FINAL
Preliminary Assessment Report
Rickenbacker Army Enclave
Columbus, Ohio

Perfluorooctane-Sulfonic Acid (PFOS) and Perfluorooctanoic Acid (PFOA) Impacted Sites
ARNG Installations, Nationwide

March 2019

Prepared for:

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Table of Contents

Figures

Appendices

Acronyms and Abbreviations

AASF	Army Aviation Support Facility
AECOM	AECOM Technical Services, Inc.
AFFF	aqueous film forming foam
AOI	Area of Interest
ARNG	Army National Guard
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CRAA	Columbus Regional Airport Authority
CSM	conceptual site model
°F	degrees Fahrenheit
FTA	fire training area
HEF	high expansion foam
IED	Installations & Environment Division
OHANG	Ohio Air National Guard
OHARNG	Ohio Army National Guard
PA	Preliminary Assessment
PFAS	per- and poly-fluoroalkyl substances
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
RAE	Rickenbacker Army Enclave
RIA	Rickenbacker International Airport
US	United States
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
WWTP	Waste Water Treatment Plant

Executive Summary

The United States (US) Army Corps of Engineers (USACE) Baltimore District on behalf of the Army National Guard (ARNG)-Installations & Environment Division (IED), Cleanup Branch contracted AECOM Technical Services, Inc. (AECOM) to perform *Preliminary Assessments (PAs) and Site Inspections for Perfluorooctanesulfonic acid (PFOS) and Perfluorooctanoic acid (PFOA) Impacted Sites at ARNG Facilities Nationwide*. The ARNG is assessing potential effects on human health related to processes at facilities that used per- and poly-fluoroalkyl substances (PFAS), primarily in the form of aqueous film forming foam (AFFF) released as part of firefighting activities, although other PFAS sources are possible.

AECOM completed a PA for PFAS at the Rickenbacker Army Enclave (RAE) in Columbus, Ohio to assess potential PFAS release areas and exposure pathways to receptors. The RAE has been used and occupied by the Ohio Army National Guard (OHARNG) since August 1998, with an indefinite license granted by the Department of the Army. The performance of this PA included the following tasks:

- Reviewed data resources to obtain information relevant to suspected PFAS releases
- Conducted a site visit on 26 July 2018
- Interviewed current OHARNG RAE personnel, including OHARNG environmental managers and operations staff, during the site visit
- Completed visual site inspections at known or suspected PFAS release locations and documented with photographs
- Developed a conceptual site model (CSM) to outline the potential release and pathway of PFAS for the Area(s) of Interest (AOIs) and the facility

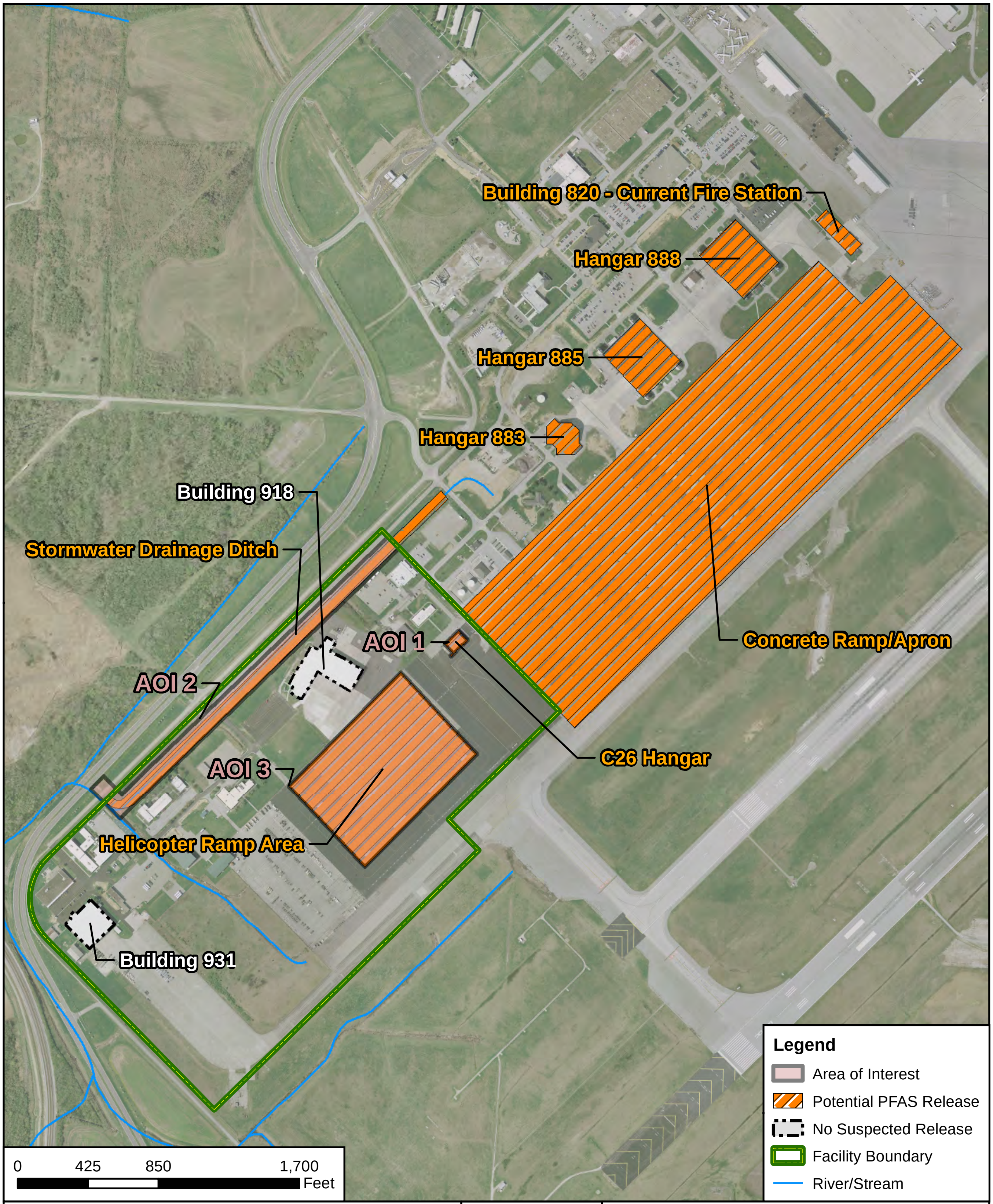
Three AOIs related to a PFAS release were identified at RAE during the PA. These AOIs are shown on **Figure ES-1** and described in the table below:

Area of Interest	Name	Used by	Release Dates
AOI 1	C26 Hangar	OHARNG	No suspected release
AOI 2	Drainage Ditch	Ohio Air National Guard (OHANG) and OHARNG	Approximately 1987-2007
AOI 3	Helicopter Ramp Area	OHARNG	No suspected release

Based on documented presence and testing of the fire suppression system at AOI 1, there is potential for exposure to PFAS in groundwater and drinking water with potentially complete pathways existing to site workers, construction workers, trespassers, and resident receptors via ingestion. As testing of the system was contained within the hangar, incomplete exposure pathways exist for soil and subsurface soil at this AOI. The CSM for AOI 1 is shown on **Figure ES-2**.

Based on numerous potential AFFF releases at AOI 2, there is potential for exposure to PFAS contamination in surface soils to site and construction workers, residents, and recreational users/trespassers, and in subsurface soils to site and construction workers via inhalation and ingestion. There is also the potential for exposure to PFAS contamination in surface water and sediment for all receptors via ingestion, and in shallow groundwater for all receptors due to the close proximity of private drinking water wells within a half mile of the facility. The CSM for AOI 2 is shown on **Figure ES-3**.

Based on the long-term uncontrolled exterior storage of AFFF tanks at AOI 3 as well as the presence of stormwater drains and drainage channels, site and construction workers could potentially be exposed to PFAS contamination in surface and subsurface soil to via inhalation and ingestion. Given water flow patterns and the close proximity of private drinking water wells, there is the potential for exposure to PFAS contamination in groundwater and surface water via ingestion to site workers, construction workers, trespassers, and resident receptors at AOI 1. The CSM for AOI 3 is shown on **Figure ES-4**.



CLIENT	ARNG			
NOTES	Preliminary Assessment for PFAS at Rickenbacker, OH			
REVISED	1/11/2019	GIS BY	MS	1/11/2019
SCALE	1:10,200	CHK BY	TK	1/11/2019
Base Map: OSIP Imagery		PM	RG	1/11/2019

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Summary of Findings

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Figure ES-1

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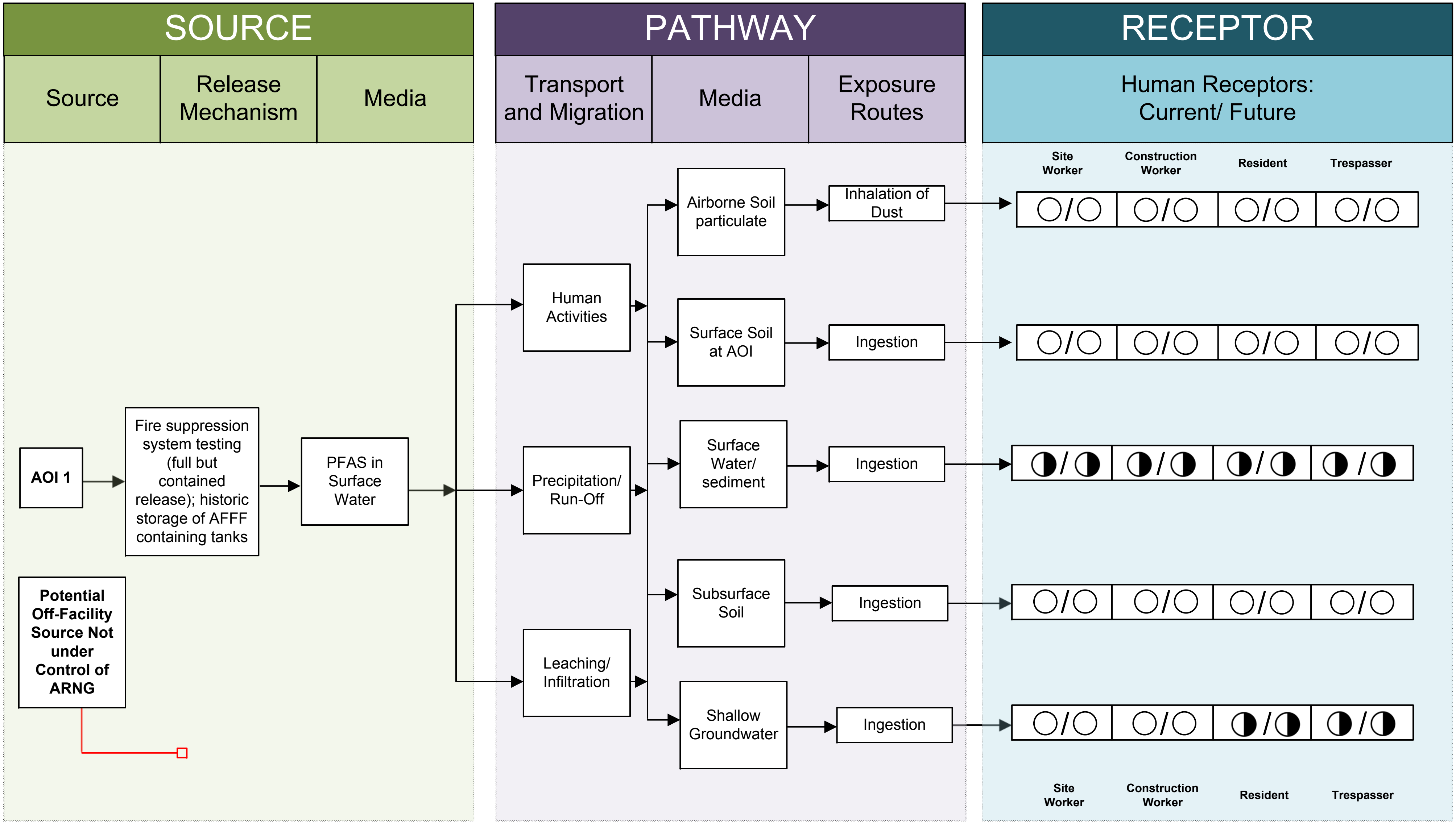


LEGEND

Flow-Chart Stops

Flow-Chart Continues

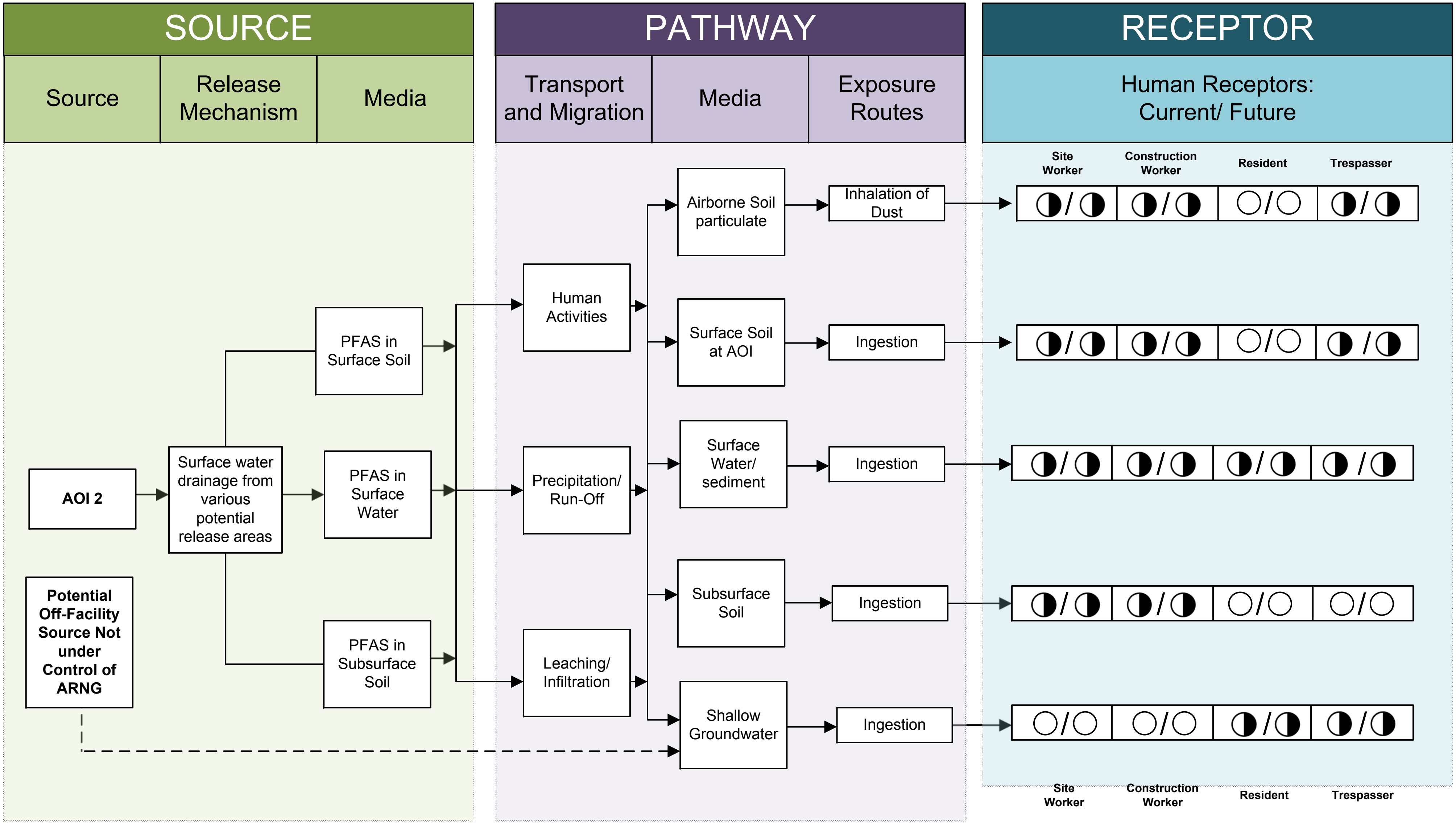
Partial / Possible Flow

○ Incomplete Pathway

◑ Potentially Complete Pathway

● Complete Pathway

Figure ES-2
Conceptual Site Model
AOI 1 C26 Hangar
Rickenbacker Army Enclave



	Site Worker	Construction Worker	Resident	Trespasser
Airborne Soil particulate – Inhalation of Dust	◑/◑	◑/◑	○/○	◑/◑
Surface Soil at AOI – Ingestion	◑/◑	◑/◑	○/○	◑/◑
Surface Water/ sediment – Ingestion	◑/◑	◑/◑	◑/◑	◑/◑
Subsurface Soil – Ingestion	◑/◑	◑/◑	○/○	○/○
Shallow Groundwater – Ingestion	○/○	○/○	◑/◑	◑/◑

LEGEND

- 🟥 Flow-Chart Stops
- → Flow-Chart Continues
- - - → Partial / Possible Flow
- ○ Incomplete Pathway
- ◑ Potentially Complete Pathway
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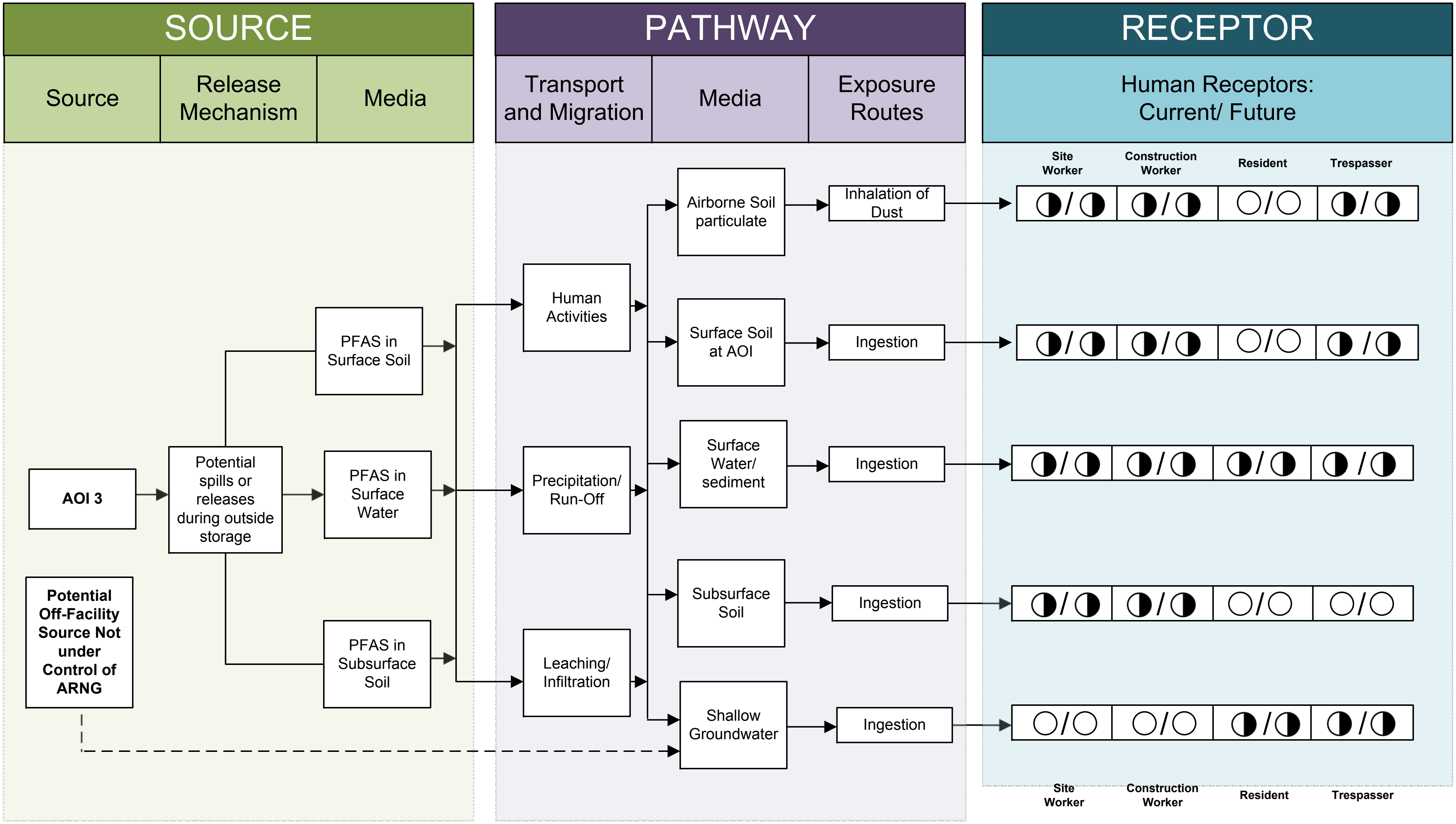
Figure ES-3
Conceptual Site Model
AOI 2 Drainage Ditch
Rickenbacker Army Enclave



LEGEND

Flow-Chart Stops

Flow-Chart Continues

Partial / Possible Flow

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◐ Potentially Complete Pathway

● Complete Pathway

Figure ES-4

Conceptual Site Model

AOI 3 Helicopter Ramp Area

Rickenbacker Army Enclave

1. Introduction

1.1 Authority and Purpose

The United States (US) Army Corps of Engineers (USACE) Baltimore District on behalf of the Army National Guard (ARNG)-Installations & Environment Division (IED), Cleanup Branch contracted AECOM Technical Services, Inc. (AECOM) to perform *Preliminary Assessments (PAs) and Site Inspections for Perfluorooctanesulfonic acid (PFOS) and Perfluorooctanoic acid (PFOA) Impacted Sites at ARNG Facilities Nationwide* under Contract Number W912DR-12-D-0014, Task Order W912DR17F0192, issued 11 August 2017. The ARNG is assessing potential effects on human health related to processes at facilities that used per- and poly-fluoroalkyl substances (PFAS), primarily in the form of aqueous film forming foam (AFFF) released as part of firefighting activities, although other PFAS sources are possible. In addition, the ARNG is assessing businesses or operations adjacent to the ARNG facility (not under the control of ARNG) that could potentially be responsible for a PFAS release.

PFAS are classified as emerging environmental contaminants that are garnering increasing regulatory interest due to their potential risks to human health and the environment. PFAS formulations contain highly diverse mixtures of compounds. Thus, the fate of PFAS compounds in the environment varies. The regulatory framework at both federal and state levels continues to evolve. The US Environmental Protection Agency (USEPA) issued Drinking Water Health Advisories for PFOA and PFOS in May 2016, but there are currently no promulgated national standards regulating PFAS in drinking water. In the absence of federal maximum contaminant levels, some states have adopted their own drinking water standards for PFAS.

This report presents findings of a PA for PFAS at the Rickenbacker Army Enclave (RAE) in Columbus, Ohio, in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, the National Oil and Hazardous Substances Pollution Contingency Plan (40 Code of Federal Regulations [CFR] Part 300), and USACE requirements and guidance.

This PA documents locations where PFAS may have been released into the environment at the RAE and surrounding off-site locations. The term PFAS will be used throughout this report to encompass all PFAS chemicals being evaluated, including PFOS and PFOA, which are key components of AFFF.

1.2 Preliminary Assessment Methods

The performance of this PA included the following tasks:

- Reviewed data resources to obtain information relevant to suspected PFAS releases
- Conducted a site visit on 26 July 2018
- Interviewed current Ohio Army National Guard (OHARNG) RAE personnel, including OHARNG environmental managers and operations staff, during the site visit
- Completed visual site inspections at known or suspected PFAS release locations and documented with photographs
- Developed a conceptual site model (CSM) to outline the potential release and pathway of PFAS for the Area(s) of Interest (AOIs) and the facility

1.3 Report Organization

This report has been prepared in accordance with the USEPA *Guidance for Performing Preliminary Assessments under CERCLA* (USEPA, 1991). The report outline is as follows:

- **Section 1** – **Introduction:** identifies the project purpose and authority and describes the facility location, environmental setting, and methods used to complete the PA
- **Section 2** – **Fire Training Areas:** describes the fire training areas (FTAs) at the facility identified during the site visit
- **Section 3** – **Non-Fire Training Areas:** describes other locations of PFAS releases at the facility identified during the site visit
- **Section 4** – **Emergency Response Areas:** describes areas of AFFF release at the facility, specifically in response to emergency situations
- **Section 5** – **Adjacent Sources:** describes sources of PFAS release adjacent to the facility that are not under the control of ARNG
- **Section 6** – **Conceptual Site Model:** describes the pathways of PFAS transport and receptors for the AOIs and the facility
- **Section 7** –**Conclusions:** summarizes the data findings and presents the conclusions of the PA
- **Section 8** – **References:** provides the references used to develop this document
- **Appendix A** – Data Resources
- **Appendix B** – Preliminary Assessment Documentation
- **Appendix C** – Photographic Log

1.4 Facility Location and Description

RAE is home to the OHARNG’s 1st Battalion 137th Aviation Regiment. It is located in Franklin County, approximately 12 miles southeast of downtown Columbus, Ohio (**Figure 1-1**). The facility primarily supports readiness and training activities associated with helicopter missions. Helicopter and aircraft parking, maintenance and fueling, administration, billeting/transient barracks, and mission support facilities are all OHARNG operations occurring at RAE.

The area comprising RAE was originally named the “Northwest Training Center of the Army Air Corps” in 1942, later renamed to the “Lockbourne Air Force Base” in 1948 and then “Rickenbacker Air Force Base” in 1974 (AFRPA, 2007). The base was transferred to the Ohio Air National Guard (OHANG) in 1980 and renamed the “Rickenbacker Air National Guard Base.” A portion of the property was transferred to the Rickenbacker Port Authority in 1984, at which time Rickenbacker International Airport (RIA) was established. RIA primarily serves as a cargo-only airport for the city of Columbus, allowing government, private, and commercial cargo planes to transports goods internationally. In 1987, the ARNG entered into a federal-state agreement with the State of Ohio for the construction of an Army Aviation Support Facility (AASF) on land owned by the Rickenbacker Air National Guard Base. An indefinite license was granted in 1998 for the use, occupancy, training, and support of 126 acres for the OHARNG.

In 2003, the Rickenbacker Port Authority merged with the Columbus Airport Authority to form the Columbus Regional Airport Authority (CRAA). The CRAA currently owns and operates RIA, for which the OHARNG is an adjacent tenant. The RAE is located within the Rickenbacker Air National Guard Base as part of a joint military facility, with additional tenants including the

CRAA, the 121st Air Refueling Wing of the OHAN, a Naval Reserve Center, and various commercial businesses (USACE, 2017). RAE is part of the 126-acre panel of land that was licensed to the ARNG per the August 1998 agreement (**Appendix A**).

1.5 Facility Environmental Setting

RAE is located in the Interior Plains region of Ohio. The Interior Plains encompass most of the western part of the state, and are characterized by lower relief than the Appalachian Highlands to the east. The terrain around the facility exhibits moderately low relief, with a broad regional slope to the southeast towards the Scioto Valley. The elevation of the facility is approximately 740 feet above mean sea level (Engineering-Science, 1988). The facility is surrounded by farmland and deciduous forest to the west, and by RIA to the east.

1.5.1 Geology

RAE lies within the Central Lowland physiographic province, Columbus Lowland district. The Columbus Lowland is a lowland area with many larger streams that is bounded to the north by Powell Moraine, to the east/south by the Berea and Allegheny Escarpments, and to the west by the flatter and higher Darby Plain (ODGS, 1998).

RAE is situated on loamy, medium-lime Wisconsinan-age clay glacial till and outwash (ODGS, 1998). The glacial drift unit is generally 211 to 260 feet thick (ODGS, 2004). The glacial drift unit is underlain by the Ohio Shale Unit, an Upper Devonian sedimentary bedrock unit composed primarily of black shale. The Chagrin Member of the Ohio Shale also contains some siltstone and very fine-grained sandstone (Slucher, E.R. *et al*., 2006).

1.5.2 Hydrogeology

RAE is not located on a principal aquifer system due to the low permeability of the underlying shale bedrock. The surficial aquifer system consists of regionally extensive, thick, permeable deposits of sand and gravel, which may be overlain by low-permeability glacial till. Coarse deposits located at depths of 30 to 200 feet below ground surface may yield as much as 500 gallons per minute (Schmidt, 1958). Groundwater and surface water flow is generally to the west, in the direction of Big Walnut Creek (**Figure 1-2**).

RAE obtains its drinking water from the City of Columbus public water system, which utilizes both surface water and groundwater for drinking water. The City of Columbus has three main plants that treat all source water; RAE receives water from the Parsons Avenue Water Plant, approximately five miles northwest of the facility, which utilizes groundwater for drinking water and serves southeastern Franklin County (City of Columbus, 2018). No potable water wells are located within RAE; however, domestic wells and monitoring wells exist within a mile of the facility (**Figure 1-2**).

The City of Lockbourne is approximately 3,500 feet west of RAE. Like the RAE facility, Lockbourne is connected to the City of Columbus public drinking water system; however, the Ohio State Water Well database shows that several private drinking water wells are located within a mile of the facility. One domestic well is reported a half mile north of the facility, while several other domestic wells located within one mile west of RAE, in the direction of groundwater and surface water flow.

1.5.3 Hydrology

Regional surface water features include Big Walnut Creek and the Scioto River. Big Walnut Creek converges with the Scioto River approximately 2.8 miles from the facility.

RAE employs a series of drainage ditches to convey runoff off-site. One drainage ditch originates on OHANG property, enters the site from the north running parallel to the northwest facility boundary, and exits the facility in the western portion. A second drainage ditch originates in the southern portion of the facility and flows northwest to where it converges with the first drainage ditch, at which point it exits the facility on the northwest boundary. The drainage ditch system conveys runoff to Big Walnut Creek, approximately 1.4 miles from the property boundary.

