment that remained since the main section of the creek bed because it was covered with 1-6 feet of clean fill.

In the future, Parcel E will be developed as a recreational park and residences by the City of Kettering. The creek will essentially be the boundary between the recreational park and the Kettering Business Park. As a result of the one confirmatory sediment sample with the high concentration of total PAHs, the property could not be legally transferred from the USAF to the City of Kettering without provisions designed to limit public use of the creek. Therefore the USAF, City of Kettering, Ohio EPA and EPA agreed to use institutional controls, in this case signs posted along the creek, to discourage public access to the creek.

In conjunction with our evaluation of potential exposures to the creek, ATSDR considered the potential exposure of people who ignore the current signs and use the on-base portion of the creek for recreation.

Environmental Monitoring Data

Surface water and sediment samples were obtained from Little Beaver Creek within the Gentile AFS property boundaries. The results of those monitoring efforts are described in greater detail in this section and summarized in Tables 6, 7, 8, and 9. Potential public health hazards associated with surface water or sediment exposure are evaluated in the "Public Health Implications" section, which follows this section.

On-Base Surface Water Sampling Results

Surface water samples were obtained in 1977, 1991, and 1995. Table 6 summarizes the chemicals detected, along with their minimum, maximum, and average measured concentrations and the corresponding ATSDR CV. As the table indicates, five chemicals were detected at least once at concentrations above ATSDR's CV for drinking water.[1] To evaluate the possibility of health effects from drinking water with chemical concentrations above the CV, ATSDR considers how much water is ingested on a daily basis, how many days a year that water is ingested, how many years that water is ingested, and the range of concentrations measured for that chemical in the water.

[1] ATSDR does not have CVs for surface water. For comparison, ATDSR used its drinking water CVs when assessing surface water concentrations. The drinking water CVs are set very low and are designed to represent a chemical concentration that people could consume when drinking about 2 liters every day for 70 years without any concern about potential health effects. It is important to note that drinking water with chemical concentrations greater than the CV will not necessarily cause harm or illness.

The five chemicals detected in Little Beaver Creek surface water are common in the environment due to natural processes, commercial/industrial operations, or vehicle activity. Table 7 compares the average concentration of the chemical measured in at least one of the creek surface water samples at a concentration above the ATSDR drinking water CV to the concentrations that have been measured in other creeks and streams in the United States. The average concentration considers all of the samples taken during just the sampling events where one or more of the samples were detected above ATSDR's CVs. This means the average concentration reported in Table 7 for the Gentile AFS section of Little Beaver Creek is a little higher than would be reported if all of the samples were included in the calculation.

Table 7 illustrates that the chemical concentrations found in the surface water of Little Beaver Creek on Gentile AFS tended to vary over the sampling period. While each of the detected chemicals was found during one of the sampling events at concentrations higher than those normally found in U.S. surface waters, none were consistently found at concentrations above those normally found in creeks, streams, and rivers. In addition, none of the chemicals were consistently detected at concentrations above the ATSDR drinking water CV. The sampling data suggest that there are no chemicals that represent a long-term exposure concern for the creek's surface water.

On-Base Sediment Sampling Results

Sediment samples were obtained from the Gentile AFS section of Little Beaver Creek in 1991 and 1995. Table 8 summarizes the minimum, maximum, and average concentration for each chemical detected at least once at a concentration above ATSDR's CV for residential soil. As the table indicates, several metals and various PAH compounds were detected in the sediment at concentrations above ATSDR's residential soil CV for children.[2] The metals and PAHs detected in the sediment are commonly found in the urban environment because of natural, commercial, and industrial processes and vehicle activity.

Typically, the greatest concern for chemicals present in sediment is the possibility that children will ingest some of the chemicals along with the sediment when they play in the creek. If the concentrations of the chemicals in the sediment are low enough that there will be no health problems associated with incidental ingestion, the chemicals in the sediment will not cause health effects if they get on skin. ATSDR evaluates the possibility of health effects resulting from incidental ingestion for chemicals having concentrations above the CV by considering how much sediment would likely be ingested on a daily basis, how many days a year the sediment is ingested, how many years the sediment is ingested, and the range of concentrations measured for that chemical in the sediment.

[2] ATSDR does not have CVs for sediment. To assess public health issues for sediment, ATSDR uses CVs established for soil. ATDSR's CVs for soil represent chemical concentrations in soil that children could accidentally ingest every day without risk of developing health effects. Contact with, and incidental ingestion of, sediments with chemical concentrations greater than the CV will not necessarily cause illness.

The chemicals in Little Beaver Creek are common to the urban environment. For comparison, ATDSR reviewed the concentrations of these contaminants detected in other waterways. Table 9 presents the average concentration of the chemicals measured in at least one of the on-base creek samples at concentrations above the ATSDR residential soil CV, comparing those averages to the concentrations that have been measured in other U.S. creeks and streams.

Table 9 indicates that, although the concentration of the metals might be above ATSDR's residential soil CVs, they are within the average ranges measured in other creeks, streams, or rivers. Little information is available for individual PAHs. For the two PAHs for which some data are available, the concentrations measured in the Gentile AFS section of the creek are a little higher than those measured in other waterways. Most striking is that the average total PAH concentration for the Gentile AFS section of the creek is substantially higher than that reported for other downstream sections of Little Beaver Creek. This is likely due to the proximity of the coal pile drainage to the on-base section of the creek where the highest PAH concentrations were measured.

Figure 5 shows the creek sediment sampling locations and the total PAH concentrations. The figure shows that the highest PAH concentrations are located on the western side of Gentile AFS: in the western drainage ditch, the middle ditch, and the section of the creek that connects those two ditches. The middle drainage ditch drained a portion of the coal pile and the wash rack. Both are potential sources of PAHs. The lowest concentrations of PAHs in the sediment were in the eastern drainage ditch and near the creek's exit from the air station (URS Greiner 1997b).

PAHs tend not to dissolve in water; instead, they bind tightly to the organic carbon particulate matter associated with soil or sediment (ATSDR 1995). Sediments and the associated PAHs then migrate downstream. Sediment transport is a function of several factors, including the cross-sectional shape of the creek, the type of material that lies on the streambed, the particle size distribution of the sediment, and the velocity of the water in the creek. As Figure 5 shows, it is likely that in the past, the highest PAH concentrations were found in the Gentile AFS section of the creek. The average PAH concentrations downstream of Gentile AFS are expected to be less than the concentrations measured on base.

Figure 5 also shows the approximate sampling locations and total PAH concentrations measured in sediment taken from the storm water system at locations a short distance upstream from Gentile. This system is designed to move storm water from the commercial, industrial, and residential areas west of Gentile AFS into the Gentile AFS section of Little Beaver Creek. Prior to emptying into the creek, the storm water system exists as a large, rectangular concrete pipe. Due to the low slope, significant amounts of sediment accumulate in the pipe. Sampling results indicate that PAHs are present in the sediments that are brought onto Gentile AFS from the storm water system. While it is not possible to estimate the amount of PAHs that are brought onto Gentile AFS from the storm water system, it is likely that this system has been and will continue to be a source of PAHs to the air station (URS Greiner 1996).

Following the sediment removal action the creek bottom sediments were sampled again to identify if the contaminant concentrations in the remaining sediments were within the regulatory cleanup goals. The results indicate that contaminant levels were below the original goals for most of the creek. Only 1 of the 16 sediment samples obtained had PAH concentrations above the cleanup goals (Jacobs Engineering 2000). The sample with the high concentration of total PAHs was collected from the eastern drainage ditch, approximately 100 feet from a freshly paved parking lot (Jacobs Engineering 2000). This sample is believed to represent the effects of parking lot drainage, not those of an uncontrolled spill or disposal site.

The total PAH concentration in the eastern ditch sample was 286 ppm, while the total PAH concentration in the other 15 samples ranged between non-detectable and 15.3 ppm. PAHs are common contaminants in urban streams and creeks. The average concentrations of total PAHs in the sediment of other sections of Little Beaver Creek and the Great Miami River range between 6.88 and 36.7 ppm. This indicates that while the high PAH concentration in the eastern drainage ditch is above the levels commonly found in other sections of Little Beaver Creek and the Great Miami River, the average concentration and all of the concentrations measured at the other sampling locations are within the range of total PAH concentrations found in local urban streams.

Public Health Implications

Potential Health Effects from Playing in Little Beaver Creek before On-Base Creek Remediation
Several community members described how they or their children spent much of their free time playing in the creek. Anecdotal information indicates that most children played in the creek sections outside of Gentile, both downstream and upstream. (Prior to the completion of the storm water system, the stream extended through the neighborhood west of Gentile AFS.) ATSDR evaluated the potential health effects from playing in the creek on either side of Gentile AFS using the sampling data obtained from the on-base section of the creek. In this evaluation, ATSDR reviewed data for the Gentile AFS section of the creek that were collected prior to the creek's remediation between January and March 2000. These sampling results from the creek provide a conservative estimate of the potential past exposures.

Sampling data are not available prior to 1977 and no sampling data are available for the creek sections outside of Gentile AFS property. Anecdotal information indicates that the creek's water quality may have been periodically affected by chemicals disposed of through Gentile AFS's storm water system or directly into the creek or ditches. There are no sampling data for those time periods, but community members described seeing colored chemicals or smelling strong odors from the creek. One community member said Gentile AFS staff attributed at least one instance to accidental disposal of paint that made its way to the creek.

Because of the lack of historical data on the off-base sections of the creek, ATDSR cannot definitively evaluate the potential exposure children would experience while playing in the creek under all possible situations. However, the sampling data that are available suggest that the major

contaminant contributor to the creek was the coal pile. These data indicate that the concentrations were likely highest on Gentile AFS property near the coal pile. ATSDR evaluated the surface water and sediment sampling data described above to gain some understanding about whether the children who played regularly in the creek would be expected to develop health effects as a result of frequent exposure to the chemicals identified in the sampling events.

ATSDR assumed that children spent 190 days per year, a little over 6 months, at the creek. ATSDR also assumed that children spent the majority of that time (about 5 hours per day) actually in the creek, playing in the water and handling the sediment. ATSDR assumed that the children ingested small amounts of water and, to a lesser extent, sediment every day they played in the creek. However, ATSDR assumed that the children did not purposefully drink large amounts of water from the creek every day they played there. To ensure that hazards were not underestimated, ATSDR assumed that the children were exposed to the maximum concentration of contaminants detected in the on-base section of the creek within the Gentile AFS property, even though children were unlikely to have played there.
ATSDR estimated the potential exposure of children and adults to the chemicals detected in the creek surface water or sediment samples at concentrations above ATSDR's CVs based on the assumptions described above. *The results indicate that while some chemicals did exist in the surface water and sediment of Little Beaver Creek, adults and children who visited or played there in the past, would not be expected to develop any health problems due to those chemicals.*

The results of this evaluation are most applicable for the time period when the majority of the samples were taken (1990s). However, results from the surface water sampling performed in 1977 and knowledge about the material disposal history of Gentile AFS suggest that the evaluation would be relevant for the majority of the time that DESC operated at Gentile AFS and for the period during the base closure activities. As briefly discussed earlier, it is possible that some chemicals disposed on Gentile AFS, or upstream from Gentile AFS, were able to quickly make their way to the creek at concentrations higher than those represented by the sampling data. This evaluation would not be relevant for the time it took for the chemicals to be flushed downstream. However, the anecdotal information suggests that those conditions were periodic, not continuous. While brief and infrequent exposures to chemicals at higher concentrations would not be expected to cause health problems, it is not possible to provide a definitive evaluation for those specific time periods.

Because this evaluation used sampling data taken from the Gentile AFS property, this evaluation is most appropriate for people who played in the creek on the installation property. Adults and children who played in the creek upstream from and west of Gentile AFS would likely have had a lower, essentially nonexistent, exposure to Gentile AFS-related chemicals. This is because surface water and sediment contaminants migrate downstream; Gentile AFS-related contaminants would not have traveled upstream from the base past the western boundary. Therefore children and adults who played in the creek west of Gentile AFS were not exposed to Gentile AFS-related chemicals.

The downstream section of Little Beaver Creek is toward the east. People who played in the creek downstream from Gentile AFS are also expected to have had a lower exposure than that indicated in this evaluation because the contaminant concentrations are naturally reduced the further the stream travels from the contaminant source. The concentrations of Gentile AFS-related contaminants in the sections of the creek immediately to the east of the base would have been higher than those west of the base, but lower than the concentrations measured on base. Therefore children and adults who played in Little Beaver Creek east of Gentile AFS are not expected to have been exposed to Gentile AFS-related chemicals at levels that could cause health effects.

Potential Health Effects From Playing in the Creek After Creek Remediation
Creek remediation was essentially completed in March 2000. Contaminated sediments were removed from sections of the creek and eastern ditch, where previous sampling had identified high concentrations of primarily PAHs. Some of the removed sediment sections had concentrations of metals or pesticides above the remediation goals. Sediments were removed to a depth of 1 to 6 feet at each section (URS Consultants 2002). Post-excavation samples were taken from the creek bed after the overlying sediments had been removed. As mentioned above, clean silty soil from the Phillips borrow area in Xenia, Ohio, was added to the creek bed to create the creek bed slope necessary for proper drainage (Jacobs Engineering 2000).

ATSDR reviewed the post-excavation sampling results to evaluate if the chemical concentrations measured in the creek bed would be expected to cause health problems for people who come into frequent and direct contact with the Gentile AFS section of the creek. Sixteen samples were taken from the creek bed and two samples were taken from the eastern ditch bed. All of the samples were analyzed for metals, PAHs, pesticides, and other organic chemicals. Arsenic was found in all of the creek bed samples at concentrations above ATSDR's CVs; this is consistent with the high arsenic concentrations measured in the background soil on Gentile AFS and is likely influenced by natural sources (URS Consultants 2000). Some PAHs were also detected in some of the creek bed samples at concentrations above ATSDR's CVs. However, the maximum concentrations were significantly lower that those measured in the sediment prior to sediment removal. In addition, PAHs were only detected in a few places, not throughout the length of the creek. Relatively low concentrations of PAHs were detected near the western end of the creek and again near the eastern end of the creek. The highest PAH concentrations were measured in the eastern ditch, which runs next to an asphalt parking lot before emptying into the creek. This parking lot was repaved before the post-excavation sampling was completed. The available sampling data do not make it clear whether the PAHs measured in the creek bed are a result of runoff from the parking lot or are remnants of the original PAH contamination, however the parking lot is a likely source of the PAHs.

ATSDR evaluated the potential for the PAHs measured in the creek bed to impact the health of children or adults who might have frequent and direct contact with the creek during recreational activities. Because the main section of the creek bed was covered with 1-6 feet of clean fill, there would be no exposure to the remaining PAHs in the main creek bed. Because the eastern ditch

was not covered with fill, adults and children who play in the eastern ditch could be exposed to the PAHs remaining in that sediment.

ATSDR evaluated the potential exposure of adults and children to the PAHs measured in the eastern ditch following the procedure used for the previous creek evaluation. ATSDR assumed that children and adults would spend 190 days per year at the eastern ditch. ATSDR also assumed that the children and adults would actually be in the ditch handling the sediment and that they would ingest small amounts of the sediment during each visit to the ditch. In addition, ATSDR assumed that during each visit the children and adults would contact sediment with the maximum measured concentrations of PAHs.

The results of this evaluation indicate that even if children and adults have frequent and direct contact with the PAHs in the eastern ditch, *they would not be expected to develop any health problems due to the PAHs*. People who have regular contact with sediments in the creek, on or near Gentile AFS, are also not expected to develop health effects due to Gentile AFS-related chemicals.

The post-excavation sampling results clearly show that the sediment removal performed in the creek removed essentially all of the PAHs from the creek bed. The PAH concentrations measured in the creek bed near the western and eastern ends of the creek are within levels commonly measured in other urban creeks. These sampling results also clearly show that the highest PAH concentrations are located in the eastern ditch. ATSDR's evaluation indicates that people who use that ditch or the creek for recreational activities would not be expected to develop health concerns from Gentile-related chemicals. Contact with the chemicals measured in the creek bed does not represent a public health hazard.

Potential Health Effects from Local Flooding

On Gentile AFS the creek currently flows in a channel approximately 4 to 5 ft below the surrounding ground surface. Immediately east of Gentile AFS, the creek continues in a similarly sized channel. Some of the homes surrounding the creek, predominately east of the air station property, are in low-lying areas that are prone to flooding during periods of relatively heavy rains. Significant amounts of water can accumulate in the yards and lower levels of these homes. Figure 6 delineates the floodplain boundary.

Some residents questioned if the floodwaters could have exposed them to Gentile AFS-related chemicals at levels that could cause health problems. There are no sampling data from the residential areas to evaluate chemical concentrations in the soil or sediment that may have been deposited inside flooded homes. However, contaminant and sediment transport within creeks, streams, and rivers has been studied by many different researchers; several have addressed sediment deposition in floodplains during flood events. ATSDR combined this information with information about the potential contaminants in the sampling data from the creek and on-base sites near the floodplain boundary. The results of this evaluation indicate that the *sediment deposited in residential areas would not be expected to contain Gentile AFS-related chemicals at*

levels that would be detectable in soil sampling results or be expected to cause any type of health problem. The following paragraphs provide a brief summary of the evaluation.

ATSDR did not identify any sampling results that described the concentrations of Gentile AFS-related chemicals in the creek during periods of high creek flow. According to the available monitoring information, the most likely change is that heavy rains would be expected to deliver runoff from the coal pile (when it was present) and on-base parking lots and roads to the creek. These sources are consistent with those commonly identified for urban areas. Urban development has a noticeable effect on the water quality of storm water runoff. Chemicals commonly found in storm water include metals (e.g., copper, lead, zinc); gasoline additives; PAHs from vehicle traffic and roads; and pesticides used on commercial, industrial, and residential properties (Lee et al. 1998; USGS 1999). Frequently, the concentrations of these chemicals in the storm water exceed state and federal safe drinking water levels. This is a concern for many municipalities that obtain drinking water from surface water reservoirs. (Kettering residents receive groundwater unaffected by Gentile AFS or the creek.) ATSDR's review of the published literature did not identify any health problems associated with periodic exposure to chemicals that may be present in urban storm water.

In general, storm water runoff traveling in a creek or over the ground surface can pick up sediment from one area and deposit it further down its flow path. At any given location, the energy available in the moving water to transport sediment is a function of the slope of the creek bed or ground surface and the water velocity. Slow-moving water or water moving over a small slope will have less energy. This water will carry smaller amounts of sediment and smaller sediment particles than would be carried in a fast-moving, steeply sloped stream. In creeks, the slope of the creek bed is the most significant factor influencing the amount and type of sediment that can be transported by the water. Again, creeks with a low slope will transport significantly less sediment (White et al. 1992). Because the sections of Little Beaver Creek in and around Gentile AFS have a gentle slope, the surface water in the creek would not be expected to carry a significant amount of sediment under normal conditions or during periods of heavy rainfall.

