EPA/ROD/R05-98/105
1998

EPA Superfund
Record of Decision:

WRIGHT-PATTERSON AIR FORCE BASE
EPA ID: OH7571724312
OU 09, 11
DAYTON, OH
09/30/1998

United States Air Force
Installation Restoration Program
Wright-Patterson Air Force Base
88 Air Base Wing
Wright-Patterson Air Force Base, Ohio

Record of Decision for 41 No Action Sites at Wright-Patterson Air Force Base, Ohio

PROTECT RESTORE ENHANCE

Environmental Management
Wright-Patterson AFB

28 August 1998

RECORD OF DECISION
FOR 41 INSTALLATION RESTORATION PROGRAM SITES
AT WRIGHT-PATTERSON AFB

TABLE OF CONTENTS

List of Figures

List of Tables

ACRONYM LIST

ARAR	Applicable or Relevant and Appropriate Requirements
BGS	Below Ground Surface
BMP	Basewide Monitoring Program
BRA	Baseline Risk Assessment
BRAP	Basewide Removal Action Plan
BS	Burial Site
BTEX	Benzene, Toluene, Ethylbenzene, and Xylene
BUSTR	Bureau of Underground Storage Tank Regulations
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CO	Consent Order (Administrative Orders on Consent)
COCs	Contaminants of Concern
COPCs	Contaminants of Potential Concern
DCE	Dichloroethylene
EE/CA	Engineering Evaluation/Cost Analysis
EOD	Explosive Ordnance Disposal
ERA	Ecological Risk Assessment
EFDZ	Earthfill Disposal Zone
FS	Feasibility Study
GPM	Gallons Per Minute
GPR	Ground Penetrating Radar
HP	Central Heating Plant
HQ	Hazard Quotient
IAG	Interagency Agreement
IRP	Installation Restoration Program
LF	Landfill
LNAPL	Light, Non-Aqueous Phase Liquid
MCD	Miami Conservancy District
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goals
MSL	Mean Sea Level
NA	No Action
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEPA	National Environmental Policy Act
NGVD	National Geodetic Vertical Datum
NPL	National Priorities List
NUC	Deactivated Nuclear Reactor
OEPA	Ohio Environmental Protection Agency
OU	Operable Unit
PAH	Polyaromatic Hydrocarbons
PCB	Polychlorinated Biphenol
PCE	Tetrachloroethylene
PPB	Parts per billion
PPM	Parts per million
PRGs	Preliminary Remediation Goals
RADB	Radioactive Waste Burial Site
RCRA	Resource Conservation and Recovery Act

RI	Remedial Investigation
RME	Reasonable Maximum Exposure
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SI	Site Investigation
SMCL	Secondary Maximum Contaminant Levels
SOV	Soil Organic Vapor
SP	Spill Site
SSRAP	Site-Specific Removal Action Plan
SVOC	Semi-volatile Organic Compound
TCE	Trichloroethene
TDS	Total Dissolved Solids
TIC	Tentatively Identified Compound
TPH	Total Petroleum Hydrocarbons
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VOCs	Volatile Organic Compounds
WPAFB	Wright-Patterson Air Force Base

RECORD OF DECISION
FOR 41 INSTALLATION RESTORATION PROGRAM SITES AT WRIGHT-PATTERSON AFB

1.0 THE DECLARATION

1.1 Site Name and Location:

Wright-Patterson Air Force Base (WPAFB)
Greene and Montgomery Counties, Ohio.

WPAFB is listed on the National Priorities List (NPL) and is not scheduled for closure under the Base Realignment and Closure program. The following is a list of the forty-one (41) sites that are recommended for No Action (NA):

Landfill 1	Central Heating Plant 2	Burial Site 2
Landfill 2	Central Heating Plant 4	Burial Site 3
Landfill 3	Central Heating Plant 5	Burial Site 5
Landfill 4	Spill Site 4	Burial Site 6
Landfill 5	Spill Site 5	Building 4020 UST
Landfill 6	Spill Site 6	Chemical Disposal Area
Landfill 7	Spill Site 7	East Ramp UST
Landfill 9	Spill Site 8	Radioactive Waste Burial Site
Landfill 11	Spill Site 9	Deactivated Nuclear Reactor
Landfill 12	Spill Site 11	Explosive Ordnance Disposal Range
Central Heating Plant 1	UST 71A	Earth Fill Disposal Zones 2 through 10

1.2 Statement of Basis and Purpose

This decision document presents the rationale for selection of the NA remedial alternative for 41 Installation Restoration Program (IRP) sites at WPAFB. The selection process was conducted in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). WPAFB, the lead agency, and the U.S. Environmental Protection Agency (USEPA) and the Ohio EPA (OEPA), support agencies, recommend the NA remedial alternative for soils at these sites. This recommendation is supported by the Administrative Record for each site. Documents, correspondence, and other resources which are included in the Administrative Record for the sites contained in this ROD are identified in Attachment 1.

1.3 Description of the Selected Remedy: No Action

WPAFB has selected NA as the remedial alternative for each of the 41 sites at WPAFB listed in Section 1.1. The NA decision for these sites deals only with soils; remedies for groundwater, surface water, and sediments at the sites will be addressed under the Basewide Monitoring

Program (BMP). Under this program, WPAFB will study the types and movements of contaminants in groundwater, surface water, and sediment across the base. The BMP will examine all of the IRP sites as well as parts of the Base that do not contain hazardous waste sites. Section 2.4 discusses the role of this ROD and how it fits into the overall Base cleanup strategy in more detail.

WPAFB, USEPA, and OEPA have determined that the land uses upon which this ROD is based are the current land use scenarios for these sites and that these land use scenarios are highly likely to remain the same in the future. Table 1 identifies the land use classification and current use of the 41 sites included in this ROD.

In addition, the selected remedial alternative of NA includes the following conditions:

- Access restrictions: Most of these sites are located within an active military installation with limited access. Some sites have additional fencing around them, further limiting access.

- Institutional controls: Digging and/or excavating at any of these sites, especially those with waste/contamination left in place (such as the landfills), is currently restricted by the nature of the installation and should remain minimal.

- Continued maintenance: For Landfills 1 through 7, 9 and 11, maintenance of the landfill caps will be conducted as described in the Operation and Maintenance Plans specific to each landfill.

- Deed restrictions: If, in the future, portions of the Base are transferred, appropriate land use restrictions will be incorporated into the deed prior to transfer. These restrictions will ensure that the land use does not interfere with the remedy implemented at these sites, and that the proposed reuse is protective of human health and the environment. For the Explosive Ordnance Disposal (EOD) Range, in the event of property transfer, restrictions will be placed on the deed to restrict further land use to industrial uses.

The NA remedial alternative is protective of public health because there is no current exposure to subsurface contamination, however low, and future exposure is considered extremely unlikely because of the nature of the land uses.

Table 1. Land Use

Site Name	Site Tracking Name	Land Use Classification [1]	Current Land Use
Landfill 1	LF1	O	Undeveloped
Landfill 2	LF2	O	Wooded, undeveloped
Landfill 3	LF3	C	Golf course
Landfill 4	LF4	I	Equipment storage
Landfill 6	LF6	O	Pasture
Landfill 7	LF7	O	Equestrian facility
Landfill 5	LF5	I/O	Recreational
Landfill 9	LF9	O	Undeveloped
Landfill 11	LF11	O	Recreational
Landfill 12	LF12	O	Recreational
Spill Site 5	SP5	I	Research laboratories
Spill Site 6	SP6	C	Building, grass
Spill Site 7	SP7	I	Fuel storage
Spill Site 9	SP9	I	Fuel storage
Spill Site 11	SP11	I	Aircraft Survivability Research Facility
UST71A	UST71A	I	Research laboratories
Earthfill Disposal Zone 2	EFDZ2	I	Undeveloped
Earthfill Disposal Zone 3	EFDZ3	I	Undeveloped
Earthfill Disposal Zone 4	EFDZ4	O/I	Paved streets, grass
Earthfill Disposal Zone 5	EFDZ5	O	Grass
Earthfill Disposal Zone 6	EFDZ6	I	Developed/building site
Earthfill Disposal Zone 7	EFDZ7	O	Paved streets, grass
Earthfill Disposal Zone 8	EFDZ8	O/I	Undeveloped
Earthfill Disposal Zone 9	EFDZ9	O	Undeveloped
Earthfill Disposal Zone 10	EFDZ10	O	Wooded, undeveloped
Burial Site 3	BS3	O	Undeveloped
Burial Site 5	BS5	O	Undeveloped
Burial Site 6	BS6	O	Undeveloped

Site Name	Site Tracking Name	Land Use Classification [1]	Current Land Use
Landfill 1	LF1	O	Undeveloped
Deactivated Nuclear Reactor	NUC	I	Decommissioned, laboratories, classroom
Spill Site 4	SP4	I	Building/paved streets
East Ramp UST	ERTR	I	Paved/grass
Burial Site 2	BS2	O	Paved/grass
Building 4020 UST	UST4020	I	Paved/grass
Chemical Disposal Area	CDA	I/O	Paved/grass
Central Heating Plant 1	HP1	I	Closed heating plant
Central Heating Plant 2	HP2	I	Closed heating plant
Central Heating Plant 4	HP4	I	Operational heating plant
Central Heating Plant 5	HP5	I	Operational heating plant
Spill Site 8	SP8	I	
Radioactive Waste Burial Site	RADB	O	Undeveloped
Explosive Ordnance Disposal Range	EOD	I	Industrial

1 Based on 1997 Management Action Plan.
I = Industrial, including aircraft maintenance
C = Commercial, including administrative and office
O = Open, including recreational

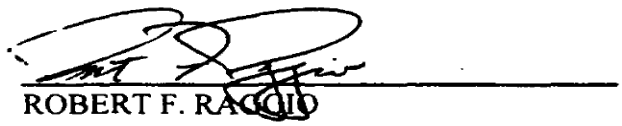
1.4 Declaration Statement:

1.4.1 Declaration Statement: United States Air Force - Aeronautical Systems Center

It has been determined that no remedial action is necessary at any of the following sites:

Landfill 1	Central Heating Plant 2	Burial Site 2
Landfill 2	Central Heating Plant 4	Burial Site 3
Landfill 3	Central Heating Plant 5	Burial Site 5
Landfill 4	Spill Site 4	Burial Site 6
Landfill 5	Spill Site 5	Building 4020 UST
Landfill 6	Spill Site 6	Chemical Disposal Area
Landfill 7	Spill Site 7	East Ramp UST
Landfill 9	Spill Site 8	Radioactive Waste Burial Site
Landfill 11	Spill Site 9	Deactivated Nuclear Reactor
Landfill 12	Spill Site 11	Explosive Ordnance Disposal Range
Central Heating Plant 1	UST 71A	Earth Fill Disposal Zones 2 through 10

Based on the evaluation of analytical data and other information, the United States Air Force has determined that no remedial action for soils is necessary to ensure protection of human health and the environment at these sites. The No Action alternative meets ARARs established by federal, state, or local environmental laws. In accordance with NCP Section 300.430 (f)(4)(ii), a review will be conducted every five years after finalization of this Record of Decision to ensure that this decision provides continued protection of human health and the environment. This five-year review will be performed as part of the Basewide Monitoring Program.



ROBERT F. RACCIO
Lieutenant General, USAF
Commander

28 Sep 98
Date

RECORD OF DECISION
FOR 41 INSTALLATION RESTORATION PROGRAM SITES AT WRIGHT-PATTERSON AFB

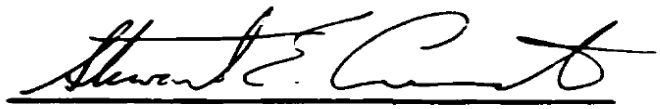
1.4 Declaration Statement:

1.4.2 Declaration Statement: United States Air Force - Air Force Materiel Command

It has been determined that no remedial action is necessary at any of the following sites:

Landfill 1	Central Heating Plant 2	Burial Site 2
Landfill 2	Central Heating Plant 4	Burial Site 3
Landfill 3	Central Heating Plant 5	Burial Site 5
Landfill 4	Spill Site 4	Burial Site 6
Landfill 5	Spill Site 5	Building 4020 UST
Landfill 6	Spill Site 6	Chemical Disposal Area
Landfill 7	Spill Site 7	East Ramp UST
Landfill 9	Spill Site 8	Radioactive Waste Burial Site
Landfill 11	Spill Site 9	Deactivated Nuclear Reactor
Landfill 12	Spill Site 11	Explosive Ordnance Disposal Range
Central Heating Plant 1	UST 71A	Earth Fill Disposal Zones 2 through 10

Based on the evaluation of analytical data and other information, the United States Air Force has determined that no remedial action for soils is necessary to ensure protection of human health and the environment at these sites. The No Action alternative meets ARARs established by federal, state, or local environmental laws. In accordance with NCP Section 300.430 (f)(4)(ii), a review will be conducted every five years after finalization of this Record of Decision to ensure that this decision provides continued protection of human health and the environment. This five-year review will be performed as part of the Basewide Monitoring Program.



STEWART E. CRANSTON
Lieutenant General, USAF
Commander

30 Sep 98
Date

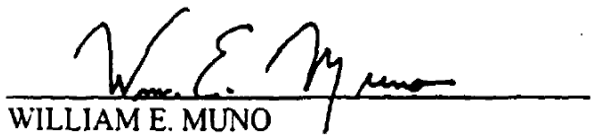
1.4 Declaration Statement:

1.4.3 Declaration Statement: United States Environmental Protection Agency

It has been determined that no remedial action is necessary at any of the following sites:

Landfill 1	Central Heating Plant 2	Burial Site 2
Landfill 2	Central Heating Plant 4	Burial Site 3
Landfill 3	Central Heating Plant 5	Burial Site 5
Landfill 4	Spill Site 4	Burial Site 6
Landfill 5	Spill Site 5	Building 4020 UST
Landfill 6	Spill Site 6	Chemical Disposal Area
Landfill 7	Spill Site 7	East Ramp UST
Landfill 9	Spill Site 8	Radioactive Waste Burial Site
Landfill 11	Spill Site 9	Deactivated Nuclear Reactor
Landfill 12	Spill Site 11	Explosive Ordnance Disposal Range
Central Heating Plant 1	UST 71A	Earth Fill Disposal Zones 2 through 10

Based on the evaluation of analytical data and other information, the United States Air Force has determined that no remedial action for soils is necessary to ensure protection of human health and the environment at these sites. The No Action alternative meets ARARs established by federal, state, or local environmental laws. In accordance with NCP Section 300.430 (f)(4)(ii), a review will be conducted every five years after finalization of this Record of Decision to ensure that this decision provides continued protection of human health and the environment. This five-year review will be performed as part of the Basewide Monitoring Program.



WILLIAM E. MUNO
Director, Superfund Division
U.S. Environmental Protection Agency Region V

9/30/98
Date

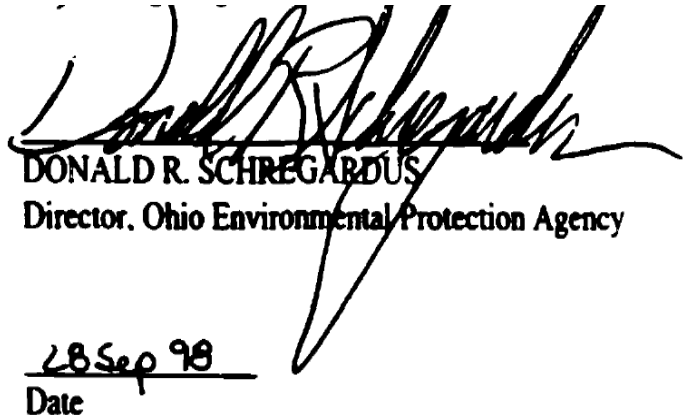
1.4 Declaration Statement:

1.4.4 Declaration Statement: Ohio Environmental Protection Agency

It has been determined that no remedial action is necessary at any of the following sites:

Landfill 1	Central Heating Plant 2	Burial Site 2
Landfill 2	Central Heating Plant 4	Burial Site 3
Landfill 3	Central Heating Plant 5	Burial Site 5
Landfill 4	Spill Site 4	Burial Site 6
Landfill 5	Spill Site 5	Building 4020 UST
Landfill 6	Spill Site 6	Chemical Disposal Area
Landfill 7	Spill Site 7	East Ramp UST
Landfill 9	Spill Site 8	Radioactive Waste Burial Site
Landfill 11	Spill Site 9	Deactivated Nuclear Reactor
Landfill 12	Spill Site 11	Explosive Ordnance Disposal Range
Central Heating Plant 1	UST 71A	Earth Fill Disposal Zones 2 through 10

Based on the evaluation of analytical data and other information, the United States Air Force has determined that no remedial action for soils is necessary to ensure protection of human health and the environment at these sites. The No Action alternative meets ARARs established by federal, state, or local environmental laws. In accordance with NCP Section 300.430 (f)(4)(ii), a review will be conducted every five years after finalization of this Record of Decision to ensure that this decision provides continued protection of human health and the environment. This five-year review will be performed as part of the Basewide Monitoring Program.



DONALD R. SCHREGARDUS
Director, Ohio Environmental Protection Agency

28 Sep 98
Date

2.0 DECISION SUMMARY

2.1 Site Details

2.1.1 Name and Location

WPAFB is located in southwestern Ohio, about 10 miles northeast of the city of Dayton and adjacent to the city of Fairborn. The Base is approximately 60 miles north of Cincinnati and 50 miles west of Columbus in Montgomery and Greene counties. (See Figure 1).

2.1.2 Size and Description

The installation is composed of Wright and Patterson Fields, which are separated by State Route 444. Wright Field comprises Area B, covering approximately 2,800 acres, including three runways that are no longer used for flights. Patterson Field comprises Areas A and C, covering approximately 5,711 acres. The Base is Headquarters to the Air Force Materiel Command and home to organizations such as the Air Force Wright Aeronautical Laboratories, Air Force Institute of Technology, and the Aeronautical Systems Center. The Base has a significant proportion of its acreage devoted to logistical support/warehouse land use, research and development, and administrative and classroom space. Airfield functions constitute 24 percent of all on-base land use, including more than 2,000 acres. The Base also has more than 2,500 acres of undeveloped land, but much of that acreage is restricted from certain types of development by environmental constraints, such as flood plains, steep slopes, Indian burial mounds, and other cultural/natural features. Other constraints, such as a new national park, laser testing facilities, explosive safety zones, and clear zones for runways also restrict development in certain areas.

2.1.3 Geography/Topography

WPAFB lies within the Till Plains section of the Central Lowlands Physiographic Province. The regional land surface is typically flat to gently rolling. Area streams and rivers have developed generally level flood plains, such as the Mad River flood plain on which much of WPAFB is situated. Where the airfields are located, the terrain is generally level. In the higher areas to the southeast, where much of the Base housing and support facilities are located, the terrain is gently rolling.

The land surface altitude at WPAFB varies from 800 feet above the National Geodetic Vertical Datum of 1929 (NGVD) in Areas A and C, within the Mad River flood plain, to 975 feet above NGVD in Area B. Surface drainage from WPAFB runs ultimately to the Mad River by way of Hebble and Trout Creeks and several small, unnamed tributaries.

2.1.4 Climate

The climate in the area is temperate and humid with a mean annual temperature of 52.3 degrees Fahrenheit (°F) and a mean annual precipitation of 36.25 inches. Precipitation is generally heavier in the spring and fall. The accepted last frost date for this region is May 20th. In the autumn, the average initial occurrence of freezing temperatures is in late October. Temperatures of 0°F or below will be experienced in about four years out of five, while 100°F or higher will occur in about one year out of five.