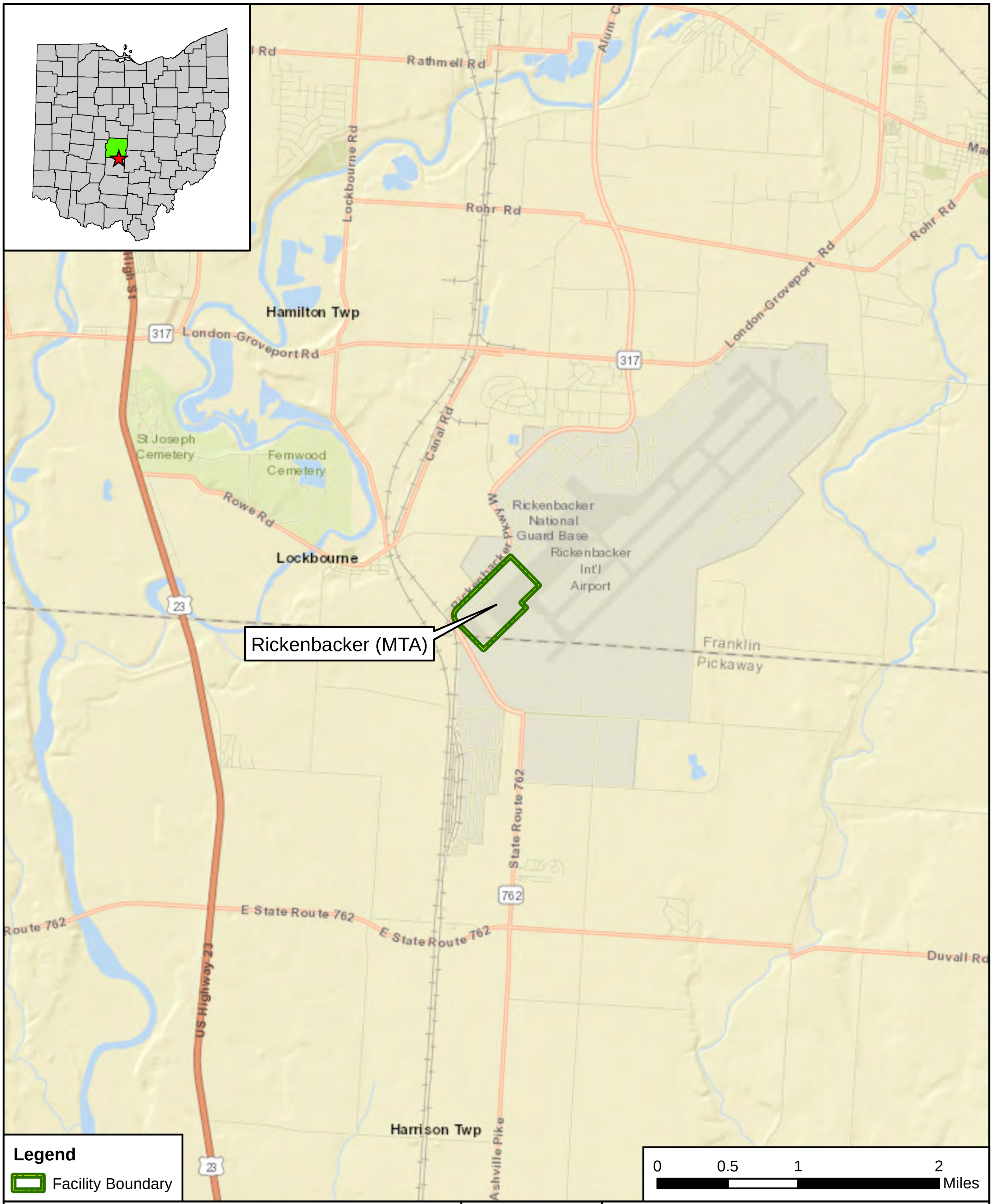
One emergent wetland is located in the southern portion of the facility. The wetland area is approximately 0.3 acres. Surface drainage from RAE empties into the drainage ditches as well as this wetland (**Figure 1-3**).

1.5.4 Climate

The climate at RAE is temperate, humid subtropical, with cool to cold winters and long, hot summers. The average temperature is 52.7 degrees Fahrenheit (°F), with summer highs of 84.9 °F and winter lows of 21.1 °F. Average annual precipitation is 40.11 inches (NOAA, 2018).

1.5.5 Current and Future Land Use

The RAE is located adjacent to RIA and an OHANG enclave, surrounded by small residential and industrial areas. The northeast boundary of the RAE connects with the southwest boundary of the OHANG enclave.Directly east of RAE lies Runways 5 and 23, owned and operated by RIA. Within RAE are several hangars, storage buildings, and a helicopter ramp area. RAE supports the operation of helicopter and aircraft parking, maintenance and fueling, billeting/transient barracks, and mission support facilities. Operations within the facility will continue to support the 137th Aviation Regiment for the duration of the lease which was issued for an indefinite term. Future land use is not anticipated to change.



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SCALE	1:63,360	CHK BY	VK	9/13/2018
Base Map: Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI,		PM	RG	9/13/2018

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Facility Location

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Figure 1-1

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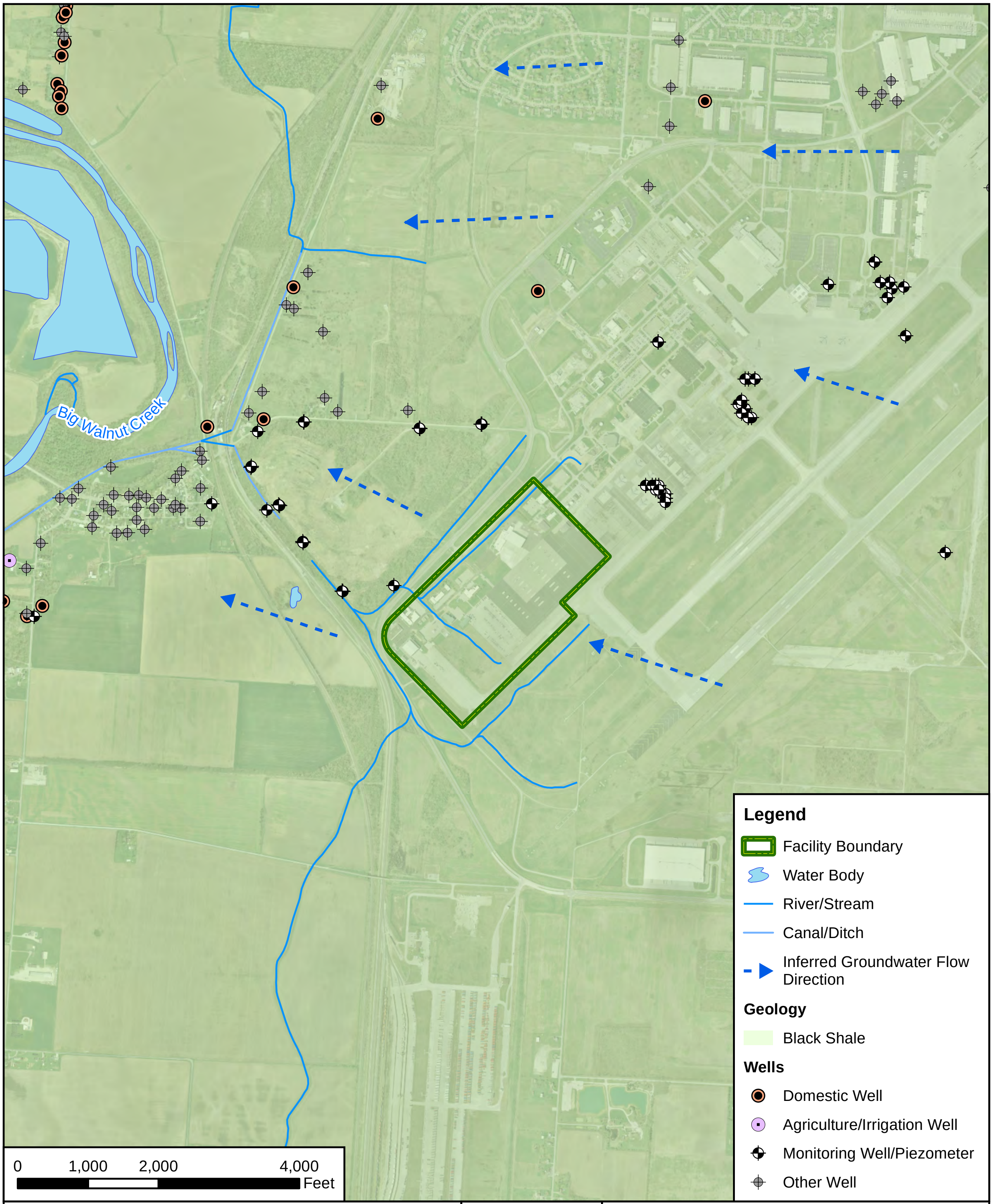

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Base Map: OSIP Imagery		PM	RG	1/21/2019

Groundwater Features

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Figure 1-2

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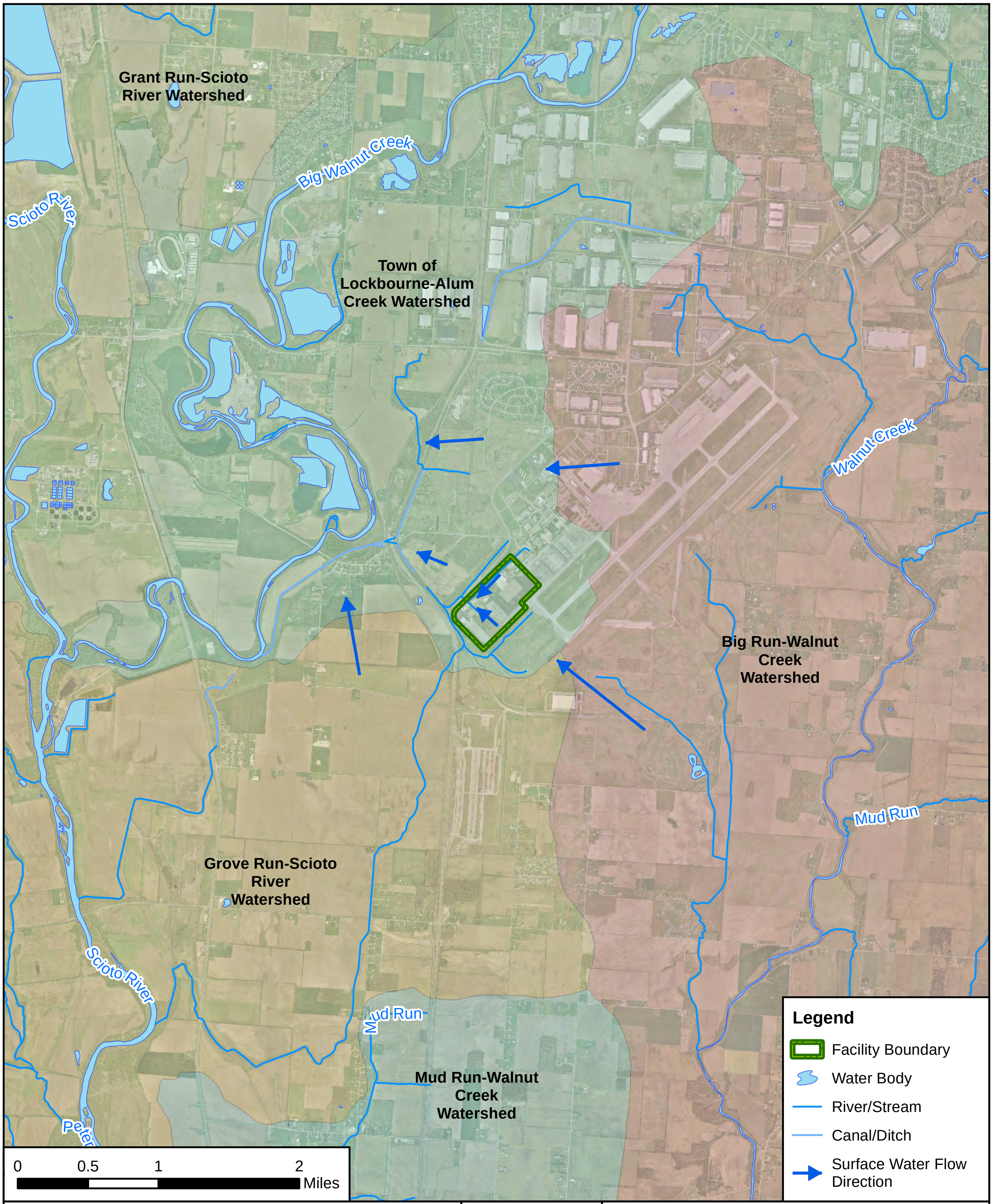

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Base Map: OSIP Imagery		PM	RG	11/2/2018

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Surface Water Features

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Figure 1-3

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2. Fire Training Areas

No FTAs were identified within the RAE during the PA through interviews or a review of Environmental Data Resource reports. There is no fire department located within the RAE and no fire training activities historically or currently occur within the facility boundary.

3. Non-Fire Training Areas

Five non-FTAs where AFFF was stored and/or released were identified during the PA. Descriptions of the non-FTAs are presented below and the non-FTAs are shown on **Figure 3-1**.

3.1 C26 Hangar

The C26 Hangar is located on the northeast side of RAE (**Figure 3-1**). The geographic coordinates are 39°48'28.88"N, 82°56'52.53"W. The C26 Hangar was constructed in 2003. The hangar is primarily used for the storage of small aircraft and various equipment; no operational maintenance on aircraft is conducted at this hangar. While located within RAE, operation and maintenance of the C26 Hangar are separate from other facility operations. Designated ARNG personnel are responsible for the operations at the C26 Hangar; however, personnel and activities at this hangar are separate from the rest of RAE.

The C26 Hanger included a fire suppression system with 2.75 percent (%) Jet-X high expansion foam (HEF) installed between 2007 and 2008. The Jet-X holding tank has a capacity of approximately 900 gallons. According to interviewees, a test of the system was conducted following installation that involved a release of an unknown amount of Jet-X foam from the fire suppression system. The hangar doors were closed during this initial testing and all material from the suppression system was allowed to dissipate into the floor drains of the hangar that led to the sanitary sewer. No other spills or releases have been reported from this hangar.

RAE and the surrounding airport are connected to the Big Walnut Augmentation/Rickenbacker Interceptor sewer that drains to the City of Columbus' Southerly Wastewater Treatment Plant (WWTP). The Southerly WWTP is located approximately 12 miles west of the RAE. All waste treated at the Southerly WWTP is discharged to the Scioto River, west of the RAE, which is commonly used for recreational activities.

One mobile tank located directly outside the bay doors to the C26 Hangar contains 125 pounds of Purple K dry chemical, a non-PFAS containing material. Interviewees had no knowledge of any release or unintentional spills involving the Purple K dry chemical during its storage outside the C26 Hangar. It was estimated that the Purple K dry chemical tank has been stored outside the hangar for several years; however, an exact year could not be recollected. Interviewees recalled that one mobile TriMax tank was historically present outside of the C26 Hangar. The TriMax tank was estimated to be present outside of the C26 Hangar from approximately 2002 until 2013. The TriMax tank was removed and replaced with the aforementioned Purple K dry chemical tank. Whether unintended spills or releases occurred from this TriMax tank during the duration of its storage is unknown.

3.2 Building 918

Building 918 was constructed in 1993 and is located directly west of the C26 Hangar. The coordinates for this building are 39°48'11.68"N, 82°57'20.04"W. Building 918 is the RAE hangar that stores helicopters and other aircraft, and routine maintenance of aircraft occurs at this hangar. No fire suppression system is present within Building 918.

During interviews with OHARNG personnel, it was noted that nine 5-gallon containers of concentrated 6% AFFF were previously present in the ground handling area of Building 918 (see **Figure 3-1**). The AFFF product was from Minnesota Mining and MFG Co Industrial Chem Products; pictures of these buckets are provided in **Appendix C**. According to facility personnel, the containers were unopened and unused during the entire duration of storage at Building 918. It is unknown how long the 5-gallon buckets of AFFF were stored prior to their disposal in

November 2017, or where the buckets originated from; however, interviewees confirmed the buckets were at least ten years old. Personnel had no knowledge of the procurement of the AFFF or whether minor spills or releases from the containers may have occurred. The manifest associated with the disposal of the nine 5-gallon buckets shows a total disposal weight of 45 gallons, confirming the buckets were full upon disposal. The manifest associated with the disposal and the safety data sheets for the AFFF concentrate are included in **Appendix A**.

One to two TriMax tanks were stored inside of Building 918 from approximately 2002 to 2013. In 2013, the TriMax tanks were transferred to the cold storage building until their disposal in 2017. Based on interviewee knowledge, no spills or releases occurred from these tanks throughout the duration of their storage in Building 918.

3.3 Building 931

Building 931 is a hanger located on the very southwest portion of the RAE. The coordinates for this building are 39°48'11.68"N, 82°57'20.04"W. The exact data of construction of the hangar is unknown; however, interviewees believe the hangar was already constructed when the OHARNG was granted a lease in 1987.

One TriMax tank was previously stored directly outside the bay door of Building 931. The TriMax tank arrived sometime between 2004 and 2005 and was disposed of approximately three months prior to the PA site visit (i.e., approximately April 2018). According to interviewees, the tank was never used, emptied, or tested, and was located in the same place for the duration of its storage at Building 931. No spills or releases were reported from this tank. There are no AFFF fire suppression systems in Building 931 and no knowledge of any other AFFF-containing tanks in or around this building.

3.4 Drainage Ditch

On the southwest corner of the facility is a stormwater drainage ditch which originates on the OHANG property, entering OHARNG property from the north. Stormwater runoff from OHANG hangars and ramp areas are discharged into this ditch, which then flows through OHARNG property. The drainage ditch travels along the northwestern side of the OHARNG property, and then continues to the west, eventually exiting the facility boundary in the west near the Lockbourne Air Force Base Landfill. Two small detention ponds along the southwest edge of the OHARNG pavement and two small drainage channels north of the helicopter ramp area connect to this stormwater drainage ditch. Any potential spills or discharges on either ramp area or near these drainage channels would eventually flow into the stormwater drainage ditch.

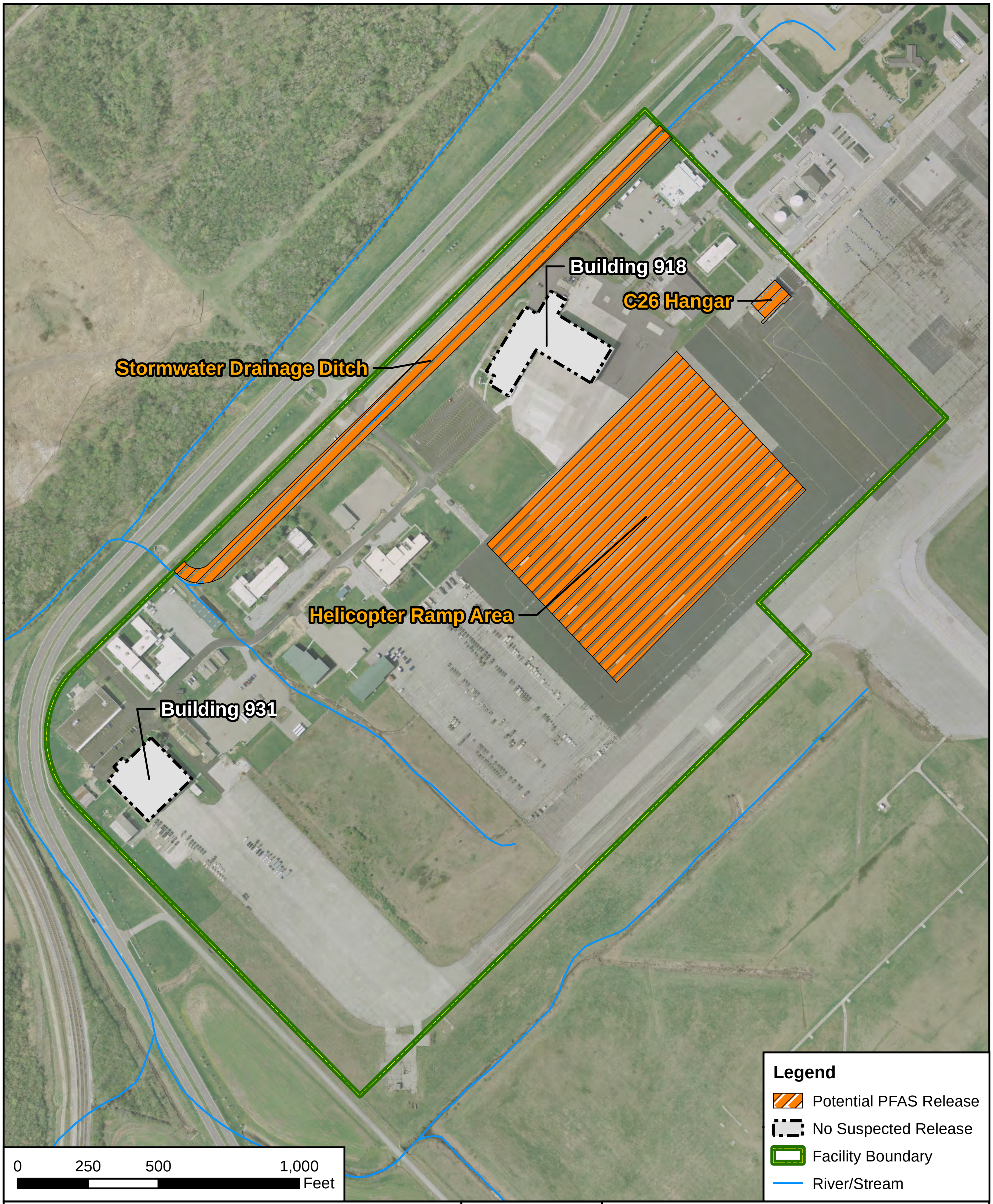
A second drainage ditch originates in the southern portion of the facility and flows northwest, where it converges with the first drainage ditch and exits the facility on the northwest boundary. As mentioned above, any releases between the two properties would likely be captured in the storm drain system, which then discharges to this drainage ditch system, and eventually conveys runoff to Big Walnut Creek, approximately 1.4 miles from the property boundary.

A PA performed by BB&E in 2016 at the OHANG facility shows several potential AFFF releases that could impact this stormwater drainage system (BB&E, 2016). Additionally, any potential release from RAE would be captured in surrounding storm drains and discharged into this drainage ditch.

3.5 Helicopter Ramp Area

A helicopter ramp area outside of Building 918 contained between nine to eleven mobile TriMax tanks from approximately 2002 to 2013. While exact specifications for these TriMax tanks, including concentration and quantity, was not available for these tanks, they are likely PFAS-containing AFFF tanks. Based on interviewee knowledge, these tanks were never used or deployed for fire training purposes or emergency response incidents. Interviewees confirmed that these tanks remained outside during their storage on the ramp, but they could not confirm if regular maintenance occurred on the tanks. It was noted that one tank did not properly work and was subsequently emptied of all AFFF, although the emptying date could not be recalled. This tank remained at the facility on the wash rack and was used for fire training activities to teach personnel how to operate the tank nozzles.

The northwest and southwest ends of the helicopter ramp area each contain one drainage channel that eventually discharges into the stormwater drainage ditch, mentioned in **Section 3.4**. Any potential spills or discharges on the helicopter ramp area or near these drainage channels would eventually flow into the stormwater drainage ditch.



CLIENT	ARNG			
NOTES	Preliminary Assessment for PFAS at Rickenbacker, OH			
REVISED	1/11/2019	GIS BY	MS	1/11/2019
SCALE	1:6,000	CHK BY	VK	1/11/2019
Base Map: OSIP Imagery		PM	RG	1/11/2019

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Fire Training Area

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Figure 3-1

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4. Emergency Response Areas

Based on interviewee knowledge the facility history since 1984, no emergency response incidents that required the use of AFFF has occurred. No information was available prior to 1984. Any emergency services for the RAE are provided by the 121st Air Wing Division of the adjoining OHANG facility.

5. Adjacent Sources

Several potential off-facility sources of PFAS adjacent to RAE, not under the control of the OHARNG, were identified during the PA. All of these potential AFFF release areas exist within OHANG property. Descriptions of the off-facility sources are presented below and are shown on **Figure 5-1**.

5.1 OHANG Property

Based on a 2016 PA report conducted by BB&E, in addition to information obtained by AECOM during interviews, several potential AFFF release areas lie within the OHANG property adjacent to the RAE. These areas are described below:

- Building 820, Current Fire Station: As of 2016, approximately 2,300 gallons of concentrated AFFF are stored within the fire station. Annual tests previously involved spraying approximately one gallon of AFFF into a bucket and then releasing contents down the drain.
- Hangar 888, Aircraft Maintenance: Scheduled tests on the fire suppression system would result in releases inside the hangar from approximately 1987 to 2003. Whether these releases were contained and captured within the hangar is unknown.
- Hangar 885, Aircraft Maintenance: Scheduled tests on the fire suppression system would result in releases inside the hangar from approximately 1987 to 2002. Whether these releases were contained and captured within the hangar is unknown.
- Hangar 883, Fuel Cell: This hangar, approximately 1,000 feet northwest of the C26 Hangar, routinely held scheduled tests on the fire suppression system and would result in releases inside the hangar from approximately 2000 to 2007. Following installation, the system underwent an initial test release during which foam filled the hangar 8 feet high within 3 minutes. The quantity of AFFF released during the other testing events is unknown.
- Stormwater Drainage Ditch: Trench drains throughout the facility, including outside the hangars and parking ramp areas, discharge into a stormwater drainage ditch located on the southwest portion of the OHANG facility. Residual from any AFFF-related activity has the potential to flow into these drains and discharge into the stormwater drainage ditch. This ditch then continues onto the OHARNG property, eventually discharging offsite (see **Section 3.4**).
- Concrete Ramp/Apron: Interviewees claimed that mobile fire extinguishers were previously located along the concrete ramp/apron area; however, whether these tanks were PFAS-containing is unknown. This concrete ramp/apron area is adjacent to the hangars and has a past and present historic presence of aircraft, leaving the high potential for the presence of AFFF.
- Old OHANG FTA: According to a report published in 1988 by Engineering-Science, a previous fire training area was located on OHANG property, several hundred yards east of the RAE. The timeframe of fire training activities at this location is unknown. The previous FTA consists of three loosely-packed dikes, ranging in size from 4,000 to 22,000 square feet (Engineering-Science, 1988). The dikes are located directly on top of an old runway surface. Various flammable liquids and fuels were ignited in the dikes for fire training purposes. Surface runoff from this FTA that was not confined within the dikes and it likely entered the storm drains and discharged into surrounding surface water bodies (Engineering-Science, 1988). Groundwater and surface water flow at RAE is generally northwest, meaning any contamination or release at this previous FTA has the potential to impact surface soil, groundwater, and surface water at RAE.

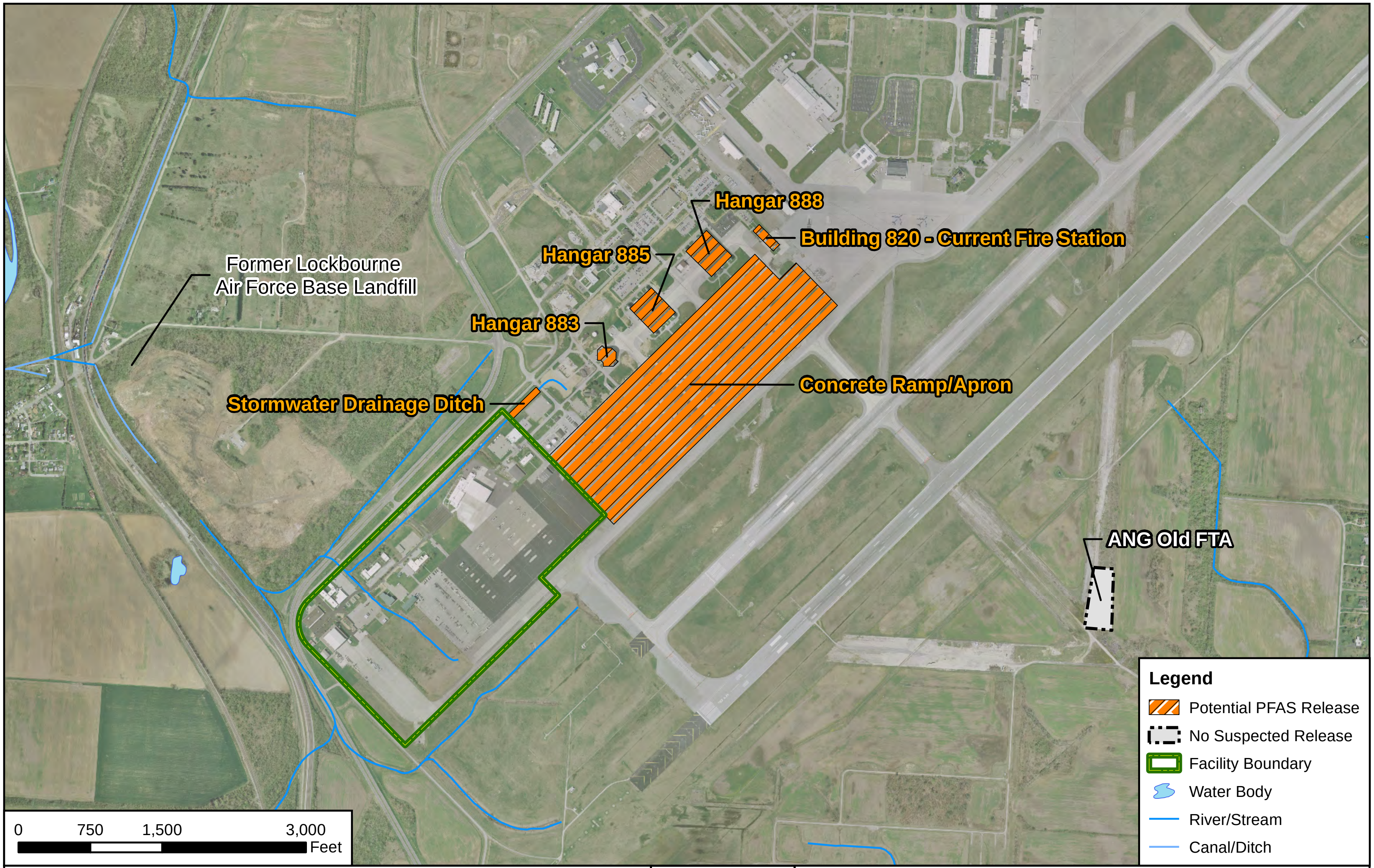
- Interviewees did not have knowledge of any previous fire training activities at this location and it is unknown whether AFFF was utilized during the prior training activities. However, given the historic use of AFFF for fire training activities and controlled burning of fuels, it is likely that AFFF was used at this location.Hanger Testing Events: Potential AFFF that was released during hangar testing events was captured in the floor drains within the hangars, which discharge to the sanitary sewer and is then transferred to the nearby Southerly WWTP (see **Section 3.1**). Based on interviewee knowledge and historical record review performed by BB&E, these areas are potentially impacted by AFFF use, storage, or release since 1987. The close proximity of these known and potential release areas leaves the potential for AFFF to impact the RAE.

5.2 Landfills

The former 135-acre Lockbourne Air Force Base landfill is located adjacent to RAE, directly northwest of the OHARNG property boundary. According to the Ohio Environmental Protection Agency, little is known about the operations that occurred at this landfill (OHEPA, 2009). From 1951 until 1979, various unknown wastes, such as potential pesticides, herbicides, ammunition, airplane parts, hazardous material, and other military debris, were brought to the landfill for burying and burning (USACE, 2011). Capping of the landfill began in 2011 and was fully complete by 2016. The cap includes 24 inches of compacted soil and six inches of topsoil. Several groundwater monitoring wells are located within the landfill as part of long-term, post-closure management based on federal and state cleanup procedures for sanitary landfills (USACE, 2012). The location of these monitoring wells is shown on **Figure 1-2**.

The Franklin County Sanitary Landfill, operated by the Solid Waste Authority of Central Ohio, is a municipal solid waste landfill that has been in operation since 1984. The landfill is located 11 miles west of RAE and approximately 6.5 miles from the Scioto River.

Landfills are not usually a primary potential release area of PFAS, but materials disposed in landfills may create a secondary source of contamination. Such materials may include sludge from a WWTP that processes PFAS-laden water, used AFFF storage containers, or products associated with waterproofing uniforms or boots.



CLIENT	ARNG			
PROJECT	Preliminary Assessment for PFAS at Rickenbacker, OH			
REVISED	1/11/2019	GIS BY	MS	1/11/2019
SCALE	1:18,000	CHK BY	TK	1/11/2019
Base Map: OSIP Imagery		PM	RG	1/11/2019

N

Adjacent Source

12420 Milestone Center Drive
Germantown, MD 20876

Figure 5-1

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6. Conceptual Site Model

Based on the PA findings, three AOIs were identified at the RAE: (1) AOI 1 C26 Hangar, (2) AOI 2 Drainage Ditch and (3) AOI 3 Helicopter Ramp Area. The AOI locations are shown on **Figure 6-1**. The following sections describe the CSM components and the specific CSMs developed for AOI 1 and 2. The CSM identifies the three components necessary for a potentially complete exposure pathway: (1) source, (2) pathway, (3) receptor. If any of these elements are missing, the pathway is considered incomplete.