In the area of Gentile AFS, sediment transport during rainstorms would be similar to that described for the storm water. Under most rainfall conditions, sediment would be delivered to the creek at the western boundary of the installation by the storm water systems. On Gentile AFS, sediment would be added to the creek with the storm water runoff from the coal pile (when it was present), and on base parking lots and roads. Under mild to heavy rainfall conditions, less than that required to cause flooding, sediment would be added to the creek by storm water runoff from residential yards and roads. In addition, the water moving into and through the creek would pick up sediment from the creek banks and bed along the entire flow path and redeposit it back to the creek bed further down the flow path.

During heavy rainfall conditions, the residential area near the creek and east of Gentile AFS may flood. These flood waters come from a variety of sources: rain that fell directly on a low spot of the surface, rain that fell on adjacent impermeable surfaces (roofs, roads, or water-soaked lawns),

rain that fell on impermeable surfaces located uphill from the flooded area, and possibly surface water from the creek if it is overflowing its banks.

The sediment that is deposited on yards and homes during a flood in the area is also expected to come from the same variety of sources. Typically, most of the sediment picked up from the creek bed by the water under flood conditions is redeposited back into the creek (Dunne et al. 1998). It is expected that the majority of the sediments deposited at a particular residence would have originated from neighboring areas, including roads, which are a common source of sediment in urban environments (Nelson and Booth 2002). The greatest contribution is likely to be from sources uphill from the residence.

Some of the sediments deposited in residential homes and yard could have originated from the creek bed or the environmental sites located on the air station. These sediments would be expected to be just a portion of the total amount of sediment deposited in the home or yard and would not be expected to cause any type of health problem. The chemical concentrations detected in the surface soil of the Gentile AFS sites indicate that if sediment from any of these sites were transported by floodwaters and re-deposited in a residential yard, there would be no measurable change in the soil characteristics and no exposure to chemicals that could cause health problems.

C. Potential Exposure to Contaminants While Gardening

Potential Exposure to Soil Contaminants in On-Base Gardens

A couple of community members explained that, in the past, employees were allowed to plant vegetable gardens in the southeastern section of Parcel E. This area was bordered by the creek to the north, the railroad tracks to the west and southwest, and the base boundary to the east. Within this area, eight sites were investigated and remediated as necessary. The community members were concerned about whether contaminants in the soil could have been present in, or on, their vegetables and if eating those vegetables could harm their health.

The exact location of these garden plots is not known. The southeast area of Parcel E where the plots reportedly were located contained sites C3, C5, C7, C8, D1, D3, D4, and S2. It is possible that the gardens were not on or near any of those sites. To be conservative, ATSDR reviewed the available documents describing the history and sampling data for the sites. The goal was to identify the contaminants that were detected at least once in the surface soil at a concentration above ATSDR's CVs. ATSDR then reviewed published information about each of the chemicals to identify:

- The concentrations that are commonly measured in urban soils.
- The concentrations that are commonly measured in fruits and vegetables, especially those grown in soils with similar chemical concentrations.

- The health effects associated with eating the chemical, especially in the concentrations that may have been present in, or on, the food.

ATSDR's review of historical operations in Parcel E indicates that a couple of the sites had activities that could have resulted in environmental contamination. These activities include the small arms and skeet range, a 20-gallon fuel spill (which was removed shortly after it occurred), reserve coal storage in one area, rubbish-burning in two areas, scrap material storage in two areas, and the burial of waste materials under 10 to 20 feet of soil in two areas. While some of the materials from these activities were disposed of or stored in a manner that could contaminate soil, the contamination is not expected to have been widespread. Rather, it would have been localized within the immediate area of the source. Table 2 provides a brief description and history of each site, including a summary of the environmental sampling and remedial activity that was performed.

The soil sampling results indicate that four chemicals were detected in surface soil collected from Parcel E at least once at concentrations above ATSDR's CV for residential use. These chemicals include arsenic, benzo(a)pyrene, dibenz(a,h)anthracene, and trichloroethylene (TCE). Dibenz(a,h)anthracene and TCE were each detected at only one site. Arsenic and benzo(a)pyrene were detected at most of the sites. The maximum concentration of each chemical was higher than the concentrations typically measured in rural or urban soils. However, the sampling data clearly indicate that high concentrations of these chemicals are isolated to specific sites within this area and that the majority of the surface soil in this area is unaffected by high contaminant concentrations.

ATSDR reviewed the published literature for information on whether small concentrations of each of the chemicals found in the soil could be accumulated by various kinds of fruits and vegetables. The information suggests that most of these chemicals are not strongly taken up by plants. Furthermore, the soil concentrations in this area, even though above ATSDR CVs, are generally not very high. Because of the low soil levels, chemical concentrations in the produce, if any, are also expected to be low.

Small amounts of soil contaminants could have been present on unwashed produce eaten by local consumers if contaminated soil was covering the produce surface during its growing season. Given this potential exposure situation, ATSDR evaluated the exposure of gardeners and produce consumers with respect to what is known about the effects of these chemicals (i.e., those found in the Parcel E surface soil) on people. ATSDR assumed that gardeners spent 45 days per year working closely with the soil and that they ingested 1 gram (g) of soil each day (1 g of soil is about 1 level teaspoon of soil). ATSDR also assumed that garden produce consumers ate 300 g of produce every day for 4 months of the year (300 g is about five or six servings of garden produce). It is unlikely that many people had that much contact with the soil or ate that much produce from these gardens. However, even under these conditions, *gardeners, garden produce consumers, and people who both worked in the garden and ate the produce would not be expected to have any health effects.*

VI. Community Health Concerns

ATSDR met with several community members prior to, and during, the Open House on January 29, 2004. The following concerns were either presented directly to ATSDR or provided to representatives from the City of Kettering.

Questions About Little Beaver Creek

- ***If my house, yard, or garden floods, are chemicals from Gentile AFS contaminating my floors, children's play areas, or vegetable garden?***

Probably not. It is not possible to identify with certainty where the water in a flooded yard or home originates. The flood water contains both the rainwater that fell directly on the yard or home and water that fell on the ground uphill from the yard and then ran onto the yard. In a floodplain, such as that near the creek, some of the water in a flooded yard may have come from the creek. However, not all of the water in the creek came from Gentile AFS. Some of the water in the creek came from the storm water drainage system that empties into the western end of the creek and some came from the streets in the neighborhood east of Gentile AFS. Chemicals in the floodwaters in the communities neighboring Gentile AFS are likely have the same types of chemicals commonly found in urban storm water: chemicals from roads and vehicular traffic and pesticides from neighboring homes and businesses. ATSDR did not identify any information that suggests homes or yards near Gentile AFS would contain environmental chemicals at levels of health concern following small localized floods.

- ***When the water in the Little Beaver Creek rises, did it contain contaminants from Gentile AFS?***

Probably. The water sampling data indicate that some chemicals were in the creek water as a result of materials used and disposed at Gentile AFS. The sampling data also illustrated that water coming onto Gentile AFS through the storm water system also was carrying some chemicals, as expected in an urban environment. Even though the environmental sites at Gentile AFS have been remediated, the base still contains large parking lots and vehicle traffic, as do the communities surrounding Gentile AFS. These parking lots, roads, and other urban sources still provide storm water to the creek. As a result, small concentrations of urban chemicals would be expected in the creek during periods of normal flow and during storm flow. Again, ATSDR did not find any information that suggests homes or yards could be contaminated by urban chemicals at levels of health concern during small localized floods, such as those that have occurred near Gentile AFS.

ƒ ***Could a sump pump bring contaminated water onto my property?***

Probably not. A sump pump would not pull groundwater located below the building foundation into the house. In addition, surface water from the creek would not be pulled into the home by a sump pump. Rather, a sump pump is designed to remove small quantities of water that accumulate in the sump of a building's basement or ground floor level. In most cases, a sump's major source of water is condensation in the building or infiltration from storm water. In both cases, the chemicals found in the sump water would most likely be chemicals used in and around the building (i.e., pesticides, fertilizers, paints, cleaners).

One individual mentioned that some homeowners would irrigate their yards or gardens with water from the creek using a sump pump or possibly a utility pump. It is not clear how frequently this practice occurred. However, the water sampling data from the creek that ATSDR reviewed indicates that using surface water from the creek to supplement lawn or garden irrigation would not be expected to cause health concerns.

ƒ ***Could I get sick from ingesting the creek water or by having it touch my skin?***

Probably not from the chemicals released at Gentile AFS. ATSDR's evaluation suggests that while some chemicals did, and do, exist in the surface water and sediment of the creek, adults and children would not be expected to develop any health problems by playing in the creek or incidentally ingesting some of the creek water or sediment.

It is important to remember, however, that the water quality in all creeks may be affected by bacteria or parasites from natural sources. As a result, it is best to avoid ingesting the water or sediment and to wash your hands after playing in the creek prior to eating.

ƒ ***Has anyone sampled the creek east of the Gentile fence?***

ATSDR did not identify any sampling results for the creek taken immediately east of the Gentile AFS fence. Some sampling has been conducted by the Ohio EPA on other downstream sections of Little Beaver Creek. Those results indicate that the PAH concentrations in the sediment near the coal pile were higher than other sections of Little Beaver Creek. Other sections of the Gentile AFS portion of the creek had PAH concentrations within the range of those measured in Little Beaver Creek.

ƒ ***During the 1970s and 1980s, the water in the creek would sometimes be colored or have a strong smell. What caused that? Could it cause health problems?***

A variety of factors can influence surface water quality like this. Some of them may not be related to Gentile AFS operations. Based on the documents reviewed, ATSDR was not able to definitely identify the process or chemicals that could have discolored the creek water or caused odors. There are a few possible explanations related to Gentile AFS operations. First, almost all

of the industrial wastewaters were released to the sanitary sewer system. However, if there were problems with the connection to the sanitary sewer system, waste water would be redirected to the storm water system and into the creek. Apparently this did occasionally occur, about once every few years. Second, the recirculating cooling water of the heating plant was released approximately four times per year directly to the storm water system that emptied to the creek. While in use, the cooling water was treated with chemicals to reduce slime accumulation in the piping and corrosion of the cooling towers. This water could have had a noticeable amount of slime or corrosion inhibitors when it was released to the storm water system. It is also possible that some paints, solvents, or other chemicals used for normal operations or building maintenance were improperly disposed of into the storm water system or creek (DESC 1979).

In these cases, higher concentrations of some chemicals would have been expected in the creek. While it is not possible to evaluate the potential health effects from unknown chemicals at an unknown concentration, it is expected that there was little direct or frequent contact with those chemicals when the water quality of the creek was noticeably poor. The sampling data suggest that once this chemical passed, the water quality returned to levels that would not be expected to cause health problems.

Other processes unrelated to Gentile AFS operations may also have an affect on the water quality of the creek, including biological growths or mineral content. Biological growths can create a sheen, discoloration, or odor in surface water; especially if the water has been stagnant or if there has been a recent temperature change. High concentrations of minerals, such as iron, can cause water discoloration.

f ***Could runoff from the salt pile contaminate the creek and cause health problems?***

Health effects are not expected. Approximately 100 tons of road salt was used annually to maintain the roads on Gentile AFS during snow and ice conditions. The salt was stored in Building 85, just north of the creek and west of the middle ditch. The road salt consisted primarily of sodium chloride and calcium chloride. Small amounts of anticaking agents containing cyanide were also included in the road salt mixture (DESC 1979). Due to the storage practices used at this site, road salt was likely washed toward the ditch and/or creek during rain storms heavy enough to generate runoff and surface water flow.

The sodium and chloride associated with heavily salted roads have been linked to reduced surface water quality, stressed vegetation, stressed aquatic life, and damaged road surfaces and vehicles (Foster 2000; Envirocast 2003). While the presence of the road salts in the soil, surface water, and groundwater is an environmental concern near areas of heavy road salt use, the concentrations of sodium and chloride are below levels of health concern for humans (Environment Canada 2003; Envirocast 2003).

ATSDR reviewed soil and groundwater sampling results from the area of the salt pile (M7, Base Civil Engineering Storage) to evaluate if cyanide was present at concentrations that could impact

human health. Cyanide was not detected in the surface soil samples. It was detected in the groundwater above the EPA drinking water standard. However, the groundwater in this area is not used and the contaminants are not migrating off base, so there is no exposure to the cyanide in the groundwater.

During storm events, some of the road salt and associated cyanide could have been washed into the creek. The actual concentration of cyanide is expected to be below levels of concern. Use of cyanide-containing anticaking agents is common throughout the United States and Canada. While the greatest concerns are typically associated with the effects of sodium and chloride, no adverse health effects are expected from the use or storage of road salt at Gentile AFS.

Questions About the Emissions From the Coal-Fired Heating Plant

One citizen stated that if the weather conditions were just right, ash would be deposited on the ground, table tops, cars, and other flat surfaces outside the house. The citizen suspected that the ash came from the heating plant smoke stacks and had the following questions about the material:

- ***What was burned in the coal-fired heating plant?***

The four heating plant boilers burned coal; normally the coal used in the boilers contained less than 1% sulfur and less than 6.5% ash (DESC 1979). Periodically waste solvents and oils were applied to the coal pile (DESC 1979; URS Greiner 1996). The available information does not identify how often, or how much waste solvent and oil was applied.

- ***Was the coal-fired heating plant also used as an incinerator to burn paper or other waste materials?***

ATSDR did not identify any information that indicated anything other than coal was burned in the four heating plant boilers. It is not possible to state that the boilers were never used to incinerate waste materials; however the boiler configuration makes it unlikely. The past practices of spraying the coal pile with oil or spent solvents is not expected to significantly affect the characteristics of the ash.

The heating plant consisted of four boilers; all four boilers were "underfeed." The coal was delivered to the underside of the boiler by a large screw or ram device. Essentially the feed coal was continuously delivered to the base of the fire in the combustion chamber. The two larger boilers may have had some additional coal added to the upper-section combustion chamber. Underfeed boilers like these have been used successfully for years. They work best when using coal meeting the boiler manufacturer's coal size and composition specifications. Most require the feed coal to be composed of "nuts" approximately 1 to 2 inches in diameter and no more than 50% of the feed coal should have a diameter less than ¼ inch. The composition specifications include the amount of ash that can be generated by the fuel and the temperature at which the ash

forms (USACE 1989). Burning fuels other than the specified coal products could lead to boiler malfunction—therefore ATSDR expects that coal meeting the boiler's specifications was the primary and possibly only fuel burned in the heating plant boilers.

f ***Were the emissions from the boilers ever evaluated?***

Yes. Emissions from the coal-fired boilers have been periodically evaluated since 1975 and used by EPA and the Air Force to identify equipment and procedure modifications necessary to achieve compliance with the national Clean Air Act (DESC 1979).

f ***Could exposure to the emissions cause health effects?***

The available information is not sufficient to evaluate the specific exposure to the boiler emissions. While it is likely that the emissions from the boilers did contribute particulates and combustion by-products that may have affected the local air quality, the downwind concentrations of these materials were likely below levels of health concern under most operating conditions. It's important to remember that the boiler emissions were just one of many active sources that could affect this area. Automobile and truck exhaust, emissions from other local commercial and industrial operations, and some residential heating systems also contribute particulates and combustion by-products. The actual exposure of residents would be influenced by each of these sources. Ambient air monitoring conducted in the area during the mid-1970's indicates particulate concentrations periodically exceeded the National Ambient Air Quality Standard (DESC 1979). More recent data indicates that since 1994, the air quality index for Montgomery County, Ohio, is typically 'good' to 'moderate', with approximately 4 to 21 days per year classified as 'unhealthful' or 'unhealthful for sensitive population' (EPA 2004). Taken together this information suggests that while it is not possible to evaluate the specific exposure to the boiler emissions it is unlikely that those emissions caused adverse health effects for the neighboring residents.

f ***Do the emission tests describe the ash that came from the heating plant smoke stack?***

No. The emission test data reviewed by ATSDR (DESC 1979) describes the basic composition (oxygen, carbon dioxide, nitrogen, and temperature), flow rate of the smoke stack gasses, and emission rate of the particulate material in the gas (mass of particulates emitted per unit of heat energy produced [lb/MBTU]). This information describes the efficiency of the boiler's combustion process and the efficiency of the pollution control equipment that was used at the time of the testing. It does not directly describe how much ash was released or what was in the ash.

f ***What was in the ash that came from the heating plant smoke stack?***

Ash emitted to the air from the stacks of a coal-fired heating plant typically contains a variety of sulfur oxides, nitrogen oxides, metals, PAHs, and other organic compounds. The actual amount

of each compound that would be released depends on the characteristics of the coal that was burned and the operational characteristics of the boiler and pollution control equipment. Local weather conditions, wind direction, wind speed, and the presence or absence of an inversion layer will greatly affect both the formation of ash and the direction and distance that the ash will travel before it settles to the ground.

ƒ ***Could contact with the ash cause cancer or other health problems?***

No health effects are expected. ATSDR evaluated the potential exposure of gardeners using plots located in the southern portion of the base. The surface soil samples from this area would be expected to have similar concentrations of heating plant ash-related chemicals as the yards of residents adjacent to Gentile AFS. It is possible that some of the garden plot soil samples would actually have higher concentrations than those expected in the residential yards near the heating plant because these samples were taken from sites under investigation for environmental contamination due to previous disposal activities. The evaluation indicates that no health problems would be expected for people who gardened in the soil from the southern portion of the base or ate the produce from the garden. Similarly, we would expect that people who garden in their yards and/or eat the produce from their gardens would not develop health problems due to the ash-related chemicals released by the coal-fired heating plant.

Questions About the Runoff From the Coal Pile

The primary coal storage pile was located on the western side of the base between Building 17 (the heating plant) and the base boundary. ATSDR received several inquiries about the coal pile, how it was used in the past, how it was investigated and remediated, and if local residents could have been exposed to chemicals from the coal pile. The following questions and answers identify the specific concerns and ATSDR's evaluation.

ƒ ***Why were solvents poured on the coal pile?***

Base personnel applied solvents as well as waste oils to the coal up until 1978 (URS Greiner 1996). Also, the supplier applied oil to the coal prior to its delivery to the air station (DESC 1979). ATSDR did not identify any information that described why Gentile AFS personnel poured solvents or the waste oils on the coal pile. Anecdotal information gathered during evaluations at other locations where this practice occurred provided three possible explanations: 1) an easy disposal method for the solvents and waste oil, 2) better coal dust suppression and coal handling characteristics than water, and 3) it increased the energy content of the coal. Although the solvents and oils applied to the coal likely increased the concentration of contaminants in the coal pile runoff and in the groundwater beneath the coal pile, they also reduced the amount of dust that would be released to the air from the coal pile.

ƒ ***When did this practice start and stop?***

This practice ended in 1978. However, ATSDR didn't find any information that described when it started.

ƒ ***Could runoff from the coal pile affect neighboring garden plots? Was it safe to eat produce from those gardens?***

Water running off from the coal pile contained coal pile-related chemicals. The concentrations of several chemicals were measured in the coal pile runoff during a rainstorm in 1977. However, the chemical concentrations would be quickly diluted as the coal pile runoff mixed with the other water on the ground surface, in the ditch, and, especially, the creek (DESC 1979).