2.1.5 Basewide Geology

The geology of the area consists of Ordovician and Silurian Age rocks overlain by unconsolidated deposits of Pleistocene and Recent Age materials. The bedrock unit underlying most of WPAFB is the Richmond Group of Ordovician Age. It consists of up to 265 feet of interbedded shales and limestones that outcrop in portions of eastern Montgomery and western Greene Counties, and is capped in some areas of WPAFB by thin, discontinuous erosion remnants of Brassfield Limestone of Silurian Age. The Brassfield Limestone is a relatively pure limestone up to 30 feet thick.

The bedrock reflects a preglacial drainage system which is masked by overlying unconsolidated Pleistocene Age glacial till and outwash deposits. These materials were deposited during the last period of Wisconsin glaciation, and are present throughout the area. Glacial till consists of a heterogeneous mixture of cobbles, gravel, sand, silt and clay that were deposited directly by the glacier as it moved over the region. These deposits, interbedded with water-bearing sand and gravel zones, locally may form confined aquifers or may limit recharge to underlying unconsolidated aquifers.

As the glacier retreated, melt streams flowing through the valleys and lowlands deposited large accumulations of sand and gravel identified as outwash deposits. These deposits attain a maximum thickness of 250 feet around Dayton and usually overlie till deposits. Outwash deposits form the most prolific aquifer of the Ohio region.

Recent Age alluvium deposited in relatively thin sequences by modem streams is present in the ground surface adjacent to all major streams. The alluvium consists of both sorted and unsorted accumulations of sand, silt, gravel, and clay.

2.1.6 Basewide Surface Water and Groundwater Resources

The majority of WPAFB lies within the flood plain of the Mad River Valley. The Mad River originates about 60 miles northeast of the Base and flows generally south and southwest, past WPAFB, to its confluence with the Great Miami River in Dayton. The Mad River flows along the western boundary of Area C and passes to the north and northwest of Area B. The section of the Mad River that runs in the area of the Base has been designated by the State of Ohio as a state water resource--a warm water habitat that provides primary contact recreation. It also acts as a source for agricultural and industrial water supply. The river generally follows the course of the Mad River Buried Valley Aquifer, an inconspicuous bedrock valley that has been filled with unconsolidated sediments consisting primarily of glacial outwash deposits with discontinuous zones of glacial till. The glacial outwash deposits are very permeable and exhibit high transmissivity and hydraulic conductivity, while the till deposits can act as aquitards with relatively low hydraulic conductivity. Vertical hydraulic gradients vary throughout the area, and both upward and downward gradients have been recorded in monitoring well clusters at WPAFB.

Water is present in the unconsolidated deposits and the underlying bedrock. Water occurs in intergranular pore spaces in the unconsolidated deposits; in bedrock, water occurs in fractures, joints, and solution openings in the shale and limestone. The unconsolidated alluvium, outwash, and till interact to form a complex aquifer system at WAFB. Outwash is locally separated from

overlying alluvial materials by 2 to 7 feet of dense, unsorted till composed of clay, silt, gravel, and sand. In many areas, the till layer is thin or absent and alluvium directly overlays the outwash deposits. Also, in many areas two till layers occur within the glacial outwash, dividing it locally into separate hydraulic units. The till, wherever it occurs, can be described as a semiconfining layer with many holes, tears, and missing pieces.

Most of Area C, which ties behind Huffman Dam, is subject to flooding. The 10-year floodplain of the Mad River and WPAFB is 804.7 feet above mean sea level (MSL), while the 100-year flood plain, based on recent modeling studies conducted by the Army Corps of Engineers, is at an elevation of 814.3 feet above MSL.

Alluvial deposits may be locally productive, yielding 100 to 500 gallons per minute (gpm). Normal practice in the Dayton area, however, is to obtain water supplies from the more productive, underlying glacial outwash deposits. The alluvium, where present at WPAFB, is typically 40 to 60 feet thick and occurs under water table conditions. The alluvial deposits provide base flow to streams during low flow periods.

Outwash deposits yield greater than 1,000 gpm. At WPAFB, the hydraulic conductivity of the outwash ranges from 1,000 to 3,000 gallons per day per square foot (gpd/ft^2). The buried valley aquifer, a Federally designated Sole Source Aquifer, is used by WPAFB for water supply and is also the primary unit from which municipal supplies are drawn at the nearby Dayton Municipal Wellfield on Rohrer's Island. The city of Fairborn's North Wellfield (adjacent to OU2) also draws water from this aquifer. Fairborn uses this wellfield only during periods of drought for emergency use and twice a year during hydrant flushing. Groundwater occurs in the outwash deposits under both water table and artesian conditions and locally may provide base flow to streams during low flow conditions in areas where it is at or near the ground surface. Total depth of the sole source aquifer varies between approximately 50-250 feet depending on position within the buried valley and also depending on water producing horizons within that range.

Groundwater contained in the scattered sand and gravel sequences of till provides domestic supplies on the order of 10 gpm. The till is generally more than 20 feet thick and may overlie units of greater productivity. The bedrock deposits are a minor source of groundwater. The shale and interbedded limestone of the Richmond Group yield water of sufficient quantity only for household use. The Brassfield Limestone generally yields greater quantities of water than the Richmond Group and is suitable for both farm and home use.

Water level measurements from across the base indicate that the Mad River Buried Valley Aquifer is unconfined within and around WPAFB except in some localized areas where perched water tables exist or in areas that are overlain by till. Good hydraulic connection exists between the aquifer and the river, as indicated by the high dry-weather flow index of the Mad River. The upland areas in this region serve in part as recharge areas for the buried valley aquifer. These upland areas, including a groundwater mound in southeastern Fairborn, form groundwater divides which control groundwater flow in and around Areas A and C, much like the surface water drainage basin.

The City of Dayton conducted an assessment of water quality in the Mad River Wellfield, concluding that, with the exception of 15 of Dayton's wells that contain detectable levels of volatile organic compounds (VOCs), the Mad River Wellfield produces high quality drinking

water. Low levels of VOCs have been identified in groundwater samples from some of the on-Base water supply wells.

There are four lakes on base: Upper Twin Lake (4.67 acres), Lower Twin Lake (3.17 acres), Gravel Lake (6.73 acres), and Bass Lake (42.0 acres). Twin and Gravel lakes are more properly classified as ponds because of their shallow depth. The lakes are used for fishing and recreational activities by base employees and their families.

2.1.7 Natural Resources

General land use classifications of terrestrial communities found on WPAFB include hardwood forest, characteristic of second growth oak/sugar maple. Black cherry and flowering dogwood, honeysuckle, autumn olive, and various herbaceous plant species are typical of the area. The most commonly observed species of fauna in the forested areas are white-tailed deer, raccoon, eastern chipmunk, eastern cottontail rabbit, and opossum.

The ruderal communities are characterized by areas of disturbance including residential housing complexes, commercial and industrial complexes, the Twin Base Golf Course, and other developed WPAFB areas. Commonly observed native vegetation associated with residential complexes includes sugar maple, cottonwood, and oak. Non-native ornamental trees and shrubs are also present. Mammals include eastern cottontail rabbit, chipmunk, opossum and gray squirrel. Birds include those seen in the forest along with pigeon, killdeer, English sparrow, mockingbird, and red-winged blackbird.

Huffman Prairie is a 109-acre remnant of a once much larger prairie, and is one of the largest remnants of native prairie in the state. The Ohio Natural Areas Council declared Huffman Prairie a State Natural Landmark in 1985. Dominant native grass species of this prairie are Indian grass and big and little bluestem. Nesting bird species in Huffman Prairie include Bobolink, Henslow's sparrow, grasshopper sparrow, and Eastern meadowlark. There are at least 20 different species of grasses found in the prairie. The fauna includes many species commonly observed in the other communities; however, the more abundant species are the red-winged blackbird, Eastern meadowlark, and groundhogs.

North of Gravel Lake is a 5-acre tract of Type 3 Emergent Wetland, designated by the Ohio Department of Natural Resources in September 1987. A seven acre riverine wetland is located on the east shore of the Mad River, just upstream of the mouth of Trout Creek. Aquatic and wetland communities are also found in several isolated wetlands on the beds and banks of Hebble Creek, Trout Creek, and portions of the Mad River, as well as in the lakes on Base.

The Base has confirmed the presence of the Indiana bat, a federal endangered species, in the Mad River valley area. The Base is home to several other endangered, potentially threatened, and special interest species of animal and plant, including but not limited to the Eastern Massasauga rattlesnake, upland sandpiper, and glade mallow.

2.1.8 Cultural and Historic Resources

Based on a survey of WPAFB, there are five known historic sites on the installation. Two Indian mound sites and the Huffman Prairie Flying Field, the location of early Wright brothers aircraft

development, are both listed on the National Register of Historic Places. The Huffman Prairie Flying Field is a National Historic Landmark and is part of the Dayton Aviation Heritage National Historical Park.

A 1990 study of historical mapping of the WPAFB area identified 117 potential historical archaeological sites of the European settlement period such as farmsteads, mill races, and cemeteries. These archaeological sites have been plotted and characterized as to their potential importance.

Several hundred buildings on Base are currently being evaluated for eligibility for listing on the National Register of Historic Places. For example, Building 10280 (a warehouse where German prisoners of war were fed while on work detail) contains a mural that was painted by the prisoners. Written plans have been generated in an effort to continue to preserve historic sites on base.

2.1.9 Adjacent Land Use

Adjacent land uses include agricultural, residential, institutional, commercial, and industrial. Commercial strip development in the nearby cities of Fairborn and Riverside are situated across from the installation on State Route 444 and Springfield Pike and adjacent to the Page Manor residential area to the southwest. Adjacent industrial activities are situated to the northeast and northwest. Wright State University is adjacent to the south central portion of the installation. Open space remains primarily along the northern/northwestern boundary (the Huffman Reserve) and to the east. Residential development is established all along the southern/southeastern boundary and occurs sporadically along other perimeter areas.

More detailed information regarding the previous topics can be found in the Final Site-Wide Characterization Report written for WPAFB by International Consultants Incorporated and Science Applications International Corporation, 3 March 1995. The report was written as a compilation of regional and Base-wide data to be used as a reference for all National Environmental Policy Act (NEPA) studies.

2.2 Site History and Enforcement Activities

In 1981, the IRP was initiated at WPAFB with a Phase I, Problem Identification and Records Search. Phase II, Stages 1 and 2 Investigations were conducted for the 33 sites initially identified. WPAFB entered into Administrative Orders on Consent (also referred to as the Consent Order or CO) with OEPA in February 1988. The CO specifies requirements for conducting Preliminary Assessments, Site Investigations (SI), Remedial Investigations (RI) and Feasibility Studies (FS), Remedial Designs, and Remedial Actions on Base. A list of documents that describe the activities conducted to date under CERCLA and the IRP program for the sites contained in this ROD is provided in Attachment 1.

After the Base was placed on the NPL by the USEPA in 1989, WPAFB entered into a Federal Facilities Agreement (also referred to as the Interagency Agreement or IAG) with USEPA, signed in March 1991. This agreement establishes a procedural framework and schedule for implementing and monitoring response actions at the Base.

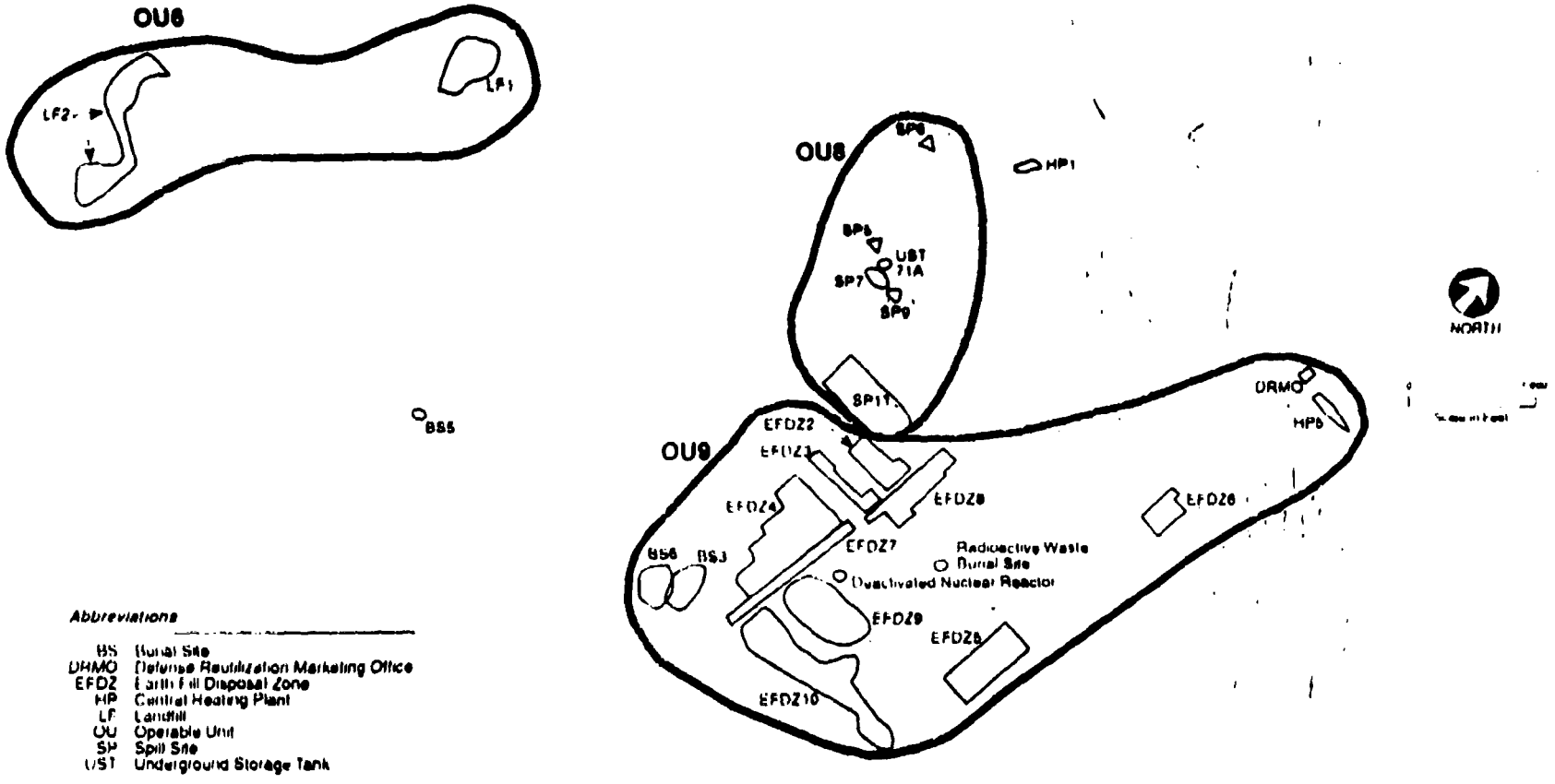


Figure 2. Proposed Sites in Area B.

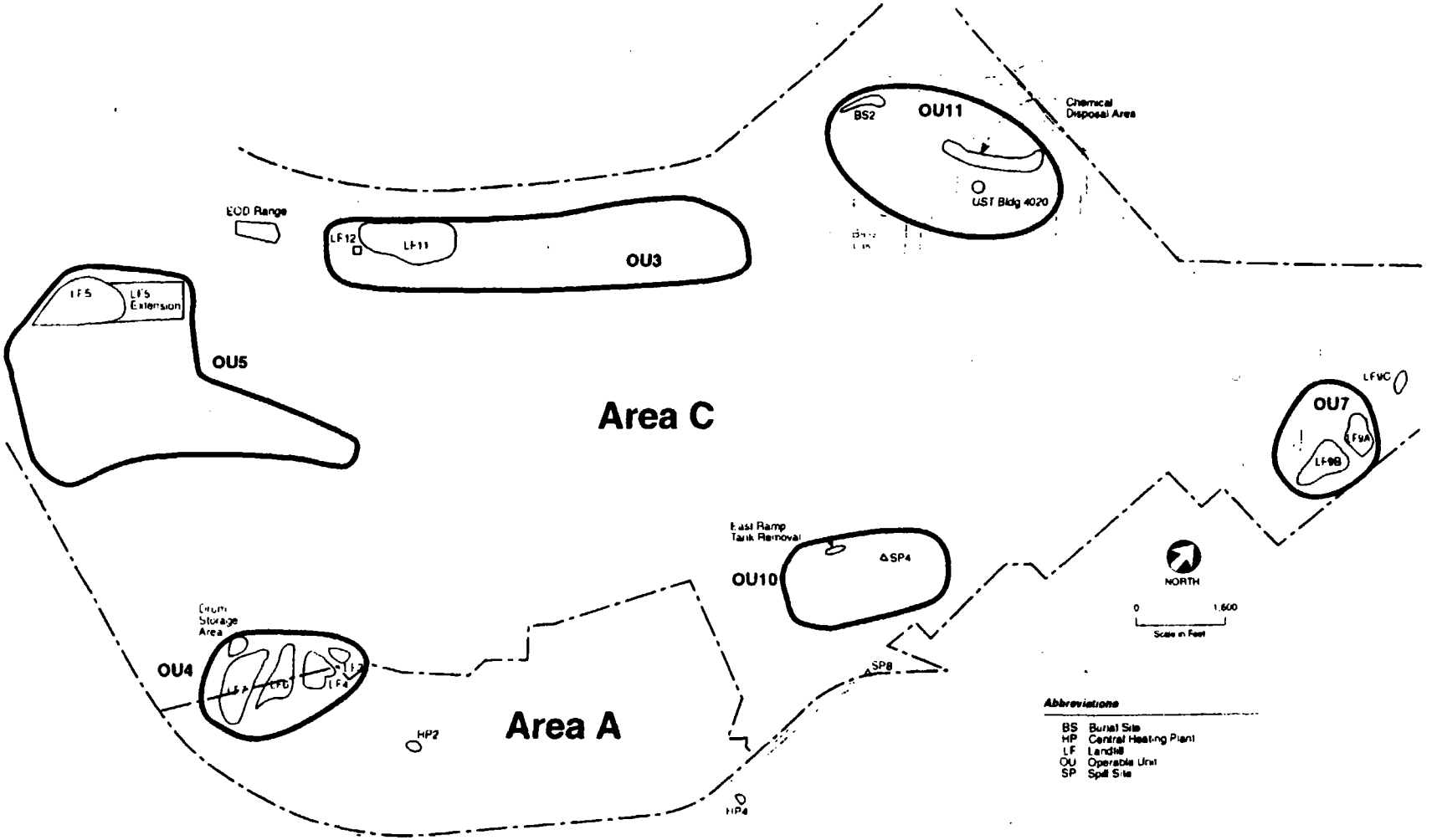


Figure 3. Proposed Sites in Areas A and C.

As part of the IRP, an RI/FS Work Plan was developed for 39 potential waste disposal sites. Subsequently, 26 additional sites were also identified and investigated, for a total of 65 IRP sites. Most of these sites were grouped into 11 Operable Units (OUs) across the Base. Twenty-six sites were included in previously approved Records of Decision (RODs); 38 of the original 65 sites, plus 3 additional sites, are included in this document. The last remaining IRP site, the BMP, will be addressed in a future document. The Proposed Plan describing the Preferred Alternative Remedial Action for the 41 sites was approved by the USEPA on June 26, 1998 and by OEPA on June 12, 1998. The location of each site is identified on Figures 2 and 3; the histories of each individual site will be discussed in Section 2.5.