In general, the potential PFAS exposure pathways are ingestion and inhalation. Dermal contact is not considered to be a potential exposure pathway as studies have shown very limited absorption of PFAS through the skin (NGWA, 2018). Receptors at the RAE include facility personnel, site workers and construction workers, residents, and trespassers. The CSM for the RAE indicates which specific receptors could potentially be exposed to PFAS.

6.1 AOI 1 – C26 Hangar

AOI 1 is the C26 Hangar. As identified in **Section 3.1**, the C26 Hangar includes a HEF fire suppression system with Jet X foam. Initial testing of the system released foam into the hangar in approximately 2007 or 2008 in which the Jet X foam was allowed to dissipate through the floor drains. The floor drains in the C26 Hanger collect in sanitary sewers that are transferred to the Southerly WWTP (described in **Section 3.1**). Additionally, as described in **Section 3.1**, a non-PFAS tank containing Purple K is stored outside of the C26 Hangar. Interviewees had no knowledge of any release or unintentional spills involving the Purple K. Prior to the acquisition of the Purple K tank, there was one TriMax tank stored outside of the C26 Hangar. The TriMax tank was removed several years ago and whether unintended spills or releases occurred from this TriMax tank during the duration of its storage is unknown.

While no other releases or spills have been reported from this hangar, the presence of a HEF system, and the historic presence of an AFFF-containing TriMax tank outside the hangar, has the potential to impact groundwater and surface water via run-off and infiltration to groundwater. While no potable water wells are located within RAE, domestic drinking water wells exist within a half-mile of the facility (**Figure 1-2**).

No spills or releases were reported at the C26 Hangar that would impact sediment, surface, or subsurface soil. Therefore, the ingestion exposure pathway for these media is considered incomplete.

Groundwater and surface water flow near the C26 Hangar is generally to the northwest, with the nearest residences approximately 3,500 feet west of the RAE. Additionally, wastewater treated at the Southerly WWTP discharges to the Scioto River, which includes numerous surface water intakes and is heavily used for recreational purposes. Therefore, the ingestion pathway for downgradient residents relying on groundwater for drinking water and recreational users of the Scioto River is considered potentially complete. The CSM for AOI 1 is shown on **Figure 6-2**.

6.2 AOI 2- Drainage Ditch

AOI 2 is the Drainage Ditch. RAE employs a series of drainage ditches to convey runoff off site. Refer to **Section 3.4** for a description of the drainage ditch system. Stormwater drains throughout the OHANG facility and RAE connect with this drainage ditch system. Any residual AFFF or potential releases between the OHANG property and RAE are captured within storm drains or drainage channels which are then discharged to this drainage ditch, which eventually discharges to the northwest of the facility at Big Walnut Creek, near the Former Lockbourne Air

Force Base Landfill. According to a PA conducted by BB&E in 2016, several potential release areas exist within OHANG property that could potentially affect this ditch, and this drainage ditch was subsequently recommended for Site Investigation.

Ground-disturbing activities at AOI 2 could result in site worker, construction worker, resident, and trespasser exposure to potential PFAS contamination via ingestion of surface soil or inhalation of soil particles (dust). Ground-disturbing activities to subsurface soil could result in site and construction worker exposure via ingestion of subsurface soil. Therefore, the inhalation and ingestion pathways for these receptors are considered potentially complete for AOI 2.

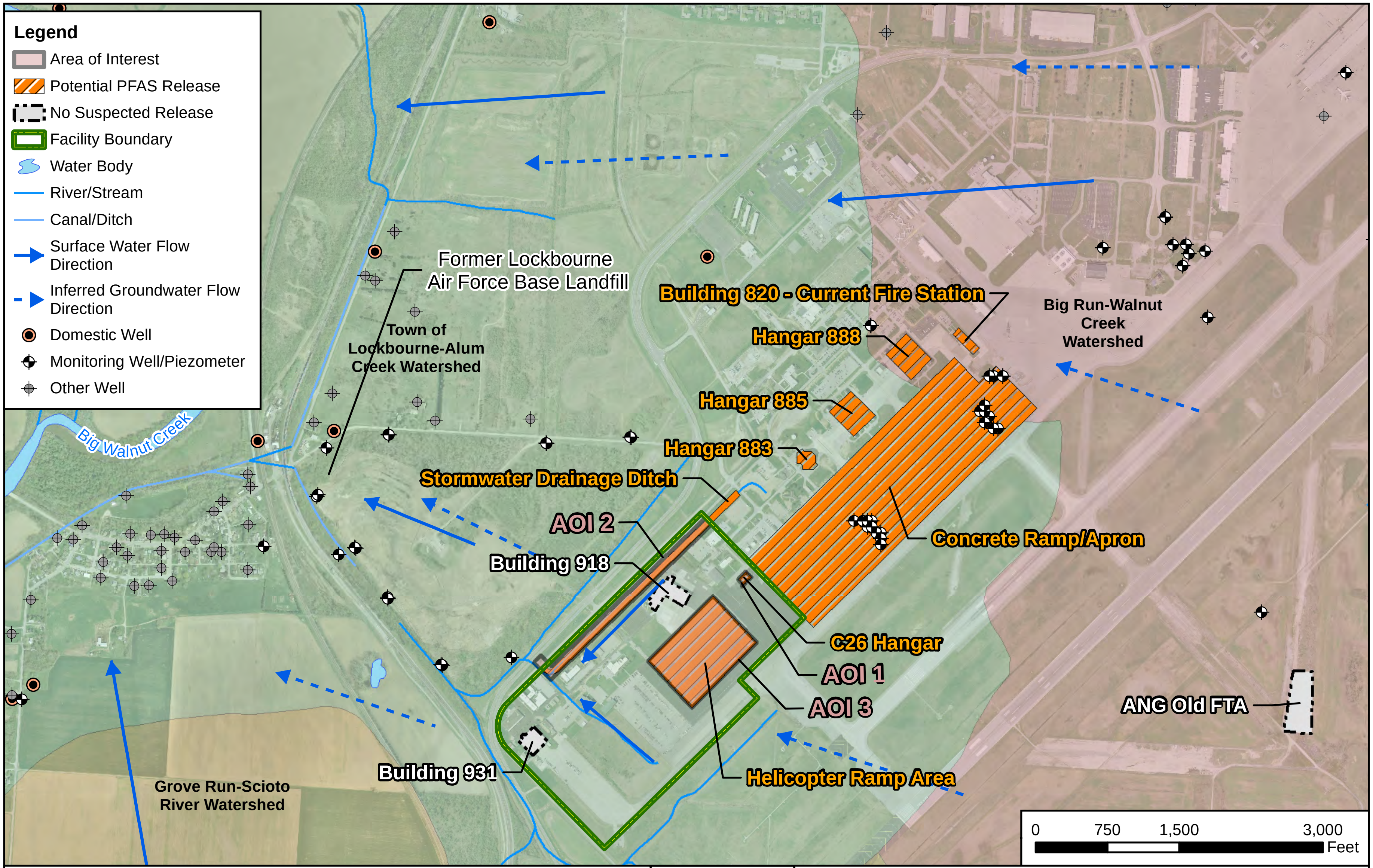
Groundwater and surface water flow near at the RAE is generally west/northwest, towards the drainage ditch. One domestic well is reported a half mile north of the facility, while several other domestic wells located within a half mile west of RAE, in the direction of groundwater and surface water flow (**Figure 1-2**). Additionally, surrounding bodies of water including Big Walnut Creek and the Scioto River are popular for recreational activities. Wastewater treated at the Southerly WWTP discharges to the Scioto River, which includes numerous surface water intakes and is heavily used for recreational purposes. Because private drinking water wells are located less than a mile downgradient of the RAE and recreational use of the surrounding surface water bodies is heavy, the ingestion pathway for downgradient residents relying on groundwater for drinking water and recreational users of the Scioto River is considered potentially complete. The CSM for AOI 2 is shown on **Figure 6-3**.

6.3 AOI 3 - Helicopter Ramp Area

AOI 3 is the Helicopter Ramp Area. Approximatley ten TriMax 30 tanks were historically stored outside around the helicopter ramp from 2002 until 2013. No spills or releases have been reported from these tanks; however, as described in **Section 3.5**, the storage of TriMax tanks in non-climate controlled areas since at least 2002 leaves the potential for unintended spills or releases from these tanks. Additionally, two small drainage channels exist on the northwest and southwest ends of the helicopter ramp area, eventually discharging into the drainage ditch identified as AOI 2. Any potential spills or relases on or near these drainage channels will flow into this drainage ditch channel.

If unintentional releases from the TriMax tanks or spills near the ramp area drains or drainage channels occurred, ground-disturbing activities at AOI 3 could result in site and construction worker exposure to potential PFAS contamination via inhalation of dust or ingestion of surface soil. Therefore, the inhalation and ingestion pathways for these receptors are considered potentially complete.

The Helicopter Ramp Area is located on the southern end of the facility, west of the C26 Hangar and south of Building 918. Groundwater flow in this area is generally to the west, towards the direction of private drinking water wells. Drinking water within the facility is provided by a public water utility company; however, private drinking water wells are located within a half-mile of the facility (**Section 1.5.2**). RAE is surrounded by small residential and industrial areas. Therefore, the ingestion exposure pathway for groundwater and surface water is considered potentially complete. The CSM for AOI 3 is shown on **Figure 6-4**.



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PROJECT	Preliminary Assessment for PFAS at Rickenbacker, OH			
REVISED	1/21/2019	GIS BY	MS	1/21/2019
SCALE	1:18,000	CHK BY	TK	1/21/2019
Base Map: OSIP Imagery		PM	RG	1/21/2019

N

Area of Interest

AECOM

12420 Milestone Center Drive
Germantown, MD 20876

Figure 6-1

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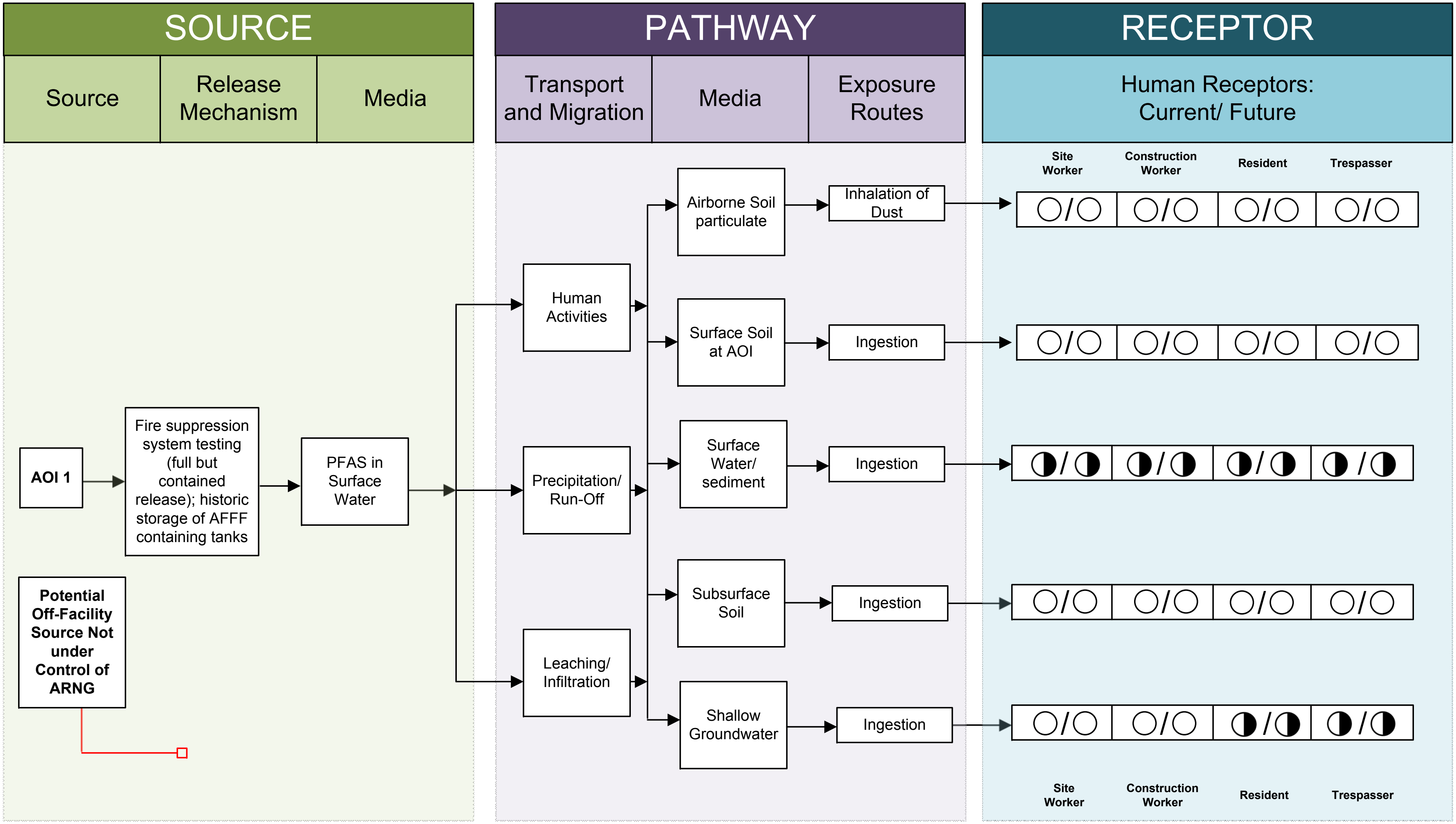


LEGEND

Flow-Chart Stops

Flow-Chart Continues

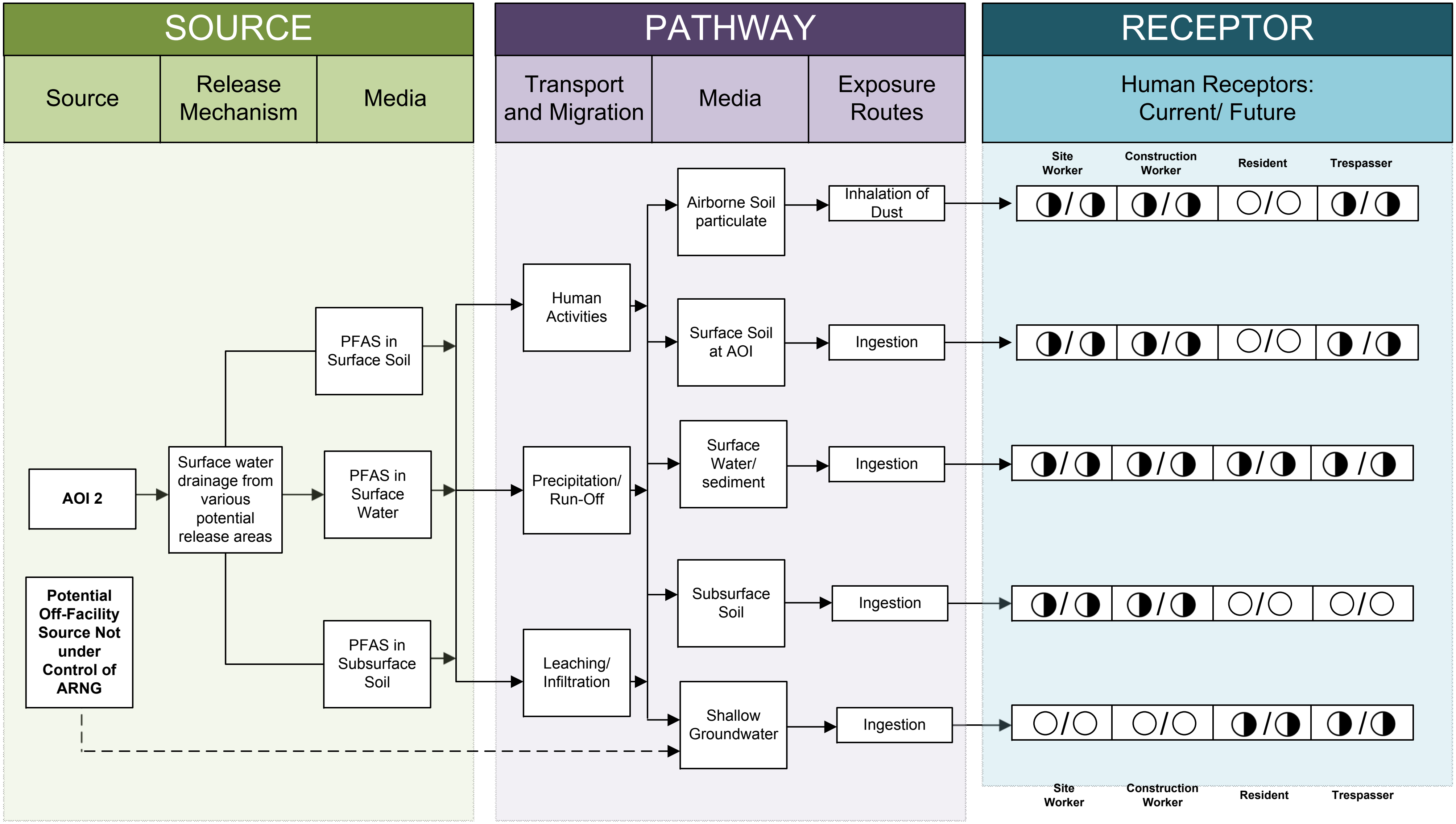
Partial / Possible Flow

○ Incomplete Pathway

◐ Potentially Complete Pathway

● Complete Pathway

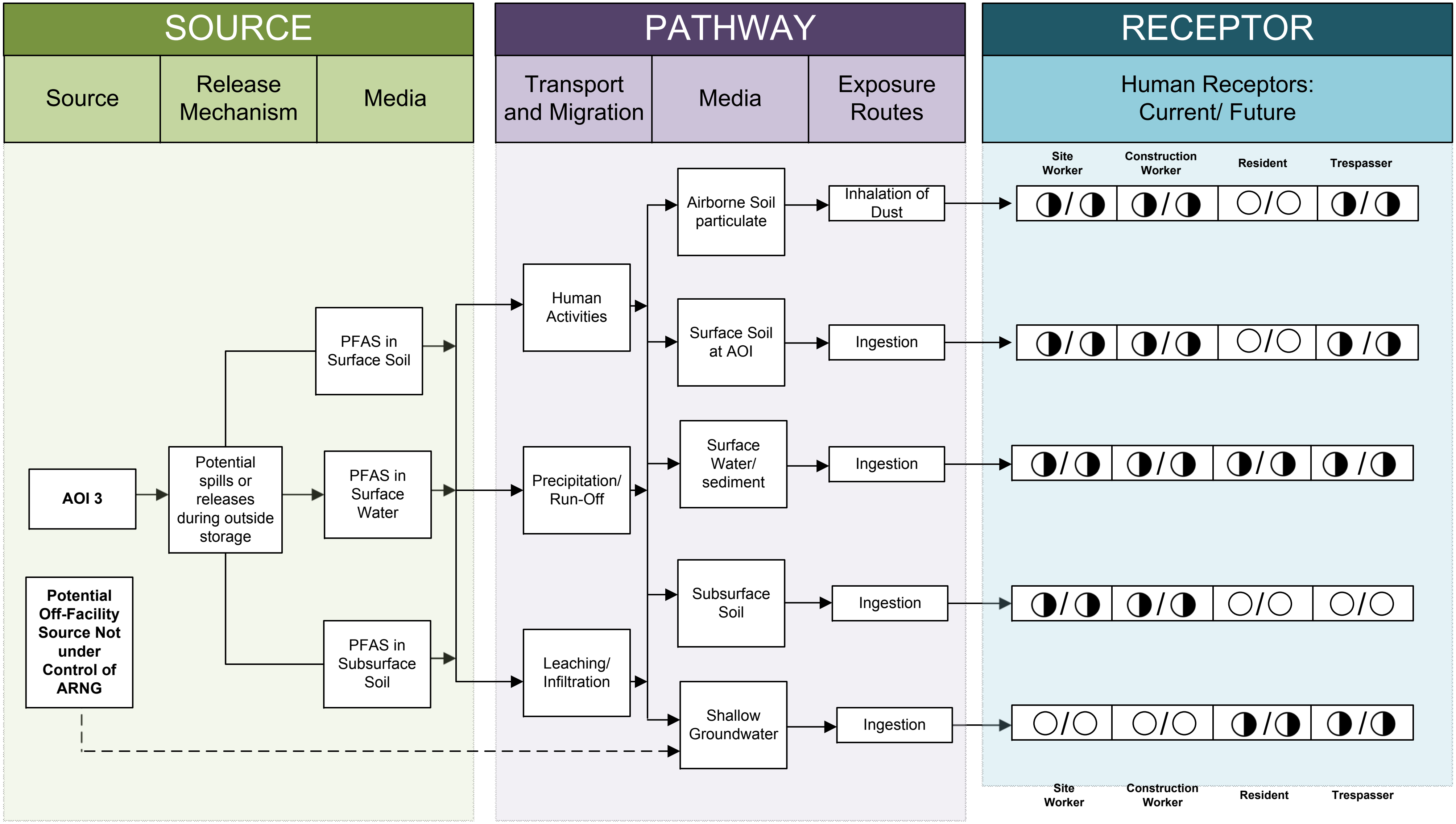
Figure 6-2
Conceptual Site Model
AOI 1 C26 Hangar
Rickenbacker Army Enclave



LEGEND

- Flow-Chart Stops
- Flow-Chart Continues
- Partial / Possible Flow
- ○ Incomplete Pathway
- ◑ Potentially Complete Pathway
- ● Complete Pathway

Figure 6-3
Conceptual Site Model
AOI 2 Drainage Ditch
Rickenbacker Army Enclave



LEGEND

Flow-Chart Stops
Flow-Chart Continues
Partial / Possible Flow
○ Incomplete Pathway
◑ Potentially Complete Pathway
● Complete Pathway

Figure 6-4
Conceptual Site Model
AOI 3 Helicopter Ramp Area
Rickenbacker Army Enclave

7. Conclusions

This report presents a summary of available information gathered during the PA on the use and storage of AFFF and other PFAS-related activities at RAE. The PA findings are based on the information presented in **Appendix A** and **Appendix B**.

7.1 Findings

Two AOIs related to a PFAS release were identified at RAE during the PA. These AOIs are shown on **Figure ES-1** and described in the table below:

Area of Interest	Name	Used by	Release Dates
AOI 1	C26 Hangar	OHARNG	No suspected release
AOI 2	Drainage Ditch	OHANG and OHARNG	Approximately 1987-2007
AOI 3	Helicopter Ramp Area	OHARNG	No suspected release

Based on documented presence and testing of the fire suppression system at AOI 1, there is potential for exposure to PFAS in groundwater and drinking water with potentially complete pathways existing to site workers, construction workers, trespassers, and resident receptors via ingestion. As testing of the system was contained within the hangar, incomplete exposure pathways exist for soil and subsurface soil at this AOI. The CSM for RAE AOI 1 is shown on **Figure ES-2.**

Receptors are less likely to be exposed to potential PFAS contamination through soil and air; however, some PFAS chemicals are water soluble and can migrate readily from soil to groundwater or surface water via leaching and run-off. Based on numerous potential AFFF releases at AOI 2, there is potential for exposure to PFAS contamination in surface soils to site and construction workers, residents, and recreational users/trespassers, and in subsurface soils to site and construction workers via inhalation and ingestion. There is also the potential for exposure to PFAS contamination in surface water and sediment for all receptors via ingestion, and in shallow groundwater for all receptors due to the close proximity of private drinking water wells within a half mile of the facility. The CSM for RAE AOI 2 is shown on **Figure ES-3.**

Based on the uncontrolled exterior storage of AFFF tanks at AOI 3 as well as the presence of stormwater drains and drainage channels, site and construction workers could potentially be exposed to PFAS contamination in surface and subsurface soil to via inhalation and ingestion. Given water flow patterns and the close proximity of private drinking water wells, there is the potential for exposure to PFAS contamination in groundwater and surface water via ingestion to site workers, construction workers, trespassers, and resident receptors at AOI 3. The CSM for AOI 3 is shown on **Figure ES-4**.

7.2 Uncertainties

A number of information sources were investigated during this PA to determine the potential for PFAS-containing materials to have been present, used, or released at the facility. Historically, documentation of PFAS use was not required because PFAS were considered benign. Therefore, records were not typically kept by the facility or available during the PA on the disposition and use of PFAS in training, firefighting, or other non-traditional activities.

The conclusions of this PA are predominantly based on the information provided during interviews with personnel who had direct knowledge of PFAS use at the facility. Sometimes the provided information was vague or conflicted with other sources. Gathered information has a degree of uncertainty due to the absence of written documentation, the limited number of personnel with direct knowledge due to staffing changes, the time passed since PFAS was first used (1969 to present), and a reliance on personal recollection. Inaccuracies may arise in potential PFAS release locations, dates of release, volume of releases, and the concentration of AFFF used. There is also a possibility the PA has missed a source of PFAS, as the science of how PFAS may enter the environment continually evolves.

In order to minimize the level of uncertainty, readily available data regarding the use and storage of PFAS were reviewed, retired and current personnel were interviewed, multiple persons were interviewed for the same potential source area, and potential source areas were visually inspected.

The following table summarizes the uncertainties associated with the PA:

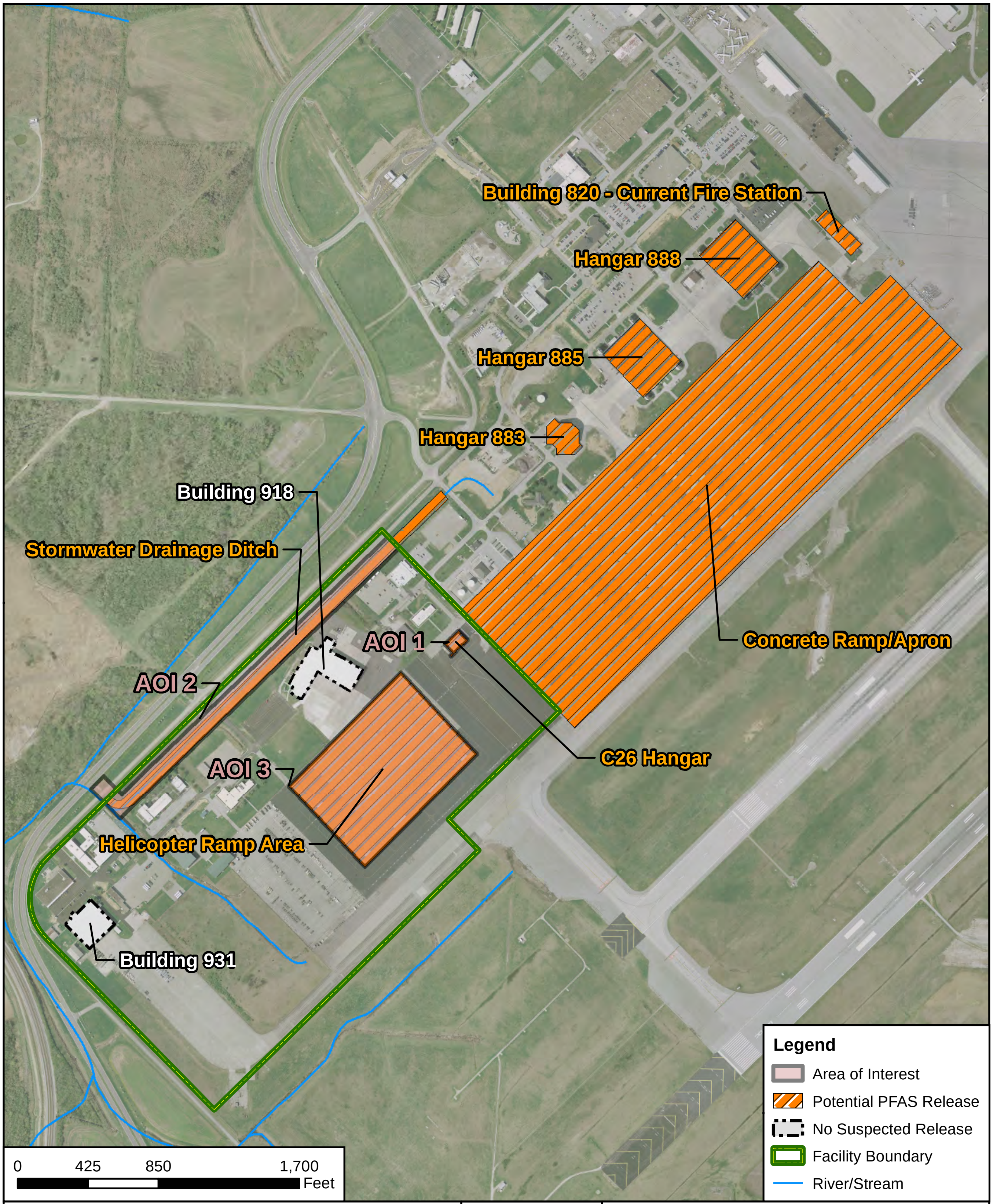
Area of Interest	Source of Uncertainty
All AOIs	The timeframe of known or potential AFFF releases at RAE is limited to interviewee knowledge which extends from approximately 1984 until present.
AOI 1 (C26 Hangar)	Limited information was available on the amount of Jet X foam used during the initial testing release.
AOI 2 (Drainage Ditch)	Manufacturer, quantity, and concentration of AFFF that potentially reached this drainage ditch are unknown. Exact dates of potential releases to this ditch are estimated between the time hangar testing releases began on OHANG property in 1987 and the last release reported from OHANG or RAE in 2007.
AOI 3 (Helicopter Ramp Area)	Whether any potential spills or releases of AFFF from the various TriMax tanks occurred throughout the duration of storage is unknown.
Building 918	It is unclear how long the 5-gallon buckets of AFFF were stored at this facility before disposal.
All OHANG Potential Release Areas	Potential release areas within the OHANG facility were not visually seen during the site inspection. The information provided on these potential releases comes from interviews with OHARNG personnel, historical document review, and review of the 2016 PA conducted at the OHANG facility by BB&E.
OHANG Old FTA	No interviewees had knowledge of this previous FTA owned and operated by OHANG. All information regarding this previous FTA was obtained from a report published by Engineering-Science in 1988. Additionally, it is unknown whether AFFF was used to suppress fires during these training activities.

7.3 Potential Future Action

Interviews and records (covering 1984 to present) indicate that current or former ARNG activities may have resulted in potential PFAS releases at the three AOIs identified during the PA. Based on the CSMs developed for the AOIs, there is potential for receptors to be exposed to PFAS contamination in soil, subsurface soil, groundwater, sediment, and surface water at these AOIs. The table below summarizes the rationale used to determine if the AOI should be considered for further investigation under the CERCLA process and undergo a Site Inspection (SI).

ARNG will evaluate the need for an SI at RAE based on the potential receptors, the potential migration of PFAS contamination off the facility, and the availability of resources.