It is not known if coal pile-related chemicals were present in the surface water that drained from Gentile AFS into backyards near the coal pile storage area. To address the concerns associated with the coal pile runoff, ATSDR reviewed soil and sediment sampling results taken from areas near the coal pile and the ditch sediments slightly downstream from the pile.

Under most rainfall and snowmelt conditions, runoff from the coal pile flowed to the creek via the western ditch or over the ground surface and toward the middle ditch. Anecdotal information indicates that during periods of heavy rain, water from Gentile AFS would flow onto the backyards of homes along the western fence boundary. ATSDR evaluated soil and sediment sampling results related to the coal pile to identify if yards adjacent to the coal pile could have accumulated coal pile-related chemicals at concentrations that would cause health problems for children or adults working or playing in the yard. These concentrations were expected to highly overestimate the actual chemical concentrations that might be found in the yards adjacent to the coal pile. It is likely that the concentrations in those yards are significantly lower than the sampling data reviewed.

ATSDR assumed that children and adults spent every day of the year in their backyards, in direct contact with the soil, and that the entire backyard had the same chemical concentrations as those measured in the coal pile soil and ditch. ATSDR also assumed that the children and adults ingested small amounts of the soil every day they were in their backyards. Results of the evaluation indicate that *health problems are not expected for children or adults who worked or played in the yards neighboring the coal pile or ate produce from the gardens in those yards.*

ƒ ***Did the coal pile cause groundwater contamination?***

Probably. Contaminants have been identified in the groundwater in the vicinity of the coal pile. However, the groundwater in that location is not moving off base, and the neighboring residents are not exposed to the groundwater contaminants.

- ***Could the health of residents near the coal pile be affected by the contamination of the ditch, groundwater, or soil caused by the coal pile?***

No health effects are expected. Residents near the coal pile would not be exposed to contaminants in the groundwater. Small exposures to the chemicals found in the surface soil or ditch sediments have been possible following heavy rains that caused more runoff from the coal pile than the ditch could contain. However, these conditions were infrequent, and the actual exposure to residents is expected to be less than levels known to cause health effects.

- ***Was the dirty soil tested and removed after the coal was removed from the C1 coal storage pile?***

Soil was sampled in the fall of 1995 and 1996. Results indicate some chemicals were present in the soil beneath and near the coal pile and in the ditch sediments at concentrations above ATSDR's comparison values. The coal-fired heating plant was demolished and removed, as were all of the buildings west of Building 3 and the concrete pad that held the coal since the mid-1980s. None of the soil or creek sediments were removed, but clean soil was brought in and placed on top of the existing soil. The area was then paved to be a parking lot (AFBCA 1999). Although contaminants are still present in the original soil and sediments, base workers, visitors, and neighboring residents are protected from exposure by the additional soil covering and asphalt parking lot.

- ***Why was 5 feet of additional soil added after the coal pile was removed?***

The additional soil was brought in to raise the grade of the parking lot (AFBCA 1999).

- ***Some backyards on Broadmoor Drive bordering Gentile AFS flood more since the coal pile was removed. Are there contaminants in the water coming from Gentile AFS that could cause health problems?***

Following the removal of the coal pile, the coal pile area and ditch were filled in with new topsoil and paved. The new parking lot was designed to empty in the creek via an underground drainage system. Rain water in the yards of neighboring homes is not affected by contaminants from the coal pile, and is not expected to be affected by the parking lot. The City of Kettering suggests that residents who are experiencing an increased amount of storm water runoff from this area of Gentile AFS contact Kettering's Director of Public Works at 937-296-2436.

General Concerns and Questions

- ***Could chemicals from Gentile AFS have killed the animals in the western ditch?***

Several citizens mentioned that in the past, while Gentile AFS was operational, small animals (birds, cats) were occasionally found dead in the western ditch near the pesticide storage area and the coal pile.

ATSDR reviewed soil, sediment, and surface water sampling data gathered during the environmental investigations of the coal pile (S1), the pesticide storage area (S3), and the paint booth oil/water separator (O2). Due to the nature of the work that was performed at the paint booth oil/water separator, it was only sampled for contamination from solvents; there are no soil sampling results for PAHs, pesticides, or metals at that site. Only soil samples were obtained near the pesticide storage building; there are no sediment samples for the ditch near this site.

Results of the soil and sediments sampling indicate there are elevated concentrations of some PAHs and other chemicals associated with the coal-pile, and pesticides in the ditch. While ATSDR's evaluation indicates that these levels would not be expected to cause health problems for people who are frequently in direct contact with the sediments, it is not known if small animals that may use the creek as a primary source of drinking water or food could be affected. Unfortunately, without more information that could describe the cause of the animal deaths, it will not be possible to identify if the deaths are attributable to Gentile AFS-related chemicals.

- ***When the commander's house was used as a day care center, could children have been exposed to hazardous chemicals in the soil?***

ATSDR was not able to identify any information that indicated the commander's house or yard was used as a child care facility. However, Building 5 was identified as housing the Child Development Center (AFBCA 1994).

Soil samples from the commander's yard indicate that high concentrations of arsenic existed in the upper soil layer throughout most of the yard around the house. The high arsenic concentrations are believed to be a result of past arsenical pesticide application. The pesticide was typically applied every spring until the use of arsenic-based insecticides was banned in 1974 (AFBCA 1997). Soil removal and confirmatory sampling were completed in March 1997. Application of arsenical pesticides in agriculture, orchards, and residential yards was common up until 1974.

It is possible that children of the commander or others in the community did play in the yard. Those children may have been exposed to some of the arsenic-contaminated soils. However, it is not possible to evaluate with certainty whether that potential exposure would be expected to cause health problems for the children. While arsenic is a toxic chemical and ingestion of large

amounts of arsenic can cause significant health effects, it is likely that the children who played in the yard did not experience any health effects from the arsenic.

Anecdotal information indicates that much of the yard was covered by vegetation or a grass lawn prior to the soil removal. The grass cover would limit the amount of soil the children would actually contact; children who played in the yard would be expected to have significantly less contact with the soil in a grass-covered yard than if they played in bare soil. In addition, most forms of arsenic tend to bind tightly to soil materials. Over time, the fraction of arsenic in the soil that is bound to soil particles increases. As a result, most soil that is ingested will pass straight through the body without releasing the arsenic. Research suggests that typically 75 to 90 percent of the total arsenic in the soil is in a form that would *not* be absorbed by the human body (Turpeinen et al. 2003; Kim et al. 2002; Roberts et al. 2002).

- ***Could Gentile AFS-related contaminants cause health problems like Ewing's sarcoma, learning difficulties (ADD/ADHD), juvenile rheumatoid arthritis, strokes, migraines, fibromyalgia, interstitial cystitis, sjogren's syndrome, digestive problems or irritable bowel syndrome?***

Probably not. ATSDR was not able to identify any information that indicates exposure to certain chemicals would be expected to cause one or more of these diseases or conditions. In addition, the environmental information evaluated by ATSDR indicates that nearby residents and people who gardened, played ball, or spent time on Gentile AFS or in the creek were not exposed to Gentile AFS-related chemicals at levels that would be expected to cause health effects.

- ***Could ATSDR collect radon information for the homes surrounding Gentile AFS to make sure there is no radiation hazard associated with the site?***

By Congressional mandate, ATSDR does not gather samples in evaluations such as this. However, in 1989, the USAF tested 26 occupied facilities at Gentile AFS for radon. The only building that had detectable levels of radon above the EPA's recommended level was the commander's residence. The building was remediated through the installation of a sub-slab ventilation system and has since been demolished (AFBCA 1994; USAF 2004).

Radon is a naturally occurring gaseous radioactive element that can be found in the soil beneath buildings, in groundwater, or in building materials. Montgomery County, Ohio, has been identified as an area with a high potential for naturally occurring radon; the USAF's sampling indicates that indoor concentrations above the EPA-recommended concentration are possible in this area. Additional information about the potential health effects associated with radon exposure and some of the sampling options available for homeowners are available through the following EPA Web sites (AFBCA 1994; EPA 2003, 2004b):
http://www.epa.gov/iaq/radon/zonemap/ohio.htm and
http://www.epa.gov/iaq/radon/radonqa1.html.

- ***I think a 1945 photo shows a possible dump site east of building 4, near the water tower. Has that site been investigated? If not, will it be investigated?***

ATSDR did not identify any information describing a dump site near the water tower. However, the soil around the water tower was sampled and analyzed for metals to identify if the soil was impacted by lead from the water tower paint. Results indicate that the lead concentration in the soil near the water tower is higher than the background levels for the base; however, the concentration is within the levels recommended for commercial and industrial property. This sampling did not identify any evidence of a disposal site near the water tower.

- ***How do we know all of the sites have been found?***

The USAF, under the oversight of EPA and Ohio EPA, has conducted an extensive review of the documents describing the industrial processes conducted at Gentile AFS and has also interviewed many employees who worked at installation. The USAF gathered information about the types of chemicals and materials that were used on base, how those chemicals and materials were used, and how they were disposed. Sites where spills or disposal may have occurred were investigated to identify if contamination was possible. Sites where environmental contamination was considered possible based on personnel interviews or document review were sampled and, if necessary, remediated.

While the investigation has been extensive, additional information could surface that indicates an additional spill or disposal site may exist. In that case, the USAF is still legally responsible to conduct an investigation, and as necessary conduct the sampling and remediation actions required to protect human health and the environment.

- ***What was used/spilled/disposed of at Gentile AFS, especially in the buildings, that could cause cancer in the employees? What can be done to investigate the health of former Gentile AFS employees?***

By Congressional mandate, ATSDR concentrates on identifying and evaluating potential exposures to the community surrounding a site. Occupational exposure concerns are generally addressed by the base's occupational health and safety office as required by Occupational Safety and Health Administration.

Information reviewed by ATSDR indicates that occupational health and safety issues regarding past and current DESC operations could likely be addressed by the Defense Supply Center Columbus Safety and Health Office. The phone number for that office is (614) 692-2332.

- ***Could working with ammonia or in a room with asbestos cause ovarian cancer, kidney cancer, COPD, sleep apnea, or nosebleeds?***

ATSDR reviewed information in the Toxicological Profile for Ammonia (ATSDR 2002) to identify if these health effects typically result from exposure to ammonia. Unfortunately, the results of this review are inconclusive. Some studies have linked exposure to high concentrations of ammonia in air to upper respiratory irritation and decreases in pulmonary function, but sleep apnea and nosebleeds are not specifically identified as resultant health effects. Nosebleeds can result from nasal irritation, so an exposure to ammonia could cause a nosebleed. However, while ammonia exposure has been associated with upper respiratory effects, it is not possible to identify if upper respiratory effects, including nosebleeds, are due to ammonia exposure. A variety of other chemicals and conditions are also associated with upper respiratory effects, COPD, sleep apnea, and nosebleeds. Based on the available data it is not possible to determine if ammonia causes cancer, however the toxicological profile did not identify any studies where cancer of the kidney or ovaries was associated with ammonia exposure.

ATSDR also reviewed the information in the Toxicological Profile for Asbestos (ATSDR 2001). Again, the results are inconclusive. Exposure to high concentrations of asbestos in air has been associated with fibrotic lung disease (asbestosis) and other conditions that can significantly reduce lung function. Some research suggests there may be an association between asbestos exposure and kidney cancer. Asbestos exposure has not specifically been associated with sleep apnea, nosebleeds, or cancer of the ovary. Although exposure to asbestos has been associated with specific pulmonary diseases and possibly kidney cancer, it is generally not possible to identify if these effects are due to asbestos exposure.

There are no specific causes for any of the diseases listed, and for each disease a number of environmental and personal factors are believed to be associated with the disease occurrence. Kidney cancer has been associated with cigarette smoking, diet, obesity, exposure to asbestos and cadmium, family history, and pre-existing diseases (i.e., von Hippel-Lindau syndrome and tuberous sclerosis). Ovarian cancer has been associated with personal reproductive history, family cancer history, and use of talcum powder (possibly containing small amounts of asbestos) applied directly to the genital area or on sanitary napkins. Chronic obstructive pulmonary disease (COPD) is an umbrella term for breathing difficulties most commonly due to emphysema and chronic bronchitis. Most new cases of COPD are attributed to smoking or exposure to second-hand smoke. However, COPD does occur in people who never smoked and had limited exposure to second-hand smoke. Those cases may be associated with family history, childhood history of respiratory infections, and certain occupational exposures to cadmium and silica dusts. Sleep apnea most commonly occurs when the soft tissue in the rear of the throat blocks the airway during sleep. This may cause labored breathing and may actually stop airflow completely; the brain then sends a signal to awaken the individual enough to re-start breathing. People with sleep apnea tend to have excessive daytime sleepiness because they do not sleep well at night. Obstructive sleep apnea is associated with a family history of sleep apnea; smoking; alcohol use; being overweight; or having a large neck, recessed chin, or physical abnormalities of the upper

airway structure. ATSDR did not identify any association between environmental or occupational chemical exposures and sleep apnea. The Web sites listed below provide more information about each of these conditions and their potential causes.

It is important to remember that, in general, if a particular chemical has been associated with a disease, diagnosis of that disease does not indicate that there was a prior exposure to the chemical. There is still much to learn about the specific causes of diseases like cancer, COPD, and other respiratory conditions. In most cases, several different factors are associated with each disease.

Web sites for information on kidney cancer:
http://www.umm.edu/urology-info/cancer.htm
http://www.cancer.org/docroot/home/index.asp
http://www.cancer.org/docroot/CRI/CRI_2x.asp?sitearea=&dt=22
http://www.cornellurology.com/uro/cornell/kidney/causes/

Web sites for information on ovarian cancer:
http://www.ovariancanada.org/
http://www.cancer.gov/cancerinfo/types/ovarian
http://www.nlm.nih.gov/medlineplus/ovariancancer.html
http://www.ovariancancer.org/content/1-3-1.html

Web sites for information on COPD:
http://www.nlm.nih.gov/medlineplus/copdchronicobstructivepulmonarydisease.html
http://www.lungusa.org/press/lung_dis/asn_copdback.html
http://www.cdc.gov/nceh/airpollution/copd/copdfaq.htm
http://www.priory.com/cmol/causesof.htm

Web sites for information on sleep apnea:
http://www.sleepapnea.org/
http://www.nhlbi.nih.gov/health/public/sleep/sleepapn.htm
http://familydoctor.org/212.xml
http://health.yahoo.com/health/centers/sleep_disorders/127.html

- ***I know someone who has information about past chemical disposal activity, but they don't think they can tell anyone because they might lose their job or go to jail. Is there any way they can share their information without getting into trouble?***

ATSDR met with USAF representatives to address this concern. The information provided to us indicates that the USAF's primary purpose for obtaining information about past spills or waste disposal activities is to be able to fulfill its obligations as a federal environmental steward to protect human health and the environment. However, the USAF does not have the authority to offer or promise immunity from criminal prosecution or civil enforcement initiated by any

government agency under local, state, or federal laws if the environmental enforcement agencies believe you are responsible for contamination which endangered human health or the environment.

ATSDR contacted representatives of the Ohio EPA and U.S. EPA to identify the policy of these agencies regarding potential criminal or civil investigation or prosecution. Ohio EPA encourages past workers or those that have firsthand knowledge of past spills or disposal activities at the former Gentile Air Force Station to provide that information to Ohio EPA. If you have such information, please contact Mike Proffitt at (937) 285-6603. It is not Ohio EPA's usual practice to prosecute past workers involved with these activities, especially if they occurred before 1980 when federal and state hazardous waste laws went into effect. However, if someone knows about spills or disposal occurring now at the site (including dumping into the creek or dumping on-site), please contact the Ohio EPA. Such dumping is illegal in Ohio and offenders may be prosecuted.

The U.S. EPA does not provide counsel to non-EPA persons as to their legal liabilities or options. Persons concerned about liability under CERCLA or any other statute should consult an attorney. There are defenses to CERCLA liability set forth in CERCLA 107 and individuals may want to consult an attorney for advice on whether they qualify for one of those defenses.

ƒ ***Is my community safe?***

ATSDR did not identify any past or current exposures of Gentile AFS-related chemicals that could cause health effects for people who live near Gentile AFS, play ball on Gentile AFS property, play in the creek, or garden.

ƒ ***Is it safe to build homes on Parcel E?***

Yes. ATSDR understands that the area identified for potential new home construction at Gentile AFS is on the southern portion of Parcel E. This area had contained the reserve coal storage pile (S2) and some disposal sites (C5, C7, C8, and D3). Those sites have been investigated, evaluated, and remediated as necessary. The groundwater beneath the planned building area is not affected by the groundwater contaminants identified in the northern section of this parcel (potentially associated with C7 and D1). In addition, the groundwater in the northern sections of the parcel will continue to be monitored until the concentrations meet regulatory standards.

ƒ ***Is it safe to build a park on Parcel E?***

Yes. The area identified for the potential new park at Gentile AFS property is on Parcel E, just south of the creek. This area had contained the reserve coal storage pile (S2), some disposal sites (C3, C4, C7, D1, and D4), and the creek (C1). Those sites have been investigated, evaluated, and remediated as necessary. There are no exposure concerns associated with the soil at these sites and there will be no contact with the groundwater in this section of the parcel.

- ***Was/is my drinking water safe?***

Yes. Details are provided in the text.

VII. ATSDR Child Health Considerations

ATSDR recognizes that the unique vulnerabilities of infants and children demand special emphasis in communities faced with concerns about potential exposure to contaminants in water, soil, air, or food. Children are at greater risk than adults from certain exposures to hazardous substances emitted from waste sites and emergency events involving hazardous chemicals. In general, children are more likely to be exposed because they play outdoors, have more hand-to-mouth behavior, and often bring food into contaminated areas. They are shorter than adults, which means they breathe dust, soil, and heavy vapors that are close to the ground. Children are also smaller, so they receive higher doses of chemical exposure proportional to their body weight. The developing body systems of children can sustain permanent damage if toxic exposures occur during critical growth stages. Most importantly, children depend completely on adults for risk identification and management decisions, housing decisions, and access to medical care.

ATSDR attempted to identify populations of children living near Gentile AFS and consider their recreational activities while evaluating their potential exposures to Gentile AFS-related chemicals. About 2,550 children under the age of 6 are estimated to live within 1 mile of the Gentile AFS site. Children in the community that surrounds Gentile AFS attend schools within the City of Kettering. The Kettering School District currently serves roughly 8,000 students. The school district has nine elementary schools, serving kindergartners through fifth graders; two middle schools, serving sixth, seventh, and eighth graders; and a 4-year high school (Kettering 2000).

After carefully evaluating possible exposure situations for children at Gentile AFS IRP sites, ATSDR determined that it is unlikely harmful exposures or physical risks occurred in the past or occur now. Although contaminants have been detected at Gentile AFS, children are not expected to have had frequent and direct access to IRP sites or other potential areas of concern. The infrequent, indirect contact with the contaminated sites children may have had while in the garden area or playing on the recreational equipment is not expected to cause any type of health concern.