2.3 Highlights of Community Participation

WPAFB currently has an Environmental Advisory Board composed of representatives from local government agencies, businesses, and the community groups that actively play a role in the WPAFB IRP process. The group meets quarterly to discuss and concur on a variety of topics related to the environmental program at WPAFB. The group also has the opportunity to review and comment on all documents addressing the IRP sites.

WPAFB offered opportunities for public input and community participation during the RIs and the Proposed Plan for all of the sites in this ROD. In addition, public comments were solicited for each of the removal actions implemented at various sites contained in this ROD. The Proposed Plan was made available to the public in both the Administrative Record and the Information Repository. The notice of availability for the Proposed Plans was published in the Dayton Daily News (local paper) on June 28, 1998, and in The Skywrighter (Base newspaper) on July 10, 1998. A public comment period was held from July 1, 1998 to July 30, 1998. The public comment period was not extended as there were no requests for an extension. The Base held a public meeting on July 14, 1998 at Fairborn High School to discuss the investigatory activities that took place at the sites. Representatives from the USEPA, OEPA and WPAFB were all present and answered questions about the Base and the 41 sites recommended for NA. Information was provided which was used as the foundation for proposing NA for each of the individual sites.

A summary of the questions and responses from the public meeting is included in the Responsiveness Summary (Section 3.0). These community participation activities fulfill the requirements of Sections 113(k)(2)(B)(i-v) and 117(a)(2).

2.4. Scope and Role of Response Action within Base Strategy

Base operations have contributed to soil, sediment, surface water, and groundwater contamination at WPAFB. Contamination has been identified at landfills, chemical disposal sites, earthfill disposal zones, coal storage yards, and at other waste disposal or material storage areas. Following the initial investigations, most of the IRP sites were divided into 11 OUs based upon geographic location. Further investigations were generally divided into two parts, namely: (1) source area investigations, completed by OU; and, (2) the BMP, initially called the Groundwater Operable Unit. Thus, in most cases, the RIs that occurred at the sites discussed in this ROD addressed only the source areas; groundwater, surface water, and sediment will be addressed and monitored under the BMP.

The streamlined cleanup approach that WPAFB has undertaken allows the Base to identify and close out those sites which do not require remediation. This ROD is part of that process. The sites that-are the subject of this ROD have been selected because, based on the assessment information collected to date, no remedial action (or no further remedial action beyond that which has been completed) is necessary to protect human health and the environment at any of these NA sites. By historically using this approach, WPAFB has been able to concentrate resources on those sites requiring remediation. Remedial actions for several IRP sites have also been addressed using a streamlined approach. Landfills with similar types of contamination (e.g. Landfills 1 through 9, and 11) are identified in the Base-wide Removal Action Plan (BRAP) for Landfill Capping. This Base-wide program speeds up the process of cleaning up a landfill site by using remedies already approved by USEPA. USEPA refers to these actions as presumptive remedies, since they have been proven to effectively reduce risks to human health and the environment from contaminants that are commonly identified at CERCLA sites. For example, as a result of the Site-Specific Removal Action Plan (SSRAP), Landfill 5 was designated for an early action landfill cap as a presumptive remedy. Potential exposure to soil contaminants at this site were effectively eliminated by the cap. Sites that are remediated under the streamlined method forego the standard FS process because a remedy has already been selected through the presumptive remedy.

Four RODs have already been signed for the base, namely, the "On-Source" and "Off-Source" RODs at OU1; the ROD for three spill sites in OU2; and an August 1996 ROD covering 21 IRP sites. This ROD will be the fifth one for WPAFB. A sixth and final ROD will be generated in the future which will address groundwater, surface water, and sediment at WPAFB. These media are being evaluated under the BMP. The BMP is tasked with complete evaluation of contaminant movement for groundwater, surface water and sediment; assessment of the risks posed to human health and the environment by exposure to contaminants; and design of a remedy for groundwater throughout the Base. This program consists of:

- Characterization of groundwater, surface water, and sediment sufficiently to conduct a final assessment of risks to human health and the environment.

- Development, evaluation, and selection of appropriate removal actions for groundwater at WPAFB.

The specific objectives of the BMP, as presented in the Site-Specific BMP Work Plan are to:

- Compile existing characterization and monitoring data from source area OUs at WPAFB to verify conceptual models, establish basewide background conditions, and summarize groundwater, surface water, and sediment contaminant conditions.

- Summarize groundwater and surface water flow and contaminant transport patterns within and adjacent to WPAFB, establishing background and base-related conditions.

- Evaluate and modify, as necessary, existing predictive models for analysis of groundwater flow and contaminant transport to provide input data for evaluation of future risk conditions and to assist in remedial design activities.

- Assess current and future risk to human health and the environment from potential multiple source, multiple contaminant plumes for on- and off-site receptors thereby

defining areas requiring removal or remedial measures.

- Prepare a coherent removal action strategy.
- Evaluate removal alternatives consistent with an overall remedy for groundwater, surface water, and sediment.

Additional characterization of groundwater, surface water, and sediment and evaluation of the data has been completed and presented in the following documents:

- Final BMP Background Technical Memorandum
- Final BMP Field Activities Technical Memorandum
- Final BMP Groundwater Flow Modeling Technical Memorandum
- Draft-Final (Approved) BMP Transport Modeling Technical Memorandum
- Draft-Final (Approved) BMP Current Conditions Human Health Risk Assessment Technical Memorandum
- Final Future Conditions Human Health Risk Assessment Technical Memorandum
- Draft-Final BMP Ecological Risk Assessment Technical Memorandum

In addition to these documents, an Engineering Evaluation/Cost Analysis (EE/CA) is currently being prepared by WPAFB. In this document, the extent of groundwater contamination has been reviewed and those areas requiring further action (such as groundwater extraction, in-situ treatment) have been identified and alternatives for further action have been evaluated. In addition, the EE/CA presents the proposed long-term monitoring plan for areas of groundwater that do not require active remediation, but require on-going monitoring.

2.4.1 Assessment of Site Risks

In general, a Baseline Risk Assessment (BRA) was conducted at each site to determine if the contaminants present at the site pose a risk to human health or the environment. Baseline risks are risks to human health and the environment that might exist if no remediation or institutional control is applied to the site. Observed contamination within each site is evaluated with respect to levels of contamination present in background samples; contaminants present at elevated concentrations compared to background are called Contaminants of Concern (COCs). Human health risks or hazards are defined for two classes of chemical contaminants, carcinogens and non-carcinogens. Exposure to carcinogenic chemicals may result in an increased risk of a specific type of cancer.

One of three types of risk assessments were conducted at these sites. The first type of risk assessment is the quantitative risk assessment. This type of risk assessment uses USEPA-approved risk assessment methods to determine the baseline risks associated with the chemicals present at, or released from contaminated areas at a particular site. The risk of cancer

calculated in a quantitative risk assessment is expressed as the chance of the occurrence of that type of cancer per number of the population. These cancers are over and above the background rate of cancer in the United States which is about one in every four people. A risk level of one in a million ($1 X 10^{-6}$) means that one additional person out of 1 million people could develop cancer as a result of exposure to the environmental contaminant. The USEPA has established a target risk range of an excess cancer rate of one in a million people to one in ten thousand ($1 x 10^{-6}$ to $1 x 10^{-4}$) people. Cancer risks greater than one in ten thousand generally require a remedial action to reduce the risks to the population. For non-carcinogenic contaminants, the likelihood of adverse health effects is expressed as a numerical ratio called the Hazard Quotient (HQ). Values for the HQ of less than 1.0 indicate that non-carcinogenic adverse health effects are not likely to occur. Non-carcinogenic health affects are also expressed as a Hazard Index, which is equal to the sum of the HQs for each contaminant.

The second type of risk assessment is a semi-quantitative risk assessment. This type of risk assessment also uses USEPA-approved risk assessment methods; however, this type of risk assessment compares contaminant concentrations at a particular site to risk-based Preliminary Remediation Goals (PRGs) to determine if the risks associated with the chemicals present at, or released from contaminated areas at a particular site exceed USEPA accepted ranges. PRGs are calculated using the same methods and equations that are used in the quantitative risk assessment. PRGs represent acceptable levels of COCs in environmental media based on target carcinogenic risks or non-carcinogenic hazards.

The third type of risk assessment is a qualitative risk assessment. This type of risk assessment compares contaminant concentrations at a particular site to state and Federal regulatory criteria. Such as maximum contaminant levels (MCLs) established under the Clean Water Act, cleanup levels for polychlorinated biphenols (PCBs) under the Toxic Substances Control Act, or cleanup levels for petroleum compounds under state underground storage tank (UST) regulations.

A description of the risk assessment conducted and the results of the assessment is provided within the narrative for each site under the heading "Risk Assessment."

2.4.2 Selection of the No Action Alternative

As shown in the following narratives, the selection of the NA alternative for the 41 sites is based on several factors.

- The results of the risk assessment indicated that the site did not pose an unacceptable risk.

- For sites where the risk assessment identified an unacceptable risk, removal actions were implemented which reduced the risk or eliminated the exposure pathway (e.g., UST and soil removal or presumptive remedies for landfills).

- Groundwater, surface water, and sediment at these NA sites will be monitored under the BMP.

- The NA alternative for these sites is the preferred remedy presented in the Proposed Plan, released for public review and comment on July 1, 1998.

USEPA, OEPA, and WPAFB have determined that conditions at the NA sites addressed in this ROD pose no current or potential threats to human health or the environment at levels that warrant any remedial action. Removal actions implemented at some of the 41 sites have reduced the risk to acceptable levels or have eliminated the exposure pathway. No further action is warranted at these sites to protect human health or the environment. Thus, while some of the sites may exhibit low, acceptable levels of risk, no cleanup action is warranted because of the low frequency of human exposure and the likelihood that any attempt to further reduce risk could result in more harm than good to the environment.

A review of the selected NA remedial alternative is required every five years under NCP ºº300.430 (f)(4)(ii) because the NA alternative relies on currently existing restricted land uses. If, after conducting such a review, it is determined that the NA remedy is no longer protective, alternatives for addressing the risk posed by contaminants at these sites will be evaluated and a remedy implemented. The BMP is in place at WPAFB to monitor groundwater quality and the types and movements of contaminants in groundwater at key locations throughout the base. Under the BMP, WPAFB will examine groundwater from all of the OUs as well as from parts of the Base that do not contain hazardous waste sites. It will be the vehicle used to assure that no releases of contaminants occur from any of these NA sites. If monitoring indicates that contaminant concentrations have increased, implementation of additional actions to reduce the risk to acceptable levels will be evaluated.

2.5 Summary of Site History, Characteristics, Risks, and Description of the No Action Alternative for 41 Sites

The following narratives describe the history, characteristics, risks, and the basis of the NA decision for each of the 41 sites included in this ROD.

Landfills 1 and 2 (LF1 and LF2)
History and Description. LF1 and LF2 are in OU6, near the southwestern boundary of Area B, within the Mad River floodplain (see Figure 2). The area is nearly level, with a gently sloping terrain. Surface and groundwater generally drain northwest toward the Mad River. One other IRP site in OU6 was included in a previously approved ROD. LF1, a 4-acre site, was used for surface disposal and burning from the 1920s through 1940; LF2, covering 15 acres, was operated from the early 1940s through 1951. Both sites reportedly received Area B refuse containing unknown quantities of oily wastes and organic and inorganic chemicals. At LF2, the wastes were placed into gravel pits in direct contact with groundwater. The pits were closed in 1951. From 1955 through 1975, LF2 was used for surficial disposal of hardfill and construction debris. The area is fenced and portions of the landfill surface are now densely forested. During the implementation of landfill capping as a presumptive remedy, existing ground covers were augmented or modified to ensure adequate protection and proper drainage. LF2 is bordered on the east by Harshman Road and on the west and northwest by the Municipality of Riverside. LF1 is currently grassy and well-maintained.

Site Characteristics. The OU6 RI included sampling of refuse and fill, surface and subsurface soil, groundwater, and landfill gas at LF1 and LF2. Refuse/fill samples indicated the presence of VOCs, pesticides, PCBs, total petroleum hydrocarbons (TPH), semivolatile organic compounds (SVOCs), and metals. Surface and subsurface soil samples indicated the presence of VOCs, SVOCs, pesticides, TPH and metals. Although groundwater samples indicated the presence of

low concentrations of VOCs, SVOCs, pesticides, TPH and various metals, only cadmium, chromium and nickel exceeded MCLs. Soil gas samples from leachate wells indicated the presence of VOCs, but methane was not detected. Surface water and sediment samples from LF2 indicated the presence of VOCs, SVOCs, pesticides, TPH and metals.

Risk Assessment. WPAFB conducted a quantitative BRA at LF1 and LF2 as part of the RI, to determine the baseline risks associated with chemicals present at, or released from, the sites. The increased lifetime cancer risk associated with exposure to the soil or landfill gas is less than 1 X 10^{-6}; non-cancer exposure: risks result in a Hazard Index less than 1. These levels are below the USEPA-accepted range for exposure. For exposure to groundwater, the increased lifetime cancer is greater than 1 x 10^{-6}, but less than 1 x 10^{-5}, and non-cancer exposure risks result in a Hazard Index greater than 1. The carcinogenic risk is within the USEPA-accepted range for exposure; however, the non-carcinogenic risk is greater than the USEPA-accepted criterion for exposure. The Ecological Risk Assessment (ERA) indicated that several metals in soil pose an ecological risk to primary arid secondary consumers.

Previous Actions and the NA Alternative. The risk assessment concluded that the carcinogenic risk and non-carcinogenic hazard posed by contaminants in soil were within the USEPA-accepted range for exposure; however, the presence of several metals in the soil presented an ecological risk. Based on these conclusions, landfill capping was selected and implemented as a presumptive remedy for LF1 and LF2, and was the final CERCLA response action. Limited recreational/industrial use of the land at these sites reduces the risk to people, plants, and animals who visit/inhabit this area; and landfill capping will limit the exposure of human and ecological receptors to landfill refuse. Soil contamination and the risk it causes no longer creates any danger and groundwater will be addressed under the BMP. The preferred alternative for LF1 and LF2 is no action. Because all of the above actions have been implemented, no additional action is necessary at the site to protect human health and the environment under current and future land use plans.

Landfills 3, 4, 6 and 7 (LF3, LF4, LF6, and LF7)

History and Description. LF3, LF4, LF6, and LF7 are in OU4, in the southeastern section of Area C, with a portion of the sites extending into the southwestern corner of Area A (see Figure 3). Several unnamed tributaries traverse the OU4 area, discharging into Hebble Creek, which flows along a portion of the northern boundary. All of the landfills accepted general refuse and may have accepted hazardous waste. LF3 operated as a surface dump and burn operation from about 1940 to 1944 and covered 3 acres. It underlies the tenth hole of the Military Golf Course and is currently covered with grass and shrubs, with no observed erosion or exposed debris. LF4, covering 8 acres, operated from 1944 to 1949. Historical aerial photographs show that the landfill included a one-acre, water-filled gravel pit. LF4 reportedly accepted large objects such as automobile bodies, in addition to general refuse, to bring the grade of the gravel pit above the 20 to 30 feet of water reportedly in the pit. The pit is no longer visible from the surface. LF6, covering 7 acres, operated from 1949 to 1952 as a trench and cover operation for general refuse. Historical aerial photographs from 1946 show that part of LF6 was formerly a water-filled gravel pit covering about 2 acres. The location of the pit is no longer visible from the surface. LF6 is covered with a mixture of grasses and is used by the WPAFB equestrian facility as pasture land; LF7, covering 18 acres, operated from 1952 to 1962 as a trench and cover operation for general refuse. LF7 currently supports the WPAFB equestrian facility. Differential settlement was visible at LF7 throughout the horse stable complex. The parking lot had subsided in some places,

and the horse bams are sagging and shifting. Refuse had reportedly been uncovered during grass seeding and planting operations, indicating that only a thin soil cover existed over portions of the landfill. A section of the west side of LF7 had steep, 10- to 20-foot slopes where scrap metal and concrete rubble were exposed. An area adjacent to the northwestern edge of LF7 is referred to as the drum staging area, and an area northwest of the landfill, where scattered drums were located, is referred to as the drum disposal area.

Prior to its use as part of the WPAFB golf course, LF3 received a cover of about 6 to 8 inches of sandy silt and 4 to 6 inches of topsoil. The thickness of cover ranges from 6 to 12 inches, and there are no observed areas of exposed debris or erosion. In 1988, the southwestern edge of LF4 was excavated for the construction of Skeel Avenue. Wastes were removed and part of the surface was paved with asphalt; other areas are covered with densely compacted sand and gravel fill. The site is currently a fenced area used by Civil Engineering for equipment storage. The thickness of cover at LF4 ranges from a few inches to about 3 feet. In 1984, a clay and topsoil cover was placed on LF6 and LF7. Measured thickness of cover over fill and refuse is 6-inches to 2-feet thick. Drums from the Drum Disposal Area and the Drum Staging Area were recovered and disposed of in 1990. To implement the presumptive remedy of landfill capping, an additional protective topsoil cover was constructed on LF6 and LF7 by regrading and/or adding to the existing cover and reseeding the area to improve surface runoff and eliminate ponding. In addition, a cover maintenance program was developed and landfill gas monitoring was initiated at all the landfills.

Site Characteristics. OU4 RI field activities, conducted between 1992 and 1994, identified VOCs, SVOCs, pesticides, TPH, and metals in sediment samples in Hebble Creek; VOCs. SVOCs, and pesticides in the unnamed tributary between Landfills 4 and 6 and in sediments downstream of LF6; and, VOCs, SVOCs, TPH, metals, and cyanide in the sediments downstream of LF7. TPH and metals were detected in surface water samples from Hebble Creek; metals were detected in the unnamed tributary between Landfills 4 and 6; VOCs and metals were detected in surface water samples from the unnamed tributary that traverses LF6; and VOCs were detected in the surface water from the tributary northwest of LF7. VOCs were present in groundwater both upgradient and downgradient of Landfills 3, 4, and 6. Metals were the primary contaminant present in groundwater downgradient of LF7 and were also present downgradient of Landfills 3, 4 and 6. LF3 leachate and samples of refuse/fill had significantly higher concentrations of target VOCs than Landfills 4, 6, or 7. Samples of landfill gas from LF3 also indicated elevated levels of hydrocarbons other than methane. Surface soil samples from LF3 indicated the presence of SVOCs, pesticides, TPH, and metals. Although metals and organic contaminants were detected in LF4, LF6, and LF7 leachate, the concentration of contaminants was less than that normally found in typical landfill leachates. Landfill gas concentrations and contaminants were generally characteristic of that found in conjunction with municipal solid waste landfills. Surface soil samples taken in the Drum Staging and Drum Disposal Areas indicated the presence of VOCs, SVOCs, TPH and metals.