Area of Interest	AOI Location	Rational	Potential Future Action
AOI 1 C26 Hangar	39°48'28.88"N and 82°56'52.53"W	Initial testing of AFFF fire suppression system in 2007 as well as historic outside storage of TriMax tank from approximately 2002 until 2013 leaves the potential for spills or releases from this AOI.	Proceed to an SI, focus on groundwater
AOI 2 Drainage Ditch	39°48'22.14"N and 82°57'08.24"W	Known and suspected releases from both the OHANG and the OHARNG between approximately 1987 through 2007.	Proceed to an SI, focus on soil, sediment, and groundwater
AOI 3 Helicopter Ramp Area	39°48'21.34"N and 82°56'58.25"W	Historic outside storage of between nine and eleven TriMax tanks from approximately 2002 through 2013. The drainage channel that originates on OHANG property flows through the middle of this ramp area.	Proceed to an SI, focus on groundwater



CLIENT	ARNG			
NOTES	Preliminary Assessment for PFAS at Rickenbacker, OH			
REVISED	1/11/2019	GIS BY	MS	1/11/2019
SCALE	1:10,200	CHK BY	TK	1/11/2019
Base Map: OSIP Imagery		PM	RG	1/11/2019

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Summary of Findings

AECOM
12420 Milestone Center Drive
Germantown, MD 20876

Figure 7-1

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Appendix A
Data Resources

Data Resources will be provided separately on CD. Data Resources for Rickenbacker AASF #2 includes:

Rickenbacker Leases, Licenses, and Permits

- 1988 Federal-State Agreement for Nonarmory Project on Federal Property Between the National Guard Bureau Departments of the Army and Air Force and the State of Ohio. Federal-State Agreement No. NBG 33-88-H-0003
- 1998 Department of the Army License for National Guard Purposes Rickenbacker Air National Guard Base Franklin County, Ohio. No. DACA27-3-98-022

Rickenbacker AFFF Release Documentation

- 2018 Disposal manifest for firefighting foam from Rickenbacker AASF #2
- 1997 AFFF MSDS from Minnesota Mining & MFG Co Industrial Chem Products
- 2000 MSDS for TriMax Arctic Minus 40 Degree AFFF
- 2018 Interview Schedule

Previous Investigations Completed at Rickenbacker

- 1988 Installation Restoration Program Rickenbacker Air National Guard Base Columbus, Ohio: Site Inspection/Remedial Investigation/Feasibility Study/Remedial Design Work Plan Final
- 1989 Installation Restoration Program Rickenbacker Air National Guard Base Columbus, Ohio: Additional Site Inspection Sampling Addendum #1 to SI/RI/FS/RD Work Plan
- 1995 Record of Decision for Disposal of Portions of Rickenbacker Air National Guard Base, Ohio
- 2006 Site Investigation of 21 Areas of Concern Former Lockbourne Air Force Base Columbus, Ohio
- 2007 First Five-Year Review Report for Rickenbacker Air National Guard Base (Protected document; available on CD only)
- 2010 Former Lockbourne Air Force Base Landfill Remediation Investigation Report. FUDS Site: G05 OH0007
- 2011 USACE Fact Sheet: Former Lockbourne Air Force Base Landfill
- 2012 USACE Final Remediation Design: Former Lockbourne Air Force Base Landfill Columbus, Ohio
- 2016 BB&E Final Perfluorinated Compounds Preliminary Assessment Site Visit Report: Rickenbacker Air National Guard Base Columbus, Ohio (Protected document; available on CD only)
- 2017 USACE Decision Documents for AOCs 17/18/19/103, Former Lockbourne Air Force Base

Rickenbacker Installation Maps

- 1995 Rickenbacker ANGB Parcelization Map
- 2018 Installation Map
- 2018 Aerial Photos

Rickenbacker Correspondence

- 2018 Manifest and License Correspondence
- 2018 Confirmation of Building Correspondence

Rickenbacker EDR Report

- 2018 Rickenbacker AASF #2 EDR Report

ORE FILE

DEPARTMENT OF DEFENSE
UNITED STATES OF AMERICA

DEPARTMENTS OF THE ARMY AND THE AIR FORCE
NATIONAL GUARD BUREAU
WASHINGTON, D.C. 20310-2500

REPLY TO
ATTENTION OF
NGB-ARI-C (415-10f)

12 FEB 1988

MEMORANDUM FOR: The Adjutant General, Ohio

SUBJECT: AASF, Columbus, Ohio; FY 88 MCARNG (Major)

The 16 Dec 87 Federal-State Agreement (NGB 33-88-H-0003) for the subject project has been reviewed by NGB-JA, found legally sufficient and is returned herewith.

FOR THE CHIEF, NATIONAL GUARD BUREAU:

Encl
as

for

FRED W. ARON
Chief, Army Installations Division

CF:
USPFO, OH

350 YEARS NATIONAL GUARD
1636-1986

Federal-State Agreement No. NGB 33-88-H-0003

Description of Project: New Army Aviation Support Facility #2

Location of Project: Rickenbacker Air National Guard Base
(Franklin County)

FEDERAL-STATE AGREEMENT
FOR NONARMORY PROJECT
ON FEDERAL PROPERTY

BETWEEN

THE NATIONAL GUARD BUREAU
Departments of the Army and the Air Force

AND

THE STATE OF Ohio

This Agreement by and between the United States of America hereinafter called the GOVERNMENT, represented by the Contracting Officer executing this Agreement, and the State (Commonwealth, Territory, or Possession) of Ohio, hereinafter called the STATE, covering the construction of the above-described project at Rickenbacker ANGB, in said State with the assistance of funds appropriated by the Congress of the United States for the GOVERNMENT contribution to the cost of said project pursuant to Chapter 133, Title 10, U.S. Code, Facilities for Reserve Components.

WHEREAS, section 2233(a)(2)-(6) and 2233(e) of Chapter 133, Title 10, U.S. Code, authorizes contributions of Federal funds to the several States, Puerto Rico, District of Columbia, the Virgin Islands and Guam to support the design and construction of such facilities for the Reserve Components as the Secretary of Defense shall determine to be necessary; and

WHEREAS, the Secretary of Defense, as required by the above-cited sections of Title 10, U.S. Code, has determined the above-described project to be necessary; and

WHEREAS, the STATE has submitted satisfactory evidence of the possession of a valid license or other appropriate document for an adequate term granted by a duly authorized agent of the GOVERNMENT, for utilization of the Federal property on which the project is to be located and that the proposed project does not conflict with any conditions set forth in the license; and

NOW THEREFORE, the said parties do mutually promise and agree with each other to construct, expand, rehabilitate or convert the facilities covered by this Agreement under the conditions hereinafter provided.

NGB Form 85-3-R
1 Jul 86 (Replaces NGB Form 85-3(LRA) dtd 1 Apr 84, which will not be used.)

ARTICLE I. The STATE agrees:

1. To submit to the GOVERNMENT sets of plans, specifications and cost estimates for prior approval by the GOVERNMENT.

2. To contract all work, material, and/or services required to carry out this Agreement, and to require each construction contractor to furnish bonds of such type and in an amount adequate to secure faithful performance of his contract.

3. To execute construction, supply, and/or services contracts in accordance with the laws of such STATE, and under those regulations within OMB Circular A-111 which are applicable to federally-assisted programs insofar as the application of such regulations by supervisory officials of the STATE is not precluded by nor inconsistent with STATE laws. All such contracts, subcontracts and change orders or other contract modifications shall be submitted to the GOVERNMENT for prior approval by the GOVERNMENT.

4. To permit supervision and inspection by representatives of the GOVERNMENT during the performance of engineering and construction contracts.

5. To supervise and be responsible for necessary construction of the facilities authorized under this Agreement, and to make inspections of the work done under this Agreement as may be deemed necessary by the GOVERNMENT.

6. To furnish inspector's certificates, satisfactory to the GOVERNMENT, as the work progresses on the project, certifying amounts due the construction contractor as the basis for preparation of payment vouchers.

7. To maintain an accounting system for the construction work acceptable to the GOVERNMENT.

8. To make, either directly or through other agencies under STATE supervision, and to render to the GOVERNMENT, a satisfactory accounting of all original disbursements on account of the construction.

9. To the extent of its power or authority, to take necessary action to prohibit outside interests (such as adjacent land-owners, public utility corporations, etc.) from any utilization of adjacent land that would interfere with the use of the facility for its intended purposes.

10. To take the necessary actions, with the assistance of the National Guard Bureau, to apply for renewal of the current license prior to the expiration date contained therein.

11. To submit a "Certificate of Availability of State Funds" to meet its contribution, if any, in the support of the cost of the above described project prior to any obligation of Federal funds for the construction.

12. Title to property constructed under this agreement vests in the United States.

13. The STATE hereby agrees to make such facility available for joint utilization with another Reserve component to the extent that the STATE shall hereafter deem it to be practicable.

ARTICLE II. The GOVERNMENT agrees:

1. To contribute Federal funds in the amount of 100 percent of the GOVERNMENT-approved cost of the project covered by this Agreement.

2. To reserve funds for the purpose of making payment to the STATE for the cost of the buildings and appurtenances thereto during the life of the contract for the construction of this project.

3. To pay the STATE or construction contractor as the construction work progresses for the GOVERNMENT's share of said cost on the basis of the percentages which the GOVERNMENT contribution bears to the total cost.

4. To pay the State or the architect - engineer as the work progresses for the Government's share of the cost of the services performed by the A-E under the GOVERNMENT-approved contract.

a. The [illegible]ernment will advance by allotment its share of the fee or fees for four services (i.e., project design, topographic survey, surface and sub-surface soil investigation, and reproduction of bidding documents) for a total cost not to exceed the amount based on the percentage listed in the attached table (Encl 1) in column A (where project requires all new design work) or column C (where design work consists of adapting an existing facility design to a different site) or for a combination of the two columns A and C (where both site adaptation and new design work are included in the project). The initial allotment to be provided to the State will be determined by multiplying the appropriate percentage from column A and/or C for the combined total estimated cost of the project (i.e., Federal, State, county, city, etc) times the Government's share of the estimated construction cost of the project. The GOVERNMENT's share of the fee or fees will then be adjusted at the time of contract award with the final amount to be established as follows: 1) the percentage/s from column A and/or C (or both if site adapt work has been included) will be revised to those which correspond to the lowest responsible bid (or sum of low bids when multiple contracts are used) at which a construction contract (or contracts) is to be awarded; 2) the percentage specified in column B or D for inspection and supervision services, during construction, will be determined on the same bid basis; and 3) the adjusted share will then be calculated by multiplying these designated percentages times the GOVERNMENT's share of the lowest acceptable bid for items, authorized for inclusion in the project, based on conformance with National Guard criteria. Another allotment of funds will be provided to the State for the difference between the GOVERNMENT's adjusted share and the initial allotment (or allotments in cases where there have been more than one due to significant increases in the GOVERNMENT-approved estimated construction cost of the project). This fee determination is exclusive of any lump-sum fees allotted to the State in support of supplemental agreements approved by the GOVERNMENT for work not covered by the original contract/s.

b. [illegible] the State contracts for A-E srvices in such a manner that the total compensation for the contract/s would be less than the amount derived from the attached Table (Encl 1), the Government's share of the lower fee or fees will be set at the same ratio to the total contracted fee or fees as the Government's share of the construction costs bears to the total construction cost; both for the initial (estimated cost) and final (actual cost) determination. The difference in amounts between the lower A-E fee or fees and the maximum allowable Federal support as based on Encl 1 cannot be used to reduce the State's (including other agency's) share of the fees below its proportional share based on the construction contract awarded costs.

c. When a project is cancelled and/or an A-E contract terminated prior to the bidding of the project for the award of a construction contract, the Government's share of the fee due for completed services shall be based on the estimated percent of the completed work (as approved by the GOVERNMENT) under the original contract/s with the theoretical total fee adjusted in line with the latest cost estimate for the project as approved by the GOVERNMENT. The remaining amount of the advanced allotment will be returned to the National Guard Bureau or an additional allotment will be provided the State if the initial allotment is insufficient to support the revised GOVERNMENT share of the adjusted fee or fees.

d. The GOVERNMENT's contribution shall at no time be at a greater ratio to the total fee or fees than the ratio of the GOVERNMENT's share of the construction contract/s to the total cost of the construction contract/s (including other agencies) unless specifically modified by a GOVERNMENT approved supplemental agreement/s to the A-E services contract/s.

ARTICLE III. It is further expressly understood and agreed between the GOVERNMENT and the STATE that:

1. Funds necessary to pay for other than GOVERNMENT approved cost, if any, shall be borne by the State.

2. The GOVERNMENT shall determine what costs incurred by the STATE are allowable under the terms and condition of this Agreement.

3. Contract clauses prescribed by OMB Circular A-111 for use in Federally-assisted programs will be included in all State contracts for the project covered by this agreement.

4. This Agreement shall remain in full force until the Federal license is terminated.

5. All costs and contributions under this agreement shall be subject to approval by the Government and the availability of appropriated funds.

ARTICLE IV. Approval. This Agreement shall be subject to the approval of the Chief, National Guard Bureau, or his duly authorized representative, and shall not be binding until so approved.

ARTICLE V. Alterations. The following alterations have been made in the provisions of this Agreement.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement on this 16 th day of December, 19 87.

THE UNITED STATES OF AMERICA

By Robert P. Orr

USPFO For Ohio
(Official Title)

Robert P. Orr
COL, NGB
USPFO For Ohio

Witnesses as to signature
of State Representative

Michael W. McHenry
MICHAEL W. MCHENRY
(Address)
USPFO for Ohio
2811 West Granville Road
Worthington, Ohio 43085-2712

Ann Weaver
2825 West Granville Road
Worthington, Ohio 43085-2712
(Address)

STATE OF Ohio

BY R C Alexander

(Official Title)

Richard C. Alexander
Major General (OH)
The Adjutant General

CERTIFICATE

By virtue of the authority vested in me by ORC 5911.18 (State Statute or Legislative Act) under the laws of the State of Ohio I hereby certify that the execution of this Agreement was duly authorized and that this Agreement is legal and binding upon said State.

Cherry Lynne Poteet
Attorney General
(or Legal Representative)

Cherry Lynne Poteet
Assistant Attorney General

NATIONAL GUARD BUREAU
UNIFORM STANDARDS FOR THE PAYMENT OF ARCHITECT-ENGINEER
SERVICES FOR ARMY NATIONAL GUARD
ARMORY AND NONARMORY PROJECTS
(SHORT TITLE: ARNG A-E FEE SCHEDULE)

ESTIMATED PROJECT COST OR LOWEST RESPONSIBLE BID AWARDED FOR CONTRACT (Cost of construction changes not to be included)	NEW WORK			SITE ADAPTATION		
	Total Percent	Col A (75%)	Col B (25%)	Total Percent	Col C	Col D
Less than $50,000	10.7	8.03	2.67	8.7	6.03	2.67
$ 50,000 and under $53,000	10.6	7.95	2.65	8.6	5.95	2.65
53,000 and under 56,000	10.4	7.80	2.60	8.4	5.80	2.60
56,000 and under 60,000	10.2	7.65	2.55	8.2	5.65	2.55
60,000 and under 65,000	10.0	7.50	2.50	8.0	5.50	2.50
65,000 and under 70,000	9.8	7.35	2.45	7.8	5.35	2.45
70,000 and under 75,000	9.6	7.20	2.40	7.6	5.20	2.40
75,000 and under 80,000	9.4	7.05	2.35	7.4	5.05	2.35
80,000 and under 87,000	9.2	6.90	2.30	7.2	4.90	2.30
87,000 and under 95,000	9.0	6.75	2.25	7.0	4.75	2.25
95,000 and under 105,000	8.8	6.60	2.20	6.8	4.60	2.20
105,000 and under 115,000	8.6	6.45	2.15	6.6	4.45	2.15
115,000 and under 125,000	8.4	6.30	2.10	6.4	4.30	2.10
125,000 and under 135,000	8.2	6.15	2.05	6.2	4.15	2.05
135,000 and under 150,000	8.0	6.00	2.00	6.0	4.00	2.00
150,000 and under 165,000	7.8	5.85	1.95	5.8	3.85	1.95
165,000 and under 190,000	7.6	5.70	1.90	5.6	3.70	1.90
190,000 and under 215,000	7.4	5.55	1.85	5.4	3.55	1.85
215,000 and under 250,000	7.2	5.40	1.80	5.2	3.40	1.80
250,000 and under 300,000	7.0	5.25	1.75	5.0	3.25	1.75
300,000 and under 360,000	6.8	5.10	1.70	4.8	3.10	1.70
360,000 and under 440,000	6.6	4.95	1.65	4.6	2.95	1.65
440,000 and under 530,000	6.4	4.80	1.60	4.4	2.80	1.60
530,000 and under 620,000	6.2	4.65	1.55	4.2	2.65	1.55
620,000 and under 720,000	6.1	4.58	1.52	4.1	2.58	1.52
720,000 and under 850,000	6.0	4.50	1.50	4.0	2.50	1.50
850,000 and under 1,000,000	5.9	4.43	1.47	3.9	2.43	1.47
1,000,000 and under 1,200,000	5.8	4.35	1.45	3.8	2.35	1.45
1,200,000 and under 1,500,000	5.7	4.28	1.42	3.7	2.28	1.42
1,500,000 and under 2,200,000	5.6	4.20	1.40	3.6	2.20	1.40
2,200,000 and over	5.5	4.13	1.37	3.5	2.13	1.37

NOTES:

1. Column A percentages equal the total allowed for four (4) items of work consisting of original design, investigation of site soil conditions, topographic survey of the project site, and reproduction of bidding documents.

2. The portion of the Column A percentage allocated to only original design work (i.e., exclusive of soil investigation, topographic survey, and bidding document costs) cannot exceed the Congressional statutory limit of 6.00 percent.

3. Columns B and D percentages equal the total allowed for supervision and inspection services during the construction period of the project.

4. Column C percentages equal the total allowed for the same four (4) items of work as Column A but with a 2 percent reduction to reflect the reduced design work required (including the design of exterior supporting features needed for the facility), to adapt a previously designed facility to a different location.

Encl 1

NO. DACA27-3-98-022

DEPARTMENT OF THE ARMY

LICENSE FOR

NATIONAL GUARD PURPOSES

RICKENBACKER AIR NATIONAL GUARD BASE

FRANKLIN COUNTY, OHIO

THE SECRETARY OF THE ARMY, hereinafter referred to as the Secretary, under the authority of Title 32, United States Code, Section 503, hereby grants to the State of Ohio, hereinafter referred to as the grantee, a license to use and occupy for training and support of the Ohio Army National Guard certain land and improvements, hereinafter referred to as the premises, as shown identified in Exhibits "A", "A-1", "A-2", "B", "B-2" attached hereto and made a part hereof.

THIS LICENSE is granted subject to the following conditions:

1. TERM

This license is granted for an indefinite term, beginning 24 September 1996, but revocable at will by the Secretary.

2. SUPERVISION BY THE INSTALLATION COMMANDER

The use and occupancy of the premises shall be without cost to the regular establishment of the military departments of the Department of Defense and shall be under the general supervision of the U.S. Property and Fiscal Officer for Ohio, hereinafter referred to as said officer, and subject to such rules and regulations as may be prescribed from time to time by said officer.

3. APPLICABLE LAWS AND REGULATIONS

The grantee shall comply with all applicable Federal, state, county, and municipal laws, ordinances, and regulations wherein the premises are located.

NON-HAZARDOUS WASTE MANIFEST

1. Generator ID Number: [illegible]

2. Page 1 of 1

3. Emergency Response Phone: [illegible]

4. Waste Tracking Number [illegible]

5. Generator's Name and Mailing Address

AASF #2
7750 South Access Rd
Columbus, OH 43217

Generator's Phone: [illegible]

Generator's Site Address (if different than mailing address)

same

6. Transporter 1 Company Name

Environmental Management Specialists, Inc

U.S. EPA ID Number OHD000182212

7. Transporter 2 Company Name

U.S. EPA ID Number

8. Designated Facility Name and Site Address

Tradebe Treatment Recycling
4343 Kennedy Avenue
East Chicago, In 46312

Facility's Phone: 219-397-3951

U.S. EPA ID Number IND000646943

9. Waste Shipping Name and Description	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.
1. Non hazardous non regulated material (firefighting foam)	9	DF	45	6
2.				
3.				
4.				

13. Special Handling Instructions and Additional Information

1. 1000169306

[illegible]

14. GENERATOR'S/OFFEROR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations.

Generator's/Offeror's Printed/Typed Name [illegible]

Signature

Month 11 Day 28 Year 17

INT'L

15. International Shipments ☐ Import to U.S. ☐ Export from U.S.

Port of entry/exit:

Transporter Signature (for exports only):

Date leaving U.S.:

TRANSPORTER

16. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name [illegible]

Signature

Month 11 Day [illegible] Year 17

Transporter 2 Printed/Typed Name

Signature

Month Day Year

DESIGNATED FACILITY

17. Discrepancy

17a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

17b. Alternate Facility (or Generator)

U.S. EPA ID Number

Facility's Phone:

17c. Signature of Alternate Facility (or Generator)

Month Day Year

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a

Printed/Typed Name

Signature

Month Day Year

GENERATOR

169-BLC-O 6 10498 (Rev. 9/09)

GENERATOR'S/SHIPPER'S INITIAL COPY

NON-HAZARDOUS WASTE MANIFEST

1. Generator ID Number: [illegible]

2. Page 1 of 1

3. Emergency Response Phone: [illegible]

4. Waste Tracking Number: [illegible]

5. Generator's Name and Mailing Address

AASF #2
7750 South Access Rd
Columbus, OH 43217

Generator's Phone: [illegible]

Generator's Site Address (if different than mailing address): same

6. Transporter 1 Company Name: Environmental Management Associates, Inc

U.S. EPA ID Number: [illegible]

7. Transporter 2 Company Name

U.S. EPA ID Number

8. Designated Facility Name and Site Address

Tradebe Treatment Recycling
4343 Kennedy Avenue
East Chicago, In 46312

Facility's Phone: 219-397-3951

U.S. EPA ID Number: IND000646943

9. Waste Shipping Name and Description	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.
1. Non hazardous non regulated material (firefighting foam)	9	DF	45	6
2.				
3.				
4.				

13. Special Handling Instructions and Additional Information

1. 1000169386

14. GENERATOR'S/OFFEROR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations.

Generator's/Offeror's Printed/Typed Name: [illegible]

Signature

Month: 11 Day Year

15. International Shipments ☐ Import to U.S. ☐ Export from U.S.

Port of entry/exit:

Transporter Signature (for exports only):

Date leaving U.S.:

16. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name: [illegible]

Signature

Month: 11 Day Year

Transporter 2 Printed/Typed Name

Signature

Month Day Year

17. Discrepancy

17a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

17b. Alternate Facility (or Generator)

U.S. EPA ID Number

Facility's Phone:

17c. Signature of Alternate Facility (or Generator)

Month Day Year

18. Designated Facility Owner or Operator: Certification of receipt of materials covered by the manifest except as noted in Item 17a

Printed/Typed Name

Signature

Month Day Year

GENERATOR

INT'L

TRANSPORTER

DESIGNATED FACILITY

169-BLC-O 6 10498 (Rev. 9/09)

GENERATOR'S/SHIPPER'S INITIAL COPY

Form Approved. OMB No. 2050-0039

Please print or type. (Form designed for use on elite (12-pitch) typewriter.)

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator ID Number: OHD000004416
2. Page 1 of 1
3. Emergency Response Phone: 877-816-9111
4. Manifest Tracking Number: 016687624 JJK

GENERATOR

5. Generator's Name and Mailing Address:
AASF #2
7750 South Access Rd
Columbus, OH 43217

Generator's Site Address (if different than mailing address): Same

Generator's Phone: 614-336-7394

6. Transporter 1 Company Name: Environmental Management Specialists, Inc
U.S. EPA ID Number: OHR000153312

7. Transporter 2 Company Name: Tradebe Environmental
U.S. EPA ID Number: IND000646943

8. Designated Facility Name and Site Address:
Tradebe Treatment Recycling
4343 Kennedy AVE.
East Chicago, IN 46312

U.S. EPA ID Number: IND000646943

Facility's Phone: 219-397-3951

9a. HM	9b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.	13. Waste Codes
X	1. UN2810, Waste Toxic Liquids, organic n.o.s. (methylene Chloride, lead) 6.1 II	1	DF	10	P	D007 U080 D008
X	2. UN1263 WASTE paint, 3, II	1	DM	55	P	D001 D005 D007
X	3. UN1993, Waste Flammable Liquids n.o.s. (methanol, methyl ethyl ketone) 3, II	2	DM	125 ~~220~~	P	D001 D007 D035 U154 U220
X	4. UN2375, Waste Amines, Liquid, corrosive, n.o.s. ([illegible]) 8, II	1	DF	10	P	D002

14. Special Handling Instructions and Additional Information
1 LP-01L (2I) 3 LP-01L (2F)
2 LP-02 (2I) 4 LP-01L (2I)
SO# 1614852
Labpacks
P.H. DAR000541?? on 11/30/17
1614852

15. **GENERATOR'S/OFFEROR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. If export shipment and I am the Primary Exporter, I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent.
I certify that the waste minimization statement identified in 40 CFR 262.27(a) (if I am a large quantity generator) or (b) (if I am a small quantity generator) is true.

Generator's/Offeror's Printed/Typed Name: Shane Mathers
Signature:
Month: 11 Day: 29 Year: 17

INT'L

16. International Shipments ☐ Import to U.S. ☐ Export from U.S.
Port of entry/exit:
Date leaving U.S.:
Transporter signature (for exports only):

TRANSPORTER

17. Transporter Acknowledgment of Receipt of Materials
Transporter 1 Printed/Typed Name: Troy Young
Signature: Troy Young
Month: 11 Day: 29 Year: 17

Transporter 2 Printed/Typed Name: Keith McDonough
Signature:
Month: 11 Day: 30 Year: 17

DESIGNATED FACILITY

18. Discrepancy
18a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection
Manifest Reference Number:

18b. Alternate Facility (or Generator)
U.S. EPA ID Number:
Facility's Phone:

18c. Signature of Alternate Facility (or Generator)
Month: Day: Year:

19. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)

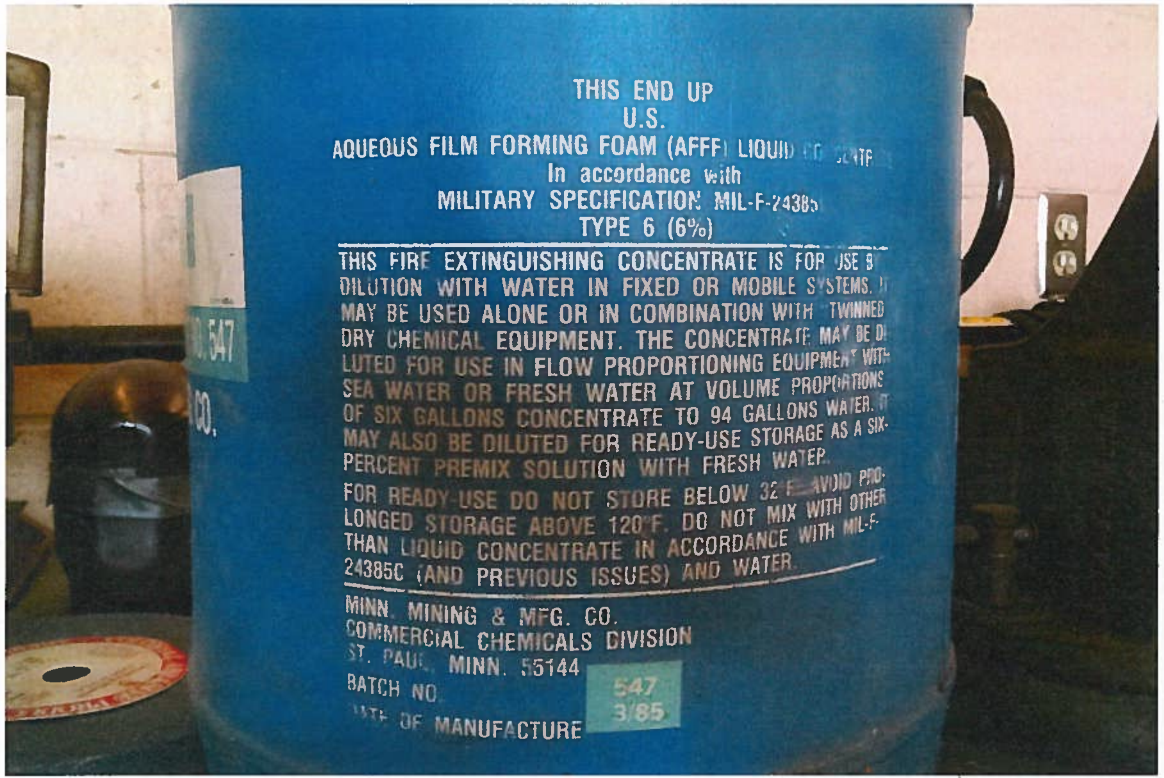
1.	2.	3.	4.
H141	H141	H061	H141

20. Designated Facility Owner or Operator: Certification of receipt of hazardous materials covered by the manifest except as noted in Item 18a
Printed/Typed Name: Larissa Banks
Signature: Larissa Banks
Month: 12 Day: 04 Year: 17

EPA Form 8700-22 (Rev. 3-05) Previous editions are obsolete.

DESIGNATED FACILITY TO GENERATO

Rickenbacker

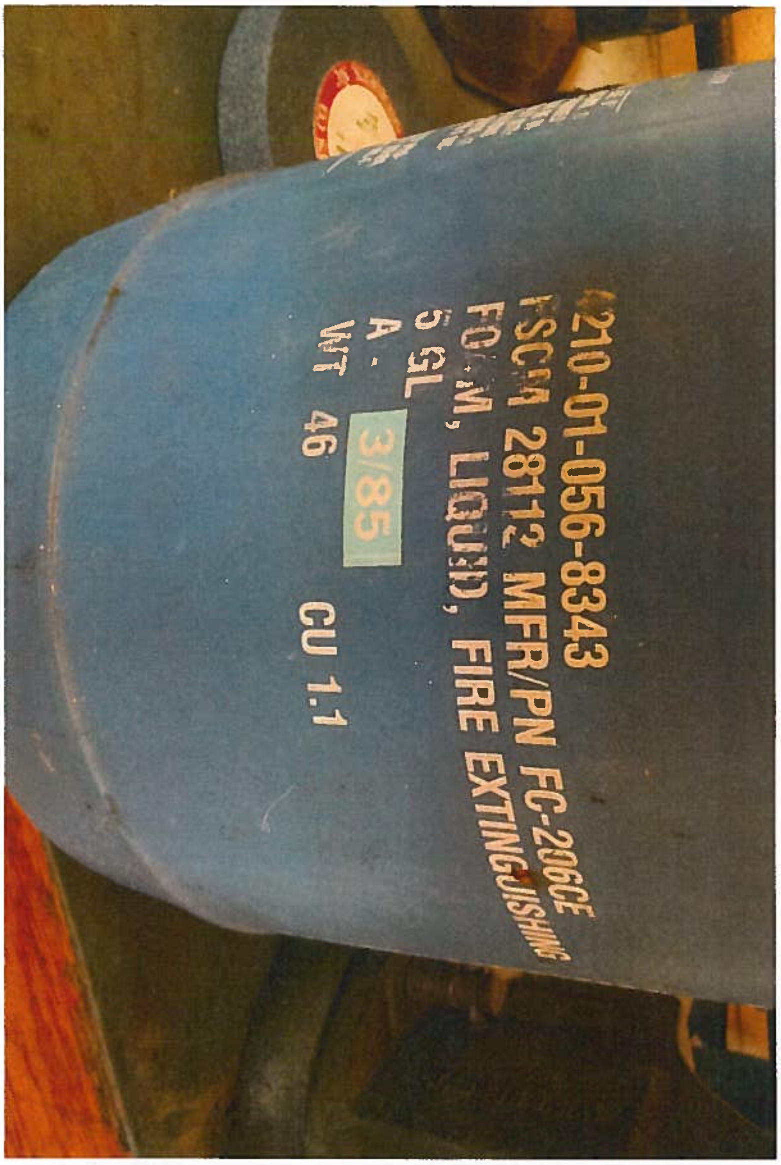


THIS END UP
U.S.
AQUEOUS FILM FORMING FOAM (AFFF) LIQUID CONCENTRATE
In accordance with
MILITARY SPECIFICATION MIL-F-24385
TYPE 6 (6%)

THIS FIRE EXTINGUISHING CONCENTRATE IS FOR USE B DILUTION WITH WATER IN FIXED OR MOBILE SYSTEMS. I MAY BE USED ALONE OR IN COMBINATION WITH TWINNED DRY CHEMICAL EQUIPMENT. THE CONCENTRATE MAY BE DILUTED FOR USE IN FLOW PROPORTIONING EQUIPMENT WITH SEA WATER OR FRESH WATER AT VOLUME PROPORTIONS OF SIX GALLONS CONCENTRATE TO 94 GALLONS WATER. I MAY ALSO BE DILUTED FOR READY-USE STORAGE AS A SIX-PERCENT PREMIX SOLUTION WITH FRESH WATER.