Like other people living near Gentile AFS, children might contact Gentile AFS-related contaminants both on- and off-base. Possible exposures include use of the west branch of Little Beaver Creek and contact with site-related contaminants deposited in yards or gardens following floods, or playing in on-base recreational areas or in the garden plots. ATSDR evaluated these situations and, when necessary, estimated the potential exposure doses for children. These potential exposure situations are discussed in the "Public Health Evaluation of the Potential Exposure Pathways" section of this PHA. Results of the evaluations indicate that children are not expected to develop any type of health problem as a result of exposure to Gentile AFS-related chemicals found on base or in the creek.

VIII. Conclusions

Conclusions regarding potential past, current and future exposure situations on Gentile AFS and in the surrounding community are based on our evaluation of site investigation data and observations made during site visits. Conclusions about exposures are described below. (The public health hazard conclusion categories are described in the glossary.)

Individual IRP Sites and the Commander's Yard

ATSDR reviewed data for Gentile AFS's 40 IRP sites to determine if any of the individual sites were associated with past, current, or future public health hazards. Some of the sites had contaminant concentrations above ATSDR's health-based comparison values. However, ATSDR's evaluation indicates that neighboring residents and Gentile AFS visitors would not be exposed to contaminants at levels associated with known public health hazards. Community exposure to these sites was categorized as *no apparent public health hazard*.

Exposure to Contaminants in Drinking Water

The homes neighboring Gentile AFS are connected to the municipal water system. The municipal drinking water delivered to the residents is unaffected by Gentile AFS-related chemicals and consistently meets or exceeds federal drinking water standards. Anecdotal information suggests that some residents in the neighboring community still use private groundwater wells. Water obtained from local private wells is also unaffected by Gentile AFS-related chemicals. Because the drinking water for the neighboring community is not affected by Gentile AFS-related chemicals, it was categorized as *no public health hazard*.

Exposure to Contaminants in Little Beaver Creek's Surface Water and Sediment

Anecdotal information from many community members indicates that they or their children played in the creek in the section before it entered Gentile AFS or the section after it left the installation. Some chemicals were detected in the on-base section of the creek's surface water or sediment at concentrations above ATSDR's health-based comparison values. However, adults and children who played in the creek in the past were not exposed to contaminants at levels known to cause health effects. Adults and children who played in the creek would not be expected to develop any health problems due to exposure to Gentile AFS-related chemicals in the surface water or sediment of the creek. Past exposure to contaminants in the creek was categorized as *no apparent public health hazard.*

To assess current exposure situations, ATSDR also reviewed the sampling data for the creek bed sediment taken after sediment removal was completed in March 2000. While PAHs were detected in one sample from the eastern ditch at concentrations above the regulatory cleanup goals, the remaining 15 samples illustrated that the sediment removal action significantly reduced the PAH concentrations throughout the on-base section of the creek and drainage ditches. In addition 1 to 6 feet of clean fill was added to the main section of the creek, thereby

eliminating the potential for exposure to contaminants remaining in the main section of the creek bed. ATSDR concluded that adults and children who play in the eastern ditch where the high PAH concentration was measured would not be expected to develop any health problems. Current exposure to Gentile AFS-related contaminants in the creek was categorized as *no apparent public health hazard*.

Several residents described how their yards or homes flood during periods of heavy rain when the creek overflows its banks. ATSDR reviewed available information about surface water and sediment transport. Results of this evaluation indicate that the sediment deposited in residential areas from flooding would not be expected to contain Gentile AFS-related chemicals that would be detectable in soil sampling results or be expected to cause any type of health problem. Exposure to Gentile AFS-related contaminants in flood deposits was categorized as *no apparent public health hazard.*

Exposure to Contaminants While Gardening

Anecdotal information indicates that, in the past, employees were allowed to plant vegetable gardens in the southeastern section of Parcel E. The citizens were concerned about whether contaminants in the soil could have been present in, or on, their vegetables and if eating those vegetables could harm their health. Results of this evaluation indicate that gardeners, garden produce consumers, and people who both worked in the garden and ate the produce would not be expected to have any health effects. Exposure to contaminants while gardening was categorized as *no apparent public health hazard*.

IX. Recommendations

If requested, ATSDR will review new or additional environmental data if those data could affect a public health evaluation.

X. Public Health Action Plan

The public health action plan (PHAP) for Gentile Air Force Station describes actions taken and those to be taken by the USAF, EPA, and Ohio EPA. The purpose of the PHAP is to ensure that this document not only evaluates potential exposures to identify if a public health hazard exists, but also describes the plan of action for preventing adverse human health effects resulting from potential exposure to hazardous substances in the environment. The public health actions that are completed, ongoing or planned are as follows:

Completed Actions

1. The USAF has identified and investigated 40 IRP sites at Gentile AFS.

2. The USAF has undertaken measures to reduce the sources of contamination at Gentile AFS. These measures include removal of contaminated soil from source areas; excavation of contaminated equipment, such as oil-water separators; and dredging the on-base section of the Little Beaver Creek.

3. The USAF recommended 35 IRP sites for no further action because they pose no risk to human health or they have been remediated to cleanup standards. Additional measures were undertaken and completed at the five remaining sites.

4. ATSDR visited Gentile AFS in 2004 to tour the site; meet with representatives from the USAF, EPA, Ohio EPA, and the City of Kettering; and gather environmental and exposure information to complete the public health evaluation. ATSDR also meet with many of the community members before and during the Open House on January 29, 2004.

5. Under the oversight of Ohio EPA, the USAF investigated and remediated as necessary 127 acres of industrial-use property at Gentile AFS to the City of Kettering. The property is now being used as the Kettering Business Park.

Ongoing and Planned Actions

1. The USAF will transfer another 26 acres of property in the southern portion of the site to the City of Kettering for use as a residential area and park. Land use restrictions on groundwater use will accompany the transfer of this parcel of land. The deed will contain the following language: "…any additional remediation action found to be necessary after the date of this Deed, and any additional remedial action existing prior to the date of this Deed, shall be conducted by the United States."

2. Groundwater sampling will continue at sites in Parcels A (Site R2), B (Site S1), and E (Sites C7 and D1) until the contaminant levels remain below the U.S. EPA's drinking water standards for 2 consecutive years (Ohio EPA 2004a, 2004b).

3. The USAF will be required to periodically check that all land use controls and institutional controls are in effect.

XI. Preparers of Report

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Tables

Table 1. Site History

Year	Installation Name	Organization	Site Description/ Changes	Mission	Operations/Operational Changes
1944	Dayton Signal Corp Supply Agency	Army Air Force	Built on roughly 120 acres of partially wooded farmland and a former private airfield.	Procure, store, issue, and salvage airborne radio and meteorological equipment and supplies.	Operations were to integrate Signal Corps functions into Army Air Force.
1945	862nd Army Air Force Specialized Depot	Army Air Force			
1951	Gentile Air Force Station	Army Air Force	The site added 44 acres and the following buildings: 44: Warehouse for Suuplies 45: Graphics Photo Lab and Data Management Office 47: Warehouse for Supplies 73: Electric Power Station 74: Transportation Shop		Operations grew as a result of services provided in the new buildings.
1955	Gentile Air Force Station	Dayton Air Force Depot			
1962	Gentile Air Force Station	DESC		No significant change but the mission was divided into primary, support, and secondary functions. The primary mission - provide electronic spare parts support to U.S. military services and federal civil agencies. automatic data processing items. The support service - maintained and operated associated facilities and equipment. The secondary mission was largely administrative and warehouse-related.	

Source: URS Greiner 1996; 1997a, b.

Table 2. Site Description Table

Site Identification, Description, and History	Sampling Results of Environmental Investigations			Corrective Actions Accomplished and Planned
	Surface Soil/Sediment	Groundwater	Surface Water	
Parcel A				
C2 **Rail Lines** Railroad lines and spurs once ran to warehouses and a coal storage pile. Most of the spurs had been removed by 1985. The former railroad beds are covered by asphalt and/or gravel. Date of operation: Not provided. Size: Samples were collected from locations extending approximately 1/3 of a mile along the railroad tracks.	August 1995 Sampling interval: 0-0.5 feet (ft) Analytes: Metals and polycyclic aromatic hydrocarbons (PAHs). Results: Total PAHs reached 516 parts per million (ppm). Benzo(a)pyrene (49 ppm) Benzo(a)anthracene (44 ppm), Benzo(b)fluoranthene (56 ppm), Dibenz(a,h)anthracene (17 ppm). September 25-26, 1996 Number of samples: 10 Sampling interval: mostly 0-3 ft and below asphalt at 0.5-3.7 ft below ground surface (bgs); one sample from 0-0.5 ft bgs Analytes: PAHs. Results: In 0-0.5 ft, benzo(a) pyrene=0.37 ppm; at 0-3 ft, B(a)P=3.7 ppm, benzo(a) anthracene=2.8 ppm, benzo(b)fluoranthene=6.6 ppm, dibenz(a,h)anthracene=0.79 ppm, indeno(1,2,3-cd)pyrene=2.4 ppm.	Not sampled	Not sampled	The highest concentrations of total PAHs were measured in Parcel A where loading and unloading of rail cars occurred. This site was divided into two subareas. Site C2A includes rail lines within Parcel A; Site C2E includes rail lines in Parcel E. The USAF and regulators agreed in 1997 that no further action (NFA) was necessary for Site C2A, because it was going to be used for commercial or industrial purposes. Portions of site C2E were used as a temporary road for the 1999 removal of Site D1. Subsequent soil sampling for Site C2E found only low levels of PAHs. The USAF and regulators agreed in 2002 that Site C2E could be classified as NFA due to the low concentrations of PAHs.

Site Identification, Description, and History	Sampling Results of Environmental Investigations			Corrective Actions Accomplished and Planned
	Surface Soil/Sediment	Groundwater	Surface Water	
D5 **Electron Tube Disposal Area** During the 1940s and early 1950s, electron (vacuum) tubes were reportedly buried in a field that was later turned into a baseball diamond. This area is currently paved and used as a parking lot. It was said that these materials were covered with 8 to 12 feet of soil. Size: 300 ft by 120 ft	Samples were collected in 1979 and analyzed for gross alpha, gross beta, and gamma radioactivity. Results indicate that radionuclides were within naturally occurring levels. An additional radiation survey was conducted by the Army Environmental Hygiene Agency in 1987. It concluded that samples contained radioactivity levels less than or equal to background conditions.	Not sampled	Not sampled	No radiation above background levels was detected in cores that were drilled, and no evidence of electron tubes was identified during visual inspections of the cores. The Air Force and regulators agreed to classify this site as NFA in April 1997.
M2 **Transformer Failure Area** In approximately 1978, a transformer containing PCBs failed and leaked an unknown amount of PCB-containing transformer fluid. The transformer was located in a gravel bed. In 1995, the USAF cleaned the area and installed a replacement transformer in a gravel and concrete bed. Size: 15 ft by 20 ft	Removal of contaminated soil and confirmatory sampling was accomplished in 1995. Wipe and soil samples were obtained to identify locations where transformer parts, concrete, and soil needed to be removed. Soil removal continued until the confirmatory samples contained less than 25 ppm total polychlorinated biphenyls (PCBs) Concrete surfaces were cleaned until to less than 10 milligrams (mg)/100 square centimeters (cm^2) of total PCBs.	Not sampled	Not sampled	The transformer cleanup was conducted according to federal and state requirements for commercial and industrial buildings. The USAF and interested regulatory agencies agreed to classify this area as NFA in January 1997.

Site Identification, Description, and History	Sampling Results of Environmental Investigations			Corrective Actions Accomplished and Planned
	Surface Soil/Sediment	Groundwater	Surface Water	
M3 **Waste Oil Feed Area** Prior to 1992, waste oil was poured through a funnel located outside a building to an underground storage tank. The funnel and the tank were removed in 1992, and the area was subsequently paved. Date of operation: Not provided. Size: About 20 ft by 20 ft and just over 100 ft from Site M2.	October 1995 Number of samples: 1 Sampling Interval: 1-2 ft beneath a 4-inch layer of asphalt Analytes: Sampled for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), PCBs, and metals. Results: Arsenic (6.3 ppm) exceeded its CV of 0.5 ppm (CREG) The arsenic level measured was within the range of concentrations detected in basewide background samples, indicating the oil disposal process may have not contributed significantly to the measured arsenic level. All other measured concentrations were within the regulatory guidelines for industrial operations.	Not sampled	Not sampled	The USAF and regulators agreed to classify this area as NFA in January 1997. This is based on sampling results that indicate the contaminant concentrations were either within the regulatory guidelines for industrial operations, or the concentrations were within the background levels measured for other parts of the base.

Site Identification, Description, and History	Sampling Results of Environmental Investigations			Corrective Actions Accomplished and Planned
	Surface Soil/Sediment	**Groundwater**	**Surface Water**	
M4 **Compressor Room** A compressor in Building 2 is on top of a concrete slab that is separate from the rest of the floor slab in the building. Since the mid-1990s, a 3-ft deep trench of oil-stained gravel approximately 5 inches wide separated the compressor slab from the floor slab. Date of operation: Not provided. Size: The area is a 60 ft by 70 ft rectangle.	May 1994 Number of samples: 2 Sampling Interval: 1-2 ft in gravel beneath a 4-inch layer of asphalt Analytes: PCBs Results: Arochlor-1260 was present at concentrations between 0.68 and 1.86 ppm. November 1995 Number of samples: 4 (in 2 locations) Sampling Interval: 0-0.5 and 0.5-1 ft in soil beneath a 3-ft layer of gravel Analytes: SVOCs, PCBs, and selected metals. Results: No PCBs were detected (the detection limit was 1 ppm). Arsenic was detected at 2.8 ppm, above the CREG of 0.1 ppm.	Not sampled	Not sampled	Sampling results indicate that the PCBs had not migrated beyond the gravel. PCB concentrations in the gravel were within the regulatory guidelines for industrial operations. The USAF and regulators agreed to classify this site as NFA on January 23, 1997.

Site Identification, Description, and History	Sampling Results of Environmental Investigations			Corrective Actions Accomplished and Planned
	Surface Soil/Sediment	Groundwater	Surface Water	
M5 **Stains in Shop Area** Site M5 located in Facility 4 in the central part of the station was identified during a visual site inspection in December 1993. Surface staining was observed on concrete floor slabs in the vicinity of several shop areas including the paint, carpentry, plumbing, electrical, and welding shops. No floor drains exist in the shop floors to allow drainage of spilled materials.	Not sampled	Not sampled	Not sampled	Because no floor drains were identified, no further investigation of this site was proposed. The USAF and regulators agreed to classify this site as NFA in January 1997.
M6 **Floor Stains** Several oily floor stains were noted in Building 73, near areas where motor oil was stored. Size: An oval approximately 60 ft by 70 ft.	Two wipe samples were collected from under the sump drains for the generators at this site. The samples were analyzed for PCBs only; none were detected at levels above the 1 to 2 micrograms per square centimeter ($\mu g/cm^2$).	Not sampled	Not sampled	The USAF and regulators agreed to classify this site as NFA in January 1997 because no contaminants of concern were identified during the site inspection or sampling.

Site Identification, Description, and History	Sampling Results of Environmental Investigations			Corrective Actions Accomplished and Planned
	Surface Soil/Sediment	Groundwater	Surface Water	
O1 **Paint Drain Line** **(Steam Tunnel)** The drain line associated with O1 runs north through the steam tunnel and then underground into an oil/water (o/w) separator located west of Building 4. The o/w separator separates the paint from water. Volume: 475-gallons.	This site was not investigated under the RI program. Therefore, no environmental sampling data are available on this site.	Not sampled	Not sampled	This area was cleaned-up during October 1996. Remedial activities included sampling liquid and sludges, removal and disposal of the separator contents, flushing and plugging all lines leading into the separator, pressure washing the separator, removing the separator structure, excavating the contaminated soils, backfilling and restoring the excavation site, and disposal of all the contaminated soil and debris. Confirmatory samples of the soil following the removal actions indicate the chemical concentrations are below regulatory guidelines for industrial operations. The USAF and regulators agreed to classify this site as NFA in April 1997 based on the results of the confirmatory sampling.

Site Identification, Description, and History	Sampling Results of Environmental Investigations			Corrective Actions Accomplished and Planned
	Surface Soil/Sediment	Groundwater	Surface Water	
O3 **Oil/Water Separators and Drain** Site O3 consists of two concrete 250-gallon o/w separators and one concrete drain located within Building 74. The building was used for vehicle maintenance activities and the asphalt floors contain visible staining. Outfalls from these structures lead to the sanitary sewer system. Date of operation: The o/w separators and drain were installed in 1980. Size: The drain is 0.5 ft by 1 ft. by 75 ft	This site was not investigated under the RI program. Therefore, no environmental sampling data are available on this site.	Not sampled	Not sampled	This area was cleaned-up during October 1996. Remedial activities included sampling liquid and sludges, removal and disposal of the separator contents, flushing and plugging all lines leading into the separator, pressure washing the separator, removing the separator structure, excavating the contaminated soils, backfilling and restoring the excavation site, and disposal of the contaminated soil and debris. Confirmatory samples of the soil following the removal actions indicate the chemical concentrations are below regulatory guidelines for industrial operations. The USAF and regulators agreed to classify this site as NFA in April 1997 based on the results of the confirmatory sampling.

Site Identification, Description, and History	Sampling Results of Environmental Investigations			Corrective Actions Accomplished and Planned
	Surface Soil/Sediment	Groundwater	Surface Water	
O4 **Oil/Water Separator** Site O4 consists of a concrete 250-gallon o/w separator located in Building 74 that drains to the wash rack located outside the building. Date of operation: The separator was installed in 1981. Size: Not provided.	This site was not investigated under the RI program. Therefore, no environmental sampling data are available on this site.	Not sampled	Not sampled	This area was cleaned-up during October 1996. Remedial activities included sampling liquid and sludges, removal and disposal of the separator contents, flushing and plugging all lines leading into the separator, pressure washing the separator, removing the separator structure, excavating the contaminated soils, backfilling and restoring the excavation site, and disposal of the contaminated soil and debris. Confirmatory samples of the soil following the removal actions indicate the chemical concentrations are below regulatory guidelines for industrial operations. The USAF and regulators agreed to classify this site as NFA in April 1997.