Risk Assessment. As part of the RI, WPAFB completed a quantitative BRA, to determine the baseline risks associated with the chemicals present at, or released from contaminated areas at LF 3,4,6, and 7. The BRA indicated that the increased lifetime cancer risk for exposure to groundwater is greater than 1 x 10 -4 and non-cancer exposure risks result in a Hazard Index greater than 1. These levels are above USEPA accepted range for exposure. The increased lifetime cancer risk for exposure to surface water, sediment (all locations except one near LF7),

and surface soil in the Drum Staging Area is less than the USEPA accepted range of 1 x 10^{-4} to 1 x 10^{-6}. The increased lifetime cancer risk for exposure to surface soil at LF3 and in the Drum Disposal Area, and subsurface soil at LF4, LF6, and LF7 fall within the USEPA accepted range of 1 x 10^{-4} to 1 x 10^{-6}. The non-cancer risk for exposure to surface water, sediment, LF4 subsurface soil and to surface soil at LF3, the Drum Staging Area and the Drum Disposal Area is less than the USEPA-accepted criterion of 1. The non-cancer risk for exposure to subsurface soil at LF6 and LF7 are greater than the USEPA-accepted criterion of 1. The ecological risk evaluation concluded that the overall risk to ecological receptors from site-related contaminants was low.

Previous Actions and the NA Alternative. The risk assessment concluded that the carcinogenic risk and non-carcinogenic hazard posed by contaminants in soil were within the USEPA-accepted range for exposure and groundwater will be addressed under the BMP. Based on the conclusions of the RI and the SSRAP, landfill capping as a presumptive remedy was selected and implemented at LFs 6 and 7. The existing caps at LFs 3 and 4 were determined to be adequate. A cover maintenance program was developed for all sites. This was the final CERCLA response action for LF3, LF4, LF6, and LF7. Limited access and landfill capping will limit exposure of human and ecological receptors to landfill refuse and groundwater will be addressed under the BMP. Landfill capping and maintenance of the caps will reduce or eliminate leaching of contaminants to groundwater. The preferred alternative for this site is no action. Because all of the above actions have been implemented, no additional action is necessary at the site to protect human health and the environment under current and future land use plans.

Landfill 5 (LF5)

History and Description. LF5 is in OU5 in the southwest corner of Area C, adjacent to Riverview and Prairie Roads and north of Gravel Lake and Twin Lake (see Figure 3). The entire area lies within the 100-year flood plain of the Mad River, and large portions of OU5 are within the 25-year flood plain. Several surface water bodies are within the OU and receive runoff from the area. The Miami Conservancy District (MCD) owns the property adjacent to LF5, between the Area C boundary and Huffman Dam. MCD leases part of the land to the Dayton-Montgomery County Park District, which maintains the area as Huffman Reserve, a nature preserve and recreational area. The City of Dayton maintains a wellfield known as Rohrer's Island Wellfield and a smaller wellfield known as Huffman Dam Wellfield on property west of Huffman Dam. Land use in OU5 is generally recreational; there are no permanent residences within or adjacent to its boundaries. Three other IRP sites in OU5 were included in a previously approved ROD.

LF5 is a 23-acre site with a history of varied uses. The land was originally used as a lumber reclamation area in the 1940s, then for an unknown period was used as a surface dump for general refuse. From 1958 to 1978, the area was used for waste petroleum handling operations. Base heating plants used the landfill for disposal of coal ash from 1940 through 1991. Also, the northwestern portion of the landfill was used for explosive ordinance disposal (EOD) and EOD ash for an unspecified amount of time. Various chemical wastes were reportedly placed in the landfill, including undetermined quantities of oily wastes, solvents, and organic and inorganic chemicals.

Site Characteristics. During the IRP Phase II Stage 1 and 2 Investigations, 3 test pits were excavated and 11 monitoring wells were installed around the perimeter of the landfill and

sampled. Sediment and surface water samples were also collected. Groundwater analytical results indicated vinyl chloride, tetrachloroethylene (PCE), and trichloroethylene (TCE) near their respective maximum or proposed maximum contaminant levels. Soil sampling indicated six metals in concentrations above background levels and a high TPH concentration in one sample from one test pit. Based on these results, a soil gas survey was conducted to identify the source areas of contamination for the VOCs in the groundwater. This survey detected 9 of 9 target compounds--trans-1,2-dichloroethane, chloroform, 1,1,1-trichloroethane, carbon tetrachloride, benzene, TCE, toluene, PCE, and ortho-xylene. An investigation was conducted in 1990 which confirmed a groundwater plume of TCE migrating across the base boundary. In 1993, a field investigation was conducted to determine a specific source of VOC contamination in LF5. The investigation focused on geophysical surveys and collection and analyses of subsurface soil samples. In 1993, 35 soil borings were drilled and soil samples were taken from the southwest portion of the landfill-- 18 within the suspected source area. This investigation indicated that a point source of VOCs was not present in the southwest portion of the landfill. In addition, an RI was conducted to characterize landfill materials and determine landfill boundaries.

Risk Assessment. A semi-quantitative risk assessment was completed to compare potential site contamination with risk-based PRGs and MCLs and determine if the site selection criteria for landfill capping set forth in the BRAP were met. Benzene, bromodichloromethane, carbon tetrachloride, chloroform, dibromochloromethane, 1,1-DCE, methylene chloride, and TCE exceed PRGs in soil. Benzene, 1,2-DCE, PCE, TCE, and vinyl chloride exceed PRGs or MCLs in groundwater. Exceedances of soil PRGs and groundwater PRGs and MCLs meet the site selection criteria for landfill capping.

Previous Actions and the NA Alternative. Based on the conclusions of the RI and SSRAP, capping as a presumptive remedy was selected and implemented for LF5. The completed action included landfill consolidation under a geomembrane with a geosynthetic clay liner, and the addition of a drainage layer composed of sand and a cover layer of 18 inches of common soil and 6 inches of topsoil. The cover material was seeded to provide a vegetative cover that minimizes rainwater/floodwater infiltration into the landfill and prevents migration of contaminated soil to the Mad River via surface runoff. Large rocks (e.g., rip-rap) were placed along existing drainage channels and ditches to minimize soil erosion and maintain the integrity of the landfill cap. Although landfill gas was not detected during the RI, passive gas management measures were implemented as a precautionary measure to protect the integrity of the cap. The gas collection layer consists of a system of perforated collector pipes and vent pipes in an 8-inch layer of crushed stone. Gas venting piping, installed at a minimum of one vent per acre, will allow any landfill gas that is generated to vent to the atmosphere. The cap eliminates potential generation of airborne contaminants from the surface of the landfill. Surface water run-off will not come in contact with landfill contaminants; therefore, direct contact with contaminated surface water and potential contamination of downstream water bodies has been eliminated. By placing a barrier layer between the surface of the landfill and the waste material, generation of leachate has been minimized because precipitation will not be able to infiltrate into the waste material.

Landfill capping activities, completed in 1997, have mitigated threats to public health, welfare, and the environment and are the final CERCLA response action for the landfill. Landfill capping will limit exposure of human and ecological receptors to landfill refuse. In addition to the source control measures implemented for LF5, a groundwater extraction system has been installed to prevent further migration of contaminated groundwater beyond the Base boundary. This system

will also capture leachate produced, if any, from the landfill. Groundwater will be further addressed under the BMP. The preferred alternative for LF5 is no action. Because all of the above actions have been implemented, no additional action is necessary at the site to protect human health and the environment under current and future land use plans.

Landfill 9 (LF9)

History and Description. LF9 is in OU7, in the northeastern section of Area C in a remote area outside the main Base boundary fence (see Figure 3). The area is above the elevation of the 100-year floodplain, and there are no developed streams or drainages. Surface runoff is usually toward the west/southwest in poorly developed drainage channels or as sheet runoff, with occasional ponding. Topography generally consists of parallel ridges or mounds from landfill trenching operations. LF9 is the only IRP site in OU7. It was initially thought to be two former sand and gravel pits (Pits A & B) adjacent to Sandhill Road. Later, an area one-quarter mile northwest of Pit A, labeled Pit C, was identified as the actual disposal area. Further investigations determined Pits A & B contain no waste material. Pit C is rectangular in shape, about 570 feet by 110 feet, and was operated between 1962 and 1964 as a trench and cover operation, with 20-ft deep trenches running in a north-south direction. Because the landfill received wastes from the entire base, it potentially contained hazardous wastes.

Site Characteristics. Samples taken from groundwater monitoring wells and soil borings in OU7 indicated the presence of metals, VOCs, and SVOCs above background levels. Aluminum, manganese, total dissolved solids (TDS), and gross beta were detected in groundwater samples at levels exceeding regulatory criteria. In 1994, field screening was conducted on groundwater samples taken from five boreholes that had been drilled to bedrock in the OU7 vicinity in support of the BMP. These samples detected no significant VOC contamination; therefore, monitoring wells were not installed and the boreholes were plugged and abandoned. Analytical results at Pit C identified minor concentrations of polyaromatic hydrocarbons (PAHs), SVOCs, metals, and pesticides in surface soil samples; surface sediment samples detected VOCs, PAHs, metals, and one pesticide. Soil gas monitoring, conducted to test for possible gas migration and to provide an estimate of the rate of methane generation in the landfill, identified methane and VOCs in the northern part of the landfill.

Risk Assessment. The semi-quantitative risk assessment performed for LF9 evaluated the risks to human health and the environment from potential contamination at the landfill using PRGs. Results of the risk assessment indicated no adverse human health or ecological effects are expected due to the presence of chemical contaminants from LF9. Chemicals of Potential Concern (COPCs) at LF9 were screened using EPA Region IX residential and industrial PRG exposure pathways (no COCs were identified at the site). This approach is conservative because LF9 is located in a runway fly-over zone and neither industrial use nor residential development is viable. The maximum concentrations of all COPCs were below residential PRGs except Aroclor-1242 which was well below the industrial PRG.

Previous Actions and the NA Alternative. The human health and ecological risk assessments conducted at LF9 concluded that chemical contamination at the site was not significant enough to present a risk to human health or the environment under the assumed scenarios of exposure pathways and receptors. Implementation of capping as a presumptive remedy at LF9 was selected and implemented to meet the requirements of the OAC and to provide protection of human health and the environment by reducing or eliminating the possibility of erosion of the

landfill cover. This action was the final CERCLA response action for the landfill. Eighteen inches of common soil and six inches of topsoil were placed over the existing landfill, and the area was graded and seeded; specific measures to manage landfill gas and leachate were not required. Access to the site is restricted by a road gate and the area surrounding the site is heavily vegetated. Landfill capping at LF9 will limit exposure of human and ecological receptors to landfill refuse and has mitigated threats to public health, welfare, and the environment. The preferred alternative for LF9 is no action. Because all of the above actions have been implemented, no additional action is necessary at the site to protect human health and the environment under current and future land use plans.

Landfills 11 and 12 (LF11 and LF12)

History and Description. LF11 and LF12 are in the western half of OU3, in Area C, along the northwestern boundary of the Base between the Mad River and Riverview Road, within the 100-year floodplain of the Mad River (see Figure 3). Surface water drains directly into the Mad River or into small, unnamed tributaries that carry runoff from the flightline and other areas to the Mad River. There are no buildings within OU3, and the area has generally been designated as open space for recreational use (hunting and camping), with a small amount of light industrial use. There are three jurisdictional wetlands and two areas of wetland habitat, and abundant vegetation and animal life. OU3 contains ten IRP sites; eight sites were included in a previously approved ROD. LF11 is a 16-acre site used for general refuse disposal from 1968 to 1977. It was initially operated as a trench-and-cover landfill and later as a ramp-and-compaction landfill with daily cover. Various chemical wastes were reportedly disposed of in the landfill, including undetermined quantities of oily wastes, solvents, organic and inorganic chemicals, and hospital wastes. Disposal operations at LF11 ended in 1977. LF12 covered approximately 0.27 acres and was operated from 1968 to 1973 for chemical disposition and acid neutralization. Initially, hazardous chemicals were disposed of in 2-ft by 2-ft by 3-ft trenches. Spent acids, neutralized with lime in aboveground tanks, were poured directly on the ground and allowed to percolate into the soil. Chemical waste, removed from the chemical disposal trench at LF10 during the construction of military family housing, was reportedly disposed of in LF12. During the early 1970s, drums of waste chemicals (including materials contaminated with the herbicide "agent orange") were stored at LF12; however, these drums apparently were not opened within the storage area. In 1973, all the stored waste chemicals were removed from the fenced area and disposed of off site.

Site Characteristics. Previous environmental studies at OU3, including the RI completed in 1994, identified organic (petroleum products and solvents) and inorganic (metals and salts) chemicals in soil, sediment, surface water, and groundwater. Most of the chemicals detected in soil consisted of petroleum hydrocarbons and metals. Fewer chemicals were detected in sediment, surface water, and groundwater within the OU. Of the chemicals identified in these media, PAHs in sediment, pesticides in surface water, and metals in groundwater were the most commonly detected constituents. The pesticides resulted from the use of insecticides and herbicides both within and upgradient of the OU. Many of the metals originated from disposal activities; however, others, particularly those detected in groundwater (for example, arsenic and manganese) are naturally occurring substances.

During RI field activities, groundwater samples at LF11 contained little or no contamination above MCLs; however leachate from leachate wells contained relatively high concentrations of VOCs, metals and other inorganics, SVOCs, PAHs, TPH, and radionuclides. Analytical results

confirmed the presence of elevated levels of metals, SVOCs (including PAHs), TPH, pesticides/herbicides, and dioxin/dibenzofurans in the surface and subsurface soil. Contaminants detected in surface water samples included VOCs, SVOCs and metals at trace concentrations. VOCs, SVOCs, metals and PAH compounds were detected in sediment samples. Soil gas samples from leachate wells indicated the presence of VOCs, SVOCs, and methane. Groundwater samples collected in the vicinity of LF12 contained low concentrations of VOCs. SVOCs, metals and inorganic compounds, pesticides and herbicides. Surface soil samples contained PAHs, TPH, metals, pesticides/herbicides, and dioxin/dibenzofurans. Several intact containers containing laboratory chemicals were found buried within 3 feet of the ground surface.

Risk Assessment. A quantitative BRA was conducted as part of the RI to determine the baseline risks associated with the chemicals present at, or released from LF11 and LF12. The increased lifetime cancer risk associated with exposure to the soil is greater than 1 x 10 -6, but less than 1 x 10^{-4}, and non-cancer exposure risks result in a Hazard Index less than 1 . These levels are within the USEPA-accepted range for exposure. For exposure to surface water, the increased lifetime cancer is less than 1 x 10^{-6}, and non-cancer exposure risks result in a Hazard Index less than 1--below the USEPA-accepted range for exposure. For exposure to groundwater, the increased lifetime cancer is greater than 1 x 10 -4, and non-cancer exposure risks result in a Hazard Index greater than 1. These levels are greater than the USEPA-accepted range for exposure. For exposure to sediment at LF12, the increased lifetime cancer is greater than 1 x 10^{-6}, but less than 1 X 10^{-6}, and non-cancer exposure risks result in a Hazard Index less than 1. These levels are within the USEPA-accepted range for exposure. The ERA indicated that several metals in soil at LF11 and LF12 posed an ecological risk to mammals and bird predators (including the Indiana bat).

Previous Actions and the NA Alternative. At both LF11 and LF12, the risk assessment concluded that the carcinogenic risk posed by contaminants in soil was within the USEPA-accepted range for exposure, and the non-carcinogenic hazard was less than the USEPA-accepted criterion; however, the presence of several metals in the soil presented an ecological risk. In addition, the presence of buried containers containing laboratory chemicals at LF12 presented a risk to human health and the environment. Therefore, implementation of capping was selected and implemented as a presumptive remedy for LF11, and WPAFB implemented a Non-time Critical Removal Action at LF12.

At LF11, debris was removed from the landfill surface and the remaining debris was consolidated under 18 inches of common soil and 6 inches of topsoil. The cover material was seeded to provide a vegetative cover to minimize rainwater/floodwater infiltration into the landfill, reducing the production of leachate and preventing migration of contaminated soil to the Mad River via surface runoff. Large rocks (e.g., rip-rap) were placed along existing drainage channels and ditches to minimize soil erosion and maintain the integrity of the landfill cap. Because the landfill is not producing large amounts of landfill gas, no gas management facilities were implemented. The soil and vegetative cover will allow any landfill gas that is generated to vent to the atmosphere.

At LF12, an Engineering Evaluation/Cost Analysis (EE/CA) was prepared to evaluate reasonable removal action alternatives. Based on the conclusions of the EE/CA, excavation and disposal of waste at LF12 was selected for implementation. Surface debris was removed, buried containers

and visibly contaminated soil was excavated and disposed of at licensed off-site solid and hazardous waste facilities, and LF12 was backfilled and reseeded.

The presumptive remedy of landfill capping for LF11 and the removal action at LF12 will limit or prevent exposure to ecological receptors, have mitigated threats to public health, welfare, and the environment, and are the final CERCLA response actions at these landfills. The risk assessment concluded that the groundwater presented a risk greater than the USEPA accepted range; however, groundwater will be addressed under the BMP. The preferred alternative for these sites is no action. Because all of the above actions have been implemented, no additional action is necessary at the sites to protect human health and the environment under current and future land use plans.

Spill Site 4 (SP4)

History and Description. SP4 is in the northeast section of Area C on the west side of Building 172, about 1,500 feet west of the Base boundary at Gate 35C (see Figure 2). Although within the area designated as OU10, SP4 was not investigated as part of the OU1O RI. Land use in the area is light industrial/office, and is expected to remain the same; use for recreational purposes is unlikely. SP4 was discovered in March 1988 during construction of a water supply line. A UST, previously located at this site, is presumed to be the source of the petroleum contamination identified at the site. The UST contained leaded gasoline, and was used as an emergency supply tank for water pumping equipment in Building 172. No inventory or operational records existed for the tank, nor were records available on the size or construction specifications of the tank or system. The UST was reportedly removed in 1983. Excavation in the area confirmed that the UST had been removed; however, steel piping associated with the UST was still in place. During excavations for the water supply line, visibly contaminated soil was removed and the excavation was backfilled with uncontaminated material and closed in accordance with BUSTR and USEPA regulations for USTs.

Site Characteristics. Investigation of the UST area was conducted on a number of separate occasions to confirm that all contaminated soil had been removed. Soil borings were taken in September 1988 and in March 1989; only one boring showed a slightly elevated TPH concentration. None of the sixteen soil samples taken from the sides and bottom of the finished water supply line trench showed detectable VOC concentrations. An assessment of SP4 was conducted in December 1990 to further confirm that all contamination had been removed. A soil gas survey, conducted at 26 sample points over a 100-ft square grid, did not show detectable VOCs. Soil samples from one boring detected minor levels of VOCs (benzene, toluene, ethylbenzene, and xylene) as well as lead and TPH. Xylene and lead were detected at levels well below their respective MCLs in groundwater.

Risk Assessment. A qualitative analysis of health risk associated with SP4 indicated that VOCs and TPH remain on site at low concentrations in soil, and contaminants in groundwater do not exceed MCLs. Although concentrations are below acceptable limits, the distribution of slightly elevated TPH concentrations exclusively in shallow soils suggest high background levels for this site or a source other than SP4. Drainage from the nearby flight line (approximately 150 ft. downslope of the site) or Pearson Road (approximately 80 ft. upslope of the site) may account for the contaminants detected in shallow soils.

Previous Actions and the NA Alternative. The UST and contaminated soil have been removed

and disposed. Based on the evaluation of site data, the concurrence of BUSTR, and current site conditions, SP4 is not expected to pose significant health risks. The preferred alternative for this site is no action. Because all of the above actions have been implemented, no additional action is necessary at the site to protect human health and the environment under current and future land use plans.