FOR READY-USE DO NOT STORE BELOW 32°F. AVOID PROLONGED STORAGE ABOVE 120°F. DO NOT MIX WITH OTHER THAN LIQUID CONCENTRATE IN ACCORDANCE WITH MIL-F-24385C (AND PREVIOUS ISSUES) AND WATER.

MINN. MINING & MFG. CO.
COMMERCIAL CHEMICALS DIVISION
ST. PAUL, MINN. 55144
BATCH NO. 547
DATE OF MANUFACTURE 3/85


4210-01-056-8343
FSCM 28112 MFR/PN FC-206CE
FOAM, LIQUID, FIRE EXTINGUISHING
5 GL
A. 3/85
WT 46 CU 1.1

[redacted] NFG NG OHARNG (US)

From: [redacted] NFG NG OHARNG (US)
Sent: Monday, July 2, 2018 11:22 AM
To: [redacted] NFG NG OHARNG (US)
Cc: [redacted] NFG NG OHANG (US)
Subject: AFFF Product 2 at AASF #2 - AASF #2 RAE
Attachments: IMG_20170825_135959108.jpg; IMG_20170825_140002423.jpg; IMG_20170825_140035524.jpg; IMG_20170825_140040180.jpg; 55.pdf

Ms. [redacted],

1. This is the second email concerning firefighting foam observed at the Army Aviation Support Facility #2 (AASF #2) during the 2017 EPAS evaluation.

2. Please let me or Shane know if you have any additional questions or concerns. Thank you.

Respectfully
[redacted]

55

MINNESOTA MINING & MFG CO INDUSTRIAL CHEM PRODUCTS -- FC-206CF LIGHT WATER BRAND AQUEOUS FILM FORMING FOAM -- 4210-01-056-8343

```
====================  Product Identification  ====================

Product ID:FC-206CF LIGHT WATER BRAND AQUEOUS FILM FORMING FOAM
MSDS Date:11/05/1997
FSC:4210
NIIN:01-056-8343
MSDS Number: CCVSV
=== Responsible Party ===
Company Name:MINNESOTA MINING & MFG CO INDUSTRIAL CHEM PRODUCTS
Address:3M CTR
City:SAINT PAUL
State:MN
ZIP:55144
Country:US
Info Phone Num:612-733-1000
Emergency Phone Num:612-733-5454
CAGE:28112
=== Contractor Identification ===
Company Name:MINNESOTA MINING AND MFG CO PERFOMANCE CHEM AND FLUIDS DIV
Address:3M CTR
Box:City:SAINT PAUL
State:MN
ZIP:55144-1000
Country:US
Phone:800-364-3577/651-737-6501
CAGE:28112

============  Composition/Information on Ingredients  ============

Ingred Name:WATER
CAS:7732-18-5
RTECS #:ZC0110000
Fraction by Wt: 78-81%
Other REC Limits:NONE RECOMMENDED

Ingred Name:DIETHYLENE GLYCOL MONOBUTYL ETHER
CAS:112-34-5
RTECS #:KJ9100000
Fraction by Wt: 3-7%
Other REC Limits:NONE RECOMMENDED

Ingred Name:UREA
CAS:57-13-6
RTECS #:YR6250000
Fraction by Wt: 3-7%
Other REC Limits:NONE RECOMMENDED

Ingred Name:ETHANOL, 2,2',2"-NITRILOTRI-; (TRIETHANOLAMINE)
CAS:102-71-6
RTECS #:KL9275000
Fraction by Wt: 0.1-1%
Other REC Limits:NONE RECOMMENDED
ACGIH TLV:5 MG/M3
```

CONTINER INA WELL-VENTILATED AREA.

Other Precautions:KEEP CONTAINER TIGHTLY CLOSED. DO NOT EAT, DRINK OR SMOKE WHEN USING THIS PRODUCT. AVOID BREATHING VAPORS, MIST OR SPRAY.

============= Exposure Controls/Personal Protection =============

Respiratory Protection:NONE NORMALLY REQUIRED. IF ENGINEERING CONTROLS FAIL OR NON-ROUTINE OR EMERGENCY OCCURS, USE NIOSH/MSHA-APPROVED RESPIRATOR WITH ORGANIC VAPOR CARTRIDGE OR SCBA OR SUPPLIED-AIR RESPIRATOR. USE IAW 29 CFR 1910.134.

Ventilation:USE WITH ADEQUATE DILUTION VENTILATION.

Protective Gloves:BUTYL RUBBER GLOVES.

Eye Protection:WEAR VENTED GOGGLES.

Other Protective Equipment:NO SMOKING WHILE USING PRODUCT. DSCR-VBA STAFF: EYE WASH STATION & SAFETY SHOWER.

Work Hygienic Practices:WASH THOROUGHLY AFTER HANDLING AND BEFORE EATING, DRINKING OR SMOKING. LAUNDER CONTAMINATED CLOTHING BEFORE REUSE.

Supplemental Safety and Health

HAZ DECOMPO PROD:CONCEN DOES NOT PRESENT HAZ. DISPO:INCLUDE HF.REGS VARY CONSULT APPLICABLE REG/AUTHORITIES BEF DISPO.IF UNCONTROLLED RELASE OCCUR DETERMINE IF RELASE QUALIFIES AS RQ.HAZ WASTE#:NONE.

================= Physical/Chemical Properties =================

HCC:N1
Boiling Pt:=100.C, 212.F
Vapor Pres:17.8 @20C
Vapor Density:0.69
Spec Gravity:1.03
VOC Pounds/Gallon:103
pH:8.5
Evaporation Rate & Reference:<1.0,(N-BUTYL ACETATE=1)
Solubility in Water:MISCIBLE.
Appearance and Odor:CLEAR, AMBER COLORED LIQUID.
Percent Volatiles by Volume:90

================= Stability and Reactivity Data =================

Stability Indicator/Materials to Avoid:YES

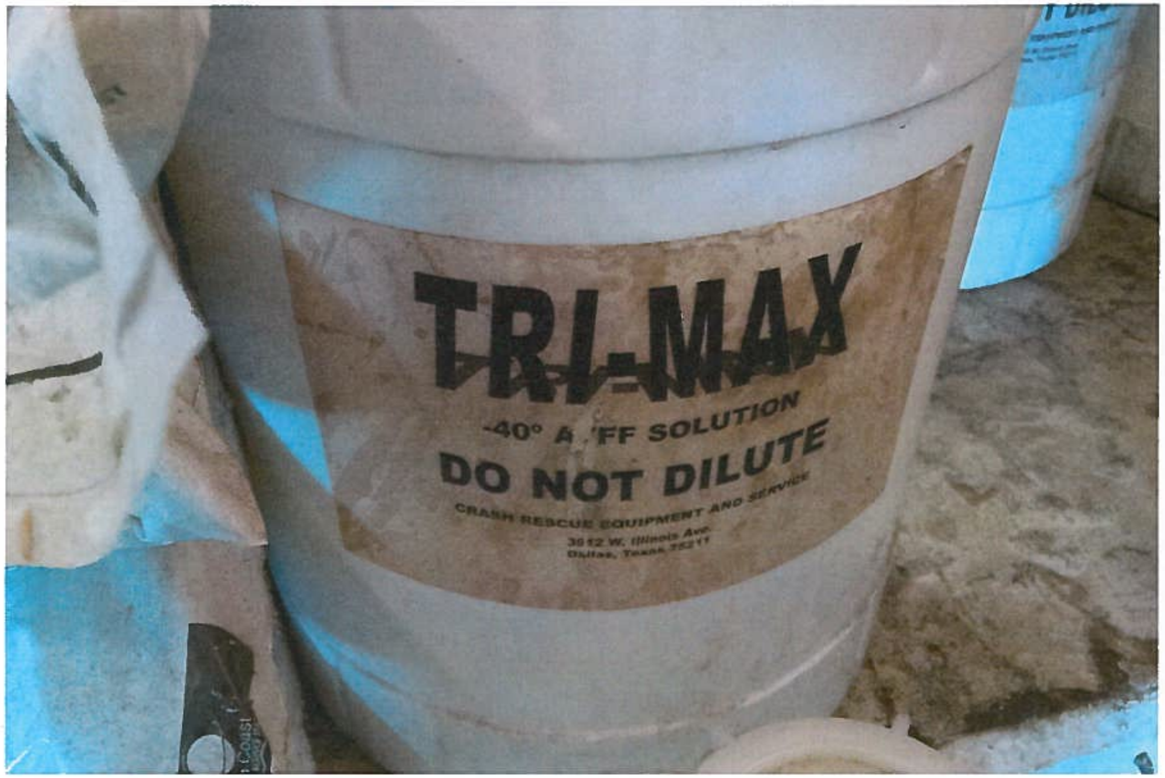
Stability Condition to Avoid:NONE SPECIFIED BY MANUFACTURER.

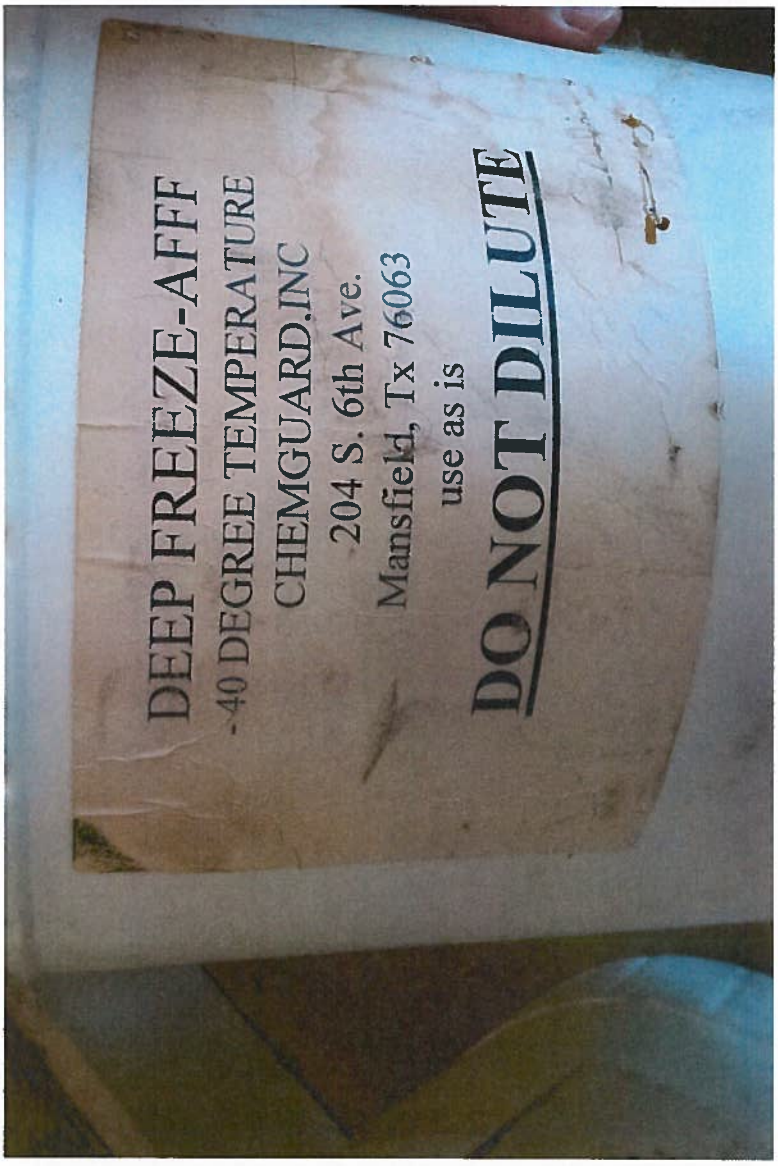
Hazardous Decomposition Products:CO,CO2,OXIDES OF NITROGEN,OXIDES OF SULFUR, HYDROGEN CYANIDE,HYDROGEN FLUORIDE,AMMONIA.THERM DECOMP OF USAGE (SUPPLEMENT

=================== Disposal Considerations ===================

Waste Disposal Methods:DISCHARGE SPENT SOLUTIONS TO WASTEWATER TREATMENT FACILITY. REDUCE RATE IF FOAMING OCCURS. INCINERATE IN AN INDUSTRIAL OR COMMERCIAL FACILITY IN PRESENCE OF SUITABLE COMBUSTIBLE MATERIAL. COMBUSTION P RODUCTS MAY INCLUDE HF.

Rickenbacker





DEEP FREEZE-AFFF
-40 DEGREE TEMPERATURE
CHEMGUARD,INC
204 S. 6th Ave.
Mansfield, Tx 76063
use as is

DO NOT DILUTE

[redacted] NFG NG OHARNG (US)

From: [redacted] NFG NG OHARNG (US)
Sent: Monday, July 2, 2018 11:21 AM
To: [redacted] NFG NG OHARNG (US)
Cc: [redacted] NFG NG OHANG (US)
Subject: AFFF Product 1 at AASF #2 - AASF #2 RAE
Attachments: IMG_20170825_140335996.jpg; IMG_20170825_140345222.jpg; IMG_20170825_140347779.jpg; IMG_20170825_140320626.jpg; 54.pdf

Ms. [redacted],

1. I am sending you pictures of the containers of firefighting foam observed at the Army Aviation Support Facility #2 (AASF #2) during the 2017 EPAS evaluation. This is the first of two emails; each email denoting a different AFFF product.

2. Mr. [redacted] and personnel from the flight facility worked to have the obsolete and unwanted AFFF products removed by contractor from the site. MSDS are included for each product.

3. Please let me or Shane know if you have any additional questions or concerns. Thank you.

Respectfully
[redacted]

54

CHEMGUARD INC.

204 S. 6th Avenue
Mansfield, Texas, USA 76063
817-473-9964
817-473-0606 fax
www.chemguard.com

MATERIAL SAFETY DATA SHEET

TRIMAX ARCTIC MINUS 40 DEGREE AFFF

SECTION I: Identity

Manufacturer
Chemguard, Inc.
204 South Sixth Ave.
Mansfield, TX 76063
(817) 473-9964
Emergency telephone (817) 473-9964

Chemical name: mixture
Chemical family: N/A
Formula: N/A
CAS No.: N/A

Revision date: 4-6-00

SECTION II: Ingredients

Hazardous Ingredients	%	CAS No.	ACGIH TLV	Other Limits
Ethylene glycol	30 – 40	107-21-1	127 mg/cubic meter	
Other Ingredients				
Proprietary mixture of water, fluorocarbon and hydrocarbon surfactants, solvents, and inorganic salts				
SARA Title III reportable components				
Ethylene glycol	30 – 40	107-21-1		

SECTION III: Physical/Chemical Characteristics

Boiling point: 212°-388°F.
Melting point: -45° - -50°F
Specific gravity: 1.50 g/ml
Vapor pressure (mm Hg): N/A
pH: 7.5 +/- 0.5

Flash point (PMCC): >155° F.
Vapor density (air = 1): N/A
Solubility in water: 100%
Evaporation rate (butyl acetate = 1): <1
Appearance and odor: clear slightly yellow liquid

SECTION IV: Fire and Explosion Hazard Data

Flash point (PMCC): >155°F. **Flammable Limits:** non-flammable
Extinguishing media: Compatible with CO2, water, foam, dry chemical and halon.
Special Fire Fighting Procedures: Follow usual fire fighting procedures.
Unusual Explosion Hazards: NONE

4. FACILITY MAINTENANCE

The grantee shall maintain and keep the premises in good repair and condition and all costs of operation, maintenance, and restoration shall be paid for from funds available to the grantee, or from funds other than those appropriated for the regular establishment of the military departments.

5. RIGHT TO USE

The United States, hereinafter referred to as the Government, reserves the right to use the premises, or any part thereof, including all buildings and improvements situated thereon, for such purposes as said officer deems necessary in the interest of national defense.

6. COST OF UTILITIES

The grantee shall pay the cost, as determined by the officer having immediate jurisdiction over the premises, of producing and/or supplying any utilities or other services furnished by the Government or through Government-owned facilities for the use of the grantee, including the grantee's proportionate share of the cost of operation and maintenance of the Government-owned facilities by which such utilities or services are produced and supplied. The Government shall be under no obligation to furnish utilities or services. Payment shall be made in the manner prescribed by the officer having such jurisdiction.

7. USE RESTRICTIONS

The buildings and improvements included in this license shall not be used for the quartering of personnel engaged in the national guard activities except when such personnel are in the federal service or are participating in authorized training.

8. IMPROVEMENTS AND ALTERATIONS

Additions to or alteration or improvement of the premises shall not be made without prior written approval of the District Engineer. All such additions, alterations or improvements shall be maintained by the grantee in good repair and condition. All such work designated as permanent by said officer shall, upon completion, become property of the Government.

9. CONDITION OF PREMISES

The grantee acknowledges that it has inspected the premises, knows its condition, and understands that the same is granted without any representations or warranties whatsoever and without any obligation on the part of the Government.

10. TERMINATION

This license may be terminated by the grantee at any time by giving the District Engineer at least thirty (30) days notice in writing.

11. RESTORATION

On or before the expiration of this license or its termination by the grantee, the grantee shall vacate the premises, remove its property (except those permanent additions, alterations, and improvements which have become property of the Government under provision of the condition on **IMPROVEMENTS AND ALTERATIONS**) and restore the premises to a condition satisfactory to said officer, ordinary wear and tear and damage beyond the control of the grantee excepted. If, however, this license is revoked, the grantee shall vacate the premises, remove said property and restore the premises within such time as the District Engineer may designate. In either event, if the grantee fails to remove said property and restore the premises, then, at the option of said officer, the property shall either become the property of the Government without compensation therefor, or said officer may cause the property to be removed at the expense of the grantee, and no claim for damages against the Government shall be created on account of such action.

12. USE BY OTHERS

The grantee shall not transfer or assign this license, or any interest in the premises, however, upon concurrence of the Director, National Guard Bureau, the grantee may (1) permit the temporary or intermittent use of the premises by elements of the Department of Defense for joint use or individual training purposes, provided such use will not interfere with the National Guard use; or (2) issue licenses for nonprofit, community service-type activities under the same conditions as those allowed by active installation commanders by existing Army regulations.

13. PROTECTION OF PROPERTY

a. The grantee shall keep the premises in good order and in a clean, safe condition by and at the expense of the grantee. The grantee shall be responsible for any damage that may be caused to property of the United States by the activities of the grantee under this license, and shall exercise due diligence in the protection of all property located on the premises against fire or damage from any and all other causes. Any property of the United States damaged or destroyed by the grantee incident to the exercise of the privileges herein granted shall be promptly repaired or replaced by the grantee to a condition satisfactory to said officer, or at the election of said officer, reimbursement made therefor by the grantee in an amount necessary to restore or replace the property to a condition satisfactory to said officer, in both instances taking into account the prior condition of the property.

b. Upon termination of the grantee's requirement for the premises, the grantee shall remain responsible to protect and maintain the premises until transfer to and acceptance by another accountability officer is accomplished or in accordance with applicable laws, rules and regulations.

14. ENVIRONMENTAL PROTECTION

a. Within the limits of their respective legal powers, the parties to this license shall protect the premises against pollution of its air, ground and water. The grantee shall comply with any laws, regulations, conditions or instructions affecting the activity hereby authorized if and when issued by the Environmental Protection Agency, or any Federal, state, interstate or local governmental agency having jurisdiction to abate or prevent pollution. The disposal of any toxic or hazardous materials within the premises is specifically prohibited. Such regulations, conditions or instructions in effect or prescribed by said Environmental Protection Agency, or any Federal, state, interstate or local governmental agency are hereby made a condition of this license. The grantee shall not discharge waste or effluent from the premises in such a manner that the discharge will contaminate streams or other bodies of water or otherwise become a public nuisance.

b. The grantee will use all reasonable means available to protect the environment and natural resources, and where damage nonetheless occurs from the grantee's activities, the grantee shall be liable to restore the damaged resources.

c. The grantee must obtain approval in writing from said officer before any pesticides or herbicides are applied to the premises.

15. HISTORICAL PRESERVATION

The grantee shall not remove or disturb, or cause or permit to be removed or disturbed, any historical, archeological, architectural, or other cultural artifacts, relics, or objects of antiquity. In the event such items are discovered on the premises, the grantee shall immediately notify said officer and protect the site and material from further disturbance until the said officer gives clearance to proceed.

16. NON-DISCRIMINATION

The grantee shall not discriminate against any person or persons or exclude them from participation in the grantee's operations, programs or activities conducted on the licensed premises because of race, color, religion, sex, age, handicap or national origin. The grantee by acceptance of this license, hereby gives assurance that it will comply with the provisions of Title VI of the Civil Rights Act of 1964 as amended (42 U.S.C. 2000d); the Rehabilitation Act of 1973 as amended (29 U.S.C. 794); and all requirements imposed by or pursuant to the Department of Defense Directive 5500.11 (32 CFR Part 195) issued on December 31, 1964.

17. MEMORANDUM OF AGREEMENT

A Memorandum of Agreement for the transition of the Management of Environmental Programs at Rickenbacker Air National Guard Base, Ohio, is attached hereto and made a part hereof as Exhibit "C". The National Guard Bureau will ensure that its tenants within the enclave perform required Environmental Compliance-Mission-Related (EC-MR) and program initiatives in accordance with any host-tenant agreements, to the extent within its control. No host-tenant agreements exist at this time.

THIS LICENSE is not subject to Title 10, United States Code, Section 2662, as amended.

IN WITNESS WHEREOF, I have hereunto set my hand by authority of the Secretary of the Army, this 9th day of September, 1998.

Michael G Barter
MICHAEL G. BARTER
CHIEF, REAL ESTATE DIVISION
CORPS OF ENGINEERS, LOUISVILLE DISTRICT
LOUISVILLE, KENTUCKY

This license is executed by the grantee this 15th day of AUGUST, 1998.

STATE OF OHIO
Adjutant General's Dept.

Tamara S. Little
Witness

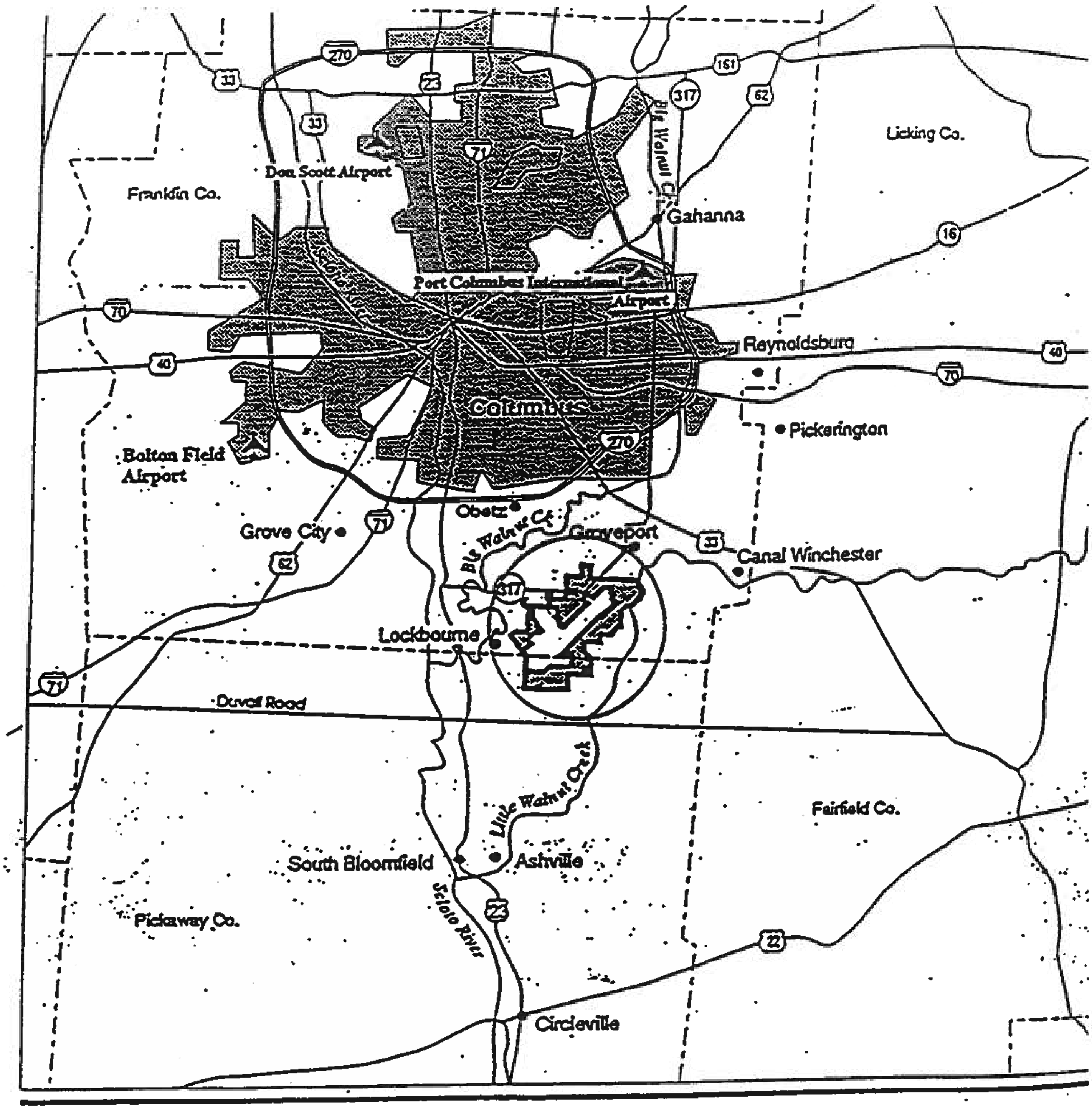
Ann Lechner
Witness

RC Alexander 15 Aug 98
RICHARD C. ALEXANDER DATE
Major General, OHARNG
The Adjutant General

George V Voinovich
GEORGE V. VOINOVICH
Governor of Ohio

8/21/98
DATE

RICKENBACKER ANGB OHIO
REGIONAL LOCATION MAP



EXPLANATION

— Rickenbacker Air National Guard Base Boundary

▨ Rickenbacker Port Authority Boundary

▨ City of Columbus

✈ Major Airport

N

Scale

0 5 10 15 20

Statute Miles

EXHIBIT A

LOCATION OF PROPERTY TO BE TRANSFERRED
RICKENBACKER ANGB OHIO

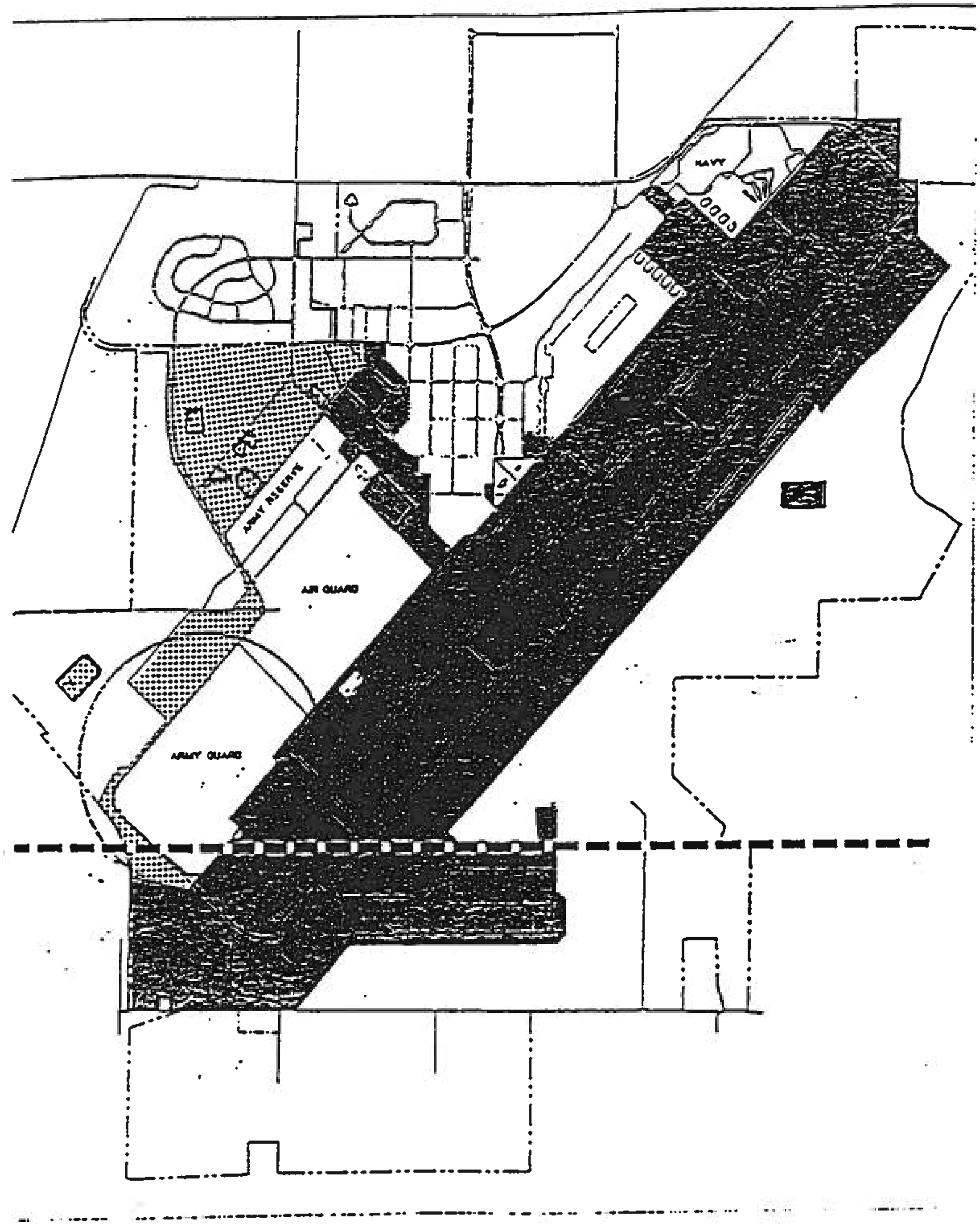


EXHIBIT A-1

P:\RICKENBA\MAPS.DOC

LOCATION OF PROPERTY TO BE TRANSFERRED
RICKENBACKER ANGB OHIO

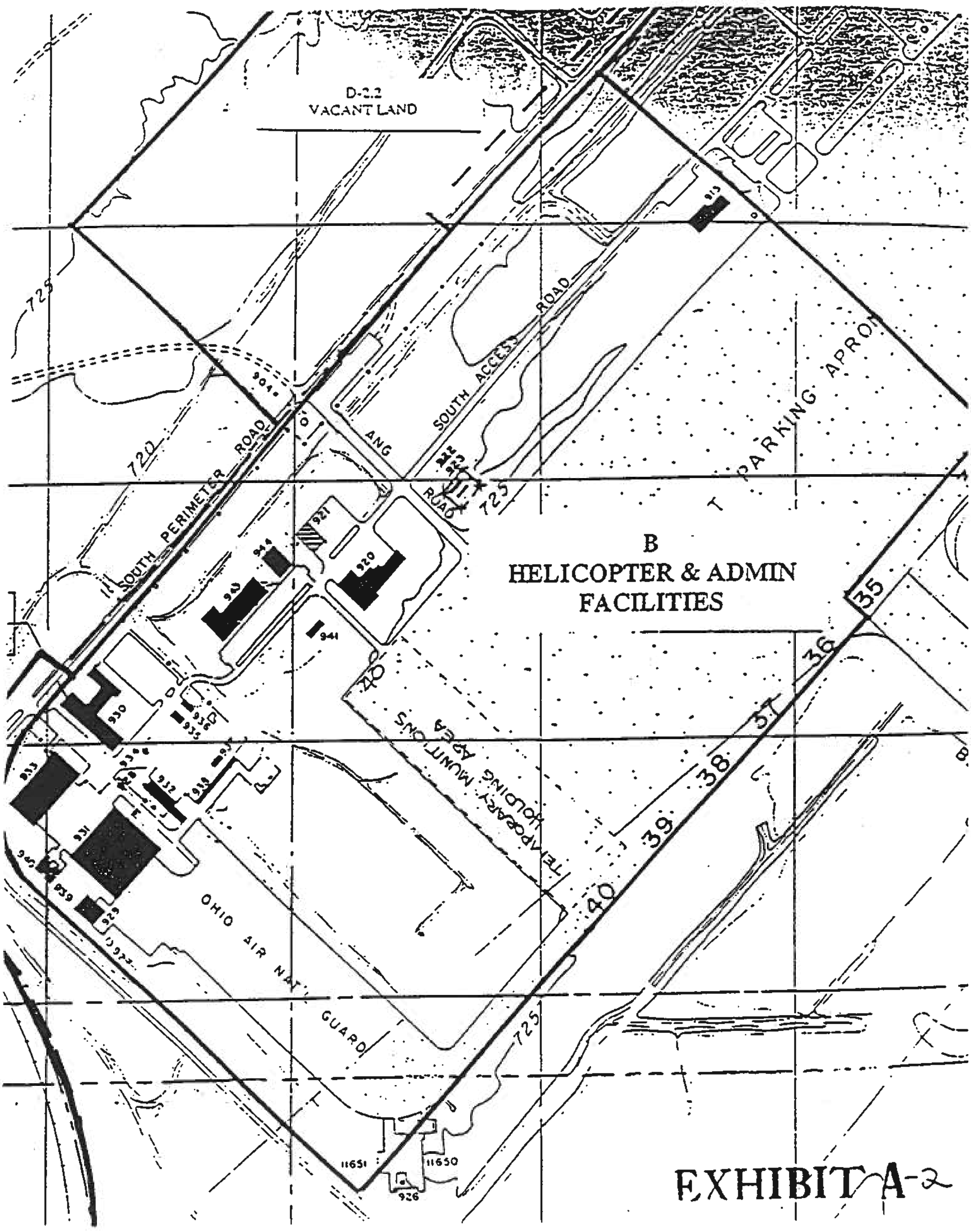


EXHIBIT A-2

Harry L Greene
ENGINEERING & SURVEYING
2122 Tremont Center, Columbus, Ohio, 43221-3110 (614) 486-0714 Fax (614) 486-5688