Site Identification, Description, and History	Sampling Results of Environmental Investigations			Corrective Actions Accomplished and Planned
	Surface Soil/Sediment	**Groundwater**	**Surface Water**	
R2 **Floor Drain to Infiltration Pit** This site consists of a gravel infiltration pit located along the west side of Building 73. The building was equipped with four emergency generators in 1973-74. Black staining was noted in the gravel pit. Chemical releases to the infiltration pit could have occurred through a discharge pipe from Building 73 or more directly by disposal from outdoor spills directly onto the pit. Building 73 has been demolished, but the pit remains. Size of the gravel pit: Approximately 4 ft wide By 6 ft long by 4 ft deep.	1996 Number of samples:4 Sampling interval: 0.5-3.5 ft Analytes: Samples were analyzed for PAHs. Results: No PAHs were detected above ATDSR's CVs.	Three different sampling events of groundwater monitoring wells or hydropunch Analytes: VOCs, SVOCs, PCBs, and metals. Previous Results: Contaminants at levels above ATSDR's CVs include: cis-1,2-DCE (2,500 parts per billion [ppb]); arsenic (110 ppb); PCE (5.3 ppb); cadmium (6 ppb); manganese (4,000 ppb); lead (98 ppb); thallium (10 ppb); and vanadium (110 ppb). Since August 1998 groundwater monitoring well results indicate the concentrations of *cis*1,2-DCE, TCE and PCE appear to be declining.		The UST in Building 73 was in 1996. Soil contamination identified during the removal action was removal excavated and disposed of. Groundwater sampling has confirmed the subsurface vertical migration of the VOC contamination, particularly chlorinated solvents, from the infiltration pit to groundwater. The hydropunch groundwater samples indicate that the solvents have migrated southwest, and that contaminant concentrations have decreased as the plume has moved away from the source and release. A NFRAP for soil was submitted in May 1997. The USAF and regulators agreed to classify groundwater at this site as NFA in April 1997, with groundwater use restrictions and monitoring. Long-term monitoring began in 1998.

Site Identification, Description, and History	Sampling Results of Environmental Investigations			Corrective Actions Accomplished and Planned
	Surface Soil/Sediment	**Groundwater**	**Surface Water**	
R3 **Wash Rack** Site R3 was a curbed concrete wash rack with a floor drain; it was located outside Building 73. The wash rack was used in the past to wash the Army Reserve howitzer. Size: About 100 ft by 50 ft.	October 17, 1995 Number of samples: 2 Sampling interval: 1-2 ft Analytes: Samples were analyzed for VOCs and SVOCs. Results: Benzo(a)pyrene (0.9 ppm) was detected above the CREG of 0.1 ppm.	Not sampled	Not sampled	Sampling results indicate there was only a small amount chemical contamination that extended below the surface soil. It did not represent a significant potential source of groundwater contamination. This area is currently paved and used as a parking lot. The USAF and regulators agreed to classify this site as NFA on January 23, 1997, because the chemical concentrations are within the regulatory guidelines for industrial operations.

Site Identification, Description, and History	Sampling Results of Environmental Investigations			
	Surface Soil/Sediment	**Groundwater**	**Surface Water**	
S4 **Herbicide Storage** Site S4 consists of Building 31, the grounds maintenance building. It was used to store pesticides in bulk quantities. The building contains a concrete floor, but no floor drains. There was visible staining on the floor. The pesticides were bagged and stored in quantities from about 300 pounds to 3,000 pounds. The available documents do not identify the actual chemicals that were stored in the building or the above ground storage tank that was located outside near the building. In 1982, the chemicals where transferred to Building 80 for storage. Building 31 is T-shaped, approximately 150 ft by 100 ft in size. The area of the above ground storage tank is about 40 ft in diameter.	August 1995 Number of samples: 2 surface soil Sampling interval: 0-0.5 ft Analytes: Samples were analyzed for VOCs, SVOCs, pesticides/ PCBs, and herbicides. Results: Benzo(a)pyrene (0.91 ppm) was detected above its ATSDR CV of 0.1 ppm.	Not sampled	Not sampled	Sampling results from the Phase I RI indicated that pesticides were released in Building 31 and that the PAHs in the soil appeared to be consistent with the proximity of the site to rail lines. The USAF and regulators agreed to classify the soil at this site as NFA in April 1997, based on findings from the Phase I RI.

Site Identification, Description, and History	Sampling Results of Environmental Investigations			Corrective Actions Accomplished and Planned
	Surface Soil/Sediment	**Groundwater**	**Surface Water**	
S5 **PCB Storage Area** Site S5 was used to temporarily store transformers and other possible PCB-containing materials. It consists of a concrete floor in Building 3 Area C, in the central part of the station. A 6- inch concrete berm surrounded the area. Size: The building is less than 100 ft by about 40 ft.	The Environmental Baseline Survey (1994) reported a potential spill or release may have occurred at Site S5. However, no staining inside or outside the bermed area was found during the site inspection. Two wipe samples were taken from the concrete floor in August 1995 and analyzed for PCBs.: PCB-1260 was found at concentrations of 3.76 and 13.8 µg/100 cm^2.	Not sampled	Not sampled	The floor of the building was double washed and rinsed in mid-October 1996. Fifteen confirmatory wipe samples taken after the cleanup was completed indicated the maximum PCB concentration on the floor of the bermed area was 4.2 µg/100 cm^3. The USAF and regulators agreed to classify this site as NFA on January 23, 1997, because the confirmatory sampling results indicate the measured PCB levels are within the guidelines for commercial or industrial operations.
S7 **Chemical Storage** Site S7 is an asphalt pad located south of Building 81 that was used to store algae inhibitors. Size: About 25 ft by 25 ft.	November 1995 Number of samples: 1 surface soil taken below the asphalt pad at 0.5-1 ft below ground surface. Analytes: Samples were analyzed for SVOCs, pesticides/PCBs, and metals. Results: Contaminants detected above ATDSR's CVs include benzo(a)pyrene at 0.66 ppm and arsenic at 4.5 ppm.			The USAF and regulators agreed to classify this site as NFA on January 23, 1997, because the Phase I RI measured concentrations were within the guidelines for commercial and industrial use.

Site Identification, Description, and History	Sampling Results of Environmental Investigations			Corrective Actions Accomplished and Planned
	Surface Soil/Sediment	**Groundwater**	**Surface Water**	
S8 **PCB Storage Area** The PCB storage area at Building 75 was used during the 1960s and 1970s to store empty PCB transformers. The asphalt-base storage area was located outside on the northwest side of the building. Size The area is about 125 ft by 50 ft.	September 1995 Number of samples: 1 surface soil Sampling interval: 0-2 ft Analyzed for PCBs. September 30, 1996 Number of samples: 2 surface soil Sampling interval: 0-2.5 ft Analyzed for PCBs. None of the samples had measured concentrations of PCBs above regulatory guidelines.	Not sampled	Not sampled	The USAF and regulators agreed to classify this site as NFA in April 1997 because the measured PCB concentrations in the soil were below regulatory levels for commercial and industrial use.

Site Identification, Description, and History	Sampling Results of Environmental Investigations			Corrective Actions Accomplished and Planned
	Surface Soil/Sediment	**Groundwater**	**Surface Water**	
T2 **Acid Neutralizing Tank** Site T2 consisted of a 35-gallon acid neutralizing tank located in Building 73, where battery acid was disposed of in the past. Size: A 35-gallon sump.	This site was not investigated under the RI program. Therefore, no environmental sampling data are available on this site.	Not sampled	Not sampled	The remediation of the o/w separator/acid neutralization tank occurred in October 1996. Activities included sampling sludge (no liquid phase) for characterization, removal and disposal of the separator contents (sludge and pea gravel), flushing and plugging all lines leading into the separator, pressure washing the separator, removing the separator structure, excavating the contaminated soils, backfilling and restoring the excavation site, and disposal of all generated soils and debris. The USAF and regulators agreed to classify this site as NFA in April 1997 because the measured concentrations in the soil confirmatory samples were below regulatory levels for commercial and industrial property.

Site Identification, Description, and History	Sampling Results of Environmental Investigations			Corrective Actions Accomplished and Planned
	Surface Soil/Sediment	Groundwater	Surface Water	
Parcel B				
D2 **Disposal Area Number 2** During the 1950s, this landfill received construction rubble. It was south of a grounds maintenance building that has been demolished. Debris is thought to be nonhazardous and has been covered with soil. Size: Roughly 7,000 square feet.	October 1995 Number of samples: 3 Sampling interval: 0-1 ft Analytes: Samples were analyzed for VOCs, SVOCs, and metals. Results: Contaminants above ATSDR's CVs were benzo(a)pyrene at 0.29 ppm and arsenic at 13.5 ppm. November 1996 Number of samples: 1 Sampling interval: 0-3 ft Analytes: Samples were analyzed for pesticides/PCBs and herbicides. Results: Contaminants above ATSDR CVs were benzo(a)pyrene at 0.29 ppm and dibenz(a,h)anthracene (0.19 ppm). PAHs may be attributable to railroad lines formerly present in this area.	October 1995 Number of samples: 2 November 13, 1996 Number of wells: 1 Analytes: Results: The following contaminants were present at levels above ATSDR's CVs: aluminum at 78,300 ppb; arsenic at 93 ppb; barium at 6,000 ppb J; total chromium at 140 ppb; cadmium at 3.4 ppb; iron at 163,000 ppb; lead at 100 ppb; manganese at 16,600 ppb; nickel at 170 ppb; thallium at 3.2 ppb; and vanadium at 70 ppb. Of these, only arsenic was significantly above its background concentration.	Not sampled	A geophysical survey was conducted. That was followed by soil and groundwater sampling. The measured concentrations of chemicals in the soil are within regulatory guidelines for commercial and industrial operations; in addition this area has been paved over and is used as a parking lot. There is no exposure to the groundwater contaminants. The USAF and regulators agreed to classify the site as NFA for soils in April 1999 and for groundwater in September 2002 (for all of Parcel B) because there is no exposure to the groundwater and the concentrations measured in the soil are within the regulatory guidelines for commercial and industrial operations.

Site Identification, Description, and History	Sampling Results of Environmental Investigations			Corrective Actions Accomplished and Planned
	Surface Soil/Sediment	Groundwater	Surface Water	
M1 **Hydraulic Lift in Motor Pool** At one time, the vehicle maintenance building housed three hydraulic lifts. Around 1990, one of the lifts leaked hydraulic oil. A tank of hydraulic oil 2 ft by 3 ft in size (holding approximately 90 gallons) emptied entirely before the leak was discovered.	November 1995 Number of samples: 1 Sampling interval: 0-2 ft Analytes: Samples were analyzed for SVOCs, metals, and petroleum hydrocarbons. Results: Contaminants above ATSDR CVs were benzo(a) pyrene at 3.4 ppm and arsenic at 4.8 ppm SJ.	October 1995 Number of samples:2 Results: A hydropunch was used to collect samples. The samples were analyzed for VOCs, SVOCs, and metals. Only lead at 17.5 ppb (EPA=15 ppb) was detected above its CV.	Not sampled	The USAF and regulators agreed to classify the site as NFA for soils in April 1999 and groundwater in September 2002 (for all of Parcel B) because there is no exposure to the groundwater and the concentrations measured in the soil are within the regulatory guidelines for commercial and industrial operations.

Site Identification, Description, and History	Sampling Results of Environmental Investigations			Corrective Actions Accomplished and Planned
	Surface Soil/Sediment	**Groundwater**	**Surface Water**	
M7 **Base Civil Engineering Storage** This consisted of Buildings 83 and 85. Building 83 was long and rectangular with one side open side and a dirt floor. It was used to store roadway and grounds equipment. Building 85 was a salt storage dome used to store roadway salt that contained ferrocyanide. Both buildings were demolished. Size: Building 85 is about 180 ft by 25 ft Building 83 is about 25 ft by 25 ft	September 12, 1995 Number of samples: 3 Sampling interval: 0-0.5 ft Analytes: Samples were analyzed for VOCs, SVOCs, and metals. Results: None were detected. Fall 1996 Number of samples: 2 Sampling interval: 0-2 ft Analytes: Samples were analyzed for VOCs. Results: None detected. September 30, 1996 Number of samples: 2 Sampling interval: 0-0.5 ft Analytes: Soil samples were analyzed for cyanide Results: No cyanide was detected in the samples.	February 1996 Number of wells: 1 Sampling events: 1 Analytes: Samples were analyzed for VOCs, SVOCs, metals, chloride and cyanide. Results: Contaminants above CVs were: cyanide at 250 ppb; arsenic at 22 ppb; lead at 140 ppb; and cadmium at 27 ppb. November 14, 1996 Number of wells:2 hydropunches Sampling events: multiple Analytes: 4 perched samples and 2 groundwater samples were analyzed for VOCs. Three samples were also analyzed metals and cyanide. Results: The following contaminants were present at levels above ATSDR's CVs in perched water: benzene (0.74 ppb); cadmium (270 ppb); cyanide (250 ppb); lead (200 ppb); and manganese (1,600 ppb). Contaminants above CVs in groundwater samples are: arsenic (77 ppb); barium (950 ppb); manganese (1,000 ppb); and vanadium (90 ppb).	October 23, 1996 Number of samples: 5 soil gas samples from the creek Analytes: Samples were analyzed for select VOCs. Results: PCE and toluene were detected and indicate that contaminants have migrated to the creek. The source is not known.	Based on the cyanide results, the storage of salt in Building 85 has impacted the perched groundwater. Arsenic in groundwater has been identified as a basewide contaminant, but the soil at this site does not appear to be a source. Soils at the site also do not appear to be the source of VOC contamination in the groundwater. The USAF and regulators agreed to classify the soil at this site as NFA on April 12, 1999. There is no exposure to the groundwater.

Site Identification, Description, and History	Sampling Results of Environmental Investigations			Corrective Actions Accomplished and Planned
	Surface Soil/Sediment	**Groundwater**	**Surface Water**	
O2 **Paint Booth Oil/Water Separator** This site consisted of Building 11, which contained three concrete o/w separators. The concrete and asphalt floor of Building 11 was stained with petroleum, oil, and lubricants. All three o/w separators were removed prior to the 1996 RI and the demolition of Building 11. OWS-11-1 (installed in 1944): a 220-gallon separator for solvents and oils. Releases occurred through spills and floor washings. OWS-11-2 (1954): a 130-gallon separator for paint, oil, and water. OWS-11-3 (1982): a 475-gallon separator outside the building for soil and fuels. Primary releases from fuels spills and truck washings.	October 25, 1996 Number of samples: 1 Sampling interval: 0.5-2 ft Analytes: Samples were Analyzed for VOCs. Results: None were detected at levels above ATSDR's CVs.	October 1996 Number of wells: 2 hydropunch Sampling events: 1 Analytes: Samples were analyzed for VOCs. One sample was also analyzed for SVOCs. Results: Only benzene at 0.39 ppb J was exceeded its ATSDR CV. The results indicate that the groundwater has been affected by a release, but not from site soil or the o/w separators.	Not sampled	The USAF and regulators agreed to classify the site as NFA on April 17, 1997. There is no exposure to the contaminants in the groundwater and no contaminants were detected in the soil at levels ATSDR's CVs.

Site Identification, Description, and History	Sampling Results of Environmental Investigations			Corrective Actions Accomplished and Planned
	Surface Soil/Sediment	**Groundwater**	**Surface Water**	
R1 **Wash Rack Draining to Creek** This site was located on the southeast end of Building 83 and consisted of a wash rack draining into the creek. A concrete pad located between Building 83 and the creek was used to wash grounds maintenance and other equipment at this location. The pad also had a floor drain that discharged directly into a storm sewer tributary (the Western Drainage Ditch) of the West Branch of Little Beaver Creek. Size: An area of about 25 ft by 40 ft.	September 1995 Number of samples:2 surface soil, 1 drain floor sediment Sampling interval: 0–0.5 ft Analytes: Samples were analyzed for VOCs, SVOCs, pesticides/ PCBs, herbicides, and metals. Results: The following contaminants were present at levels above ATSDR's CVs: benzo(a) pyrene at 1.7 ppm and arsenic at 8.7 ppm in soil and benzo(a) pyrene at 3.8 ppm and arsenic at 3.1 ppm. September 30, 1996 Number of samples: 4 Sampling interval: 0-0.5 ft Two samples analyzed for pesticides/PCBs, 2 samples analyzed for SVOCs, pesticides/PCBs, and metals. Results: Total PAHs were detected at 14.3 ppm.	Not sampled	Not sampled	Sampling indicated that activities at the wash rack have contributed to contamination of the area southeast of Site R1 and leading to the creek. The source of the low levels of PCB-1260 detected in the soil samples is unknown. The USAF and regulators agreed to classify the site as NFA for soil in April 1999 and groundwater in September 2002 (for all of Parcel B) because there is no exposure to the groundwater and the concentrations measured in the soil are within the regulatory guidelines for commercial and industrial operations.

Site Identification, Description, and History	Sampling Results of Environmental Investigations			Corrective Actions Accomplished and Planned
	Surface Soil/Sediment	**Groundwater**	**Surface Water**	
S1 **Coal Storage Area** The coal storage area was located along the western boundary of the base near Building 17. The coal was initially stored on the ground, but by the 1980s the area was covered with concrete. The concrete was removed as part of the demolition of Building 17. Waste oils, paint thinners, and solvents from paint cleaning operations were poured on the coal pile prior to 1978. It is possible that some of the waste oil infiltrated into the soil or was washed away during periods of rainfall into the storm drains or neighboring ditch, and into the West Branch of Little Beaver Creek. Prior to the base closing, coal pile drainage ditch ran south from the coal pile toward Little Beaver Creek, along the east side of Lafayette Street. Date of operation: 1945-1996 Size: An open area measuring approximately 300 ft by 150 ft.	October 1995 and 1996 Number of samples: 2 surface soil samples taken during each event. Sampling interval: varies 1-4 ft Analytes: VOCs, SVOCs, pesticides/ PCBs, and metals. Results: Arsenic (8.8 ppm) and Benzo(a)pyrene (0.22 ppm). September 1995 and 1996 Number of samples: 4 from ditch Sampling interval: varies from 0-2 ft. Analytes: VOCs, SVOCs, pesticides/ PCBs, and metals. Results: Most of the pesticide and PCB results from the 1995 sampling event were rejected for quality control reasons. During the 1996 sampling PCB 1260 (1.7 ppm).	1977 Number of samples: 2 samples of typical coal pile runoff Results: No chemicals were detected above ATSDR CVs; however, the analyte list was limited. Subsequent stream sediment sampling on the West Branch of Little Beaver Creek detected elevated levels of PAHs, which were probably due to coal pile runoff February and November, 1996 Number of wells: 3 to 4 monitoring well and 2 hydropunch Analytes: VOCs, SVOCs, pesticides/PCBs, and metals. Result: PCE (6.3 ppb); arsenic (44 ppb); lead (74 ppb); manganese (2,500 ppb); and thallium (2.2 ppb J). With the exception of arsenic, metal concentrations are similar to background concentrations.	September 12, 1995 Number of samples: 3 samples from the west ditch. Analytes: Samples were analyzed for select VOCs, SVOCs, pesticides/PCBs, and metals. Results: Only arsenic at 19.9 ppb SJ exceeded its corresponding ATSDR CV.	Sampling indicated that there is no indication that releases from the site are contributing to the Western Plume and the surface soil samples at this location contained PAH levels that were indicative of most shallow soil samples across the base. The USAF and regulators agreed to classify the site as NFA for soils in April 1999 and groundwater in September 2002 (for all of Parcel B) because there is no exposure to the groundwater and the concentrations measured in the soil are within the regulatory guidelines for commercial and industrial operations.