Spill Sites 5 and UST 71A (SP5 and UST71A)

History and Description. Spill Sites 5 and the UST at Building 71A are in OU8, in Area B. northeast of Wright Field and west of Skyline Drive (see Figure 2). The area consists of several fuel and oil testing laboratories, former and current tank farms, a former hanger and runway, and an aircraft survivability firing range. OU8 is expected to remain a research and development complex and is unlikely to be used for recreational or residential purposes in the future. The area overlies a portion of the Miami Valley Aquifer, and is upgradient of the nearby WPAFB Area B Wellfield and the City of Dayton's Rohrers Island Wellfield.

SP5 is located near the southwest comer of Building 70, the Fuel and Oil Test Laboratory. Fuel testing has been conducted in Building 70 since 1943, historically supported by a number of USTs in a tank farm immediately west of the laboratory. In 1985, the USTs were removed, including a 500-gallon waste oil UST that held the oil fraction of wastes discharged from a laboratory drainage system. The drain system was still used by the laboratories after the UST removal until a backup in the waste drainage system lead to an investigation in 1988. UST71A, also known as Tank Farm T, was located north of Building 71/71A. The Building 71\71A complex has been used for multiple purposes since its construction in 1932, including aircraft engine and propeller endurance tests. Gasoline, jet fuel (JP-4), and waste oil were stored in six USTs. In 1985, the USTs were removed and soil contamination was discovered beneath the tank areas. In addition to these two sites, an area of petroleum contamination contiguous to SP5 and UST71A was discovered during various investigations. This area of contamination appeared to be the result of historical releases from SP5, UST71A, and/or possibly from several previously removed or replaced tank farms. This area is referred to as the downgradient area of petroleum contamination.

Site Characteristics. At SP5, a Soil Organic Vapor (SOV) survey was conducted, and soil and groundwater samples were collected. Results of the SOV survey indicated that more than one source of contamination may be present and that contamination appeared to be migrating to the northwest, away from SP5. Analytical results from soil sampling suggested that two sources may exist and that the glacial till layer could be influencing contaminant movement. During the RI, four soil borings were installed within SP5, three soil borings were installed immediately downgradient of SP5, and two additional borings were installed and converted to temporary wells within SP5 as part of a Light Non-aqueous Phase Liquid (LNAPL) investigation. Concrete underground tank support saddles were encountered during drilling at SP5 at about 10 feet below ground surface (bgs) and benzene, toluene, ethylbenzene, and xylene (BTEX) were detected in the fill material at 5 to 10 feet bgs. The shallow saturated zone soils immediately downgradient of SP5 contained TPH concentrations. Several PAHs were also detected. A monitoring well was installed through the concrete saddle to determine if LNAPL was present below the former tank location; no LNAPL was encountered.

Results of early soil sampling during the Phase II, Stage II Investigation at UST71A indicated the presence of TPH, PCE, and methylene chloride. During the RI, contaminated soils were

detected from 5 feet below ground surface (bgs) to the water table at 30 feet bgs. Lead was detected in the vadose zone soils slightly above background levels. TPH was identified in the vadose zone soils and in the shallow saturated zone soils and groundwater. Toluene, ethylbenzene, TCE, and xylenes were detected in the saturated soils. TCE was not detected in the vadose zone soils at UST71A. Samples taken from a monitoring well (installed near the southeast corner of Building 71A as a downgradient monitoring well after the removal of Tank Farm F) were found to have TCE at concentrations just above the MCL. Low levels of TCE were also detected in the soil during installation of the well.

In the downgradient area of petroleum contamination over 70 soil borings and 23 monitoring wells were installed during the RI. Few contaminants were detected in the vadose zone soils outside the source areas. In shallow saturated zone soils, TPH concentrations ranged from non-detect to 1,000 ppm, with the highest concentrations directly west of SP5. Low levels of BTEX compounds were detected in a similar distribution pattern. The maximum concentration of TPH detected in groundwater was 26 ppm. Floating product was found in two monitoring wells (P6-2 and MW-165).

Risk Assessment. WPAFB conducted a quantitative human health risk assessment and an ecological risk assessment for SP5 and UST71A as part of the OU8 RI. At both SP5 and UST71A, the increased lifetime cancer risk associated with exposure to the soil COCs is less than 1×10^{-6} and non-cancer exposure risks result in a Hazard Index less than 1. These levels are below USEPA-accepted limits for exposure. Two soil samples collected west of SP5 in the downgradient area of contamination at a depth of over 20 ft bgs exceed regulatory TPH criteria. however, the minor amount of oil exceeding the criteria is not considered of sufficient mass to justify a removal action. In addition, about 80 percent of the former UST71A area is covered by an asphalt and concrete parking lot, roads, grassy areas, and landscaped medians. Current exposure is unlikely without intrusive activities as contaminants are, at a minimum, 4- to 5-feet bgs.

In groundwater, three metals and two organic compounds were identified as COCs that exceeded USEPA limits. Elevated levels of arsenic were detected in the deep aquifer in isolated areas that are likely the result in local variability in background concentrations; it was not found at concentrations statistically different than background. Antimony, manganese, and arsenic are found in the shallow saturated zone, which is not used as a drinking water source. Again the concentrations were not statistically different than background, except for two outliers for arsenic. Two organic compounds, vinyl chloride and n-nitrosodi-n-propylamine, were detected in one location in the shallow saturated zone. The concentrations do not appear to be high enough to cause MCLs to be exceeded at downgradient receptors. These groundwater exceedances will be addressed under WPAFB's BMP. A baseline ecological risk assessment was conducted to evaluate risks to plants and animals from exposure to soil contamination. Because of limited habitat and the absence of surficial soil contamination, ecological risk is minimal.

Previous Actions and the NA Alternative. The risk assessment determined that the concentration of contaminants in soil, sediment and surface water did not exceed the USEPA-accepted range for carcinogenic risk and non-carcinogenic hazard and did not pose a threat to human health and the environment; however, the removal of floating product from the water table is a requirement under the regulations established by the BUSTR. In addition, a limited amount of soils near SP5 exceeded BUSTR TPH criteria. For these reasons, an EE/CA was conducted to address a

Non-Time Critical Removal Action at SP5. The removal action consisted of removing floating product from MW16S with a bioslurper that was operated from March 1997 through December 1997. The bioslurper was also operated in the soil venting mode to remove organic soil vapors from the vadose soils. At the time of shutdown, no free product was noticeable, BTEX compounds were non-detectable, and the concentration of TPH was 310 ppm. Groundwater is currently being monitored to detect any increases in contaminant concentrations and also detect the presence of free product. Groundwater will continue to be addressed under the BMP. The removal action implemented has mitigated threats to public health, welfare, and the environment, and was the final CERCLA response actions for SP5, UST71A, and the downgradient area of petroleum contamination. The preferred alternative for SP5, UST71A, and the downgradient area of petroleum contamination is no action. Because all of the above actions have been implemented, no additional action is necessary at these sites to protect human health and the environment under current and future land use plans.

Spill Site 6 (SP6)

History and Description. SP6 is a 10-by 10-ft area at Building 14 where an electrical transformer was located (Figure 2). The transformer had leaked about 100 to 200 gallons of oil containing PCBs. The site was discovered in 1985; the transformer and pad were removed in 1986 and soil excavations were conducted in 1986, 1987, and 1992.

Site Characteristics. The transformer at SP6 was removed in 1986 and soil was excavated from an area approximately 20 ft. by 26 ft. by 4 ½ ft. deep. Soil sampling from the bottom of the excavation indicated PCB levels of 5,000 parts per million (ppm). Following soil removal and sampling, the excavation was covered with plastic sheeting until 1987 when additional soil was excavated. Following the 1987 soil excavation, soil samples taken from 7 to 10 feet depths contained PCB concentrations of 20,000 ppm. Additional soil samples collected in 1990 showed PCB contamination at 11,000 ppm at a depth of 24 feet. Based on these results, an additional 120 cubic yards of PCB-contaminated soil were excavated and disposed off-site. After the excavation, verification samples taken from side walls and bottom of the excavated site showed that PCB contamination was below l0 ppm for all but one sample at 11 ppm. These concentration levels are below the goal of 50 ppm for electrical substations. No PCBs were detected in groundwater.

Risk Assessment. The qualitative risk assessment conducted for SP6 evaluated site data with respect to PCB cleanup levels under TSCA. Site data indicate that soils contaminated with PCBs at levels of 50 ppm or greater have been removed from the site and the excavation has satisfied the TSCA clean-up criteria for electrical substations (50 ppm PCBs in 1992).

Previous Actions and the NA Alternative. The transformer and pad have been removed and disposed. Excavation at SP6 removed all soils with PCB concentrations of 50 ppm or greater. Based on the results of the qualitative risk assessments, no further action is needed at these sites because the contaminants present do not exceed regulatory action levels. The preferred alternative at SP6 is no action. Because all of the above actions have been implemented, no additional action is necessary at the site to protect human health and the environment under current and future land use plans.

Spill Site 7 (SP7)

History and Description. Spill Site 7, also known as Tank Farm F, is comprised of USTs located

south of Building 71 (Figure 2). Spill Site 7 is adjacent to Tank Farm B (Spill Site 9). The tanks at Spill Site 7 were in use from 1956 to 1992. Twelve 25,000-gallon tanks (USTs number 9-20) stored aviation fuel and fuel additives for research. The two remaining tanks, UST 21 and UST 193, were 3,000- and 1,000-gallon capacities, respectively, and were used to store waste oil. A 1989 inspection of the tank farm sump revealed a thin layer of floating product, indicating that F Farm was potentially releasing product into the environment through spills or leaks. Based on this finding, Tank Farm F was incorporated into the IRP and was placed under the oversight authority of BUSTR.

Site Characteristics. At SP7, numerous investigations conducted during 1989 and 1990 indicated that all tanks were tight and not leaking. Results from a 1989-90 UST investigation indicated that VOCs and lead at the site were within acceptable limits. During the excavation and removal of tanks at F Farm, localized petroleum contamination was evident near UST 21. Following tank removal, soil samples indicated levels of VOCs were well below health-based criteria with the exception of benzene, identified in a sample along the north wall of the Farm; however, the north wall could not be excavated further because initial excavation reached bedrock. Other analyses indicated no significant levels of lead. Analysis of metals, performed on the excavated soils, were below regulatory criteria. Results of the site investigation conducted in 1991 indicated BTEX levels in groundwater samples below detection except for benzene; however, the measured concentration for benzene (0.84 ppb) was well below the MCL. Samples were also taken during closure of the tank farm to confirm that closure was complete.

Risk Assessment. A preliminary risk evaluation was conducted that considered exposure scenarios for utility workers and for the WPAFB water supply wells. Security precautions preclude unauthorized persons; thus potential exposure is limited to site workers. The assessment concluded that concentrations of contaminants remaining in soil were below risk-based levels for a commercial\industrial scenario and concentrations in groundwater were below MCLs. In addition, base drinking water supply wells are 2500 feet downgradient of SP7, and shallow, competent limestone bedrock separates this site from the aquifer that is used as the drinking water source for the cities of Dayton and Fairborn and for WPAFB.

Previous Actions and the NA Alternative. Closure of fourteen USTs (USTs 9-21 and UST 193) at Tank Farm F was conducted in late 1991. Visual examination during removal of the USTs showed that the area around UST 21 was heavily contaminated. The site was "overexcavated" with conventional equipment to the point of bedrock exposure on the sides and floor of the pit. The north side of the pit was excavated until a building foundation (Building 21) was encountered. Representatives of BUSTR concurred with WPAFB representatives that further remediation through excavation was not possible. The UST 193 tank location was backfilled (with agency approval) and new tanks were installed at F Farm. Based on the conclusions of the risk evaluation, no further action is needed because the site has been remediated under the oversight of BUSTR, with the approval of both Ohio EPA and USEPA. The final site closure by BUSTR was deemed acceptable by both agencies. The completed UST removal is considered to be the final action for Spill Site 7. The preferred alternative for SP7 is no action. Because all of the above actions have been implemented, no additional action is necessary at the site to protect human health and the environment under current and future land use plans.

Spill Site 8 (SP8)

History and Description. SP8 is in Area C, immediately south of Building 167 and north of the

State Route 444 Base boundary fence (see Figure 3). It is not included in any OU. The site was discovered in April 1988 when two transformers, being removed as part of a Military Construction Project, were found to be leaking. The transformers were sampled and the oil was found to contain PCB concentrations ranging from approximately 67 ppm to 487 ppm.

Site Characteristics. In August and September 1988, 26 soil samples were obtained to determine the vertical and horizontal extent of the PCB contamination and provide recommendations for further actions. The results indicated that PCB concentrations ranged up to 42 ppm and that soils containing PCB contamination in excess of 10 ppm were confined to an area of 6 ft by 6 ft by 8 ft deep. Additional sampling, performed in June 1990 after excavation of PCB contaminated soil, indicated that the south wall sample contained 2.3 ppm of Aroclor 1254 and the sample from the bottom of the excavation contained 1.1 ppm of Aroclor 1254.

Risk Assessment. WPAFB did not conduct a risk assessment for this site; however, considering the site data and regulatory criteria, SP8 is not expected to pose significant risks to public health or the environment. Although soil was impacted by PCBs from the leaking transformers, verification sampling of the excavation sidewalls and floor indicated PCB concentrations of less than the regulatory criteria of 10 ppm for a residential scenario in all samples.

Previous Actions and the NA Alternative. The transformers have been removed and disposed. Based on the conclusions of verification sampling, contaminated soils at the site were excavated and the concentration of PCBs on site is less than the regulatory criteria of 10 ppm for a residential scenario. The preferred alternative for this site is no action. Because all of the above actions have been implemented, no additional action is necessary at the site to protect human health and the environment under current and future land use plans.

Spill Site 9 (SP9)

History and Description. Spill Site 9, also known as Tank Farm B, is south of Building 71B (Figure 2), adjacent to Tank Farm F. Originally identified as four abandoned underground fuel lines, the site was expanded to include the entire tank farm. The USTs were used from 1956 to 1992 to store aviation fuel and fuel additives for research purposes as part of the Aero Propulsion Laboratory Fuel Storage Facilities. B Farm was installed in a 15 ft deep unlined pit excavated out of shale and limestone bedrock. The tanks were set on concrete cradles, anchored with metal straps, and the pit backfilled with limestone gravel. All tanks were externally coated with asphalt. The tank farm was equipped with an underground tile drainage system that diverted infiltration water to a sump pit located in Building 20253. B Farm was first suspected of releasing product into the environment, either through spills or leaks, in September 1989 when hydrocarbon material was discovered in the sump pit in Building 20253. At this time, the site was included as an IRP site and placed under BUSTR oversight authority. The tanks were removed in 1992.

Site Characteristics. During a geotechnical investigation at SP9, minor concentrations of VOCs (1,1,1-TCA, chloroform, and TCE) were detected in one or more of these borings. TPH was not detected. Following discovery of a potential release in September 1989, tracer gas tightness tests were conducted on B Farm tanks that were in service. Results indicated that two USTs (USTs 139 and 143) could be leaking. It was later confirmed that UST 143 was leaking. The results of the UST investigation conducted in 1989-90 indicated elevated levels of VOCs in several soil samples collected from B Farm. The site investigation conducted under the IRP indicated the

presence of VOCS (xylene, ethylbenzene, and 4-methyl-2-pentanone) and lead in groundwater downgradient of the site. VOC concentrations were below the MCL and risk-based regulatory criteria. Lead concentrations were below the MCL. Following removal of the tank, eight soil samples were taken from the excavation: three from each sidewall and one from each end. TPH and one or more VOC compounds were detected in all samples.

Risk Assessment. WPAFB conducted a preliminary risk evaluation which considered exposure of utility workers. The security precautions within WPAFB restrict the presence of unauthorized persons at any building or facility; thus, frequent exposure or prolonged potential exposure is limited to site workers. The evaluation indicated that concentrations of contaminants remaining in soil were below risk-based levels for a commercial/industrial scenario, and concentration of contaminants in ground water values were below the MCL.

Previous Actions and the NA Alternative. Closure of Tank Farm B was conducted in September 1992. Soil was excavated to the top of each tank, the tie-down straps were cut, and the tank removed from the excavation. As each tank was excavated, cut ends of abandoned lines were plugged with hydraulic cement. Excavation of the tanks continued until all tanks were removed; however, the concrete anchor pads were left in place. To remove contamination, the site was "overexcavated" with conventional equipment to the point of bedrock exposure on the east and south sides and floor of the pit and to the north until no further remediation by excavation was possible. The east and south sides of the excavation extended until bedrock was encountered. The west side of the pit was excavated until no visual signs of contamination were evident. The north side of the pit was excavated until the road and Building 21 were encountered. Only residual soil entrained within the bedrock crevices remained within the excavation pit. A few isolated areas in the excavation contained saturated soil or ponded water from runoff of the rinse water from tank washing and from rain events. After excavation was complete, the entrapped water was removed from the excavation and disposed. Representatives of BUSTR concurred with WPAFB representatives that further remediation through excavation was not possible.

Soil sampling was conducted during replacement of the tank to determine the need for additional site remedial activities. Based on the results of this sampling, no additional remedial activities were deemed necessary and the site was closed under the supervision of BUSTR. Based on the conclusions of the risk assessment, no further action is needed because the site has been remediated under the oversight of BUSTR in accordance with all applicable federal and state regulations. The completed UST removal is considered to be the final action for Spill Site 9. The preferred alternative for SP9 is no action. Because all of the above actions have been implemented, no additional action is necessary at the site to protect human health and the environment under current and future land use plans.

Spill Site 11 (SP11)

History and Description. SP11 is in the southeastern corner of OU8, between 10th and 11th Streets, in a horseshoe-shaped area bounded on three sides by an earthen berm (Figure 2). The site is topographically uphill and hydrogeologically upgradient of the other OU8 sites. The Aircraft Survivability Research Facility is located within the berm and currently consists of two small gun ranges (Ranges 2 and 3) constructed in the late 1960s to mid-1970s. At Range 3, partially full fuel tanks were fired upon, releasing fuel onto unpaved ground. In 1981, Range 3 was equipped with a 500-gallon fuel containment system. In June 1991, an aboveground fuel-supply line ruptured, releasing an estimated 500 gallons of jet fuel to the ground surface and

to the storm sewer system. The spill was reported to be contained in the storm sewer system, and approximately 400 gallons of fuel were recovered. Contaminated soil was excavated and disposed of, and the sewer system was flushed.

Site Characteristics. Field investigations conducted at SP11 indicated that the depth to bedrock is very shallow, with generally only 1 to 5 feet of soil (fill) over the bedrock. Because of the shallow depth to bedrock in this area, groundwater is very close to the ground surface, following the slope of the bedrock in a westerly direction. During rainfall events, precipitation rapidly infiltrates the thin soil layer and raises the water table to the surface. Residual LNAPL product rises with the water and moves to the surface. After significant rainfalls, potentially petroleum contaminated water enters storm drains and nearby drainage swales. Results of the soil and sediment sampling during the SI indicated the presence of SVOCs; however, SVOCs were not detected in groundwater. During the RI, TPH, ethylbenzene and total xylene were detected in the area where the spill occurred. TPH was detected in groundwater during Round 1 of sampling. but was not detected during Round 2. BTEX compounds were detected during both rounds. Two surface water samples, collected immediately downgradient of SP11 during a rainfall event, contained TPH as did sediment samples collected in the north ditch. The deposition of TPH-containing sediments was found to be limited in extent.