126.485 ACRES
STATE OF OHIO-ADJUTANT GENERAL'S DEPARTMENT
MAY 31, 1994

Situated in the State of Ohio, County of Franklin Township of Hamilton, and County of Pickaway Township of Harrison, being a part of Sections 11, 12, & 13, Township 3 North, Range 22 West, of Matthew's Survey of the Congress Lands, and being a part of the lands of the United States of America, as described in several tracts, recorded in Deed Book 1190, Page 474, Deed Book 1634, Page 644, Deed Book 1635, Page 104, Deed Book 1640, Page 340, Deed Book 1646, Page 418, of the Franklin County Recorder's Office, Franklin County, Ohio, and being more particularly described as follows:

Beginning for reference at the Franklin County Engineer's monument (number 9958) at the southwest corner of Section 12, said monument being on the line between Franklin and Pickaway Counties;

Thence South 86 degrees 13 minutes 48 seconds East, 471.42 feet along the south line of Section 12, being the county line, to a point where said line intersects a right-of-way line (herein being established) 45.00 feet northeasterly from and parallel to the centerline of the Perimeter Road, said point being the True Point of Beginning of the tract of land herein described;

Thence North 49 degrees 24 minutes 19 seconds West, 780.37 feet along said right-of-way line of Perimeter Road, to a point of curvature referenced by a one inch (1") I.D. Pipe set, North 45 degrees 35 minutes 41 seconds East, 1.00 feet;

Thence a chord of North 00 degrees 35 minutes 41 seconds East, 480.83 feet, along said right-of-way and a curve to the right having a radius of 340.00 feet, a delta angle of 90 degrees 00 minutes 00 seconds, and an arc length of 534.07 feet to the point of tangency referenced by a one inch (1") I.D. Pipe set, South 44 degrees 24 minutes 19 seconds East, 1.00 feet;

Thence North 45 degrees 35 minutes 41 seconds East, 2830.10 feet, along said right-of-way, to a concrete monument set;

Thence South 44 degrees 24 minutes 19 seconds East, 1529.68 feet, to a P.K. Nail set;

Thence South 45 degrees 34 minutes 41 seconds West, 934.15 feet, to a P.K. Nail set;

Thence South 44 degrees 25 minutes 19 seconds East, 259.79 feet, to a concrete monument set;

Thence South 45 degrees 34 minutes 41 seconds West, 1730.55 feet, to a concrete monument set;

EXHIBIT B

126.485 ACRES (CONT.)

Thence South 44 degrees 24 minutes 19 seconds East, 203.60 feet, to a one inch (1") I.D. Pipe set;

Thence South 45 degrees 35 minutes 41 seconds West, 505.48 feet, passing at 504.48 feet a one inch (1") I.D. Pipe set, to a point on said right-of-way line;

Thence North 44 degrees 24 minutes 19 seconds West, 873.48 feet along said right-of-way line to the point of beginning, containing 6.962 acres in Pickaway County, 119.523 acres in Franklin County, for a total of 126.485 acres, more or less, and being subject to all easements, restrictions, and right-of-ways of record;

The bearings are based upon the grid bearing of North 86 degrees 13 minutes 48 seconds West from the Ohio Coordinate System, South Zone, as determined by field measurement between Franklin County Engineer's monuments #9962 and #9958.

This description was prepared by Harry L. Greene, Engineering and Surveying, in May 1994, under the supervision of William E. Chaffin, Reg. Surveyor No. 7559. All iron pipes and concrete monuments have yellow identification caps marked "ROLLING S-5569".

"EXCEPTION ADDED"

EXHIBIT B

STATE OF OHIO
THE ADJUTANT GENERAL'S DEPARTMENT
2825 W. Dublin Granville Road
Columbus, Ohio 43235-2789

31 May 1996

Stated as a supplemental description to that prepared by Harry L. Greene, Engineering and Surveying. In May 1994 the following is an exception theirin described.

Excepting as follows:

From the true point of beginning South 44 degrees 24 minutes 19 seconds East, 607.03 feet to the point of beginning for the herein described tract;

Thence North 45 degrees 34 minutes 41 seconds East, 505.48 feet to a concrete monument;

Thence South 44 degrees 24 minutes 19 seconds East, 203.60 feet to an one inch (1") I.D. pipe;

Thence South 45 degrees 35 minutes 41 seconds West, 505.48 feet to an one inch (1") I.D. pipe;

Thence North 44 degrees 24 minutes 19 seconds West, 203.45 feet to the point of beginning, containing 2.36 acres, more or less.

This exception was prepared by the Director's office of Facilities Engineering for the Adjutant General's Department in the State of Ohio on 31 May 1996.

EXHIBIT B

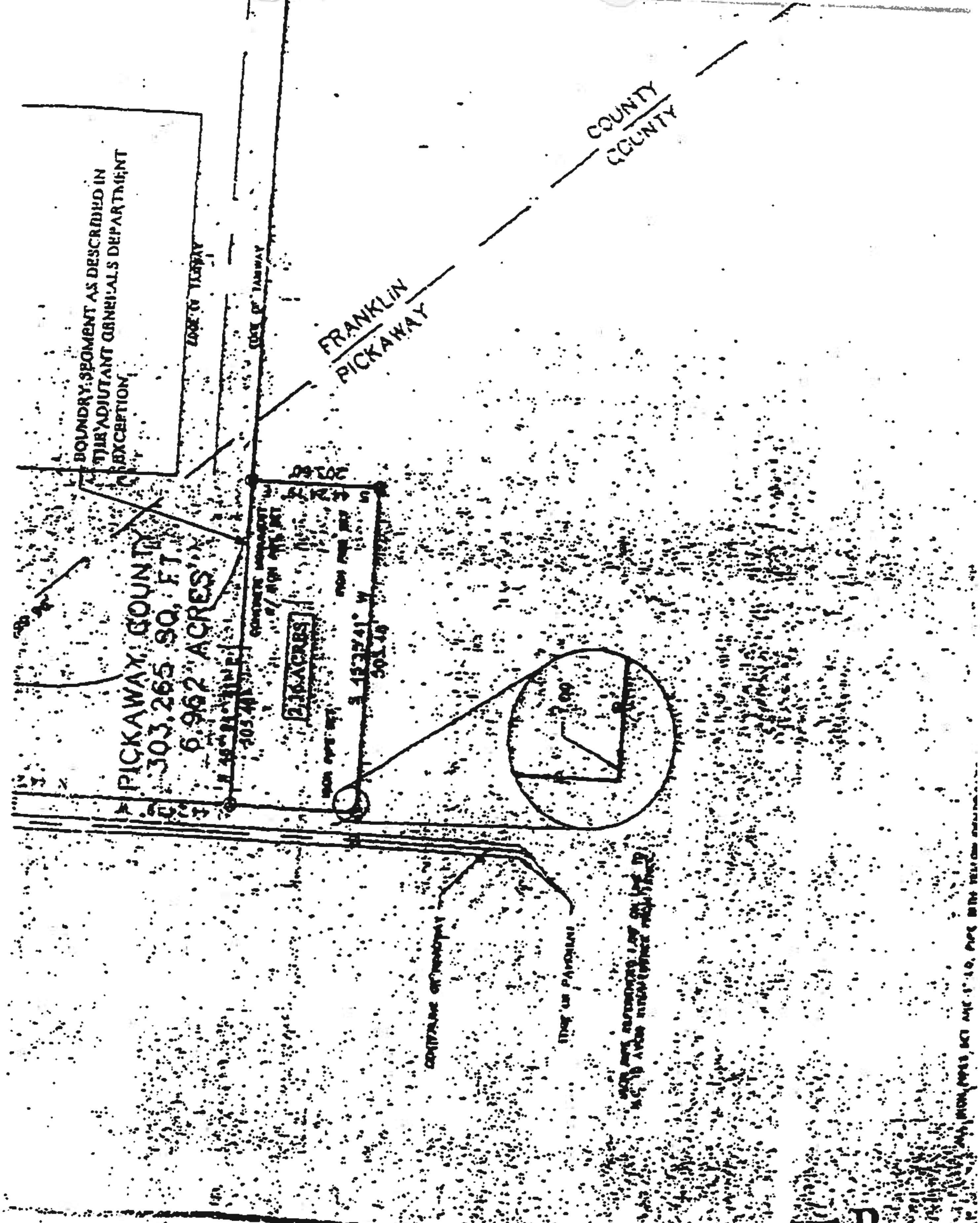

BOUNDRY SEGMENT AS DESCRIBED IN
THE ADJUTANT GENERALS DEPARTMENT
EXCEPTION
EDGE OF TAXIWAY
EDGE OF TAXIWAY
FRANKLIN
PICKAWAY
COUNTY
COUNTY
PICKAWAY COUNTY
303,265 SQ. FT.
6.962 ACRES
2.16 ACRES
207.60
303.40
301.40
S 15°37'41" W
CONCRETE MONUMENT W/ IRON PIN SET
IRON PIPE SET
IRON PIPE SET
7.00
CENTERLINE OF RUNWAY
EDGE OF PAVEMENT

EXHIBIT B

LINE 26

Situated in the State of Ohio, Franklin County, Hamilton Township, Township 3 North, Range 22 West, Sections 11 and 12, and Pickaway County, Harrison Township, Township 3 North, Range 22 West, Section 13.

Being a 20.00 foot wide easement lying 10.00 feet on each side of the following described centerline:

Beginning for reference at Franklin County monument # 9962 located at the southeast corner of the southwest quarter of Section 12, said point having state plane coordinates of 656344.314 North and 1842944.194 East;

thence with the east line of the southwest quarter, North 03 degrees 45' 36" East a distance of 4020.8 feet to a point;

thence North 86 degrees 14' 24" West a distance of 431.5 feet to the TRUE POINT OF BEGINNING;

thence with the center of the existing power line the following thirteen (13) courses:

(1) South 30 degrees 26'51" East a distance of 325.23 feet;
(2) South 51 degrees 57'35" East a distance of 371.02 feet;
(3) South 51 degrees 03'22" West a distance of 140.52 feet;
(4) South 45 degrees 31'53" West a distance of 1297.66 feet;
(5) North 64 degrees 49'24" West a distance of 297.86 feet;
(6) South 45 degrees 54'30" West a distance of 890.81 feet;
(7) South 44 degrees 49'41" East a distance of 284.58 feet;
(8) South 45 degrees 35'17" West a distance of 825.72 feet;
(9) South 58 degrees 40'51" West a distance of 350.62 feet;
(10) South 45 degrees 30'47" West a distance of 442.54 feet;
(11) South 12 degrees 46'33" West a distance of 106.88 feet;
(12) South 14 degrees 27'59" East a distance of 19.87 feet;
(13) South 44 degrees 24'55" East a distance of 1502.0 feet to the termination of this line.

This description is intended to encompass the entire length of this line including angle points and both ends.

Bearings are based on Ohio state plane coordinates (south zone). For additional information see plat of survey made in conjunction with and considered an integral part of this description. Description is based on a survey made in May of 1996 by Tobin-McFarland Surveying Inc. and was prepared by Rodney McFarland, Registered Professional Surveyor No.6416.

Rodney McFarland

Rodney McFarland, P.S.
May 29, 1996

EXHIBIT B-1

LINE 29

Situated in the State of Ohio, Franklin County, Hamilton Township, Township 3 North, Range 22 West, Section 11.

Being a 20.00 foot wide easement lying 10.00 feet on each side of the following described centerline:

Beginning for reference at Franklin County monument # 9962 located at the southeast corner of the southwest quarter of Section 12, said point having state plane coordinates of 656344.314 North and 1842944.194 East;

thence with the east line of the southwest quarter, North 03 degrees 45' 36" East a distance of 592.9 feet to a point;

thence North 86 degrees 14'24" West a distance of 2703.8 feet to the TRUE POINT OF BEGINNING;

thence North 44 degrees 20'01" West a distance of 241.84 feet;

thence North 05 degrees 11'22" East a distance of 34.49 feet;

thence North 44 degrees 23'18" East a distance of 90.59 feet to the termination of this line.

This description is intended to encompass the entire length of this line including angle points and both ends.

Bearings are based on Ohio state plane coordinates (south zone). For additional information see plat of survey made in conjunction with and considered an integral part of this description. Description is based on a survey made in May of 1996 by Tobin-McFarland Surveying Inc. and was prepared by Rodney McFarland, Registered Professional Surveyor No.6416.

Rodney McFarland

Rodney McFarland, P.S.
May 29, 1996

EXHIBIT B-1

LINE 30

Situated in the State of Ohio, Franklin County, Hamilton Township, Township 3 North, Range 22 West, Sections 11 and 12.

Being a 20.00 foot wide easement lying 10.00 feet on each side of the following described centerline:

Beginning for reference at Franklin County monument # 9962 located at the southeast corner of the southwest quarter of Section 12, said point having state plane coordinates of 656344.314 North and 1842944.194 East;

thence with the east line of the southwest quarter, North 03 degrees 45' 36" East a distance of 592.9 feet to a point;

thence North 86 degrees 14'24" West a distance of 2703.8 feet to the TRUE POINT OF BEGINNING;

thence South 44 degrees 29'09" East a distance of 133.32 feet to the termination of this line.

This description is intended to encompass the entire length of this line including angle points and both ends.

Bearings are based on Ohio state plane coordinates (south zone). For additional information see plat of survey made in conjunction with and considered an integral part of this description. Description is based on a survey made in May of 1996 by Tobin-McFarland Surveying Inc. and was prepared by Rodney McFarland, Registered Professional Surveyor No.6416.

Rodney McFarland

Rodney McFarland, P.S.
May 29, 1996

EXHIBIT B-1

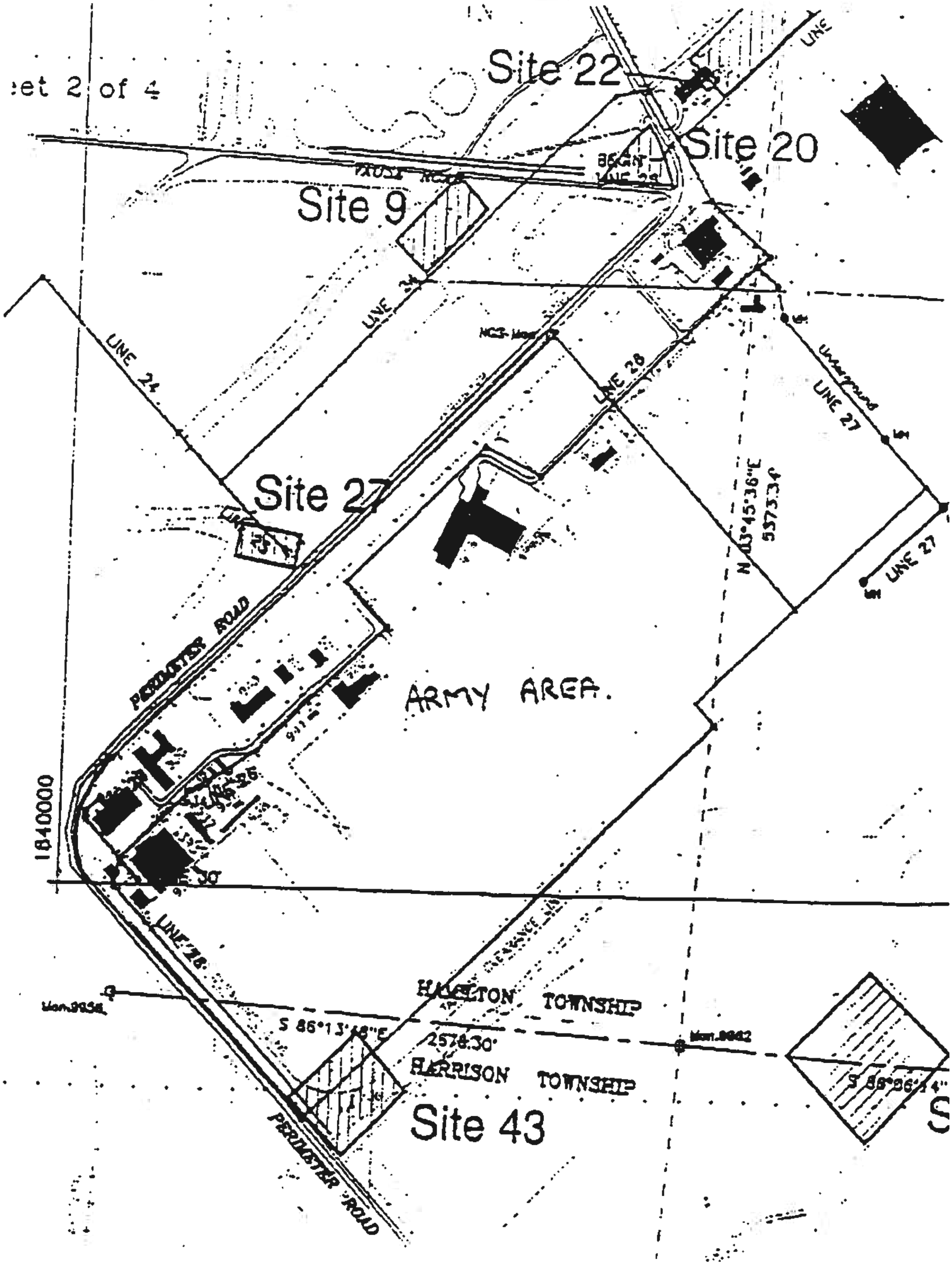

et 2 of 4
Site 22
Site 20
BEGIN LINE 23
Site 9
LINE 34
LINE 24
LINE 28
Underground
LINE 27
N 03°45'36"E
5575.34'
Site 27
PERIMETER ROAD
ARMY AREA.
1840000
LINE 30
LINE 28
Mon.9958
HAMILTON TOWNSHIP
S 86°13'48"E
2578.30'
Mon.9942
HARRISON TOWNSHIP
Site 43
PERIMETER ROAD
S 86°06'14"

EXHIBIT B-1

MEMORANDUM OF AGREEMENT FOR TRANSITION OF THE MANAGEMENT OF ENVIRONMENTAL PROGRAMS AT RICKENBACKER ANGB, OHIO

1. PURPOSE

This Memorandum of Agreement (MOA) is among the Air Force Base Conversion Agency (AFBCA); the State of Ohio Adjutant General's Department and the National Guard Bureau (NGB). This MOA defines the parties' roles and responsibilities dealing with base environmental initiatives during and after the environmental program transfer and attendant real property transfer, for purposes of coordinating fiscal resources and expenditures.

2. BACKGROUND

Rickenbacker ANGB was closed under the authority of the Defense Base Closure and Realignment Act of 1990 (DBCRA-90), Public Law 101-510. As a result, the AFBCA assumed caretaker responsibility for the base and its environmental program. During the closure screening process, the Department of the Army requested certain land and buildings (hereafter called the "enclave") for use by the Ohio Army National Guard (OHARNG).

The Air Force is both committed to and required by law to satisfy fully certain environmental restoration and compliance requirements. These requirements will continue concurrently with base closure and property disposal actions. Unless an Installation Restoration Program activity within the enclave results from ARNG activities, AFBCA will continue its programmed IRP activities within the enclave, except Remedial Designs/Remedial Actions (RDs/RAs), unless otherwise specified in this agreement.

Ongoing environmental restoration and site remediation on Rickenbacker ANGB for hazardous substances contamination is governed by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, and other Applicable or Relevant and Appropriate Requirements (ARARs), amendments, and implementing regulations.

EXHIBIT C

3. SCOPE

The AFBCA agrees to continue the IRP and Environmental Compliance-Closure-Related (EC-CR) activities within the enclave identified in the BRAC Cleanup Plan (BCP) developed by the BRAC Cleanup Team Project Team (BCTPT) until its programmed activities at Rickenbacker cease, except as otherwise specified in this agreement. This agreement will not affect AFBCA's programmatic, management and issue resolution responsibilities associated with the IRP and EC-CR programs at Rickenbacker ANGB outside the enclave. The following environmental permits will be maintained by the AFBCA until the AFBCA transfers them or disposes of the property, but will not be transferred to NGB for the benefit of the OHARNG:

PERMIT	PERMIT No.
NPDES Permit	41000000-BD
Hazardous Waste Interim Status Permit (USEPA)	OH351924544
Conditionally Exempt Generator	OH000553826

AFBCA, through its service and contract agents, will be responsible for the Environmental Impact Analysis Process (EIAP) at Rickenbacker ANGB, Disposal and Reuse Environmental Impact Statement (EIS) and Environmental Baseline Surveys (EBSs) as they relate to reuse activities. The NGB will ensure that the AFBCA and its agents receive full cooperation and access to the enclave, as necessary, for investigation and cleanup projects.

NGB will ensure that its tenants within the enclave perform required Environmental Compliance- Mission-Related (EC-MR) and program initiatives in accordance with any host-tenant agreements, to the extent within its control. No host-tenant agreements exist at this time.

4. RESPONSIBILITIES

a. The National Guard Bureau and Ohio Adjutant General's Department shall:

EXHIBIT C

(1) P[illegible]orm IRP and EC-CR program[illegible]ing, budgeting and execution in the enclave except AFBCA shall complete the following:

(a) The No Further Response Action Planned (NFRAP) for IRP site 36.

(b) Any additional field investigation that is included in the Supplemental Remedial Investigation/Feasibility Study (RI/FS) Work Plan currently being developed by an AFBCA contractor for IRP site 25, the Base Storm Drainage System. No Remedial Design/Remedial Action (RD/RA) will be performed for the portion of IRP site 25 located within the enclave by the AFBCA.

(c) Furnish all documentation related to IRP site 37, removal of an underground storage tank (UST) at Facility 944, and will be available to consult with the Ohio Environmental Protection Agency (EPA) for "closure" of site 37.

(d) The parties anticipate that all EBS sites found on the enclave will, when the applicable EBS document is finalized, require no further remedial action (RA). If any such further RA is required at those EBS sites, then the parties agree to conduct future negotiations to appropriately apportion the cost of the RA according to BRAC appropriation rules.

(2) Manage and monitor the pollution prevention programs in the enclave and coordinate with the OHANG Base Fire Department and Rickenbacker Port Authority for inclusion in the Rickenbacker International Airport Spill Plan.

(3) Conduct inspections to ensure that all environmental hazards are identified and remedied IAW all Federal, state and local regulations. Continue any Long Term Monitoring requirements not required as a result of non-OHARNG activity until programmed activities cease.

(4) Concurrent with the AFBCA, notify EPA and other regulatory agencies of the transfer of environmental responsibilities identified under this MOA, when this agreements takes effect.

(5) Establish hazardous material and waste storage facilities for the enclave.

(6) Perform RD/RA for the portion of IRP site 25, the former base storm drainage system within the enclave, if the RI/FS discloses that RD/RA is required

EXHIBIT C

(7) Perform or maintain any environmental actions required for all existing Underground Storage Tanks (USTs) within the enclave, including the abandoned hydraulic oil UST at Facility 944.

(8) Obtain a new National Pollutant Discharge Elimination System (NPDES) permit for the portion of the former base storm drainage system within the enclave. Sample and monitor wastewater discharge and storm water quality at selected locations around the enclave IAW Federal, state and local regulations.

(9) Appoint a knowledgeable employee to participate in the BCTPT and Restoration Advisory Board (RAB) meetings to represent the enclave in environmental issues.

(10) Respond to any Notice of Violation (NOV) brought about through actions or omissions of the OHARNG in the enclave.

(11) Protect endangered species, cultural resources, wetlands, and other sensitive habitats in the enclave, as identified in the Rickenbacker EIS.

(12) Conduct EIAP for those proposed actions necessary to support the enclave after its creation by real estate transfer including issuing permits or licenses for any part(s) of the enclave to other units and conduct Environmental Baseline and Close-out Surveys for subsequent real estate transactions with tenants after creation of the enclave.

(13) Assist the AFBCA in the preparation of air emission inventory documents as required by State and local regulations until the AFBCA ceases its operations at Rickenbacker.

(14) Ensure IAW Army and National Guard regulations that the water system within the enclave is maintained IAW Federal, state and municipal requirements, to the extent possible.

(15) Execute special programs (PCBs, radon, asbestos, radioactive materials and future programs) in the enclave, IAW Federal, state, and local regulations and permits.

EXHIBIT C

(16) Cooperate fully with the AFBCA or its agents in the conduct of closure-related environmental actions and investigations, but will not accept financial liability for outstanding statutory violations within the enclave not resulting from OHARNG activities.

(17) Accomplish all Department of the Army, NGB and State of Ohio coordination and EC-MR requirements in support of this MOA, to include appropriate real estate actions.

b. The AFBCA shall:

(1) Provide documents which identify IRP and EC-CR requirements, and cooperate in the preparation of appropriate programming and narrative documentation (e.g. DD 1391) for validation by NGB. No EC-CR requirements have been identified at this time.

(2) Execute the following according to the BCP:

(a) Complete the NFRAP for IRP site 36.

(b) Complete any additional field investigation that is included in the Supplemental RI/FS Work Plan for IRP site 25, the former base storm drainage system. No RD/RA is required at this time for the portion of IRP site 25 located within the enclave, based on the information now available.

(c) Furnish all documentation related to IRP site 37, removal of a UST at Facility 944, and coordinate obtaining concurrence from Ohio EPA for closure of site 37.

(d) Maintain responsibility and accept liability for management, programming, budgeting and execution of any IRP and EC-CR sites not resulting from OHARNG activity, except as otherwise expressly indicated in this agreement.

(3) Concurrent with the NGB, notify EPA and other regulatory agencies of the transfer of environmental responsibilities identified under this MOA.

EXHIBIT C

(4) Transfer all information and records concerning environmental programs within the enclave to the NGB within 3 months of the activation of this MOA.

5. AMENDMENTS

This MOA may be amended at any time through mutual agreement of the principal parties, or its or their successor organizations.

6. EFFECTIVE DATE

The effective date of this MOA will be the date of last party's signature.

7. TERMINATION DATE

This MOA will terminate on a date mutually agreed to by the parties, or their successor organizations.

EXHIBIT C

MEMORANDUM OF AGREEMENT
FOR
TRANSITION OF THE MANAGEMENT OF ENVIRONMENTAL PROGRAMS AT RICKENBACKER ANGB, OHIO

Air Force Base Conversion Agency

By: ____________________ June 12, 1996
DIRECTOR
DATE

United States Departments of Army & Air Force
National Guard Bureau

By: William L Zieber 10 June 1996
WILLIAM L. ZIEBER, COL, NGB
USP&FO for Ohio
DATE

State of Ohio
Adjutant General's Dept.

By: ____________________ 10 June 96
RICHARD C. ALEXANDER
MG, OHARNG
The Adjutant General
DATE

EXHIBIT

②

INSTALLATION RESTORATION PROGRAM

RICKENBACKER AIR NATIONAL GUARD BASE
COLUMBUS, OHIO

SITE INSPECTION/REMEDIAL INVESTIGATION/ FEASIBILITY STUDY/REMEDIAL DESIGN

WORK PLAN
FINAL

JUNE 1988

HAZWRAP SUPPORT CONTRACTOR OFFICE
Oak Ridge, Tennessee 37831
Operated by MARTIN MARIETTA ENERGY SYSTEMS, INC.
For the U.S. DEPARTMENT OF ENERGY under contract DE-AC05-840R21400

Report Document Page

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Work Plan

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Engineering - Science
19101 Villaview Road - Suite 301
Clevland, Ohio 44119

8. Performing Organization Report number

9. Sponsoring/Monitoring Agency Name(s) and Address(es)

Hazardous Waste Remedial Action Program
Oak Ridge TN

Air National Guard Readiness Center
Andrews Air Force Base, Maryland 20331

10. Sponsoring/Monitoring Agency Report Number

11. Supplemental Notes

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13. Abstract (maximum 200 words)

This work plan was prepared by Engineering Science for implementation of a Site Inspection/ Remedial Investigation/ Feasibility Study/ Remedial Design under the Installation Restoration Program at Rickenbacker Air National Guard Base, Columbus, Ohio. The purpose of the investigation is confirm or deny the presence or absence of contamination at 23 identified sites. Included in this document is the Quality Assurance/ Quality Control protocols, the Health and Safety Plan and the short term community relation plan.