Site Identification, Description, and History	Sampling Results of Environmental Investigations			Corrective Actions Accomplished and Planned
	Surface Soil/Sediment	**Groundwater**	**Surface Water**	
S3 **Pesticide Storage** This site is located near the western boundary of the base, within Building 80. This building was used to store paint, and later to store the pesticides and herbicides used on base. The storage area was on a concrete slab, with no floor drains, inside the building The building was demolished. Extensive staining of unknown origin was observed on the concrete floor. A pesticide spray rig was stored outside on a concrete pad with a floor drain and covered with a roof. The concrete pad floor drain discharged to the sanitary sewer. Size: About 100 ft by 30 ft.	September 1995 Number of samples: 2 surface soil Sampling interval: 0-0.5 ft Analytes: Samples were analyzed for VOCs, SVOCs, pesticides/ PCBs, herbicides, and metals. Results: Contaminants with concentrations above ATDSR CVs are chlordane at 35.2 ppm, heptachlor at 0.532 ppm, benzo(a)pyrene at 3.8 ppm and arsenic at 17.9 ppm SJ. September 16, 1996 Number of samples: 6 surface soil Sampling interval: varies 0-4.5 ft Analytes: Analyzed for pesticides and PCBs. Results: PCBs (0.56 ppm) were detected above its CV. Because pesticides were only detected during the first sampling event, it appears the contamination was confined to a small area just outside Bldg. 80.	February 1996 Number of wells: 2 Sampling events: 1 Analytes: Samples were analyzed for VOCs, SVOCs, pesticides/PCBs, herbicides, and metals. Results: Contaminants with concentrations above ATDSR CVs are arsenic at 76 ppb and lead at 69 ppb. Only low levels of VOCs below 1 ppb were detected. November 14, 1996 Number of wells: 2 Sampling events: 1 Analytes: One sample analyzed for VOCs; the other sample for VOCs, SVOCs, pesticides/PCBs, herbicides, and metals. Results: The levels of VOCs were below 1 ppb.	Not sampled	A 9x5x3 ft area of chlordane-contaminated soil located north of Building 80 was excavated in March 1997. Confirmatory sampling: indicated that the final chlordane concentrations were below established clean-up criteria. The USAF and regulators agreed to classify the site as NFA for soil in April 1999 and groundwater in September 2002 (for all of Parcel B) because there is no exposure to the groundwater and the concentrations measured in the soil are within the regulatory guidelines for commercial and industrial operations.

Site Identification, Description, and History	Sampling Results of Environmental Investigations			Corrective Actions Accomplished and Planned
	Surface Soil/Sediment	**Groundwater**	**Surface Water**	
S6 **Paint Storage Area** Site S6 contains Building 69. The building stored paint and other chemicals including 55 gallon drums of MEK, acetone, floor sealant, PCE, xylene, adhesives, and water proofing compounds. The concrete floor, which was heavily stained, contained no floor drains. A water fill stand near the building was used to fill locomotives. Size: The building is about 65 ft. by 60 ft. The fill stand is about 25 ft in diameter.	September 1995 Number of samples: 4 surface soil near the fill station Sampling interval: varies 0-0.5 ft Analytes: Samples were analyzed for VOCs, SVOCs, and metal. Results: Benzo(a)pyrene exceeds its ATSDR CV with a maximum concentration of 7.4 ppm and an average concentration of 3.7 ppm. August 1995 Number of samples: 2 wipe samples from the concrete floor Analytes: Samples were analyzed for SVOCs and metals. Results: Individual PAHs were detected at concentrations up to 1,600 µg/100 cm^2. Lead was detected up to 14.4 µg/100 cm^2	Not sampled	Not sampled	The Phase I RI concluded that the surface soil has not been impacted by site releases. Arsenic at the site was attributed to background soil conditions. The USAF and regulators agreed to classify the site as NFA on January 23, 1997. because there is no exposure to the groundwater and the concentrations measured in the soil are within the regulatory guidelines for commercial and industrial operations

Site Identification, Description, and History	Sampling Results of Environmental Investigations			Corrective Actions Accomplished and Planned
	Surface Soil/Sediment	Groundwater	Surface Water	
Parcel C				
C6 **Water Tower** The water tower was painted with lead-based paint. The area immediately surrounding it may have been affected by deteriorating paint, paint removal, and/or water tower cleaning.	Date: 1995 Number of samples: 1 collected as a background sample. Analytes: Samples were analyzed for VOCs, SVOCs, metals, and pesticides/PCBs. Results: 263 ppm lead was detected. Other analytes were representative of background concentrations. October, 1996 Number of samples: 12 Sampling interval: 5 at 0-0.5 ft and 6 at 1.5-2 ft or deeper Analytes: Samples were analyzed for metals. Results: From samples collected at 0-0.5 ft, the maximum detected level of arsenic was 8.5 ppm and of lead was 518 ppm. The average concentration of lead in the surface soil (0-0.5 ft) was 336 ppm. The maximum concentration of lead detected at a depth of 1.5-2 ft was 544 ppm.	Not sampled	Not sampled	The USAF and regulators agreed to classify this site as NFA in February 1998 because the soil concentrations for lead and arsenic were below the regulatory guidelines for commercial and industrial operations.
Parcel D				
No Sites were identified				

Site Identification, Description, and History	Sampling Results of Environmental Investigations			Corrective Actions Accomplished and Planned
	Surface Soil/Sediment	**Groundwater**	**Surface Water**	
Parcel E				
C1 **West Branch of Little Beaver Creek** Site C1 includes the West Branch of Little Beaver Creek that flows east through the southern portion of the base. It's about 1,650 feet long. The upgradient portion, west of the base, is a storm water drainage system primarily for off-base roads and parking lots. On-base, the creek primarily receives storm water runoff from three major ditches. The western ditch included drainage from the coal storage and the pesticide storage areas. The middle and eastern ditches carry storm water from the southern and northern portions of the base. Flow is relatively low except during and after storms. On average, the creek is 15 feet wide. To the east of Gentile AFS, the creek exits the base through culvert and flows through a residential neighborhood.	1991 Three sediment samples were collected from the creek, near Site D1 and analyzed for VOCs, SVOCs, and selected metals. Results: Arsenic (14 ppm) and benzo[a]pyrene (9 ppm). Two sampling events in 1996 Number of samples: 14 and 5 from on-base locations; 2 and 3 from sediment in the storm water drainage system west of the base. Results: Arsenic (13.1 ppm); benzo(a)anthracene (35 ppm); benzo(a)pyrene (26 ppm); benzo(b) fluoranthene (25 ppm); benzo(k)fluoranthene (14 ppm); dibenz(a,h)anthracene (6.4 ppm); indeno(1,2,3-cd)pyrene (12 ppm), and iron (63,700 ppm). Total PAHs reached 508 ppm. Pesticide and PCBs data were rejected for quality control reasons from the first sampling event. Only one pesticide was detected during the second; the concentration was below ATSDR's CV.	Not sampled	In 1977, two samples were collected where the creek enters and exits the base. Analytes: The samples were analyzed for metals. Results: Lead (31 and 27 ppb); cadmium (8 and 11 ppb); and boron (110 and 90 ppb). In 1991, three samples were collected near Site D1. No contaminants were present at levels exceeding ATSDR's CVs. September 1995 and October 1996 Number of samples: 14 and 5 on-base, and 2 and 3 upgradient. Analytes: Samples were analyzed for VOCs, SVOCs, pesticides, PCBs and metals. Results: Antimony (41.7 ppb), arsenic (7.3 ppm), lead (19.1 ppb), and manganese (703 ppm).	The creek contains contaminants contributed by Gentile AFS and the upgradient residential neighborhood. Total PAHs in the creek sediment were highest near the former coal pile, exceeding 500 ppm. In 2000, much of the creek sediments were removed and replaced with clean soil. Post-excavation sampling revealed PAHs were still present at levels exceeding cleanup goals at a few locations, but further sediment removal was impracticable. These PAHs are possibly due to asphalt parking lots (including some added since Gentile AFS closed). In addition, upstream sources of contaminants were not addressed. USAF will require a deed restriction limiting uses of the creek, and erect warning signs prohibiting swimming, wading, playing and fishing in the creek to prevent contact with the sediments.

Site Identification, Description, and History	Sampling Results of Environmental Investigations			Corrective Actions Accomplished and Planned
	Surface Soil/Sediment	**Groundwater**	**Surface Water**	
C3 **Small Arms and Skeet Range** These two ranges were used from 1961 through 1990. Small caliber weapons were fired from firing bays into a metal deflecting plate and a sand trap at the Small Arms Range. Structures to keep bullets from leaving the range were also present. The adjacent Skeet Range was in an open field. The ranges are immediately south of the West Branch of Little Beaver Creek and east of Site D1. Site C3 is within Parcel E, which will be converted to a park and residential area by the City of Kettering. Size: The two ranges together are approximately 230 ft by 190 ft The Small Arms Range alone is approximately 100 ft by 75 ft	August 1995 Number of samples: 10 Sampling interval: 0-0.5 ft Analytes: Samples were analyzed for lead. Results: Lead concentrations ranged from 27 to 275 ppm. November 1996 Number of samples: 1 Sampling interval: surface soil Analytes: Samples were analyzed only for lead Results: Lead was present at 60 ppm. 1998 Number of samples: 1 Sampling interval: surface soil Analytes: Samples were analyzed only for lead Results: Lead was measured at 39 ppm.	Not sampled	Not sampled	The USAF and regulators agreed to classify this site as NFA in November 2001 because the lead concentrations measured in the soil were within the regulatory guidelines for residential use.

Site Identification, Description, and History	Sampling Results of Environmental Investigations			Corrective Actions Accomplished and Planned
	Surface Soil/Sediment	**Groundwater**	**Surface Water**	
C4 **Railroad Parcel** Before the base closed, this 1.3-acre site was used for recreation. There are a picnic shelter, restrooms, and a paved parking area on this site. Little is known about prior use of the site other than that it was owned by a railroad company. It was considered an area of potential concern because of "unknown" historical activities. Size: 1.3 acres	October 1995 Number of borings: 3 Soil was sampled with a Hydropunch. Sampling interval: Analytes: Samples were analyzed for VOCs, SVOCs, and metals. Results: Benzo(a)pyrene (0.28 ppm) was detected at concentrations above its CV. The chemicals measured in the soil were likely from the parking lot and vehicle usage. Sampling results indicate that the parking lot or vehicles did not affect the groundwater. October 2, 1996 Number of samples: 2 Sampling interval: 0-0.5 ft Analytes: Samples were analyzed only for pesticides and PCBs. Results: None were detected.	October 1995 Number: 3 by Hydropunch. Analytes SVOCs and metals. Results: Aluminum (223,000 ppb J); arsenic (6.6 ppb UJ), barium (3,410 ppb J); cadmium (10.5 ppb SJ); chromium (total) (380 ppb J); cobalt (313 ppb J), copper (1,050 ppb J); iron (797,000 ppb J); manganese (1,180,000 ppb J); nickel (767 ppb J); thallium (8.6 ppb SJ); vanadium (511 ppb J); and zinc (3,150 ppb J); high metal concentrations may be due to the sampling technique. 1996 Number of samples: 2 Results: Aluminum (44,300 ppb); arsenic (61 ppb); chromium (71 ppb); iron (112,000 ppb); lead (76 ppb); manganese (2,500 ppb); nickel (150 ppb); thallium (2.5 ppb); and vanadium (110 ppb).	Not sampled	The USAF and regulators agreed to classify this site as NFA in November 2001 because the measured concentrations in the surface soil will not pose a concern for public health for recreational or residential use. In addition, there is no exposure to the groundwater.

Site Identification, Description, and History	Sampling Results of Environmental Investigations			Corrective Actions Accomplished and Planned
	Surface Soil/Sediment	**Groundwater**	**Surface Water**	
C5 **Howitzer Spill Site** This site is located in the southern portion of Gentile AFS. In 1989, an Army Reserve Howitzer leaked diesel fuel onto an asphalt surface located east of Site R3. The howitzer was then moved to an open area (Site C5), where diesel fuel continued to leak into the soil. It was estimated that approximately 20 gallons of fuel were spilled in each area. Soil from the spill area was excavated and disposed of off site, and the excavated area was backfilled. There is no documentation indicating how much contaminated soil was removed. Size: A circular area with a roughly 15-20 ft diameter.	Number of samples: 2 borings drilled in locations selected by employees who originally excavated the soil after the spill Sampling interval: 3-6 ft Analytes: Samples were analyzed for SVOCs. Results: Benzo(a)pyrene (0.39 ppm J) was estimated at concentrations above its CV.	Not sampled	Not sampled	The USAF and regulators agreed to classify this site as NFA in January 1997 because the sampling results indicate the original soil removal was sufficient to prevent contaminant migration to the subsurface soil.

Site Identification, Description, and History	Sampling Results of Environmental Investigations			Corrective Actions Accomplished and Planned
	Surface Soil/Sediment	**Groundwater**	**Surface Water**	
C7 **Old Salvage Yard** Site C7 was used to burn rubbish. Records reviewed during the environmental investigation indicated that small quantities of scrap materials, crushed electronic crystals, and construction rubble could have been buried at this site, but concluded that the site had little potential for environmental contamination. Date of operation**:** The 1950s and 1960s. Size: Not provided.	May 1999 Number of samples: 7 Sampling interval: 0-0.5 ft Analytes: Samples were analyzed VOCS, SVOCs, pesticides/ PCBs, herbicides, and metals. Results: The following contaminants were detected at concentrations above ATSDR's CVs: benzo(a)pyrene at 1.6 ppm; TCE at 160 ppm; and arsenic at 91 ppm.	Not sampled	Not sampled	The USAF and regulators agreed to classify this site as NFA in September 2002.

Site Identification, Description, and History	Sampling Results of Environmental Investigations			Corrective Actions Accomplished and Planned
	Surface Soil/Sediment	**Groundwater**	**Surface Water**	
C8 **Southern Storage Yard** Site C8 consists of two subareas: a storage yard in the southern tip of the property and a disturbed area between the southern portion and Hale Road. The property was used to store construction materials, and possibly for salvage-type activities. Around 1955-1960, the area was used as a baseball diamond. Since then, it has been a revegetated field. Date of operation: At least in 1945 and possibly through 1954. Size: Not provided.	May 1999 Number of samples: 7 Sampling interval: 0-0.5 ft and 1-3 ft Analytes: Samples were analyzed VOCS, SVOCs, pesticides/ PCBs, herbicides, and metals. Results: The following contaminants exceeded ATSDR's CV: benzo(a)pyrene at 0.69 ppm and arsenic at 10.4 ppm	No sampling has been conducted at Site C8. However, according to the 2000 Supplemental RI for Parcel E and a detailed risk assessment based on residential exposure, Site C8 has not been affected by harmful levels of contaminants		The USAF and regulators agreed to classify this site as NFA on July 31, 1997.

Site Identification, Description, and History	Sampling Results of Environmental Investigations			Corrective Actions Accomplished and Planned
	Surface Soil/Sediment	**Groundwater**	**Surface Water**	
D1 **Disposal Area** From 1950 to 1955, this 1.5-acre site received construction rubble, scrap electronic parts, asbestos "domes," and small quantities of waste oil and battery acid. It also may have received drums (the contents of which are not known), paint thinners, and solvents. The disposal area was covered with an estimated 10 to 20 feet of soil, and there was vegetation on the surface. Date of operation: 1950-1955. Size: 1.5 acres.	1990 Number of samples: 2 Sampling interval: not known Analytes: Samples were analyzed for VOCs and metals. Results: Trace amounts of VOCs and metals at levels generally similar to background concentrations. 1995 Number of samples: 2 Analytes: Samples were analyzed for SVOCs and metals. Results: Benzo(a)pyrene (3 ppm) was present at levels above its CV.	Dates: 1988, 1989, 1990, 1995 Number of wells: 8 Number of samples: 41 Results: Trans- and cis-1,2-DCE (1,500 ppb), TCE (13,800 ppb). BTEX compounds were also detected. Three sampling events occurred during 1996 Number of wells: 11 to 15 Results: 1,2-DCE (14 DJ ppb); benzene (91 DJ ppb); trans-1,2-DCE (110 ppb); TCE (5,800 D ppb); vinyl chloride (2.1 ppb); bromo-dichloromethane (11 DJ ppb); bromoform (30 DJ ppb); cis-1,2-DCE (6,400 D ppb); dibromo-dichloromethane (33 DJ ppb); methylene chloride (50 DJ ppb); aluminum (43,200 ppb); arsenic (120 ppb); chromium (74 ppb); iron (77,200 ppb); lead (52 ppb); manganese (1,400 ppb); thallium (13 ppb); and vanadium (110 ppb).	Not sampled	Waste materials and related surface soil were removed. The excavation pit was filled with clean soil. The subsurface soil did have high concentrations of TCE and may be a source of groundwater contamination. Investigations suggest there are two groundwater plumes: one contains TCE and its breakdown products, the other contains petroleum hydrocarbons. The latter is more widely dispersed, but the concentrations are lower. Both plumes appear to be limited to unconsolidated material. Groundwater is encountered about 17 to 30 ft bgs. No VOCs migrated beyond the furthest downgradient monitoring well or north of the creek. Groundwater contamination is not thought to be discharging to the creek. The plumes are migrating to the east, possibly along an old county sewer line. Monitoring results show the plumes are not leaving the base. There is no exposure to the groundwater.

Site Identification, Description, and History	Sampling Results of Environmental Investigations			Corrective Actions Accomplished and Planned
	Surface Soil/Sediment	**Groundwater**	**Surface Water**	
D3 **Old Salvage Yard** Rubbish was burned at this site during the 1950s and 1960s. A small amount of scrap material, including construction rubble and electronics parts, may also be buried at this site. Date of operation: 1950s and 1960s Size: an oval of about 170 ft by 75 ft	October 1995 After a geophysical survey was conducted, soil samples were collected from three locations. Analytes: The samples were analyzed for VOCs, SVOCs, pesticides, and metals. Results: Arsenic (17.8 ppm S) was measured at concentrations above it ATSDR CV. October 15, 1996 Number of samples: 1 Sampling interval: 0-0.5 ft Analytes: The sample was analyzed for pesticides and PCBs only. Results: None were detected.	October 30, 1995 Number of samples: 3 hydro-punch. Analytes: SVOCs and metals. Results: Aluminum (157,000 ppb J); arsenic (15.7 ppb J); barium (2,950 ppb J); cadmium (4.9 ppb J); total chromium (285 ppb J); cobalt (170 ppb J); copper (874 ppb J); iron (598,000 ppb J); lead (422 ppb J); manganese (9,950 ppb J); nickel (471 ppb J); and vanadium (356 ppb J), the metals may be due to the Hydropunch technique. November 13, 1996 Number of wells: 1 Analytes: Pesticides, PCBs, and metals. Results: Arsenic (7.9 ppb) and iron (11,000 ppb); these levels were within the range of concentrations measured in places selected to serve as base background locations.	Not sampled	The USAF conducted a geophysical survey to delineate the locations of buried materials, and then conducted sampling. Contaminants were present in surface soil and groundwater, but do not suggest that there were any releases from waste buried at the site. The USAF has concluded that neither surface soil nor groundwater have been impacted by past disposal practices. Soil and groundwater sampling results were to be incorporated in the baseline risk assessment. The USAF and regulators agreed to classify this site as NFA on July 31, 2001.