Risk Assessment. At SP11, contaminant concentrations in soils, sediments, and surface water do not exceed the 1 X 10^{-6} cancer risk or noncarcinogenic Hazard Index of 1 for ingestion, inhalation, and dermal contact by industrial/commercial workers. Subsurface soil concentrations of TPH exceed regulatory action levels. The shallow groundwater contaminant concentrations detected at the site were compared to MCLs because the shallow groundwater could potentially be a source of contamination to the lower aquifer which is used as a residential drinking water source. Manganese was detected at concentrations exceeding the MCL; arsenic was detected at concentrations that exceed USEPA Region IX Tap Water PRGs, which correspond to contaminant concentrations that contribute to cancer risk between the 1 x 10^{-6} and 1 X 10^{-4} range. Surface water samples were also compared to Clean Water Act criteria. The compounds that exceed Ambient Water Quality Criteria are benzo(a)anthracene, benzo(a)pyrene, and lead (lead exceeds the Ohio Water Quality Standard). The ecological risk assessment indicated that aluminum, cadmium, copper and zinc in the sediment at SP11 posed an ecological risk to small mammals, based on incidental soil ingestion.

Previous Actions and the NA Alternative. The risk assessment determined that the concentration of contaminants in soil, sediment, and surface water did not exceed the USEPA accepted range for carcinogenic risk and non-carcinogenic hazard. However, subsurface soil concentrations of TPH exceed BUSTR action levels. Manganese in groundwater also exceeded the PRG and the MCL but is comparable to background conditions. Based on these conclusions, an Action Memo was prepared to address a Non-Time Critical Removal Action. The removal action implemented consisted of the installation of a downgradient french drain to collect groundwater and surface water. The drain consists of a gravel filled trench approximately 120 feet long and 4 feet deep placed perpendicular to the direction of groundwater flow. Perforated pipe at the base of the drain collects contaminated groundwater migrating above the bedrock after rainfall events. The collected groundwater is pumped to an existing oil/water separator for treatment. The preferred alternative for SP11 is no action. Because all of the above actions have been implemented, no additional action is necessary at the site to protect human health and the environment under current and future land use plans.

Burial Site 2 (BS2)
History and Description. BS2 is in OU11, in Area C, near the northwest corner of the base (see Figure 3). OU11 is bounded on the north by State Route 235, on the south by Bass Lake, and on the west by a flood levee for the Mad River. Land use is limited and sporadic (classified as commercial), and the area is generally not frequented by Base personnel. Most of the land is well vegetated or paved. BS2 covers about six acres, and was reportedly used between 1971 and 1975 for the disposal of sludge generated from cleaning bulk fuel storage tanks. The cleaning process produced an estimated 700 gallons per year of sludge containing tetraethyl lead. It is not known if the sludge was placed in containers before disposal at the site.

Site Characteristics. During initial soil sampling activities. TPH was detected in 9 of 9 samples, lead was detected in 7 of 9 samples, and zinc was detected above the maximum background limit in one sample. During the Field Investigation, no target aromatic volatile or chlorinated organic compounds were detected during the soil gas survey. Ten soil borings were located randomly throughout the area and surface and sub-surface soil samples were collected from the soil borings. Toluene was detected at all but one surface soil sampling location, and PAHs were detected at most locations. Various concentrations of metals were detected at each sample location, with some metals exceeding background metals concentrations. Methylene chloride, toluene, PAHs and various concentrations of metals were detected in subsurface soil.

Risk Assessment. A preliminary risk evaluation of potential chemical exposures was conducted for all sites within OU11. In addition, a semi-quantitative risk assessment was conducted for BS2 during the OU11 Field Investigation. The risk assessment indicated that chemical concentrations detected at OU11 would not exceed 1×10^{-6} risk level or a Hazard Index greater than 1, assuming unchanged land use. Current land use for BS2 is considered commercial, with limited site use other than for lawn and vegetation control/maintenance. Only arsenic concentrations in surface and subsurface soil exceeded both the residential and industrial USEPA Region IX PRGs.

Results of the ERA indicated that metals in soil (arsenic, selenium, and thallium) posed a potential ecological risk to mammals and thallium posed a potential ecological risk to bird predators. Although several toxicological benchmarks were exceeded, based on the data limitations and other uncertainties, none of the compounds (arsenic, cadmium, manganese, selenium and thallium) were expected to have an adverse effect.

NA Alternative. The preferred alternative for this site is no action. The risk assessment concluded that none of the compounds detected in soil samples exceeded PRGs with the exception of arsenic and beryllium. The exposure assumptions used to calculate the PRGS. however, assumed very conservative default exposure factors for industrial and residential exposures. Reevaluation of the data using a more realistic exposure scenario based on lawn maintenance workers and visiting base personnel indicates that all compounds would be less then their respective PRGs. Based on these conclusions, WPAFB has concluded that no action is necessary to ensure protection of human health and the environment under current and future land use plans.

Burial Site 3 (BS3)
History and Description. BS3 is located in OU9, in the east portion of Area B (see Figure 2). BS3 may have been used to dispose of fuel sludge, but records indicating the amount and nature

of wastes are not available. Although the exact size and location of the site is unknown, a review of historical aerial photographs and conversations with Base personnel determined the location with reasonable certainty.

Site Characteristics. Geophysical investigations during the SI identified anomalies at BS3 consistent with fill material and small amounts of buried metal at depths ranging from 10 to 20 feet. During the OU9 R1 field activities, volatile and semivolatile TICs and metals were identified in the soil and groundwater; however, all concentrations are within the established range of regulatory limits. VOCs and SVOCs detected in groundwater were below regulatory levels. Aluminum, iron, and manganese were identified above their MCLs in groundwater.

Risk Assessment. A qualitative risk assessment was conducted for BS3 using PRGs, non-zero MCLGs and MCLs. A conservative residential land-use exposure scenario, at a 1×10^{-6} risk level, was used in the calculation of PRGs. Results of the risk assessment indicated that although lead concentrations in soils were slightly above background levels; lead groundwater concentrations were below MCLs. Therefore, no contamination was detected in the soils at BS3 that is adversely impacting the environment and no potential risk to human health and the environment is anticipated.

NA Alternative. The preferred alternative at this site is no action. The risk assessment concluded that contaminant concentrations are within the range that is considered to be naturally occurring, and contamination detected in the soils at BS3 is not adversely impacting the environment. Although several metals were detected above their MCLs in groundwater, groundwater will be addressed under the BMP. Based on these results, WPAFB has determined that no significant risk or threat to public health or the environment exists at this site and no action is required.

Burial Sites 5 and 6 (BS5 and BS6)

History and Description. BS5 and BS6 are in Area B, near the east-west runway, adjacent to and southwest of OU9 (see Figure 2). Area land use is industrial. These sites were not included in the original 65 IRP sites, but were identified in 1996 as potential hazardous waste sites from aerial photographs, comments from local residents, and interviews with WPAFB personnel. A records search, conducted in September 1996 to determine the history of BS5 and 6, included an examination of aerial photographs dating from 1944. BS5 is evident on photographs from 1944 to the present, appearing as a patch of stressed vegetation approximately one acre in size. One photograph, dated 1974, indicates a road or trail leading to BS5, suggesting some activity at the site. BS6 is west and downslope of a former building structure, the foundation of which can still be seen in the field. Evidence of activities that would indicated a burial site, such as stressed vegetation or disruption of the surface, is suggested from the historical photographs, although the evidence is not conclusive.

Site Characteristics. In 1997, soil gas, surface and subsurface soil, and groundwater samples were collected and a geophysical survey was conducted to detect buried materials and attempt to define the boundaries of the burial sites. Although results of the geophysical survey did not show evidence of burial activity, linear anomalies were identified at both sites indicating possible buried pipes or electrical cables. Subsequent trenching revealed a 4-inch steel pipeline and a one-half inch cable believed to be an abandoned communications line at BS5 and an abandoned electrical line near the center of BS6. Trenching at BS5 also revealed that a tight clay soil extended from the surface to the bottom of the trench and that topsoil was essentially absent.

These observations suggest that the area of stressed vegetation at BS5 may be due to lack of topsoil, along with surface water ponding in the area. None of the soil gas samples from either site contained VOCs above the detection limits, and only minor amounts of VOCs, SVOCs and inorganic compounds were detected in soil and groundwater samples. At BS5, the most prevalent compound detected in the subsurface soil and groundwater samples is PCE, however, the locations and concentrations of the PCE suggest that its source may be off-Base. Results of the SI at BS5 indicated that burial activity had not occurred in this area. At BS6, low concentrations of benzene, ethylbenzene, and xylenes were detected in two groundwater sampling locations. Because of the location of the contamination, it is believed that the source of these contaminants is the former underground storage tanks upgradient of BS6 that had been removed. A number of PAH compounds were detected in soil samples, and one groundwater sample contained naphthalene above the detection limit.

Risk Assessment. The semi-quantitative risk assessment performed for BS5 and BS6 evaluated potential current and future human health risks associated with chemicals detected in soil and groundwater using risk-based PRGs. MCLs were also applied as PRGs for groundwater. The risk assessment addressed potential human health risks only. Ecological risks were addressed under the BMP which concluded that although some benchmarks were exceeded for some metals and PAHs, the concentrations were consistent with urban environments and do not pose a risk to the environment.

COPCs were screened using EPA Region IX residential and industrial PRGs for soil and MCLs and EPA Region IX tap water PRGs for groundwater. The maximum concentration of all COPCs in soil are lower than their Region IX residential PRGs. In BS5 groundwater, the maximum concentration of PCE exceeds the tap water PRG, but it is likely that the source of the PCE is off-Base. Arsenic and lead also exceed their PRGs in groundwater, but this is attributed to the presence of turbidity in the samples. In BS6 groundwater, the maximum concentration of benzene exceeds the MCL and the tap water PRG, but it is likely that the source of the benzene is an upgradient UST that had been removed. Arsenic, chromium, lead, and manganese also exceeded their PRGs in groundwater, but this is attributed to the presence of turbidity in the samples. Groundwater will also be addressed under the BMP.

NA Alternative. The preferred alternative at these sites is no action. The risk assessment concluded that minor amounts of VOCs and SVOCs detected in soil did not exceed PRGs. Although several contaminants detected in groundwater exceeded PRGs, groundwater will be addressed under the BMP. Based on these conclusions, no action is needed because the contaminants present in soil are not expected to pose a significant risk or threat to public health or the environment. WPAFB has concluded that no action is necessary to ensure protection of human health and the environment under current and future land use plans.

Earthfill Disposal Zones 2 through 10 (EFDZ 2 through 10)
History and Description. EFDZ 2 through 10 are located in OU9, in the east portion of Area B, on a ridge that is the geographical high point of WPAFB (see Figure 2). All of the nine EFDZs with the exception of EFDZ 6, are located along the hillside that slopes west from EFDZ 5 down to the former runways of Wright Field. The majority of the land surface within the sites is currently open fields or wooded areas; however, areas surrounding these sites contain buildings and paved surfaces such as roadways, parking lots, and abandoned runways. EFDZ 2 through 10 were identified as IRP sites because of the potential for disposal of hazardous chemical materials

during or subsequent to fill placement. The sites range in size from two acres to 35 acres, and contain from 5,000 to 355,000 cubic yards of waste materials. Sites 2 through 8 were identified through historical aerial photographs from the 1940s; Sites 9 and 10 are thought to have been developed in the early 1950s. Although there has been no indication of the disposal of hazardous materials at these sites, materials similar to those disposed of at other landfills may have been transported to these sites.

Site Characteristics. Geophysical investigations conducted at the EFDZs during the Sis identified anomalies consistent with fill material and small amounts of buried metal at depths ranging from 10 to 20 feet. Further soil sampling and groundwater monitoring was conducted during the OU9 RI field activities. Analytical results from the SI and RI identified low levels of VOCs. SVOCs, volatile and semivolatile tentatively identified compounds (TICs), pesticides, and metals in the soils; however, only beryllium (a naturally occurring metal common in WPAFB soils) was detected in soils at concentrations above the PRGs.

Groundwater samples identified low levels of VOCs, SVOCs, metals, and/or volatile and semivolatile TICs at all of the EFDZs, but none of the concentrations detected exceeded MCLs except at EFDZs 4 and 9. At EFDZ 4, RI field activities identified benzene and 1,2-DCA in the groundwater at levels exceeding MCLs; at EFDZ 9, vinyl chloride was detected above the MCL in one groundwater sample. VOCs above MCLs were also detected in groundwater monitoring wells downgradient of EFDZ 9. Sampling conducted during the RI field activities also identified low levels of VOCs and SVOCs (mostly PAHs) at EFDZ 9, but were not able to identify a contaminant source of the VOCs or confirm widespread groundwater contamination. Sampling conducted in target locations, however, identified localized concentrations of vinyl chloride. TCE, and 1,2,-DCE that exceeded MCLs for groundwater. Antimony exceeded PRGs at EFDZ 3 and arsenic at EFDZs 4, 5, and 9. Chromium exceeded MCLs at EFDZ 8 and nickel exceeded MCLs at EFDZs 8 and 9. During the SI, bis (2-ethylhexyl)phthalate was detected at EFDZs 5 and 7.

Risk Assessment. A qualitative risk evaluation was conducted on EFDZs 2, 3, 5, 6, 7, 8, and 10 using PRGs, non-zero Maximum Contaminant Level Goals (MCLGs) and MCLs. A conservative residential land-use exposure scenario, at a 1 x 10 -6 risk level, was used in the calculation of these PRGs. A semi-quantitative risk assessment was conducted on soils in EFDZs 4 and 9. This assessment used commercial/industrial PRGs as a comparison criteria and identified COPCs throughout OU9. Ecological risks were not considered except at EFDZs 5, 8, and 9. Except at EFDZ 4, none of the compounds detected in soils exceeded PRGs except beryllium; however, the beryllium is considered naturally occurring and not site related. Site-specific risk assessment results included:

EFDZ 2. Although semi-volatile TICs were detected in soils, no risk can be assigned due to the nature of the detections. Therefore, no adverse human health effects are expected from EFDZ 2.

EFDZ 3. Antimony was identified as a naturally occurring anomaly and not of concern. Several metals exceeded the MCL; however, many of these metals are considered naturally occurring. Concentrations were also possibly affected by the seasonal fluctuation of the groundwater and were not significantly different from concentrations found in adjacent areas. Therefore, no adverse human health effects are expected from EFDZ 3.

EFDZ 4. Methylene chloride, detected in one sample during the SI, was identified as a COPC; however none of the compounds identified in the soil or groundwater exceeded PRGs except manganese and arsenic. RI field activities identified benzene and 1,2-DCA in the groundwater at levels exceeding MCLs, but not PRGs. Arsenic, also identified as a COPC, was identified above the PRG at two locations, but not the MCL, and is not indicative of contamination requiring remediation. No adverse human health effects are expected from EFDZ 4.

EFDZ 5. In groundwater, bis(2-ethylhexyl)phthalate exceeded MCLs and PRGs; and arsenic (identified as a COPC) exceeded the PRG. Arsenic is considered a naturally occurring mineral and the PRG exceedance is not considered significant. Bis(2-ethylhexyl)phthalate is not likely to migrate far at concentrations greater than MCLs or act as a source for continuing releases to groundwater because of it's tendency to adsorb to soils. Therefore the presence of bis(2-ethylhexyl)phthalate is also not considered significant. No significant ecological effects were identified and no adverse human health effects are expected from EFDZ 5.

EFDZ 6. Sources of the chromium, lead, and nickel, which exceeded MCLs for groundwater, were not determined and will be further monitored under the BMP. No adverse human health effects are expected from EFDZ 6.

EFDZ 7. None of the compounds detected in soils or groundwater at the site exceeded PRGs. Bis(2-ethylhexyl)phthalate detected during the SI exceeded MCLs, but this compound is not likely to migrate far at concentrations greater than MCLs or act as a source for continuing releases to groundwater because of its tendency to adsorb to soils. In addition, levels of bis(2-ethylhexyl)phthalate detected during the RI did not exceed the MCL. Therefore the presence of bis(2-ethylhexyl)phthalate is not considered significant. No adverse human health effects are expected from EFDZ 7.

EFDZ 8. In groundwater, only chloroform exceeded the PRG. Because chloroform is associated with the chlorination of public drinking water and did not exceed its primary MCL, the compound was not considered a concern at the site. Chromium and nickel, which exceeded MCLs, will be monitored under the BMP. No significant ecological effects were identified, and no adverse human health effects are expected from EFDZ 8.

EFDZ 9. No contaminant source was identified during the RI field activities and neither soil nor groundwater contamination appear to be widespread. The PAHs identified in the soils did not exceed RME PRGSs. Vinyl chloride, 1,2-DCE, and TCE were detected in groundwater exceeding MCLs; however, based on the half-life ranges and the low concentrations of TCE and its daughter products that were detected, TCE would persist in groundwater for only a few years at concentrations exceeding the MCL without a continued source. The inorganic metals are relatively immobile, and are not expected to migrate offsite. Only arsenic exceeded the average PRG, but did not exceed a 1 x 10 -5 risk, and is therefore within the target risk range. No significant ecological effects were identified.

EFDZ 10. Soil and groundwater sampling indicated the presence of low levels of VOCs and SVOCs, but not at levels of concern. None of the detected metals in the groundwater exceeded established MCLs. A preliminary risk evaluation of potential chemical exposures was not conducted at EFDZ 10 because of the small data set; however. SI activities conducted at the site did not indicate that the chemicals or metals detected would pose an unacceptable risk to human health or the environment.

NA Alternative. The preferred alternative for EFDZ 2 through 10 is no action. The risk assessment concluded that most of the compounds detected in soils were below the PRGs; only beryllium was detected above the PRG at EFDZs 2, 4, 5, 6, and 8. Beryllium is considered to be naturally occurring and not site related. Several metals, VOCs, and SVOCs in groundwater exceeded MCLs; however, most of these metals are naturally occurring. In addition, groundwater will be addressed under the BMP. WPAFB has concluded that no action is necessary to ensure protection of human health and the environment under current and future land use plans.

Central Heating Plant 1 (HP1)

History and Description. HP 1 is in the north-central section of Area B, between D and E streets about 200 ft south of the Springfield Pike Base boundary (see Figure 2). The site is not included in any OU. The plant contained seven coal-fired boilers and began operating in 1930, but was shut down in 1980 as part of the heating plant consolidation at WPAFB. While the plant was in operation, a coal pile was stored within an adjacent concrete structure. The former coal storage area was paved after the heating plant consolidation, and is currently used as a parking lot.

Site Characteristics. HP 1 was investigated during the IRP Phase II Stage 2 Investigation. Groundwater sampling indicated levels of sodium, chloride and TDS above background levels: and 1,1,1-TCA was detected at a very low concentration.

Risk Assessment. WPAFB conducted a qualitative analysis of the health risks associated with HP 1 based on site data, regulatory criteria, and current site conditions. Site data indicate that several inorganic compounds associated with coal may have leached into groundwater; however, contaminant levels did not exceed any MCLs. Although soil sampling was not conducted, leaching of contaminants associated with former coal storage operations from the soil is not expected.

NA Alternative. The preferred alternative at this site is no action. The risk assessment concluded that the contaminants present are not expected to pose a significant risk or threat to public health or the environment. The heating plant is no longer active, the coal storage area was removed and the majority of the site is now completely covered by an asphalt parking lot. Metals and other inorganics associated with the former coal storage operation are not expected to migrate by leaching or dust generation. WPAFB has determined that no action is required for protection of human health or the environment.