14. Subject Terms

15. Number of Pages

16. Price Code

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INSTALLATION RESTORATION PROGRAM

SITE INSPECTION/REMEDIAL INVESTIGATION/ FEASIBILITY STUDY/REMEDIAL DESIGN WORK PLAN
FINAL

RICKENBACKER AIR NATIONAL GUARD BASE
Columbus, Ohio

JUNE 1988

Prepared By

ENGINEERING-SCIENCE
19101 Villaview Road - Suite 301
Cleveland, Ohio 44119

Submitted By

HAZARDOUS WASTE REMEDIAL ACTIONS PROGRAM

Operated By

MARTIN MARIETTA ENERGY SYSTEMS, INC.
Oak Ridge, Tennessee

For The

U.S. DEPARTMENT OF ENERGY

Under Contract No.: DE-AC05-840R21400

Submitted To

NATIONAL GUARD BUREAU
ANGSC/DEV
Andrews AFB, Maryland

886DDR/110:15

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

Page

SECTION 2. (cont)

SECTION 3. SITE INSPECTION

SECTION 5. FIELD INVESTIGATION TECHNIQUES

TABLE OF CONTENTS (continued)

Page

SECTION 6. SAMPLING AND ANALYTICAL PLAN

SECTION 7. LABORATORY ANALYTICAL QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) PLAN

SECTION 8. PROJECT SCHEDULE

TABLE OF CONTENTS (continued)

LIST OF FIGURES

LIST OF FIGURES
(continued)

LIST OF TABLES

SECTION 1
INTRODUCTION

This Work Plan has been prepared by Engineering-Science (ES) for Martin Marietta Energy Systems (Energy Systems) and the National Guard Bureau (NGB) for implementation of a Site Inspection/Remedial Investigation/Feasibility Study/Remedial Design (SI/RI/FS/RD) under the Installation Restoration Program (IRP) at Rickenbacker Air National Guard Base (ANGB), Columbus, Ohio. The preparation of this Work Plan was authorized by Energy Systems under General Order No. 18B-97387C through Task Order No. X-13, Advance Agreement AAX-13. The objectives of the SI/RI/FS/RD are: (1) to confirm the presence or absence of environmental contamination, and to quantify the levels of contaminants, if found, at past hazardous waste disposal and spill sites; (2) if contamination is found at a site, to determine the source and the extent of the contamination; (3) to determine whether or not the sites require remedial action; (4) to prepare a Remedial Action Plan (RAP); (5) if directed by the National Guard Bureau (NGB), to develop plans and specifications for implementation of remedial action (for those sites where such action is warranted because of environmental contamination); and (6) to provide technical support to the Base Contracting Officer during contractor selection and to the Base Project Officer during remediation activities.

Section 2 of this Work Plan presents the tasks required to meet the objectives described above. Sections 3 through 7 present the scope of the Site Inspection and Remedial Investigation, procedures and methods, and Quality Assurance/Quality Control (QA/QC) protocols. The schedule for implementation of the SI/RI is presented in Section 8. The Health and Safety Plan and Short-Term Community Relations Plan are included in the Work Plan as Appendices A and B, respectively. The remainder of this section provides a summary of the background information which forms the basis for the development of this Work Plan. Documents which were reviewed prior to preparation of these plans are as follows:

- Hazardous Materials Technical Center, Installation Restoration Program Phase I, Records Search, Rickenbacker Air National Guard Base, Columbus, Ohio, June 1987.
- Schmidt, J.J., and Goldthwait, R.P., The Ground-Water Resources of Franklin County, Ohio: Bulletin 30, Ohio Department of Natural Resources, Division of Water, 1958.
- Pierce, L.J., 1959, The Climate of Ohio; in Climates of the States, Volume 1 - Eastern States; Water Information Center, Inc., 1974, pp. 300-317.
- Soil Conservation Service, 1976, Soil Survey of Franklin County, Ohio; USDA, Soil Conservation Service, 188 p. and 69 sheets.
- Ecology and Environment, Inc. 1986, Site Inspection Report, Lockbourne/ Rickenbacker ANG Base, Landfill Investigation, Draft Report.
- Martin Marietta Energy Systems, Inc., Statement of Work for Site Inspection, Remedial Investigation, Feasibility Study, and Remedial Design at Rickenbacker Air National Guard Base, Columbus, Ohio, August 31, 1987.

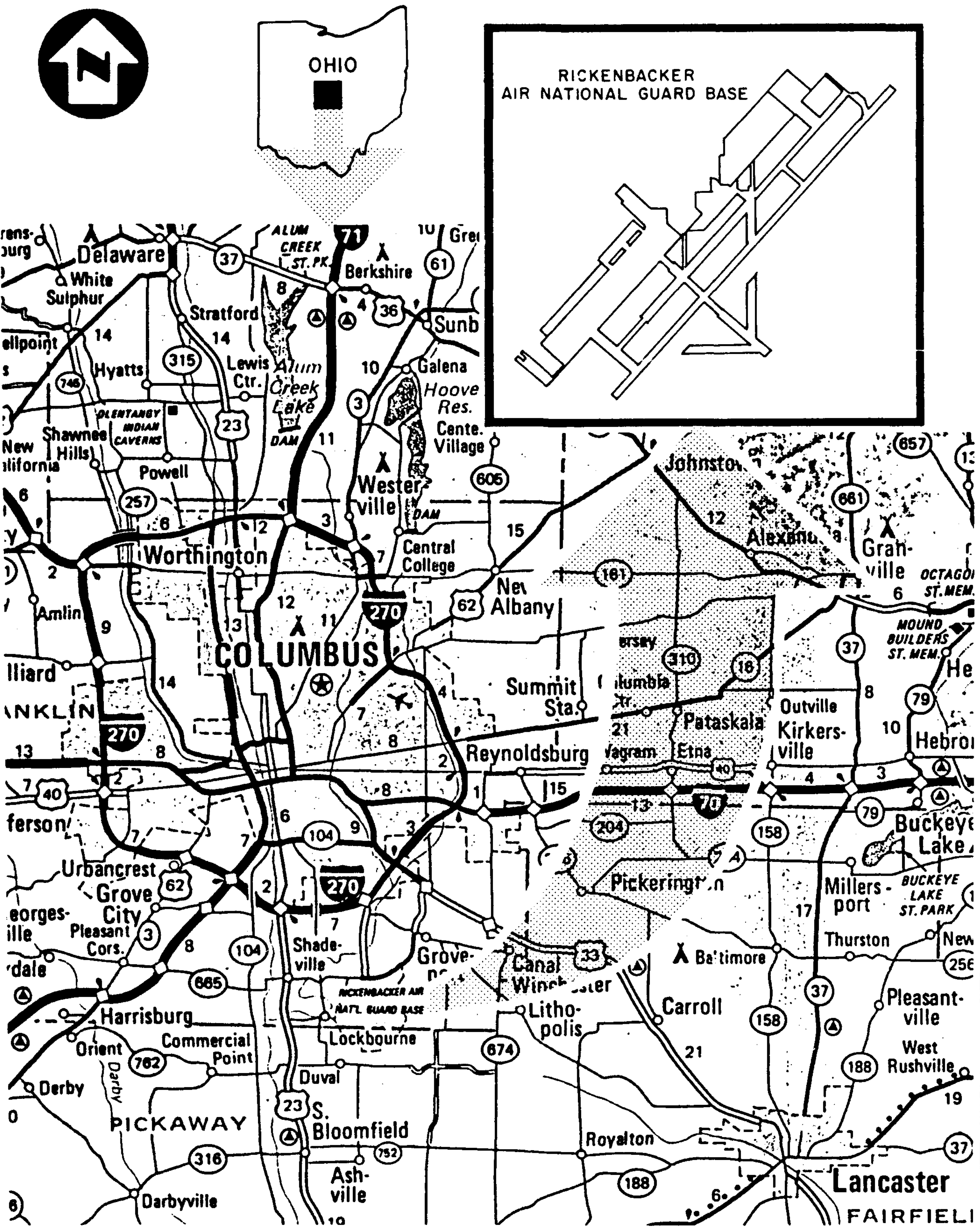
INSTALLATION DESCRIPTION AND HISTORY

The Rickenbacker ANGB is located 12 miles southeast of Columbus and 0.5 miles east of the Village of Lockbourne, Ohio (Figure 1.1). The Base currently covers approximately 2,100 acres. Ownership of a portion of the Base was transferred from the U.S. Air Force to the Rickenbacker Port Authority (RPA) in 1982. The RPA property is used as an airstrip for private aircraft and as base of operations for Flying Tigers' air delivery service. The Base occupies a plateau separating the Big Walnut and Walnut Creek Drainage Basins. Approximate elevation of the Base is 740 feet (MSL).

Rickenbacker ANGB, known as Lockbourne Air Force Base until 1974, was officially activated as the Southeastern Training Center, Army Air Corps in 1942, and used as a training center for glider pilots. In 1943, glider training was discontinued and a school for B-17 pilots was established at the Base.

In 1949, the Base was deactivated by the Air Force and used for 18 months as an Ohio ANG training base until 1951, when the Base was transferred to the Strategic Air Command (SAC) and reactivated as an Air Force Base in response to the Korean Conflict. In 1958, the 301st Bombardment Wing moved to the Base. In June 1964, the 301st Bombardment Wing was redesignated as the 301st Air Refueling Wing and began flying KC-135 Strato Tankers out of the Base. The SAC refueling mission of the 301st Air Refueling Wing is continued today at Rickenbacker by the 160th Air Refueling Group of the Ohio ANG, which moved to the Base in 1972. In July

FIGURE 1.1



LOCATION MAP

RICKENBACKER AIR NATIONAL GUARD BASE

SOURCE:
MAP OF OHIO
AMERICAN AUTOMOBILE ASSOCIATION

1965, the 840th Air Division of the Tactical Air Command moved to Rickenbacker with its C-130 Hercules Cargo Aircraft and took command of the Base. In 1971, command of the Base was again transferred to SAC under the 301st Air Refueling Wing. Also in 1971, the Air Force Reserve's (AFRES) 302nd Tactical Airlift Wing (TAW) moved to Rickenbacker from the Clinton County Air Base. The 302nd TAW flew C-130A cargo planes in support of their airlift mission. In 1981, the 302nd TAW vacated Rickenbacker ANGB, and its units were converted to the 907th Tactical Airlift Group (TAG) (AFRES), C-130A's and the aircraft currently being used by the 907th TAG. The 907th Aerial Spray Branch, under the 907th TAG, is responsible for aerial pesticide spraying missions at other bases around the country (pesticides used by the 907th Aerial Spray Branch are not stored or transported at Rickenbacker ANGB, but are supplied by the Base being sprayed). In 1977, SAC vacated the Base and turned control of the Base over to Detachment 1 Ohio ANG (121 COS), who presently serve as the Base host. In addition to the 160th Air Refueling Group (Ohio ANG) and the 907th TAG (AFRES), the 121st Tactical Fighter Wing (Ohio ANG) is also a current tenant at Rickenbacker. The 121st has been at Rickenbacker since 1949, previously flying F-100s and currently flying A-7Ds. As many as 5,000 people have worked on the Base in its history. Currently, 1,100 people are on the Base daily.

Land use adjacent to the Base is residential and agricultural. The houses and apartments in the northwest corner of the Base which were formerly occupied by Base personnel have been purchased by a private developer and are being rented. The Base and former Base housing use water supplied from Base water wells.

North of the Base lies open agricultural land with some residential development along Alum Creek Drive. East of the Base is agricultural land and residential development along the major roads. South of the Base is the former Base golf course which is now privately owned, trailer parks and widely spaced single-family homes. To the West is the Norfolk and Western and Chesapeake and Ohio railroad tracks, the abandoned Ohio Canal and the Village of Lockbourne with residential and light industrial development.

Future land use in adjacent areas will probably be residential and light industrial as the urban sprawl of Columbus extends to the southeast.

ENVIRONMENTAL SETTING

The environmental setting of the Base is described in this subsection with an emphasis on the identification of natural features that may influence the movement of hazardous waste contaminants.

Meteorology

The climate of Columbus, Ohio is characterized as continental (Pierce, 1959). The mean annual temperature is 52°F. The coldest month is January, while the warmest month is July with mean temperatures of 30°F and 74°F, respectively. Mean annual precipitation is 38 inches with October being the driest and June the wettest months. Net precipitation is calculated to be 2.71 inches per year (HMTC, 1987).

Geology

The Base is located in the Glaciated Central Lowlands Province just west of the Appalachian Plateau Province. The geology of the area is characterized by 200 feet(±) of Pleistocene glacial outwash sand and gravel and silty and clayey till filling a preglacial bedrock valley (Smith and Goldthwaite, 1958). The bedrock types under the mixed drift fill are Devonian limestones and shales of the Columbus and Delaware Formations.

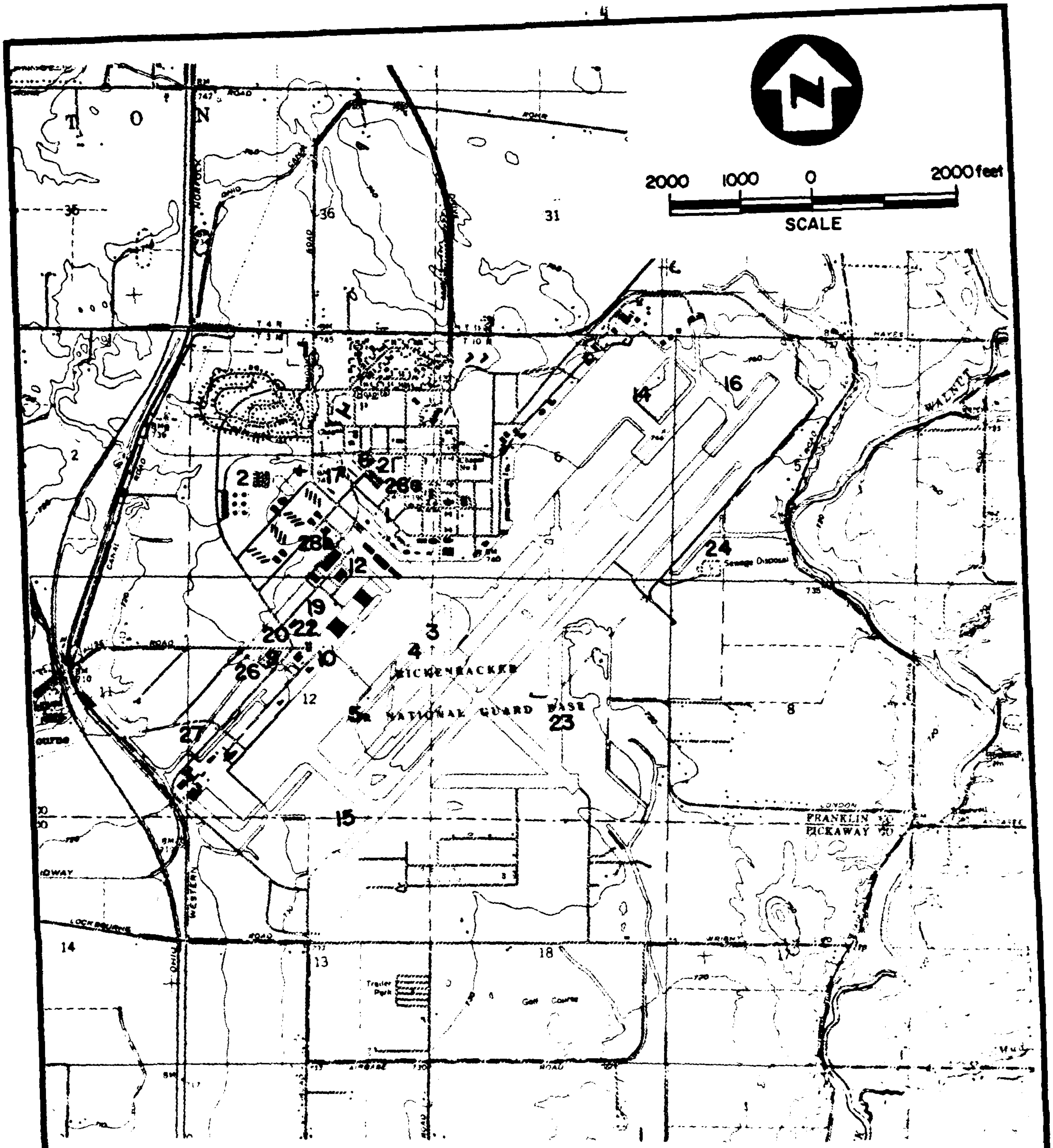
Soils

Soils mapped at the Base are of the Kokomo and Crosby Series (Figure 1.2) (SCS, 1976). The soils are characterized as deep, very poorly drained, slowly to moderately slowly permeable soils formed in glacial tills on uplands. The Crosby series soils are formed on slopes up to 6 percent grade while the Kokomo series soils form on gentler 0-2 percent slopes on the higher landscape positions. The Crosby soils exhibit permeabilities of 0.06 to 0.6 in/hr in unleached horizons. The Kokomo soils have permeabilities of 0.2 to 2.0 in/hr.

Surface Water Hydrology

Rickenbacker ANGB occupies the drainage divide between Big Walnut Creek and Walnut Creek. Surface drainage from the Base is through an extensive storm drain network which includes corrugated metal and concrete drainage pipes and open drainage ditches. All of the surface water is routed through oil-water separators before release into surrounding surface streams.

FIGURE 1.2



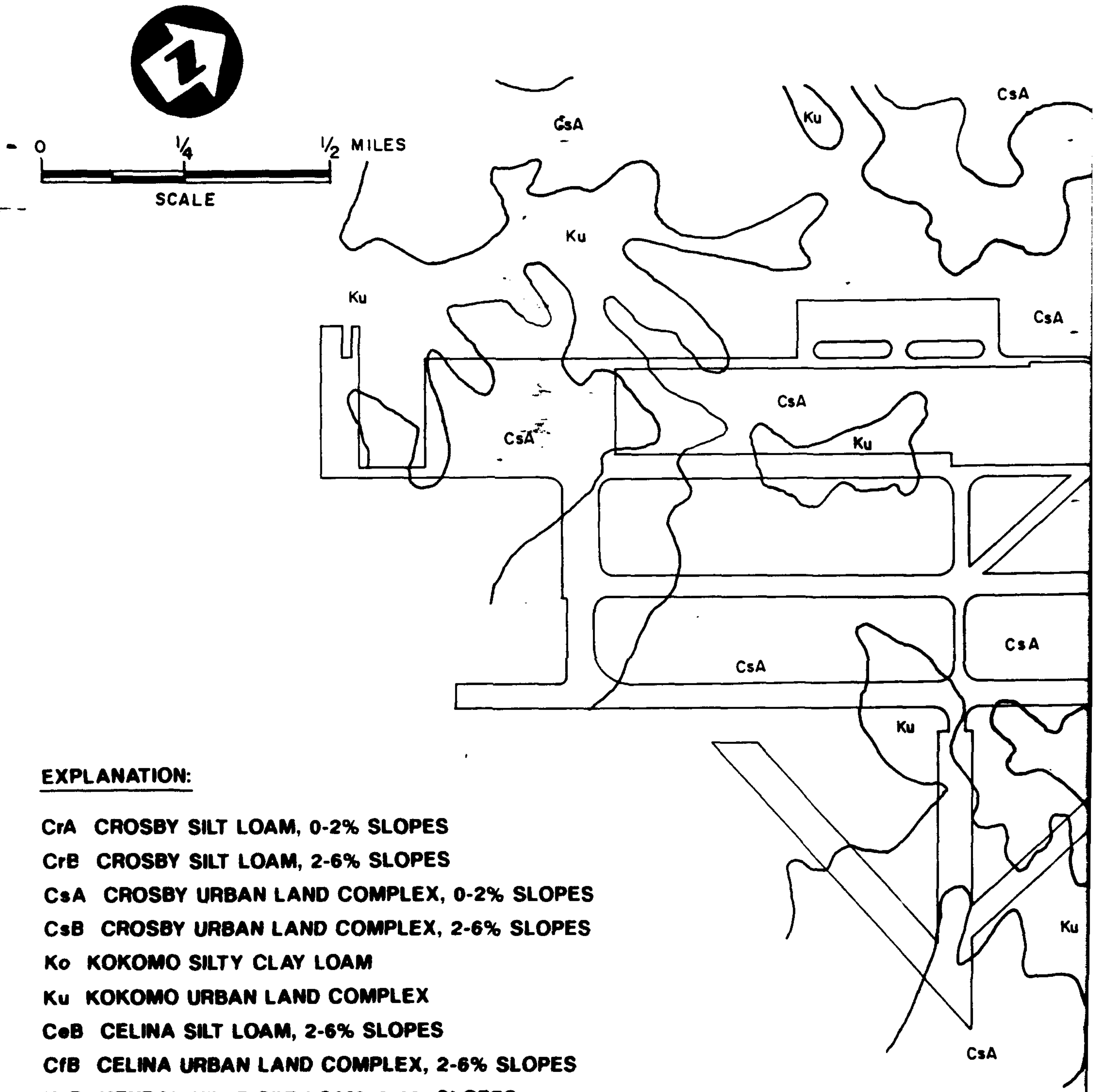
EXPLANATION:

22 – SITE NUMBER

IRP SITE LOCATIONS

RICKENBACKER AIR NATIONAL GUARD BASE

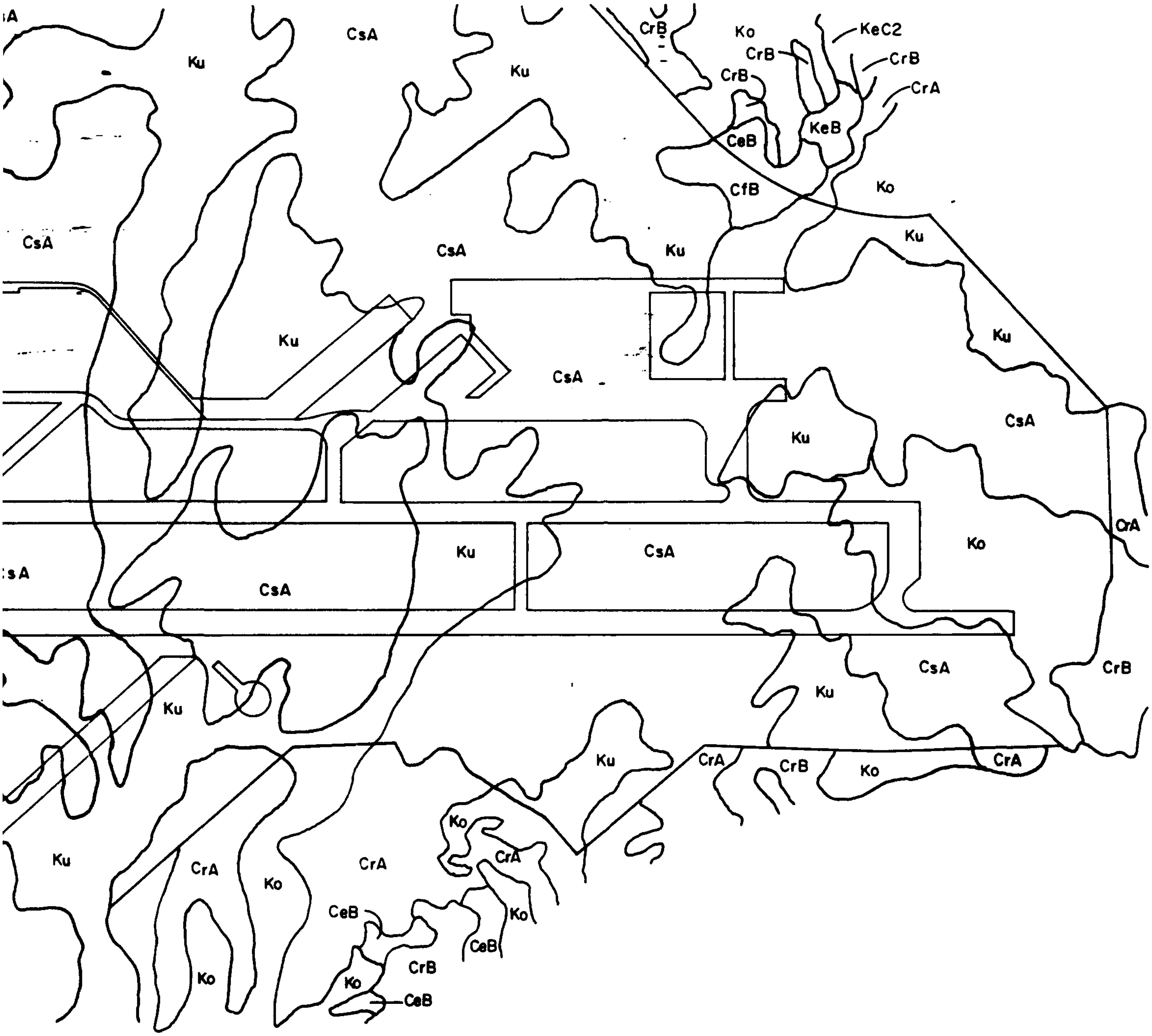
SOURCE:
USGS, LOCKBOURNE, OHIO
7.5 MIN. QUADRANGLE



EXPLANATION:

CrA CROSBY SILT LOAM, 0-2% SLOPES
CrB CROSBY SILT LOAM, 2-6% SLOPES
CsA CROSBY URBAN LAND COMPLEX, 0-2% SLOPES
CsB CROSBY URBAN LAND COMPLEX, 2-6% SLOPES
Ko KOKOMO SILTY CLAY LOAM
Ku KOKOMO URBAN LAND COMPLEX
CeB CELINA SILT LOAM, 2-6% SLOPES
CfB CELINA URBAN LAND COMPLEX, 2-6% SLOPES
KeB KENDALLVILLE SILT LOAM, 2-6% SLOPES
KeC2 KENDALLVILLE SILT LOAM, 6-12% SLOPES

SOURCE:
SOIL SURVEY OF FRANKLIN COUNTY,
USDA/SCS (1977)



SOIL MAP

RICKENBACKER
AIR NATIONAL GUARD BASE

ES ENGINEERING—SCIENCE

Groundwater

Groundwater is the primary source of drinking water for the Base and the Village of Lockbourne. According to driller's logs, the Base water-supply wells are completed in a coarse-sand and gravel aquifer directly on top of the bedrock at depths of 180 to 200 feet. Water from the five wells is treated by sand filtration and chlorination before distribution to Base water users, including the former Base housing and school. Recent testing of water from the wells for priority pollutants indicated no contamination. Homes in Lockbourne and along the rural roads surrounding the Base are served by individual domestic water wells. These wells are completed in sand and gravel aquifers between 20 and 100 feet deep. Concern for water quality in Lockbourne has increased recently following a study which indicated a higher than expected cancer rate and discovery of chlorinated methane compound contamination in some wells (Ecology and Environment, 1986). Consequently, the Village is preparing to tie into the Columbus City water system and several households are relying on trucked-in water.

Drillers' logs for nearby water wells, supplied by the Ohio Department of Natural Resources and foundation boring logs for the Base illustrate a very complex glacial stratigraphy. Drillers have logged a variety of sequences of sedimentary units ranging from alternating 5-10 foot thicknesses of sand and gravel with silts and clays to 140 feet of silty clay before penetrating the semi-continuous sand and gravel aquifer in which the Base wells are completed. Static water levels have been reported at depths of five to forty-six feet below land surface. Various Base foundation borings have encountered sands and clays of varying thicknesses in the shallow subsurface with reported depths to water of three to sixteen feet below land surface. The relationship of the shallow aquifers utilized by domestic wells and the major deep aquifer is not known.

IRP SITE IDENTIFICATION AND DESCRIPTIONS

The Preliminary Assessment (PA) (Phase I Records Search) final report was prepared by the Hazardous Materials Technical Center (HMTC) in June 1987. The result of the PA study was identification of 27 sites with potential for contamination. Five of the sites were determined to be of no further concern because of past cleanup operations or because past and current operating procedures are not likely to contribute contamination.

The 22 remaining sites were rated using the Hazard Assessment Rating Methodology (HARM). The resulting Hazard Assessment Scores (HAS) for each site are summarized in Table 1.1.

Investigation of abandoned underground storage tanks was added as Site 28 after completion of the PA Report. Figure 1.3A shows the location of each site by site number. Figures 1.3B and C are Base map enlargements of the Base office and shop area. Figures 1.4 through 1.23 are detailed site plans which include the locations of utilities in the vicinity of each site. Table 1.2 is a legend explaining the utility symbols on the drawings. This level of detail is required to insure that the proposed well and boring locations are not over buried utilities and to identify utility routes that could act as contaminant pathways.

The following descriptions of the 23 sites are based on the PA Report, site visits and information supplied by RANGB personnel.

Site 1: Hazardous Waste Storage Area (Figure 1.4)

The HAS for this site is 56, ranking 10th of the 22 rated sites. Total contaminants released at this site are estimated at less than 1,000 gallons. The site includes Building 560, two 25,000 gallon underground storage tanks (USTs) and a drum storage area adjacent to Building 560. The USTs have been used since 1950 to store waste oils (dielectric, hydraulic and lubricating), solvents and other unspecified chemical wastes. The drum storage area, adjacent to Building 560, had been used to store drums containing solvents, paint strippers and other unknown liquids, and is included in this site.

No leaks from the USTs or spills in the drum storage areas have been documented. However, the standpipe on one of the USTs was broken and some loss of contents occurred in 1982.

Adjacent to the Building 560 area are several additional known and suspected USTs. Two aircraft de-icing fluid tanks and a waste oil tank are southeast of the building, and two or three abandoned tanks of unknown use may remain in the ground under the existing roadway.

Site 2: JP-4 Bulk Storage Tank Farm (Figure 1.5)

The HAS for this site is 66, ranking 2nd of the 22 rated sites.