Site Identification, Description, and History	Sampling Results of Environmental Investigations			Corrective Actions Accomplished and Planned
	Surface Soil/Sediment	**Groundwater**	**Surface Water**	
D4 **Electron Tube Disposal Area** Electron tubes possibly containing radioactive material were reportedly buried 10 to 15 feet below the ground surface in this location during the mid-1950s. This area is slated to be converted to a park by the City of Kettering.	1979 Number of samples: 24 Sampling interval: Unknown Analytes: Samples were analyzed for gross alpha, gross beta, and gamma activity. Results: Radionuclides were within naturally occurring levels. An additional radiation survey conducted by the Army Environmental Hygiene Agency in 1987 concluded that samples contained levels less than or equal to background conditions. No information about the number of samples collection is given. A 1996 EPA electromagnetic and ground penetrating radar survey and surface survey for radiological constituents found three non-hazardous metal objects (a garbage can lid, a culvert, and a steel plate) and a 12-gallon drum, which was encased in concrete The drum emitted an elevated radioactivity level. All materials were within 5 ft of surface. Soil samples collected in each trench were free of elevated radioactivity levels.	Not sampled	Not sampled	The drum encased in concrete was opened and contained 273 individual electron tubes, which were transported off site. Based on the results of soil sampling, it was decided (in spring 1997) that no further corrective action was necessary. All materials were containerized and shipped to Wright-Patterson Air Force Base. The USAF and regulators agreed to classify this site as NFA on April 17, 1997.

Site Identification, Description, and History	Sampling Results of Environmental Investigations			Corrective Actions Accomplished and Planned
	Surface Soil/Sediment	**Groundwater**	**Surface Water**	
S2 **Reserve Coal Storage** The former reserve coal storage site is located in the southern portion of the base south of Site D1 and southwest of Building 110. Reserve coal was stored on unpaved ground in this open area. The coal was coated with oil by the supplier and wetted as required by DESC to suppress dust. It is believed liquid wastes were not disposed of in this area. Date of operation: Mid-1960s to mid-1980s Size: About 150 ft by 50 ft	October 1996 Number of samples: 3 surface soil Sampling interval: 0-0.5 ft Analytes: Samples were analyzed for SVOCs, PCBs, and metals. Results: Contaminants present at levels above ATSDR's CV were benzo(a)pyrene (2.2 ppm) and arsenic (12.3 ppm). October 1996 Number of samples: 2 surface soil Sampling interval: varies 0-2.5 ft Analytes: Analyzed for PAHs, PCBs, and metals. Results: The following contaminants were present at levels above ATSDR's CV: benzo(a)pyrene (1.7 ppm) and dibenz(a,h)anthracene (0.37 ppm). Elevated contaminant concentrations in soil occurred primarily in the deepest soil sample, from 10 to 12 feet bgs.	Date: Number of wells: 1 Sampling events: 1 Analytes: Samples were analyzed for SVOCs, PCBs, and metals. Results: Arsenic (22 ppb) and manganese (660 ppb) were detected at levels above ATSDR's CVs.	Not sampled	The sampling results indicate that the concentrations of PAHs above CVs extend to the area between Sites S2 and D1. The USAF and regulators agreed to classify this site as NFA on August 15, 2001.

Site Identification, Description, and History	Sampling Results of Environmental Investigations			Corrective Actions Accomplished and Planned
	Surface Soil/Sediment	Groundwater	Surface Water	
Parcel F				
S9 **Cobalt Storage** This site is located at Building 45 in the southeastern corner of the station. A source of cobalt was used to calibrate instruments.	Not sampled	Not sampled	Not sampled	A December 6, 1996, radiological survey found no evidence of a source of cobalt-60. The USAF and regulators agreed to classify this site as NFA on January 23, 1997, because of no evidence of past or present release or disposal of hazardous substances.

Site Identification, Description, and History	Sampling Results of Environmental Investigations			Corrective Actions Accomplished and Planned
	Surface Soil/Sediment	**Groundwater**	**Surface Water**	
T1 **Hydrofluric Acid Catch Basin** Site T1, which is the site of o/w separator 10, is located near the southwest corner of Building 46, in the eastern portion of the base. The o/w separator, or basin, consisting of two concrete chambers, was used as a neutralizing and settling tank for the waste hydrofluoric acid from the crystal etching operations in Building 46. Date of operation: 1957-1980 Size: The chambers were 12 ft long, 6 ft wide, and 5 ft deep.	This site was not investigated under the RI program. Therefore, no environmental sampling data are available on this site.	Not sampled	Not sampled	O/w separator 10 at Site T1 was remediated in November 1996. The activities included sampling sludge (no liquid phase) for characterization, removal and disposal of the separator contents (sludge and pea gravel), flushing and plugging all lines leading into the separator, pressure washing the separator, removing the separator structure, excavating the contaminated soils, backfilling and restoring the excavation site, and disposal of all generated soils and debris. Concentrations in confirmatory soil samples were below industrial use guidelines. The USAF and regulators agreed to classify this site as NFA on April 17, 1997, because concentrations measured in the confirmatory samples were below regulatory guidelines for industrial use.

Site Identification, Description, and History	Sampling Results of Environmental Investigations			Corrective Actions Accomplished and Planned
	Surface Soil/Sediment	Groundwater	Surface Water	
T3 **Acid Neutralizing Sump** This site consists of an underground acid neutralizing sump, which is located inside Building 46 in the eastern part of the station. The sump is connected to a fume hood and sink and receives acid, which is then washed down the sink and neutralized by limestone located in the sump. Size: The sump is a round, 35 gallon, fiberglass tank measuring 2 feet in diameter and 5 feet in height.	This site was not investigated under the RI program. Therefore, no environmental sampling data are available on this site.	Not sampled	Not sampled	Oil/water separator 9 at Site T was remediated in November 1996. The activities included sampling sludge (no liquid phase) for characterization, removal and disposal of the separator contents (sludge and pea gravel), flushing and plugging all lines leading into the separator, pressure washing the separator, removing the separator structure, excavating the contaminated soils, backfilling and restoring the excavation site, and disposal of all generated soils and debris. Concentrations in confirmatory soil samples were below industrial use guidelines. The USAF and regulators agreed to classify this site as NFA on April 17, 1997, because concentrations measured in the confirmatory samples were below regulatory guidelines for industrial use.

Site Identification, Description, and History	Sampling Results of Environmental Investigations			Corrective Actions Accomplished and Planned
	Surface Soil/Sediment	Groundwater	Surface Water	
Other Sites				
Commander's Yard Elevated arsenic concentrations were detected in the soil during background sampling for the RI activities.	1996 Number of samples: 2 Sampling interval: 0-5 ft Analytes: VOCs, SVOCs, pesticides/PCBs, and metals. Results: Arsenic was detected at 213 and 319 ppm., and above ATSDR's CV for arsenic in soil. 1997 Number of samples; Sampling interval: five samples between 0-5 ft and three samples between 0.5 and 2.5 ft. Analytes: Arsenic and chromium Results: The highest concentrations of arsenic (96.9 to 298 ppm) were present in the 0-5 ft samples.	Not sampled	Not sampled	In March 1997, 850 tons of contaminated soil was removed from the yard. Confirmatory samples indicated that arsenic concentrations were reduced to 21 ppm and below. The USAF and regulators agreed to classify this site as NFA on April 17, 1997.

Sources: URS Greiner 1996, 1997a, b.

Note: Values presented represent the maximum concentration detected above the lowest comparison value. **Bolded** groundwater concentrations represent concentrations 100 times higher than the lowest comparison value.

Laboratory Key J = The concentration is estimated because the results are below the sample quantitation limit or quality control criteria were not met.
U = The compound was analyzed fro but not detected. The value shown is the practical quantitation limit.
S = The reported value was determined by the method of standard additions.

Table 3. Waste Generation and Disposal History

Waste Type	Specific Site Description/ Operation	Buildings (IRP Site)	Waste Generated	Disposal Practices
Waste Oil Generation	Operations and maintenance of diesel generators at the Electric Power Station.	Bldgs. 81 and 73 (in Sites M6, R2, and R3)	1,000 gallons of waste oil per year.	1940 to 1978:Estimates by former employees suggest waste oils were disposed of by pouring oil over the coal pile stored at Site S1 from the 1940s to 1978. Post-1978: After 1978, the waste oil was processed by DPDO at Wright-Patterson Air Force Base (WPAFB).
	Routine vehicle maintenance operations for DESC equipment in the maintenance garage.	Bldg. 11	550 gallons of waste oil per year.	1940s to 1960s: Estimates by former employees suggest the waste was containerized and used for fire protection at WPAFB during this time. After 1960: The waste was stored on site until sufficient quantities accumulated for contract disposal.
	Operations, such as routine oil changes, occurred in an area referred to as the locomotive repair shop.	Bldg. 18	100 gallons of waste oil per year.	(see above)
Photographic Waste	Graphics Arts Branch.	Bldg. 45	About 5-10 gallons of photographic chemical waste per week.	1961 to 1972: The waste from Bldg. 45 was discharged to the sanitary sewer. 1972 to 1981: The waste underwent silver recovery prior to discharge. Post 1981: The waste was collected for off-base silver recovery.
	Camera Club and DESC Dispensary	Bldgs. 4 and 56	Small quantities	Post 1962: Wastes were disposed of in the sanitary sewer. The Dispensary stopped generating this type of waste in 1980.

Waste Type	Specific Site Description/ Operation	Buildings (IRP Site)	Waste Generated	Disposal Practices
Solvents Generation	Facilities Services Division paint shop.	Bldg. 1	Small quantities of solvents and paint thinner waste.	1940s to 1957: Employee reports estimate that waste was discharged to the sanitary sewer during this time. Post 1957: No information was provided for post-1957 disposal practices or whether the shop was still active.
	Office appliance maintenance and repair shop	Bldg. 11	About 40 gallons of solvents per month.	Post 1950s: The waste was consolidated with waste from the maintenance garage in Bldg 11.
	Reproduction shop	Bldg. 46	Up to 100 gallons of electrostatic etching solvents and perchloroethylene per year.	1957 to 1978: Solvents were discharged to the sanitary sewer. Post 1978: Collected on base and brought to WPAFB for contract disposal.
	Structural protective coating unit	Bldg. 16	55 gallons of painting cleaning solvents per year.	1940 to 1978: Estimates by former employees suggest that solvents were disposed of by pouring oil over the coal pile stored at Site S1 from the 1940s to 1978. Post-1978: After 1978, the solvents were processed by DPDO at Wright-Patterson Air Force Base (WPAFB).
Battery Acid	Mobile equipment maintenance garage	Bldg. 11	Less than 10 gallons of battery acid per year.	1940s to 1978: Employee reports estimate that the acid was disposed of at Site S1 during this time. 1978 to 1980: The waste was neutralized to the sanitary sewer Post 1980: The waste was hauled off site by a contractor.

Waste Type	Specific Site Description/ Operation	Buildings (IRP Site)	Waste Generated	Disposal Practices
Heating Plant	Operations at the coal heating plant that supplied the installation with heat. It contains four coal-fired boilers.	Bldg. 17	The operations generated varying amounts of coal pile runoff, about 1,500 gallons per day of boiler blowdown, and about 5 to 15 cubic feet per week of fly ash and bottom ash.	The coal pile runoff was released to a storm water sewer since 1945 and ran into the creek. According to employee accounts, the boiler blowdown was released to the storm water sewer between 1945 and 1972. After that time, it was discharged to the sanitary sewer. Since 1945, most of the ash was disposed of in off-base landfills. Some ash has been used as fill within DESC. The plant was equipped with mechanical cyclonic dust collectors. Ash was collected in an outside silo equipped with a dust washer.
Pesticide Use	Storage of various chemicals in bulk in the Grounds Maintenance Warehouse Building. The pesticides were moved to Bldg. 80 in 1982.	Bldg. 31 (Site S4)	Rinsate	1945 to 1982: According to employee accounts, empty containers were rinsed once prior to disposal and the rinse was discharged to the sanitary sewers or surface drainage at the site of application.
	Storage of liquid and dry pesticides.	Bldg. 80 (Site S4)	Rinsate	Post 1982: Empty containers are tripled rinsed prior to disposal with the general refuse and rinse water is collected for reuse in pesticide applications.
Low-Level Radioactive Waste Disposal Sites	Site D4 (formerly Site RD-1)			The mid-1950s: Electron tubes were buried at this site. Radiation surveys indicated radionuclides were within normal background levels. Geophysical investigations identified several buried objects including a concrete encased drum containing 273 electron tubes. These were containerized and transported off-base.
	Site D5 (formerly Site RD-2)			1940s and early 1950s: This area was reportedly used to bury electron tubes. No evidence of radionuclides or electron tubes was identified. The site is beneath a paved parking lot.

Waste Type	Specific Site Description/ Operation	Buildings (IRP Site)	Waste Generated	Disposal Practices
Air Force Orientation Group (AFOG) Shops	Several AFOG shops generated hazardous waste, including an exhibit and quality control shop, a photography laboratory, and a transportation shop.	Bldgs. 4 and 74	Hazardous wastes, included oils (10 gallons per month), hydraulic fluid and paint thinners (150 gallons per 6 month), solvents, and photographic chemicals (10 gallons per month).	Post 1980: These shops moved to DESC from WPAFB in 1980. The waste was stored on site until quantities warranted off-base disposal.
Storage Sites	S1-Coal Storage Area: This site was used as a coal storage area for the coal-fired heating plant. Originally, the coal was stored on the bare ground. By the 1980s, coal was stored on a concrete pad. The pad was removed with the demolition of Bldg. 17.			1945 to 1978: Small quantities of heating oil, as well as waste oil, solvents, and battery acids were poured onto the coal pile. During rainfall, small quantities may have entered Little Beaver Creek via a storm ditch near Lafayette Road.
	S2-Reserve Coal Storage Area: Site S2 was a reserve coal storage area located near the southern boundary.			No waste oils were disposed of over the coal pile. There was potential for runoff from the coal pile, however.
	S5-Polychlorinated biphenyl (PCB) Transformer Storage Site: This site was used as a transformer storage site for about 15 transformers.			All of the PCB-containing transformers were removed from the base.

Waste Type	Specific Site Description/ Operation	Buildings (IRP Site)	Waste Generated	Disposal Practices
Disposal Sites	D1-Disposal Area: The area was used as a dump area.			1950 to 1955: This area was used for the disposal of miscellaneous construction rubble, hardfill, scrap electronic parts, asbestos domes, waste oil, and possibly thinners.
	D2-Disposal Site: A small area near Building 110 that was filled with construction rubble.			The 1950s: This site was used for the disposal of construction rubble on the ground surface.
	D3-Disposl Site: D3, an old salvage yard, was located near the small arms range.			1950s and 1960s: This area was used for the disposal of crushed electronics parts, scrap metals, and construction rubble may have been disposed of at the salvage yard. These items may also have been burned at the site.

Other areas used for waste disposal (1940s and 1950s)

- **Old Salvage Yard (C7).** The Old Salvage Yard was used between the 1950s and 1960s to burn rubbish. In addition, small quantities of scrap materials, crushed electronic crystals, and construction rubble could have been buried at this site.
- **T1. Hydrofluric Acid Catch Basin.** Site T1, which is the site of o/w separator 10, is located near the southwest corner of Building 46, in the eastern portion of the base. The o/w separator, or basin, consisting of two concrete chambers, was used as a neutralizing and settling tank for the waste hydrofluoric acid from the crystal etching operations in Building 46. Date of operation: 1957-1980. Size: The chambers were 12 ft long, 6 ft wide, and 5 ft deep.

Source: ES 1982.

Table 4. Remedial History

Site ID	Description	Rational for Environmental Investigation	Date/Year Environmental Investigations Began	Date of Completed Cleanup Action/ Remedial Action	Date EPA/Ohio EPA Signed off
Parcel A					
C2	Railroad Lines	Investigations were undertaken to test whether soils were affected by rail line operations.	August 1995	1985-The railroad spurs were removed.	January 23, 1997, based on the Phase I findings.
D5	Electron (vacuum) Tubes Dispoal	This site was identified during the records search (as RD-1or RD-2). Investigations were undertaken to determine the impact from material believed to be buried at the site.	1979	None. The area will be turned into a parking lot.	April 1997
M2	Transformer Failure Area	A transformer failed at the site.	1995	1995-The USAF removed soil from the area and installed a replacement transformer,	January 23, 1997, based on the Phase I findings.
M3	Waste Oil Feed Area	Investigations were undertaken to determine the impact from former site operations.	1995	The funnel and the tank were removed in 1992, and the area was subsequently paved.	January 23, 1997, based on the Phase I findings.
M4	Compressor Room	Investigations were undertaken to determine the impact from former site operations and the presence of a 3-ft deep trench of oil-stained gravel.	May 1994	None	January 23, 1997, based on the Phase I findings.

Site ID	Description	Rational for Environmental Investigation	Date/Year Environmental Investigations Began	Date of Completed Cleanup Action/ Remedial Action	Date EPA/Ohio EPA Signed off
M5	Stains in Shop Areas	Stains were identified during a visual site inspection in December 1993. No floor drains were identified in the shops to allow drainage of spilled material.	None	None	January 1997
M6	Floor Stains	Oil stains were obseved on the floor.	1995	None	January 23, 1997, based on the Phase I findings that found no PCBs in wipe samples.
O1	Drain Line	This site was not investigated under the RI program. Therefore, no environmental sampling data are available on this site.	NA	1996-The oil/water (o/w) separator was removed.	April 17, 1997, following a removal action.
O3	Oil/Water Separator and Drain	The asphalt floors contained stains. This site was not investigated under the RI program. Therefore, no envorinmental sampling data are available on this site.	NA	1996-The o/w separator was removed.	April 17, 1997, following a removal action.
O4	Oil/Water Separator	This site was not investigated under the RI program. Therefore, no environmental sampling data are available on this site.	NA	1996-The o/w separator was removed.	April 17, 1997, following a removal action.
R2	Floor Drain to Infiltration Pit	Black staining was noted during the 1994 orientation site visit. Chemical releases could have occurred through a discharge pipe.	1995	1996-An UST and contaminated soil were removed. 1998-LTM began.	The NFRAP was submitted for soil on May 2, 1997. The NFRAP for groundwater was signed in April 1997.
R3	Wash Rack	The outside wash rack was used to clean Horwitzers. Activities related to the wash rack could have impacted the surrounding soil.	1995	This area was paved and is used as a parking lot.	January 23, 1997, based on the Phase I findings.