Central Heating Plant 2 (HP2)

History and Description. HP2 is located in the southern corner of Area A (Figure 3). The site is not within the OU4 area, but was included in the OU4 RI. HP2 and the adjacent coal storage area operated from the 1940s until 1980 when the plant was shut down as part of the heating plant consolidation at WPAFB. While in operation, the coal pile was stored within a concrete barrier adjacent to the heating plant. Construction of Building 283, in 1988, covered much of the area; the remainder of the site is covered with grass. In January 1996, globules of elemental mercury were observed in a sewer pipe that was accidentally broken while excavation work was being done near Building 271. Water, soil and elemental mercury were pumped from the excavation into drums, the storm sewer pipe that exits the heating plant was capped, and floor drain lines were cleaned and abandoned.

Site Characteristics. Three monitoring wells, installed in the vicinity of the HP2-Coal Storage Area during the Phase II, Stage 2 Investigation, indicated elevated levels of magnesium, manganese, sodium, nickel, zinc, chloride, and TDS. All of these contaminants can be attributed to coal leaching. Analytical results for soil indicated elevated boron, manganese, and butyl benzyl phthalate in the shallow soil; all parameters detected in the deeper soil samples were at acceptable levels.

In 1997, after discovery of the elemental mercury release, a field investigation was performed as an Addendum to the OU4 RI to determine the nature and magnitude of the soil, sediment, and surface water contamination related to the mercury spill. Results indicated elevated mercury concentrations in samples collected from within the former HP2 floor/funnel and roof drain system, within the 6-inch cast iron pipe and vitreous clay pipe storm sewer piping immediately adjacent to HP2, and from the 15-inch storm sewer piping just downstream (relative to stormwater flow) of HP2. Also, small globules of free mercury were observed in the 6-inch cast iron pipe sewer during sampling. Soil samples collected from areas underneath and in contact with, the 6-inch cast iron and vitreous clay pipe sewers contained low concentrations of mercury. Storm and sanitary sewer water samples contained low to non-detectable concentrations of mercury. Stream sediment samples from the unnamed tributary that received storm water discharge from HP2 also contained low concentrations of mercury.

Risk Assessment. Separate evaluations of risk were conducted for the coal storage area and the elemental mercury release. A qualitative assessment of risk for the coal storage area was made based on site data, regulatory criteria, and current site conditions. Although data indicate that several metals and other inorganic compounds associated with coal remain on site and/or have leached into site soils, only boron and manganese were detected at concentrations slightly above background for WPAFB soils. Health risks are generally not associated with these compounds in soil except at grossly contaminated concentrations. Butyl benzyl phthalate, present in site soils at low concentrations, is relatively immobile and fairly easily biodegraded. Site data also indicate that several metals and other inorganic compounds associated with coal have leached into groundwater; however, groundwater did not exceed any drinking water MCLs. The closest downgradient drinking water supply well is about 1700 feet from the site, Hebble Creek is about 2100 feet from the site.

A semi-quantitative risk assessment was conducted for the HP2 mercury release using data from the RI Addendum. Maximum detected mercury concentrations were compared to USEPA Region IX PRGs, and ARARs. The concentrations do not exceed any of the PRGs or ARARs, and do not exceed a human health Hazard Index above 1, or an ecological risk criteria.

Previous Actions and the NA Alternative. The risk assessment conducted for the HP2 Coal Storage Area concluded that the contaminants detected in soils do not pose a significant risk or threat to public health or the environment. Metals and other inorganics detected in site soils are not expected to migrate by leaching or dust generation, because the majority of the site is now covered by Building 283 and HP2 is no longer active. Also, the butyl benzyl phthalate is relatively immobile and is expected to biodegrade. Current use of this land as a building site reduces the likelihood of exposure, resulting in a minimal risk to people, plants, and animals who visit/reside in this area. The risk assessment conducted on the mercury release, after removal actions (which included removal of water, soil, and elemental mercury from the excavation; capping a storm sewer pipe; and cleaning and abandoning floor drain lines) were completed,

concluded that the remaining maximum detected mercury concentrations do not exceed any PRGs or other human health or ecological criteria. The completed response actions are expected to mitigate threats to public health, welfare, and the environment and are considered to be the final CERCLA response actions for the site. Should the heating plant be demolished, an environmental assessment (EA) would be conducted per WPAFB standard operating procedures. The EA would alert workers of the potential presence of elemental mercury in the capped storm sewers.

The preferred alternative for this site is no action. Because all of the above actions have been implemented, no additional action is necessary at the site to protect human health and the environment under current and future land use plans.

Central Heating Plant 4 (HP4)

History and Description. HP4 is located near the southeastern boundary of Area C in the Kitty Hawk Center (see Figure 3). The site was not included within any OU. The plant contains three coal-fired boilers and one gas-fired boiler, and is one of two central heating plants still in operation at WPAFB. HP4 began operation in 1957 and was expanded to its present size in 1980. A coal pile, within a containment area with a concrete pad and retaining walls, is adjacent to the plant. Runoff from the coal pile is collected, combined with other aqueous waste effluent streams from the heating plant, and neutralized before being discharged to the storm sewer system.

Site Characteristics. HP4 was investigated during the IRP Phase II Stage 2 Investigation. VOCs and SVOCs were not detected in the upgradient monitoring well. Samples from downgradient wells detected several metals (calcium, magnesium, manganese, antimony, and sodium) above background concentrations. Low concentrations of VOC and SVOC TICs were detected in one downgradient well, and TCE was detected at a concentration of 5 µg/L.

One sample of stormwater runoff was collected from surface drainage adjacent to the coal pile. Analytical results indicated several metals above background levels and surface water quality criteria. Sulfate, TDS, and specific conductance were above background levels.

Risk Assessment. WPAFB did not conduct a risk assessment for this site; however, considering site data and regulatory criteria, HP4 is not expected to pose significant risks to public health or the environment. Although the Phase II Stage 2 Investigation indicated that stormwater runoff had sufficient quantities of metals and other inorganics to impact surface water, the runoff is currently being collected and combined with other aqueous waste effluent streams from the heating plant and neutralized before being discharged to the storm sewer system. The investigation also indicated that the metals and other inorganics detected in groundwater did not exceed primary drinking water criteria, and concluded that the origin of the VOCs and SVOCs was probably an upgradient source and not directly attributed to HP4 site activities.

NA Alternative. The preferred alternative for this site is no action. Runoff is collected and combined with other aqueous waste effluent streams from the heating plant and neutralized before being discharged to the storm sewage system. Therefore, based on site data, regulatory criteria, and current site conditions, WPAFB has determined that no significant risk or threat to public health or the environment exists at this site and no action is necessary to protect human health or the environment.

Central Heating Plant 5 (HP5)

History and Description. HP5 is located in the northern portion of OU9, adjacent to Kauffman Avenue (see Figure 2). The plant began operation in 1956 and was expanded in 1980 to its present size of three coal-fired boilers and two gas-fired boilers. A large coal storage pile in a concrete containment area is adjacent to the plant. The DRMO facility, next to the plant, has been used as a storage area for transformers, scrap metal, equipment, batteries, etc. Fumes from an unknown source initiated an investigation of the area in 1996.

Site Characteristics. Site investigations conducted at HP5 indicated groundwater and surface water were not adversely impacted by activities at HP5, but soil samples were not taken at the site. RI field activities detected SVOCs (primarily PAHs), VOC and SVOC TICs, pesticides, PCBs, and metals in surface soils at the site. Subsurface soil samples indicated VOCs, SVOCs (again primarily PAHs), SVOC TICs, and metals. Groundwater sampling indicated low levels of VOCs, but no SVOCs were detected. Numerous metals were detected above MCLs and SMCLs in the initial round of sampling; additional sampling identified only aluminum, iron, and manganese above MCLs.

During the RI, a supplemental investigation was conducted at the DRMO. Surface and subsurface soil samples were collected, as well as groundwater samples. Results indicated elevated levels of SVOCs in surface and subsurface soil; VOCs, pesticides, herbicides, PCBs, and elevated concentrations of metals were also detected in subsurface soil. VOCs, SVOCs, and metals were detected in groundwater samples. A 1997 investigation confirmed the elevated levels of SVOCs (mostly PAHs) detected during the RI and delineated the extent of the soil contamination.

Risk Assessment. A semi-quantitative risk assessment was conducted on soils, surface water and sediments at HP5/DRMO using commercial/industrial PRGs as a comparison criteria. SVOCs, metals, and pesticides were identified as COPCs in surface soils. The SVOCs (primarily PAHs) exceeded the PRG for both the Reasonable Maximum Exposure (RME) scenario and the average (AVE) exposure scenario. Arsenic and Aroclor-1242 also exceeded RME PRGs in surface soil. However, Aroclor-1242 did not exceed the average PRG and arsenic was within the 1×10^{-4} to 1×10^{-6} risk range under the average exposure scenario. Metals were found to exceed criteria in both surface water and stream sediments, but were also detected upstream at slightly lower concentrations; thus these contaminants may not be site related. Many of the compounds that exceed sediment benchmarks are PAHs; however, their ecological effect is minimal. Also, WPAFB has recently upgraded the coal storage area where many of the SVOCs were detected. This construction activity will likely reduce or remove the apparent risk associated with coal in this area.

At the DRMO, estimates of the cumulative cancer risk and cumulative noncancer hazard were developed to determine locations associated with risk above the target risk range (i.e. 1×10^{-6} to 1×10^{-4} cancer risk or a Hazard Index of 1 for noncarcinogens). None of the sample locations exhibited a noncancer hazard in excess of the target of 1; however, all surface sample locations except for four express cancer risk greater than to 1×10^{-4} at the scrap metal storage area.

Previous Actions and the NA Alternative. Because PAHs were found to exceed regulatory levels where coal and coal ash has been unloaded and stored, WPAFB upgraded the coal storage area where many of the elevated contaminant concentrations were detected. Portions of the railroad

tracks were removed and surface areas were graded and either paved or resurfaced with clean gravel. Drainage lines were installed, replaced, or repaired to control storm water runoff. Retaining walls and the concrete pad were repaired and the coal silo and conveying system removed. In addition, a treatment system to control contaminant migration was installed for storm water runoff.

At the DRMO facility, the risk assessment concluded that soils at the DRMO posed an unacceptable risk. Therefore, an EE/CA was conducted to address a Non-Time Critical Removal Action. The removal action consisted of excavation and off-site disposal of surface soil and backfilling and placing clean gravel over the affected areas.

The actions taken at HP5 and at the DRMO have mitigated threats to public health, welfare, and the environment. The preferred alternative for this site is no action. Because all of the above actions have been implemented, no additional action is necessary at the site to protect human health and the environment under current and future land use plans.

Deactivated Nuclear Reactor (NUC)

History and Description. The NUC is an entombed reactor located north of EFDZ 9 (see Figure 2). Although within the confines of OU9, the site was not investigated as part of the OU9 RI. The reactor was a 10-megawatt reactor cooled and moderated with demineralized water. It was completed in 1965, and operated for five years supporting various projects of Defense Agencies, civilian institutions, and Air Force engineering students until it was shut down and decommissioned in June 1970. The facility is classified as a Site 91 B under the Atomic Energy Act of 1954, thus exempted from Nuclear Regulatory Commission oversight. The Air Force internally regulates activities at the reactor. The 88th Air Base Wing, Aeronautical Systems Center, Air Force Materiel Command is the custodian of the facility and performs applicable inspection, maintenance and monitoring activities to ensure compliance with the Air Force Nuclear Reactor Program (AFI 91-109), the USAF Special Nuclear Reactor Study 97-1, and the protection of personnel and environment from unnecessary exposure to radiation.

During decommissioning, the fuel rods were removed for reprocessing. The primary vessel was drained and dried, the penetrations were sealed, and the cavity filled with hot dry sand. Radioactive waste was shipped to a commercial low-level radioactive waste disposal facility and contaminated liquid (primarily cooling water) was released to the sanitary sewer in accordance with applicable regulations. The primary and auxiliary cooling systems, which consisted of seven USTs (three 60,000-gallon, two 5,000-gallon, one 10,000-gallon, and one 500-gallon), pipes, valves, sumps, and pits, remained in place until they were removed in 1992. Other activities that have occurred at the facility to aid in proper maintenance and/or provide additional restoration include installing a heating, ventilation, and air conditioning system to reduce condensation within the dome, removal of asbestos from the entire facility and reinsulation of the containment shell, removal of PCB transformers, removal of a low-level radioactive waste storage and disposal system from the radiochemistry laboratory, and replacement of the cathodic protection system on the containment shell.

Site Characteristics. Radiological monitoring, including soil, vegetation, surface water and groundwater monitoring, is conducted semi-annually outside the facility. Monitoring is also conducted inside the facility, including ambient air surveys and swipe surveys. In addition, groundwater monitoring was conducted in the vicinity of the reactor as part of the OU9 RI.

Results of the groundwater monitoring indicated detectable levels of gross alpha and beta.

Risk Assessment. Results of groundwater monitoring indicated that all detectable levels of radiological activity were below their respective MCLs. Because the 88th Air Base Wing, Aeronautical Systems Center, Air Force Materiel Command is custodian of the facility and performs applicable inspection, maintenance and monitoring activities to ensure compliance with AFI 91-109, USAF Special Nuclear Reactor Study 97-1, and protection of personnel and the environment from unnecessary exposure to radiation, further risk assessment under the IRP was not conducted.

NA Alternative. The preferred alternative for this site is no action. Continued maintenance of the NUC is internally regulated by the USAF and applicable inspections and maintenance and monitoring activities are performed to ensure compliance with applicable regulations and to ensure the protection of personnel and the environment from unnecessary exposure to radiation. WPAFB has concluded that no action is necessary under CERCLA and the IRP program to ensure protection of human health and the environment.

East Ramp UST

History and Description. The East Ramp UST was in the northeast section of Area C, adjacent to the tarmac south of Building 100, about 1900 ft west of the Base boundary near Gate 1C (see Figure 3). Although within the confines of OU10, the site was not investigated as part of the RI for OU10. The 12,000-gallon UST was abandoned in place prior to 1970. Records indicate the tank contained leaded gasoline as part of a defueling system, but no inventory or operational records existed due to the length of time the tank was out of service. The tank was removed in December 1988 as part of a Military Construction Project, and closed in accordance with BUSTR and USEPA regulations for USTs. During excavation activities, it was discovered that the tank was partially encased in concrete, filled with a caustic solution, and in excellent condition. Minimal soil contamination was encountered at approximately 12 ft bgs in the vicinity of the fill pipe connection to the tank, and all visibly contaminated soil was removed.

Site Characteristics. One soil sample was collected from the excavated area at approximately 12 ft bgs during removal of the UST. Results indicated the presence of organic compounds. Five additional soil samples were collected from soil borings after the UST removal. Low concentrations of petroleum VOCs were detected in one surface soil sample; no VOCs were detected in samples collected at depth. TPH and lead were also detected at low concentrations in samples collected at depth and at higher concentrations in surface samples. Two groundwater samples indicated that organic contaminants were not present. Lead was detected at concentrations less than the MCL.

Risk Assessment. A qualitative analysis of health risk was conducted based on site data, regulatory criteria, and current site conditions. Results indicate that only low concentrations of VOCs and TPH remain in soils. Site data also indicate that groundwater was not impacted by the UST and does not exceed MCLs. The excellent condition of the East Ramp UST at the time of its removal and the distribution of petroleum hydrocarbons exclusively in shallow soils suggest high background levels for this site or a source other than the East Ramp UST. Drainage from the nearby flight line (less than 20 ft from the site) or Skeel Avenue (less than 120 ft from the site) may account for the contaminants detected in shallow soils.

Previous Actions and the NA Alternative. The UST was closed in accordance with BUSTR and USEPA regulations for USTs. Based on current site conditions, the conclusions of the risk assessment, and the concurrence of the Ohio State Fire Marshal, no further action is necessary to ensure protection of human health and the environment under current and future land use. The preferred alternative for this site is no action. Because the above actions have been implemented. no additional action is necessary at the site to protect human health and the environment under current and future land use plans.

Building 4020 UST

History and Description. Building 4020 UST is located in OU11, near the northwest corner of the base (Figure 3). The 250-gallon UST was used from 1956 to 1986 to store waste JP-4 fuel and hydraulic fluid that was removed from an oil/water separator. When a leak was discovered in 1986, the contents were pumped out and the tank was removed. No records of soil removal were found, but unknown quantities of fuel had leaked during the operation of the UST.

Site Characteristics. During the Phase II, Stage 2 Investigation, four soil borings were drilled around the perimeter of the UST location and twelve soil samples were collected and analyzed for TPH and aromatic VOCs. TPH was detected in soils at 7 to 164 mg/kg (ppm); xylene was detected in one sample, at a depth of 13 feet, at a concentration of 37 mg/kg (ppm). Toluene was detected at 0.045 mg/kg in one surface soil sample. During the Field Investigation, groundwater samples were collected and analyzed from three piezometer at the Chemical Disposal Area which is downgradient of the Building 4020 UST site. The samples showed no evidence of contamination.

Risk Assessment. Although a risk assessment was not conducted for this site, the concentration of contaminants detected (TPH, toluene and xylene) did not exceed BUSTR cleanup criteria with the exception of one sample taken at a depth of 13 to 15 ft. (TPH at 164 ppm and xylene at 37 ppm exceeded the BUSTR Category 1 criteria for TPH of 105 ppm and xylenes of 28 ppm).

Previous Actions and the NA Alternative. The UST was removed in 1986. Contaminant concentrations do not exceed current BUSTR acceptable concentrations for VOCs and TPH, except for one soil sample that slightly exceeded the conservative Category 1 standards for xylene and TPH. Groundwater was not impacted and contaminants do not exceed any MCLs. The preferred alternative for this site is no action. Because the above actions have been implemented, no additional action is necessary at the site to protect human health and the environment under current and future land use plans.

Chemical Disposal Area

History and Description. The Chemical Disposal Area is a three-acre site in OU11, Area C, that is part of the Base's surface water drainage system (see Figure 3). The site consists of a drainage swale with intermittent flow that drains in a northwest direction toward the Mad River when precipitation occurs. During 1963 through 1974, personnel from the nearby industrial and maintenance shops reportedly disposed of various shop wastes in the Chemical Disposal Area drainage system, including ammonia, cleaning solutions, paint remover, and aircraft washing chemicals. Disposal of chemicals to this area ceased in 1973. Current land use is considered commercial.

Site Characteristics. An SOV survey, conducted during the SI, identified varying concentrations of 1,1,1-TCA, PCE, and TPH. The highest concentrations of TPH were found in a small drainage swale and were attributed to a wash rack used during maintenance and vehicle washing activities. The highest concentration of PCE was identified in a small drainage swale that enters the site from the maintenance area to the north. Soil boring data showed no evidence of VOC, TPH, SVOC, pesticide/PCB, or cyanide contamination. SVOC TICs (presumed to be either petroleum or general hydrocarbons) were detected in soil samples from the two site-specific sample locations (the third sample location was down-gradient of the site). Acetone was detected in one of the two sample locations. No VOCs, SVOCs, volatile or semivolatile TICs, TPH, pesticides/PCBs or cyanide were detected in groundwater samples taken during the SI. Metals in groundwater samples were considered to be within the range of naturally occurring metals in this aquifer. Common anions (chloride, fluoride, nitrate/nitrite) levels were consistent with upgradient concentrations. Other water quality parameters, such as TDS, hardness and sulfate were higher than upgradient levels. Nine sediment samples were also collected during the SI. One of the sample locations was at a half buried drum located within the site, but outside the drainage ditch. No VOCs, VOC TICs, and SVOCs were detected in any samples; SVOC TICs were detected in 6 sample locations. Low levels of TPH were detected in 4 of the 9 samples, and low levels of Aroclor-1260 (a PCB) were detected in three of the nine samples. TPH, SVOC TICs and PCB concentrations were detected in sediment samples from the drainage ditch running through the site. Sources of the low level of contaminants were suspected to be from the maintenance area along the southern edge of the site.

During the OU11 Field Investigation, surface and subsurface soil samples were collected and analyzed to supplement the previously collected data. No VOCs were detected; however, PAHs were detected in surface soils. Various concentrations of metals were detected at levels that exceeded background metals concentrations in soil samples. Acetone, 1,2-dichloroethene, 2-butanone, PAHs and various concentrations of metals were detected in subsurface soils.

Risk Assessment. A preliminary risk evaluation was conducted during the SI that indicated that the chemical concentrations detected at OU11 are within the USEPA accepted range for carcinogenic and non-carcinogenic risk, assuming unchanged land use. The semi-quantitative risk assessment conducted during the OU11 Field Investigation concluded that although arsenic in subsurface soil exceeded both the residential and industrial U.S. EPA Region IX PRGs, only the maximum concentrations were used when screening against PRGs, which is highly conservative. In addition, conservative default exposure factors for industrial and residential receptors were employed to derive the Region IX PRGs.

The ERA indicated that arsenic and selenium in soil posed an ecological risk to mammals, and cadmium and manganese in soil posed an ecological risk to bird predators. In all cases, the majority of the risk and hazard estimates were primarily attributable to metals concentrations. Land use is commercial, however, with limited site use other than for lawn and vegetation control/maintenance. Therefore, ecological exposures are limited.

NA Alternative. The preferred alternative for this site is no action. The risk assessment concluded that none of the compounds detected in soil samples exceeded PRGs with the exception of arsenic. Although the maximum concentration of arsenic exceeded the PRG, it did not exceed the background arsenic concentration. No action is necessary to ensure protection of human health and the environment under current and future land use plans.

Radioactive Waste Burial Site (RADB)
History and Description. The RADB was in the south central section of Area B at the intersection of P and 12th Streets, about 2250 feet north of the WPAFB boundary along Colonel Glenn Highway (see Figure 2). The site has not been included in any OU. The site consisted of a 7 ft by 7 ft concrete slab surrounded by an eight foot barbed wire fence labeled "Radioactive Waste Burial Site." Although the Phase I Records Search did not conclude that radioactive waste was buried at WPAFB, and no indications of elevated radiation were found at the RADB during the Phase I Investigation, the burial site was included as an IRP site because the area appeared to be a disposal site and was fenced and labeled.

Site Characteristics. In 1990, the concrete slab was removed and the soils beneath were excavated to a depth of approximately nine feet, where bedrock was encountered. No elevated radiation levels were detected in soil samples, the excavated soil, or the concrete slab. During a Ground Penetrating Radar (GPR) survey, two potential sites were identified where burial activity may have occurred, but excavation of these areas to a depth of six feet did not uncover any signs of burial activity. Following the GPR survey, the excavations were filled and graded, the fence was removed, and the concrete slab was disposed off-site as sanitary waste. Communication with personnel present during the time the concrete slab was placed indicated the slab was used as a staging area for drums of radioactive waste prior to shipment and disposal off site, and confirmed that no radioactive material was buried or disposed at the RADB.

Risk Assessment. Soil sample data from excavations at the RADB, as well as the site history, indicate that the RADB was never used as a burial site for radioactive materials--only as a staging area for drums of radioactive waste in the 1950s. Soil samples from the site showed only naturally occurring radioactivity at background levels, and there is no indication that environmental contamination resulted from previous use. Since the environment was not impacted by activities at the site, health risks do not exist.

Previous Actions and the NA Alternative. The concrete slab has been removed and disposed. Because there is no indication the environment was impacted by activities at the site, health risks do not exist. The preferred alternative for this site is no action. Because the above actions have been implemented, no additional action is necessary at the site to protect human health and the environment under current and future land use plans.

Explosive Ordnance Disposal Range (EOD)
History and Description. The EOD Range is located in Area C (see Figure 3), and has not been included in any OU. The site is regulated under State of Ohio RCRA regulations and has been included in this ROD because of the need to maintain institutional controls to limit access to the EOD Range. The facility was used for over 40 years to thermally treat unserviceable munitions via detonation and burning. WPAFB submitted a RCRA Part A permit application in November 1988, followed by a RCRA Part B permit application in April 1989 for continued operation of the EOD Range. The Part B permit application was subsequently withdrawn and the EOD Range operated under interim Status until operations ceased in late 1990. Closure activities, completed in early 1998, consisted of removing ash and debris from the Open Burning (OB) unit, removing and recycling the OB unit, removing and disposing of approximately 10 cubic yards of non-hazardous contaminated soil from beneath the OB unit, and regrading the site. Land use is industrial and will remain so.

Site Characteristics. Soil sampling activities indicated several metals (cadmium, lead, selenium and silver), VOCs, and SVOCs exceeded background concentrations and were identified as COCs. Results of groundwater sampling and evaluation of the data in accordance with RCRA guidance indicated that there was no statistical evidence to indicate that a release to groundwater had occurred.

Risk Assessment. WPAFB conducted a quantitative risk assessment, in accordance with RCRA guidance, to determine the baseline risks associated with chemicals present at, or released from, the EOD Range. This risk assessment was conducted prior to closure, and did not include data from soil beneath the OB unit. A second risk assessment was conducted after removal of the OB unit and included data from soil beneath the unit.

Prior to closure, the risk assessment indicated that the increased lifetime cancer risk associated with exposure to the soil using an industrial exposure scenario was 5.1×10^{-8}, which is less than the target risk of 1.0×10^{-5} under current RCRA guidance. In addition, noncarcinogenic hazard was estimated to be 1.4×10^{-1}, which is less than the acceptable target hazard of 1.0. Exposure to lead could not be included in the quantitative risk estimate, therefore it was evaluated relative to a soil screening level of 400 ppm. The representative concentration of lead in soil was below the lead soil screening level.

Although groundwater associated with the EOD Range is not currently available for residential use, groundwater was evaluated under a residential exposure scenario. The carcinogenic risk associated with all residential exposure is 2.2×10^{-6} for adults and 2.0×10^{-6} for children, which is less than the target risk of 1.0×10^{-5} under current RCRA guidance. Noncarcinogenic hazard is estimated to be 1.5×10^{-1} for adults and 3.4×10^{-2} for children, which is less than the acceptable target hazard of 1.0.

The risk assessment conducted after the OB unit had been removed and soil beneath the OB unit had been sampled indicated that residual carcinogenic risk associated with post excavation soil is 5×10^{-8} and residual noncancer hazard is 1×10^{-1}. Both estimates are below targets of 1×10^{-5} for cancer risk and 1 for noncancer hazard. In addition, the maximum detected lead soil concentration is 290 mg/kg which is less than the residential soil screening criteria for lead of 400 mg/kg.

NA Alternative. The preferred alternative for this site is no action. Closure activities at the site have been completed in accordance with the approved Closure Plan and are protective of human health, welfare, and the environment at this site. While the EOD Range is in the possession of the Air Force, this property will not be used other than for industrial use. If the EOD Range property should be transferred to another owner, WPAFB will implement restrictions on the deed to ensure that future land use is limited to industrial type uses. Therefore, the NA alternative is adequate to protect human health and the environment.

2.6 Explanation of Significant Changes

The Proposed Plan for the subject sites was released for public comment on July 1, 1998. The Proposed Plan identified NA as the preferred alternative for all of the 41 sites. Written comments were received from one party. These comments are provided in Section 3.0. However, no significant changes to the proposed remedies of NA, as they were originally identified in the Proposed Plan, are necessary.

3.0 RESPONSIVENESS SUMMARY

3.1 Overview

WPAFB has presented the preferred alternative of NA at 41 IRP sites across the base. Pursuant to CERCLA Section 117, the Proposed Plan was issued for the 41 sites and a public meeting was held on July 14, 1998. No comments, verbal or written, were received at the public meeting.

3.2 Comment Summary and Response to Local Community Concerns

Comments were received from The City of Dayton during the public comment period, July 1 through July 30, 1998. No other comments were received from any other parties. Comments received and a response to those comments are provided below:

The City of Dayton Environmental Manager had the following comments:

> "Thank you for the opportunity to comment on the Draft-Final Proposed Plan for 41 Sites at WPAFB. We appreciate WPAFB's attention to the location of the base and the close proximity to the City of Dayton's Well Field.
>
> We understand that the report fulfills a specific requirement for the base and is worded according to these requirements. We do, however, find the wording in the Preferred Alternative section "no action" to be misleading. Additional actions to address ground water, surface water and sediment contamination concerns are planned for the future. These actions are referred to as part of the (Basewide Monitoring Program) BMP for the site. The report should include a summary of the BMP including actions for all of the operating units and summarizing the types and movement of contaminants across WPAFB.
>
> In general while capping is the presumptive remedy specifically addressing individual landfills, it appears ongoing monitoring through the BMP process will address existing groundwater contamination. Can we assume that the monitoring wells that identified the existence of groundwater contamination will be included in the BMP relative to future monitoring? Assuming the landfills are delineated both laterally and vertically, what assurances are there that ground water will not be impacted during high water table conditions. Are there contingencies in place to address this issue?"

RESPONSE: The preferred alternatives sections in the Proposed Plan refers only to the preferred alternative for the individual source areas for each site. Groundwater, surface water, and sediment were removed from consideration in the individual sites and grouped into the BMP operable unit. For each site where groundwater contamination was noted, the Proposed Plan indicates that groundwater will be further addressed under the BMP. The Record of Decision (ROD) describes the role of the source area operable units and the BMP operable unit in greater detail. Because the BMP will be addressed under it's own Proposed Plan and ROD, a detailed description of the BMP summarizing the types and movement of contaminants across WPAFB was not included in the Proposed Plan for 41 Sites.

The commenter is correct in indicating that ongoing monitoring through the BMP will address existing groundwater contamination. In addition, an Engineering Evaluation/Cost Analysis (EE/CA) is currently being prepared by WPAFB. In this document, the extent of groundwater contamination has been reviewed and those areas requiring further action (such as groundwater extraction, in-situ treatment) have been identified and alternatives for further action have been evaluated. In addition, the EE/CA presents the proposed long-term monitoring plan for areas of groundwater that do not require active remediation, but require on-going monitoring. The on-going groundwater monitoring will ensure that potential releases caused by high water table conditions would not impact human health or the environment.

Attachment 1

Attachment 1
Document References

Site	Reference Document [1]	Applicability			
		Site History	Investigation	Risk Assessment	Remedial Action/ Preferred Alternative
Landfill 1	• OU6 Remedial Investigation Report	X	X	X	
	• BRAP for Landfill Capping			X	X
	• SSRAP for Landfills 1 and 2			X	X
	• Action Memorandum for Landfills 1 and 2				X
	• Phase II, Stage 1 Final Report		X		
	• Phase II, Stage 2 Final Technical Report		X		
Landfill 2	• OU6 Remedial Investigation Report	X	X	X	
	• BRAP for Landfill Capping			X	X
	• SSRAP for Landfills 1 and 2			X	X
	• Action Memorandum for Landfills 1 and 2				X
	• Phase II, Stage 1 Final Report		X		
	• Phase II, Stage 2 Final Technical Report		X		
Landfill 3	• BRAP for Landfill Capping			X	X
	• SSRAP for OU4 Landfills			X	X
	• Action Memorandum for OU4				X
	• Phase II, Stage 1 Final Report		X		
	• Phase II, Stage 2 Final Technical Report		X		
	• OU4 Remedial Investigation Report	X	X	X	
Landfill 4	• OU4 Remedial Investigation Report	X	X	X	
	• BRAP for Landfill Capping			X	X
	• SSRAP for OU4 Landfills			X	X
	• Action Memorandum for OU4				X
	• Phase II, Stage 1 Final Report		X		
	• Phase II, Stage 2 Final Technical Report		X		
Landfill 5	• OU5 Remedial Investigation Report	X	X	X	
	• BRAP for Landfill Capping			X	X
	• SSRAP for Landfill Capping - Landfill 5			X	X
	• Action Memorandum for Landfill Capping				X
	• Phase I, Stage 1 Final Report		X		
	• Phase II, Stage 2 Final Technical Report		X		
	• Landfill 5 Field Investigation Report		X		
	• Analyses of Soil Gas Survey Results for Landfills 3,4,5,6,7		X		

Site	Reference Document [1]	Applicability			
		Site History	Investigation	Risk Assessment	Remedial Action/ Preferred Alternative
Landfill 6	• OU4 Remedial Investigation Report	X	X	X	
	• BRAP for Landfill Capping			X	X
	• SSRAP for OU4 Landfills			X	X
	• Action Memorandum for OU4				X
	• Phase II, Stage 1 Final Report		X		
	• Phase II, Stage 2 Final Technical Report		X		
Landfill 7	• OU4 Remedial Investigation Report	X	X	X	
	• BRAP for Landfill Capping			X	X
	• SSRAP for OU4 Landfills			X	X
	• Action Memorandum for OU4				X
	• Phase II, Stage 1 Investigation		X		
	• Phase II, Stage 2 Investigation		X		
Landfill 9	• OU7 Field Investigation Report	X	X	X	
	• BRAP for Landfill Capping			X	X
	• SSRAP for Landfill 9, OU7			X	X
	• Action Memorandum, Landfill 9 Capping Presumptive Removal Action				X
	• Phase II, Stage 1 Final Report		X		
	• Phase II, Stage 2 Final Technical Report		X		
Landfill 11	• OU3 Remedial Investigation Report	X	X	X	
	• BRAP for Landfill Capping			X	X
	• SSRAP for Landfill 11			X	X
	• Action Memorandum for Landfill 11 Capping				X
	• Phase II, Stage 1 Final Report		X		
	• Phase II, Stage 2 Final Technical Report		X		
	• Analysis of Soil Gas Survey Results for Landfill 11 and 12		X		
Landfill 12	• OU3 Remedial Investigation Report	X	X	X	
	• Landfill 12 EE/CA				X
	• Action Memorandum for Landfill 12 Capping				X
	• Phase II, Stage 1 Final Report		X		
	• Phase II, Stage 2 Final Technical Report		X		
	• Analysis of Soil Gas Survey Results for Landfill 11 and 12		X		
	• Final Removal Action Report				X

Site	Reference Document [1]	Applicability			
		Site History	Investigation	Risk Assessment	Remedial Action/ Preferred Alternative
Central Heating Plant 1	• Phase I Records Search	X			
	• Phase II, Stage 2 Final Technical Report	X	X		
	• Decision Document - Central Heating Plants 1 and 2			X	X
Central Heating Plant 2	• OU4 Remedial Investigation Report	X	X		
	• OU4 RI/FS Report Addendum	X	X	X	X
	• Decision Document - Central Heating Plants 1 and 2	X		X	X
	• Phase II, Stage 1 Final Report		X		
	• Phase II, Stage 2 Final Technical Report		X		
Central Heating Plant 4	• IRP Phase I Records Search	X			
	• Phase II, Stage 2 Final Technical Report	X	X	X	X
Central Heating Plant 5	• OU9 Remedial Investigation Report	X	X	X	X
	• Phase II, Stage 2 Final Technical Report		X		X
	• Site Investigation Report		X		
	• Phase II, Stage 1 Final Report		X		
	• OU9 Remedial Investigation Report Addendum		X	X	X
Spill Site 5 and UST 71A	• OU8 Remedial Investigation Report	X	X	X	
	• EE/CA; OU8, Spill Site 5, UST 71A				X
	• Phase II, Stage 1 Final Report		X		
	• Phase II, Stage 2 Final Technical Report		X		
	• Site Investigation for 16 IRP Sites		X		
Spill Site 6	• OU8 Remedial Investigation Work Plan	X	X	X	
	• Decision Document - Spill Site 6	X	X	X	X
	• Site Investigation for 16 IRP Sites		X		
Spill Site 7	• OU8 Remedial Investigation Work Plan	X	X	X	
	• Decision Document - Spill Site 7	X	X	X	X
	• Site Investigation for 16 IRP Sites		X		
Spill Site 9	• OU8 Remedial Investigation Work Plan	X	X	X	
	• Decision Document - Spill Site 9				X
	• Site Investigation for 16 IRP Sites		X		
Spill Site 11	• OU8 Remedial Investigation Report	X	X	X	
	• OU8/Spill Site 11 Action Memorandum				X
	• Site Investigation for 16 IRP Sites		X		
Spill Site 4	• Decision Document - Spill Site 4	X	X	X	X

Site	Reference Document [1]	Applicability			
		Site History	Investigation	Risk Assessment	Remedial Action/ Preferred Alternative
Spill Site 8	• Hazardous Waste Site Preliminary Assessment - Spill Site 8 Report	X	X		
	• PCB Contamination Evaluation of Two Sites	X	X	X	
	• Final Removal Action Report		X	X	
	• Decision Document - Spill Site 8			X	X
Burial Site 2	• Site Investigation for 16 IRP Sites		X	X	
	• Phase II, Stage 2 Final Technical Report		X		
	• Technical Document to Support No Further Action Planned - Chemical Disposal Area		X		
	• Final Field Investigation Report OU11		X	X	
Burial Site 3	• OU9 Remedial Investigation Report	X	X	X	
	• Site Investigation for 16 IRP Sites	X			
	• Decision Document - Burial Sites 3 and 4			X	X
Burial Site 5	• Site Investigation Report, Burial Sites 5 and 6	X	X	X	X
Burial Site 6	• Site Investigation Report, Burial Sites 5 and 6	X	X	X	X
Building 4020 UST	• Site Investigation Report for 16 IRP Sites	X	X		
	• Phase II, Stage 2 Final Technical Report	X	X	X	
	• Final Field Investigation Report OU11		X	X	X
Chemical Disposal Area	• Site Investigation Report for 16 IRP Sites	X	X		
	• Phase II, Stage 2 Final Technical Report	X	X		
	• Decision Document - Chemical Disposal Area		X	X	X
	• Final Field Investigation Report OU11	X	X	X	
East Ramp Tank Removal	• Potential Hazardous Waste Site Preliminary Assessment	X			
	• Technical Document to Support No Further Action Planned	X	X	X	X
Radioactive Waste Burial Site	• IRP Phase I Records Search	X			
	• Decision Document - Radioactive Waste Burial Site	X	X	X	X
Deactivated Nuclear Reactor [2]	• Special Nuclear Reactor Permit	X	X	X	X
	• OU9 Remedial Investigation Report		X		
Explosive Ordnance Disposal Range [2]	• Closure Plan - Explosive Ordnance Disposal Range	X	X	X	X

Site	Reference Document [1]	Applicability			
		Site History	Investigation	Risk Assessment	Remedial Action/ Preferred Alternative
Earth Fill Disposal Zones 2 through 10	• OU9 Remedial Investigation Report	X	X	X	X
	• Site Investigation for 16 IRP Sites		X		
	• Phase II, Stage 1 Final Report		X		
	• Phase II, Stage 2 Final Technical Report		X		
	• Decision Document - EFDZs 1-8		X	X	X
	• Decision Document - EFDZs 10,11, and 12		X	X	X

(1) BRAP - Basewide Removal Action Plan
SSRAP - Site- Specific Removal Action Plan
RI/FS - Remedial Investigation/Feasibility Study
EE/CA - Engineering Evaluation/Cost Analysis
EFDZ - Earthfill Disposal Zone

(2) Reference documents for these sites are not available in the Administrative Record.