Site ID	Description	Rational for Environmental Investigation	Date/Year Environmental Investigations Began	Date of Completed Cleanup Action/ Remedial Action	Date EPA/Ohio EPA Signed off
S4	Herbicide Storage	There was visible staining on the floor.	1995	None.	April 29, 1997 for soil only, based on the findings of the Phase I RI.
S5	PCB Storage Area	The Environmental Baseline Survey (1994) reported that a potential spill or release may have occurred at Site S5. However, no staining inside or outside the bermed area was found during the site inspection.	1995	1996-The floor of the building was doubled washed and rinsed. Confirmatory samples were taken.	January 23, 1997, following a cleanup action.
S7	Chemical Storage	Algae inhibitors were stored on an asphalt pad. Investigations were undertaken to determine if the surface soil had been impacted by the chemicals.	1995	None	January 23, 1997, based on the Phase I findings.
S8	PCB Storage Area	This outside area was used to store empty transformers in the 1960s and 1970s. Investigations were undertaken to determine if soil under the asphalt had been impacted.	1995	None	April 17, 1997, based on the Phase I findings.
T2	Acid Neutralizing Tank	This site was not investigated under the RI program. Therefore, no environmental sampling data are available on this site.	NA	1996-The o/w/separator was removed.	April 17, 1997, following a removal action.
Parcel B (Note: The NFRAP for Parcel B groundwater was signed in September 2002).					
D2	Disposal Area No. 2	Investigations were undertaken to determine potential impacts to groundwater/soil from landfill contents.	1995	None	April 12, 1999, for soils.

Site ID	Description	Rational for Environmental Investigation	Date/Year Environmental Investigations Began	Date of Completed Cleanup Action/ Remedial Action	Date EPA/Ohio EPA Signed off
M1	Hydraulic Lift in Motor Pool	One lift leaked hydraulic oil about 1990. A tank of hydraulic oil 2 ft by 3 ft in size (holding approximately 90 gallons) emptied entirely before the leak was discovered.	1995	None	April 12, 1999, for soils.
M7	Base Civil Engineering Storage	Investigations were undertaken to determine if stored chemicals or salt impacted the soil.	1995	None	April 12, 1999, for soils.
O2	Paint Booth Oil/Water Separator	The concrete and asphalt floor of Building 11 was stained with petroleum, oil, and lubricants.	1996	1996-All three o/w separators were removed prior to the 1996 RI and the demolition of Building 11.	April 17, 1997
R1	Wash Rack Draining to Creek	A floor drain from the site enters a storm drain tributary (western ditch) of the creek. Investigations were undertaken to determine if effluent from the wash rack had impacted the soil/sediment of the creek.	1995		April 12, 1999, for soils.
S1	Coal Storage Area	The site was identified during the records search. The coal pile had received waste prior to 1978. Investigations were undertaken to evaluate contribution to the groundwater and soil, as well as contributions to the surface water and sediment of the creek.	1977	The drainage ditch from the coal pile was removed. The area beneath the former coal pile was covered with soil and asphalt.	April 12, 1999, for soils.

Site ID	Description	Rational for Environmental Investigation	Date/Year Environmental Investigations Began	Date of Completed Cleanup Action/ Remedial Action	Date EPA/Ohio EPA Signed off
S3	Pesticide Storage	Extensive staining of unknown origin was observed on the concrete floor.	1995	1997-A 9x5x3 ft volume of chlordane-contaminated soil located north of Building 80 was excavated. The final grade of the parking lot was rasied about 5 ft by bringing in additional soil. The lot was then covered with asphalt. This "effectively blocks any further direct contact soil exposures. " (AFBCA 1999).	April 29, 1999, for soils.
S6	Paint Storage Area	Heavy staining was noted on the concrete floors. Investigations were undertaken to determine whether hazardous material had impacted soil and groundwater.	1995	None. The PAHs in the soil were attributed to another site and the building was scheduled for demolition.	January 23, 1997

Site ID	Description	Rational for Environmental Investigation	Date/Year Environmental Investigations Began	Date of Completed Cleanup Action/ Remedial Action	Date EPA/Ohio EPA Signed off
Parcel C					
C6	Water Tower	The water tower was painted with lead paint. The area surrounding the tower may have been affected by deteroriating paint, paint removal, and/or water tower cleaning.	1995-1996:	None. Lead was detected, within industrial use standards for soil. Since the land will remain industrial use, no actions were deemed necessary. Per a February 2003 Explanation of Significant Differences to the original decision document, the commercial/industrial deed restriction for this site, and thus Parcel C, was removed after it was discovered that lead concentrations in the soil met residential use requirements.	February 9, 1998
Parcel D					
No sites were identified					
Parcel E					
C1	West Branch of Little Beaver Creek	Investigation were undertaken to determine whether storm water runoff released into on-site drainages or in storm drains routed to the creek polluted the creek.	1977	2000-The sediment in Gentile AFS section of the creek was dredged and warning signs were posted.	September 2002, with the contingency of site controls (signs) to limit access to the creek.

Site ID	Description	Rational for Environmental Investigation	Date/Year Environmental Investigations Began	Date of Completed Cleanup Action/ Remedial Action	Date EPA/Ohio EPA Signed off
C3	Small Arms and Skeet Range	Invesgtigations were undertaken to determine if lead had impacted soil.	August 1995	None. The lead concentrations measured in the soil were within the regulatory guidelines for residential use.	November 2001
C4	Railroad Parcel	The site was considered an area of potential concern due to unknown historical operations. Investigations were undertaken to determine whether soils had been impacted by past activities with respect to pesticides and PCBs.	October 1995	None	November 2001.
C5	Howitzer Spill Site	In 1989, an Army Reserve Howitzer leaked diesel fuel onto an asphalt surface located east of Site R3. The Howitzer was then moved to an open area (Site C5), where diesel fuel continued to leak into the soil.	1995	Soil from the spill area was excavated. There is no documentation indicating how much contaminated soil was removed.	January 23, 1997
C7	Old Salvage Yard	Records reviewed during the environmental investigation indicated that small quantities of scrap materials, crushed electronic crystals, and construction rubble could have been buried at this site. This site was used for rubbish burning during the 1950s and 1960s.	1999	1999 and 2002- Contaminated soils were removed. 2002-Long-term groundwater monitoring was initiated.	July 2002
C8	Southern Storage Yard	No sampling has been conducted at Site C8. However, according to the 2000 Supplemental RI for Parcel E, groundwater beneath C8 has not been affected.		None. The low level s of soil contaminants pose no significant risk to public health.	July 31, 2001

Site ID	Description	Rational for Environmental Investigation	Date/Year Environmental Investigations Began	Date of Completed Cleanup Action/ Remedial Action	Date EPA/Ohio EPA Signed off
D1	Disposal Area	The site was identified during the records search. Investigations were undertaken to determine whether and to what the contents of the former disposal area contributed to groundwater contamination.	1988	The USAF removed waste materials and contaminated surface soil. The excavation pit was backfilled with clean soil. The site is currently covered with natural vegetation. Subsurface soils still contain high concentrations of TCE and may be a source of groundwater contamination. The USAF constructed a slurry wall to control groundwater contamination.	September 11, 2002.
D3	Old Salvage Yard	Investigations were undertaken to determine whether soil and groundwater had been impacted by the contents of the former disposal area.	October 1995	None. The Phase II RI confirmed that there were no releases from the buried material.	July 31, 2001
D4	Electron Tube Disposal Area	This site was identified during the records search (as RD-1or RD-2). It was believed that the tubes in this disposal area contained radioactive material.	1996	All materials were containerized and shipped to Wright-Patterson Air Force Base.	April 17, 1997

Site ID	Description	Rational for Environmental Investigation	Date/Year Environmental Investigations Began	Date of Completed Cleanup Action/ Remedial Action	Date EPA/Ohio EPA Signed off
S2	Reserve Coal Storage	Site S2 was identified in 1982. The coal was coated with oil by the supplier and wetted at the base. No waste was poured on the pile. Investigations were undertaken to identify if the pile had impacted soil and groundwater.	October 1995	None	August 15, 2002
Parcel F					
S9	Cobalt Source Area	Invesigations were undertaken because the site was believed to be a source of cobalt used to calibrate instruments.	1996	None. A radiological survey revealed no evidence of cobalt-60.	January 23, 1997
T1	Hydrofluoric Acid Catch Basin.	Site T1 was identifid during the records search. The site contained two concrete chambers used to neutralize hydrofluoric acid. Because of the low potential for contamination, the site was not investigated during the RIs.	NA	1996-Remediaion of the catch basin and collection of confirmatory samples.	April 17, 1997
T3	Acid Neutralizing Sump	The site consisted of an underground acid neutarlizing sump. This site was not investigated under the RI program. Therefore, no environmental sampling data are available on this site.	NA	October 1996-Remediation of the sump.	April 17, 1997

Site ID	Description	Rational for Environmental Investigation	Date/Year Environmental Investigations Began	Date of Completed Cleanup Action/ Remedial Action	Date EPA/Ohio EPA Signed off
Other Sites					
	Commander's Yard	Elevated arsenic concentrations were detected in the soil at the yard when the yard was sampled as a background locations during Phase II investigations.	1996-1997	March 1997-850 tons of soil were removed and confirmatory samples collected.	April 17, 1997

Sources: URS Greiner 1996; 1997a, b.
Jacobs Engineering 2000

Table 5. Evaluation of Potential Exposure Pathways at Gentile AFS

Pathway	Elements of an Exposure Pathway						Comment
	Source	**Media**	**Point of Exposure**	**Route of Exposure**	**Time Frame**	**Exposed Population**	
Groundwater Potential exposure to VOCs in drinking water.	Former Gentile AFS activities that resulted in the groundwater plumes.	Groundwater	None	None	None	None	*There is no point of exposure*. No drinking water wells are located at the Gentile AFS property. The base and the Cities of Kettering and Oakwood obtain their drinking water from municipal sources. The source wells are located several miles from the site. No drinking water source for this area is affected by Gentile AFS-related contaminants.

Pathway	Elements of an Exposure Pathway						Comment
	Source	**Media**	**Point of Exposure**	**Route of Exposure**	**Time Frame**	**Exposed Population**	
Surface Water and Sediment Potential exposure to contaminants in surface water and sediment of the West Branch of Little Beaver Creek.	Storm water runoff from the coal pile and parking lots. Also, runoff from off-base, upstream sources.	Surface water and sediment	The West Branch of Little Creek	Incidental ingestion Dermal contact	Past Current Future	Children playing in the creek and other vistors.	*Past Exposure:* Elevated concentrations of contaminants, primarily polycyclic aromatic hydrocarbons (PAHs), have been detected in sediment of the West Branch of Little Creek. ATSDR determined that even if children and adults had frequent and direct contact with the highest levels of PAHs, *they would not be expected to develop any health problems.* *Current and Future Exposure:* Some elevated levels of PAHs still remain after most of the contaminated sediment was dredged. Residual PAHs are believed to be related to ongoing runoff from on-site parking lots and off-base, upstream sources. ATSDR determined that even if children and adults have frequent and direct contact with the highest level of PAHs, *they are not expected to develop any health problems.*

Pathway	Elements of an Exposure Pathway						Comment
	Source	**Media**	**Point of Exposure**	**Route of Exposure**	**Time Frame**	**Exposed Population**	
Flood Events Potential exposure to contaminants transported from Gentile AFS during flooding events.	Gentile AFS and other local sources	Soil, sediment, and flood debris	Local backyards	Incidental ingestion Dermal contact	Past Current Future	Local residents	No sampling data are available to evaluate residential areas near Gentile AFS. Using general information on sediment deposition patterns and available sampling data from the West Branch of Little Creek, ATSDR determined that sediment deposited in residental areas would not be expected to contain harmful levels of Gentile AFS chemicals.
Soil and Garden Crops Potential exposure to contaminants for Gentile AFS employees who were allowed to plant vegetable gardens in the southeastern section of Parcel E.	Gentile AFS activities and upstream sources	Soil and flood debris	Parcel E gardens	Dermal contact Ingestion of crops	Past	Gentile AFS employee gardeners	The exact location of the garden in Parcel E is not known. However, contaminants were detected in soil at sites within this parcel. Concentrations of contaminants in the soil are not at levels of health concern for people who contact the soil. Furthermore, these contaminants are not strongly taken up by plants nor are they likely to have acccumulated on the crop surface to harmful levels. Therefore, gardeners and produce consumers are not expected to develop health effects from potential exposure to the contaminants.

Table 6. Summary of Chemicals Detected in Little Beaver Creek Surface Water at Concentrations Above ATSDR's Drinking Water Comparison Values

Chemical	Concentration (ppb)			ATSDR Comparison Value (ppb)
	Minimum	Maximum	Average [5]	
Antimony [1]	30 (U)	41.7	30.7	6
Cadmium	8	11	9.5	5
Lead [2]	4	31	14	0 [6]
Bis(2-ethylhexyl)phthalate [3]	1 (U)	50 (U)	9.6 (U)	4.8
Phenanthrene [4]	10 (U)	67	16.2	NA

Notes

1 For one or more of the samples, the detection limit was higher than the ATSDR comparison value (CV). For these samples it is not possible to identify if the chemical's concentration was above or below the CV.
2. Lead was detected during two of the three surface water sampling events. The concentrations reported from the 1977 sampling event (2 samples) were almost 10 times higher than the concentrations reported in the 1991 sampling event (3 samples). Lead was not detected during the 1995 sampling event (9 samples). The average value was calculated using the 5 samples where lead was detected.
3. Bis(2-ethylhexyl)phthalate was never detected, however, the detection limit was frequently above the ATSDR CV. Therefore this chemical was included in the exposure evaluation for this pathway.
4. There are no drinking water CVs for phenanthrene, therefore, this chemical was included in the exposure evaluation for this pathway.
5. The average concentration was calculated by considering the measured concentrations for each sample with a detectable concentration. This method was chosen to provide the highest and most conservative value for the average concentration.
6. EPA's MCL is 15 ppb.

Key

(U) = The chemical was not detected. The concentration shown is the detection limit.

Table 7. Comparison of Chemicals Detected in the Creek at Concentrations Above ATSDR's Drinking Water Comparison Values to Concentrations Measured in Other Creeks

Chemical	Average Concentration in the Gentile Section of Little Beaver Creek [1]	Range of Concentrations Measured in Other Creeks and Steams	Comments
Antimony (only identified during the September 1999 sampling event)	30.7 ppb	ND to 12 ppb	Typically ND (about 5 ppb), max shown was geometric mean of detects in USGS national database. [2]
Cadmium (only identified during the June 1977 sampling event)	9.5 ppb	0.05 to 6 ppb	Typically in natural waters at < 1 ppb. Range measured by USGS in Mississippi River and tributaries. [3]
Lead (only identified during the June 1977 and the November 1995 sampling events)	14 ppb	5 to 30 ppb	Typical concentration was 3.9 ppb in 50,000 surface water monitoring stations. [4]
Bis(2-ethylhexyl)phthalate (only identified during the September 1999 sampling event)	9.6 ppb	NA	Although it was frequently described as 'commonly found in urban creeks', ATSDR did not find any reports describing specific sampling results.
Phenanthrene [3] (only identified during the September 1999 sampling event)	16.2 ppb	16 ppb	Detected in industrial effluent. The median concentration of 15 PAHs (including phenanthrene) in surface water was less than 10 ppb. [5]

Notes

1. The average concentration was calculated by considering the measured concentrations for each sample with a detectable concentration. This method was chosen to provide the highest and most conservative value for the average concentration.
2. Toxicological Profile for Antimony (ATSDR 1992).
3. Toxicological Profile for Cadmium (ATSDR 1999a).
4. Toxicological Profile for Lead (ATSDR 1999b).
5. Toxicological Profile for PAHs (ATSDR 1995).

Key

ppb=parts per billion.

Table 8. Summary of Chemicals Detected at Least Once in the Creek Sediment at Concentrations Above ATSDR's Residential (Children) Soil Comparison Values

Chemical	Concentration [ppm]			ATSDR Comparison Value [ppm]
	Minimum	Maximum	Average	
Arsenic	1.8	40.4	7.5	0.4
Beryllium	0.15	0.53	0.22	0.1
Copper [1]	4.2	73.4	19.4	60
Lead [1]	11.5	534	138.8	400
Benzo(a)anthracene	0.28	35	10.5	0.9
Benzo(a)pyrene	0.24	26	8.8	0.09
Benzo(b)fluoranthene	0.41	25	8.2	0.9
Benzo(g,h,i)perylene	0.15	13	4.5	
Benzo(k)fluoranthene	1.50	25	9.1	9
Benzyl butyl phthalate	0.12	7.6	2.0	0.03
Dibenz(a,h)anthracene	0.43	6.4	2.7	
Indeno(1,2,3-c,d)pyrene	0.13	14	5.0	0.9
Total PAHs	ND	508	150	

Notes

1. Only one of the soil samples had a concentration above the ATSDR CV.

Key:
ppm= parts per million.

Source: URS Greiner 1996.

Table 9. Comparison of Chemicals Detected in the Creek Sediments at Concentrations Above ATSDR's Residential (Children) Soil Comparison Values to Concentrations Measured in Other Creeks

Chemical	Average Concentration [1] [ppm]	Range of Concentrations Measured in Other Creeks and Steams	Comments
Arsenic	7.4	2.0 to 31	Range represents streams not obviously affected by mining or industrial activities. Concentrations near industrial activities (including the heating plant) ranged from 49 to 58 ppm. Maximum concentration reported for streams affected by mining was 404 ppm. [3]
Beryllium	0.22	0.5 to 1.1	From the Neosho River in southeast Kansas. [4]
Copper [2]	19.1	12.3 to 28.4	Measured in other sections of Little Beaver Creek [5]
Lead [2]	138.8	27 to 267	Range of average lead concentrations measured in Eastern and Midwestern river basins. [6]
Benzo(a)anthracene	10.5		
Benzo(a)pyrene	8.8	0.03 to 2.3	Bottom sediments from the Great Lakes and New Jersey waterways. [7]
Benzo(b)fluoranthene	8.2		NA
Benzo(g,h,i)perylene	4.5		NA
Benzo(k)fluoranthene	9.1		NA
Benzyl butyl phthalate	2.0		NA
Dibenz(a,h)anthracene	2.7	0.87	Average concentration of sites in Florida known or suspected to be contaminated. [7]
Indeno(1,2,3-c,d)pyrene	5.0		NA
Total PAHs	150	6.88 to 36.7	Measured in other sections of Little Beaver Creek [5]. The majority of the samples from the Gentile section of the creek were higher than this range. The two samples from the eastern drainage ditch and the sample on the eastern boundary of the base were within this range.

Notes

1. From URS Greiner 1996
2. Only one of the soil samples had a concentration above the ATSDR's CV.
3. Toxicological Profile for Arsenic (ATSDR 2000).
4. Toxicological Profile for Beryllium (ATSDR 2002).
5. Ohio EPA 2002.
6. Toxicological Profile for Lead (ATSDR 1999b).
7. Toxicological Profile for PAHs (ATSDR 1995)