The site consists of a diked area enclosing six one million gallon capacity, above-grade, fuel storage tanks. Three of these tanks (Nos. 824, 825 and 826) are owned by RANGB, the other three tanks have been the

TABLE 1.1

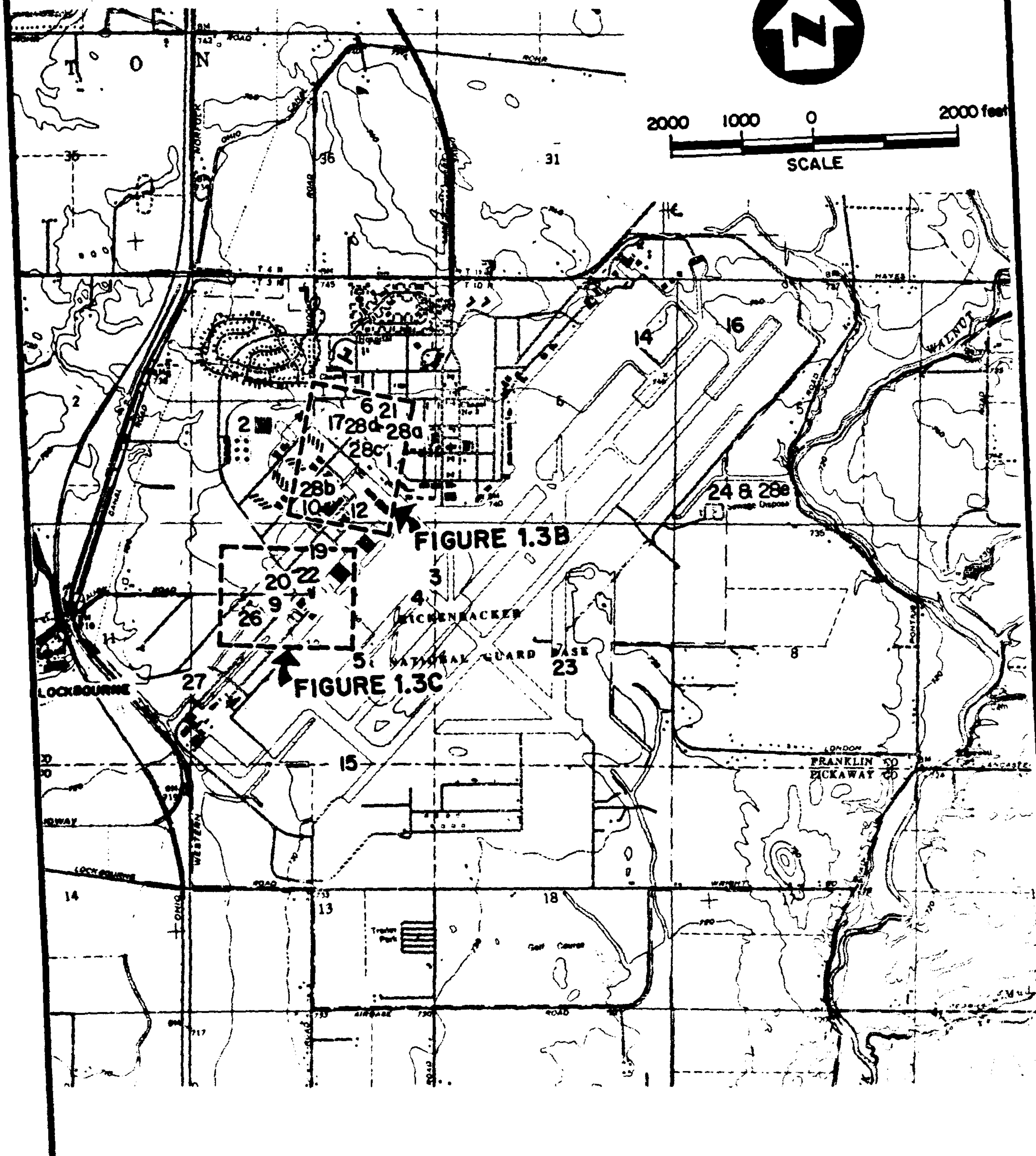
SITE HAZARD ASSESSMENT SCORES: RICKENBACKER ANGB, COLUMBUS, OH

Priority HMTC	Site* No.	Site Description	Receptor	Waste Charac.	Path-way	Waste Mgmt. Pract.	Overall Score
1	25	The Storm Drainage Ditch System	68	100	41	1.0	70
2	2	JP-4 Bulk Storage Tank Farm	68	90	41	.95	66
3	3	JP-4 Pumping Station No. 4	63	90	41	1.0	65
4	19	North Coal Pile	68	45	80	1.0	64
5	20	South Coal Pile	68	45	80	1.0	64
6	23	Fire Training Area	57	90	41	1.0	63
7	5	Lateral Safety Zone Spill	59	90	41	1.0	63
8	14	KC-135 Crash Site	57	90	41	1.0	63
9	27	Drainage Ditch Near Landfill	57	40	80	1.0	59
10	1	Hazardous Waste Storage Area, Building 560	68	60	41	1.0	56
11	10	JP-4 Fuel Line Rupture	65	63	41	1.0	56
12	17	Old Entomology Lab	68	60	41	1.0	56
13	9	Salvage Yard, Facility No. 906	63	60	41	1.0	55
14	6	Underground Storage Tank at Base Filling Station	68	54	41	1.0	54
15	4	JP-4 Pumping Station No. 5	68	54	41	1.0	54
16	21	Leaking Drum & Oil Change Area @ Water Treatment Plant	68	54	41	1.0	54
17	15	Fuel Dump Pit @ Southwest End of Runway	54	63	41	1.0	53
18	16	Fuel Dump Pit @ Northeast End of Runway	54	63	41	1.0	53
19	22	Heating Plant Lube Oil Drum Storage Area	68	45	41	1.0	51
20	24	Sanitary Sewage Treatment Sludge Beds	57	53	41	1.0	50
21	26	Electrical Transformer Storage Area	63	40	41	1.0	48
22	12	Old Drum Storage Area	68	30	41	1.0	46

* Sites 7, 8, 11, 13 and 18 were eliminated during the Preliminary Assessment.

SOURCE: Preliminary Assessment (Phase I Report - HMTC, 1987)

FIGURE 1.3A

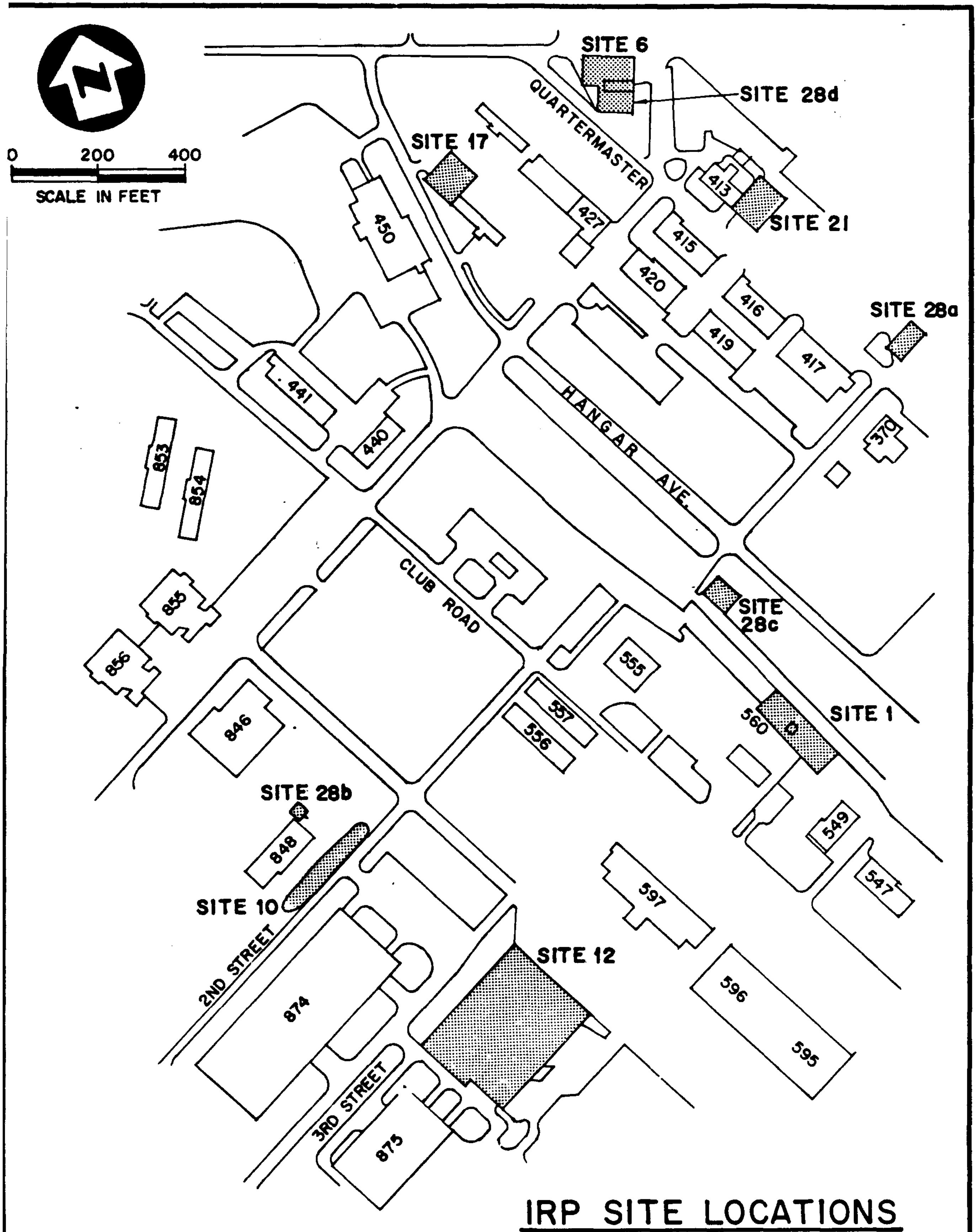


EXPLANATION:

22 - SITE LOCATION

IRP SITE LOCATIONS
RICKENBACKER
AIR NATIONAL GUARD BASE

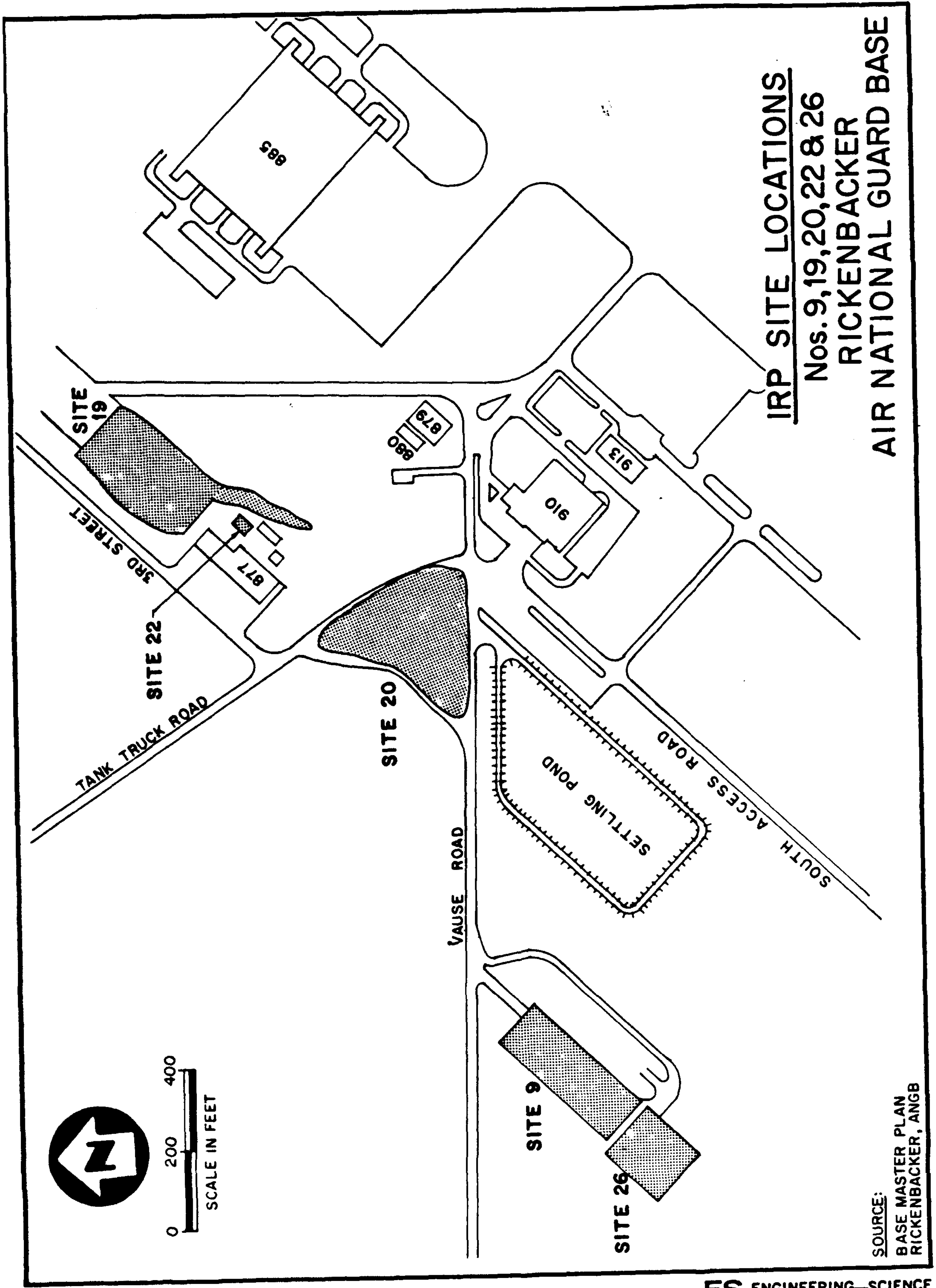
SOURCE:
USGS, LOCKBOURNE, OHIO
7.5 MIN. QUADRANGLE



IRP SITE LOCATIONS
Nos. 1,6,10,12,17,21 & 28
RICKENBACKER
AIR NATIONAL GUARD BASE

SOURCE:
BASE MASTER PLAN
RICKENBACKER, ANGB

FIGURE 1.3C



IRP SITE LOCATIONS
Nos. 9, 19, 20, 22 & 26
RICKENBACKER
AIR NATIONAL GUARD BASE

SOURCE:
BASE MASTER PLAN
RICKENBACKER, ANGB

TABLE 1.2

UTILITY LEGEND FOR SITE PLANS

RICKENBACKER AIR NATIONAL GUARD BASE
COLUMBUS, OHIO

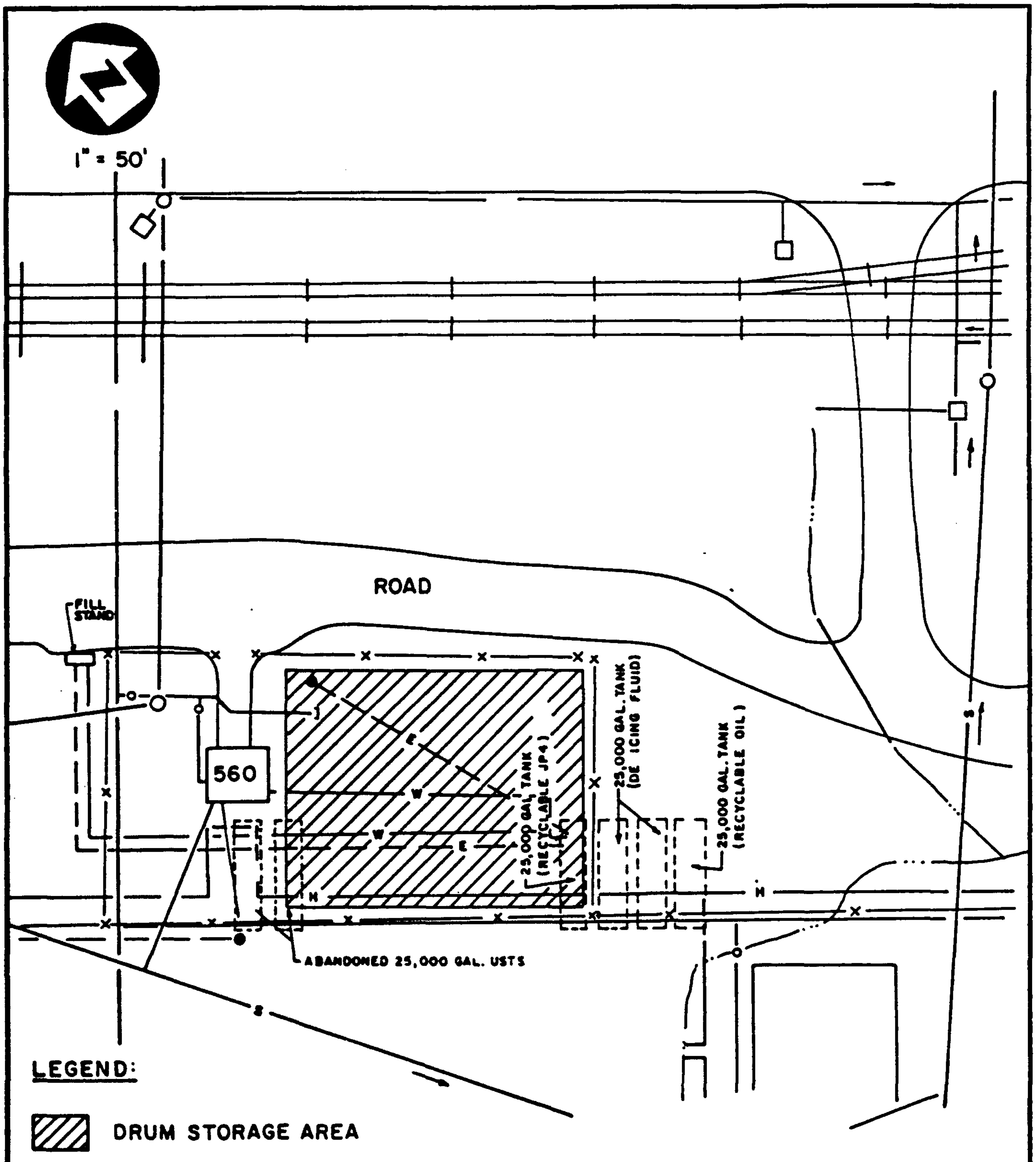
ABOVE GROUND UTILITIES AND FEATURES:

╪═╪═╪	RAILROAD
○	MANHOLE
∘	VALVE
—x—	FENCE
◉	RUNWAY / TAXIWAY LIGHT
Ω	FIRE HYDRANT
—H—	HEAT LINE
—JF—	JET FUEL LINE
△	ELECTRICAL TRANSFORMER

UNDERGROUND UTILITIES:

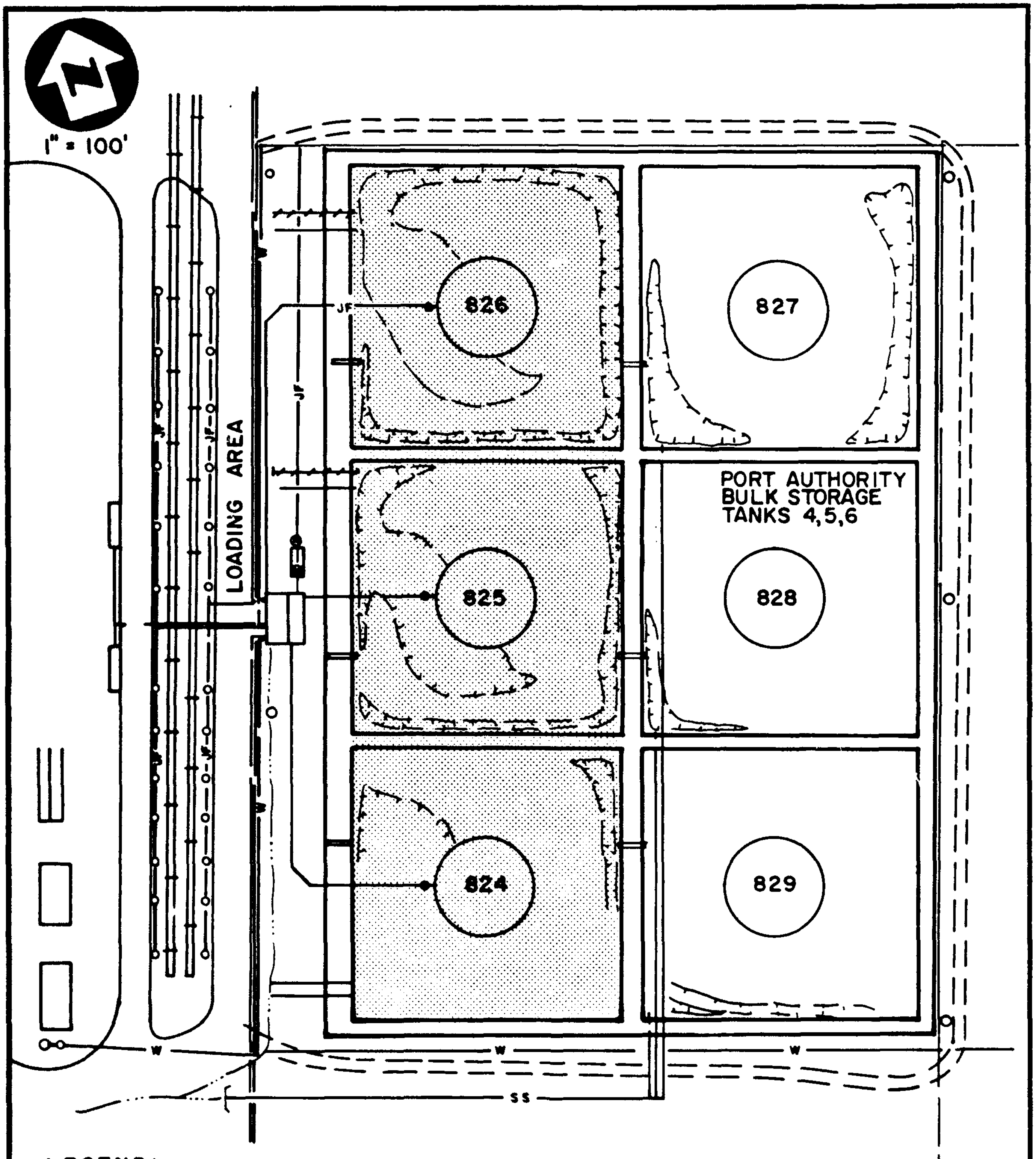
– —H— –	HEAT LINE
– —JF— –	JET FUEL LINE
– —E— –	ELECTRIC LINE
– —T— –	TELEPHONE LINE
—W—	WATER LINE
—S—	SANITARY SEWER
—SS—	STORM SEWER
□	JUNCTION BOX

FIGURE 1.4



SITE 1
HAZARDOUS WASTE STORAGE AREA
RICKENBACKER
AIR NATIONAL GUARD BASE

SOURCE:
BASE DETAILED
SECTIONAL MAPS



LEGEND:

▨ ANG TANK AREA

SITE 2
BULK STORAGE TANK FARM
RICKENBACKER
AIR NATIONAL GUARD BASE

SOURCE:
BASE DETAILED
SECTIONAL MAPS

property of the Rickenbacker Port Authority since March, 1986. Since 1979, three spills ranging in size from 1,000 to 60,000 gallons have occurred (HMTC, 1987). Most of the fuel was recovered as ponded liquid or during excavation of fuel-saturated soils. For purposes of determining a HAS, a quantity of more than 4,000 gallons of spilled fuel was estimated.

Site 3: JP-4 Pumping Station No. 4 (Figure 1.6)

The HAS for this site is 65, ranking 3rd of the 22 rated sites.

A 25,000 gallon spill of JP-4 (Jet Fuel) occurred at this site in 1976, as a result of a ruptured pipeline. Approximately 1,000 gallons of fuel were recovered. The remaining fuel evaporated, infiltrated the soils or entered the Base storm-drain network. Once in the Base storm-drain network, the fuel would have eventually been contained in separator No. 3102 or overflowed and entered a tributary of Big Walnut Creek.

Site 4: JP-4 Pumping Station No. 5 (Figure 1.7)

The HAS for this site is 54, ranking 15th of the 22 rated sites.

This site includes the area around Pumping Station No. 5 where a 200 gallon JP-4 spill occurred in 1985. None of the spill was recovered. The fuel evaporated, infiltrated the soil or entered the storm-drain network. The pumping station includes four 50,000 gallon underground storage tanks for jet fuel.

Site 5: Lateral Safety Zone Spill Area (Figure 1.8)

The HAS for this site is 63, ranking 7th of the 22 rated sites.

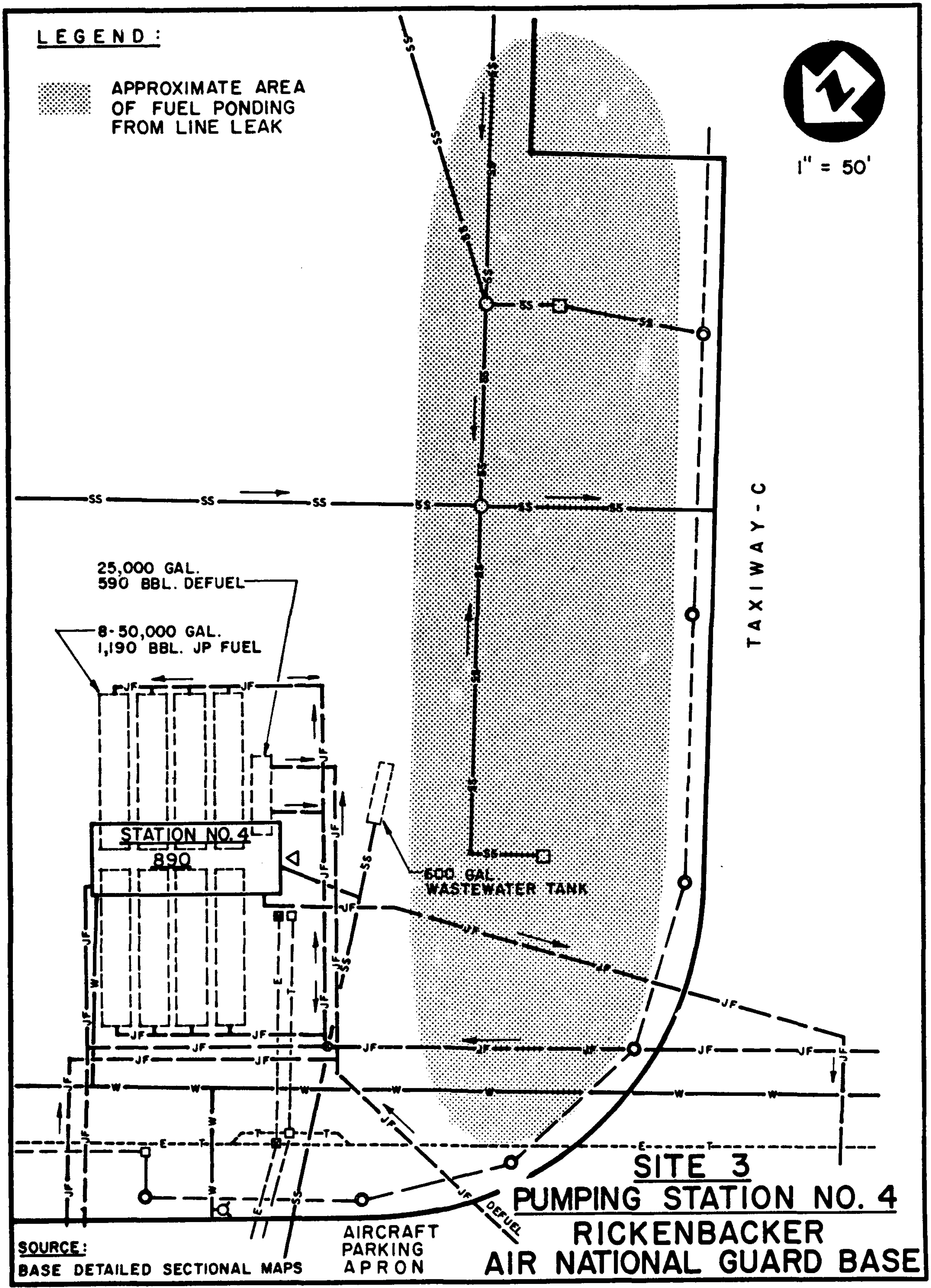
The area outlined in Figure 1.8 was covered with JP-4 following an 80,000 gallon spill from Pumping Station No. 7 in 1972. A 600 gallon spill in 1985 also occurred at this site. A drain-tile system underlies this area and probably carried most of the spill into the storm-drain network. The remainder of the spill either infiltrated the soils surrounding the drain tiles or volatilized.

Site 6: Underground Storage Tanks at Base Filling Station (Figure 1.9)

The HAS for this site is 54, ranking 14th of the 22 rated sites.

In 1985, approximately 100 gallons of unleaded fuel leaked from an underground storage tank at this site when a line connection ruptured. Since preparation of the Preliminary Assessment (Phase I) Report, ANGB personnel determined that the eastern, fiberglass tank was leaking. The tanks were removed in September 1987. Gasoline was observed floating on the water in the excavated tank pit on 24 September. The two steel and one

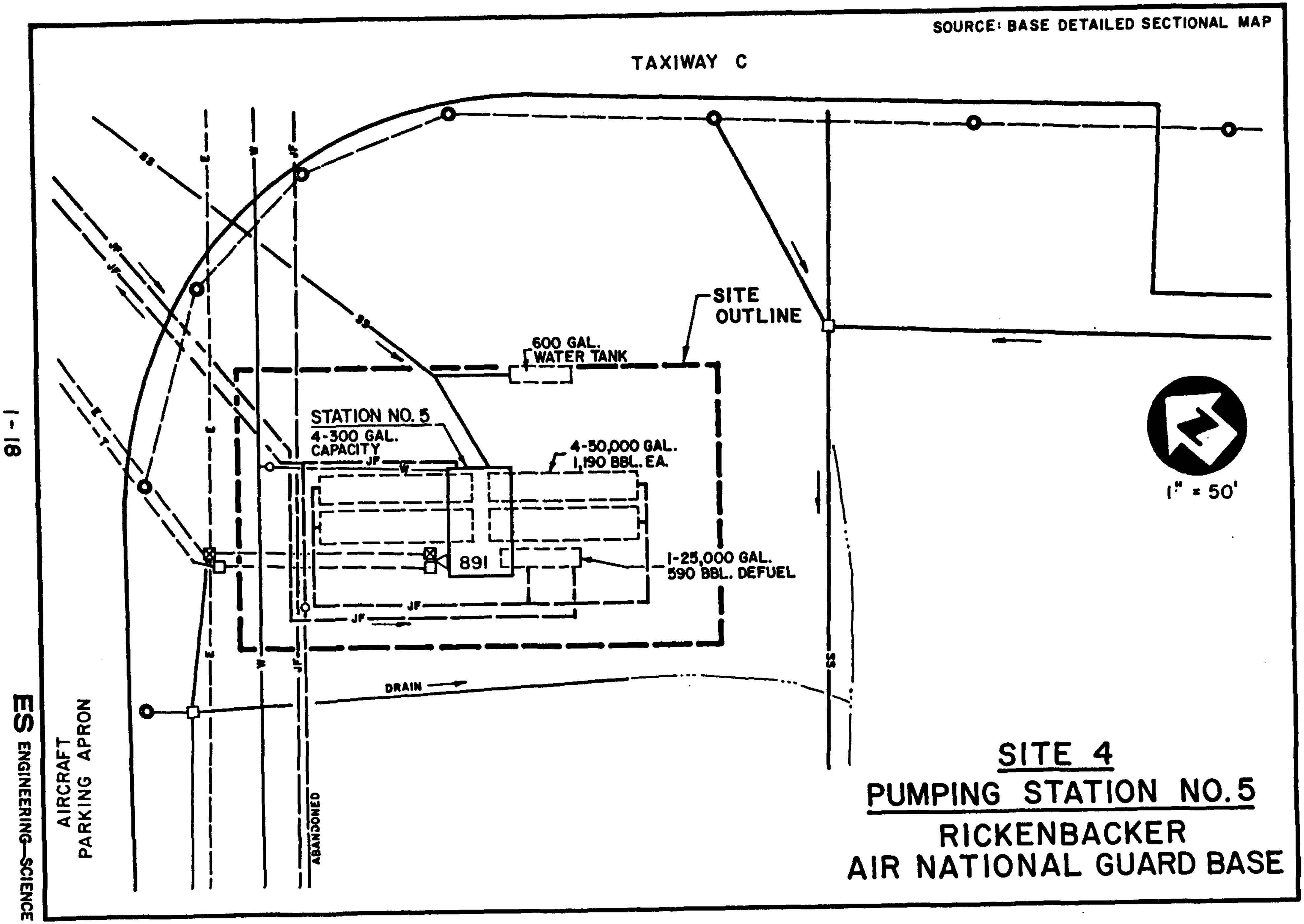
FIGURE 1.6



SOURCE: BASE DETAILED SECTIONAL MAPS

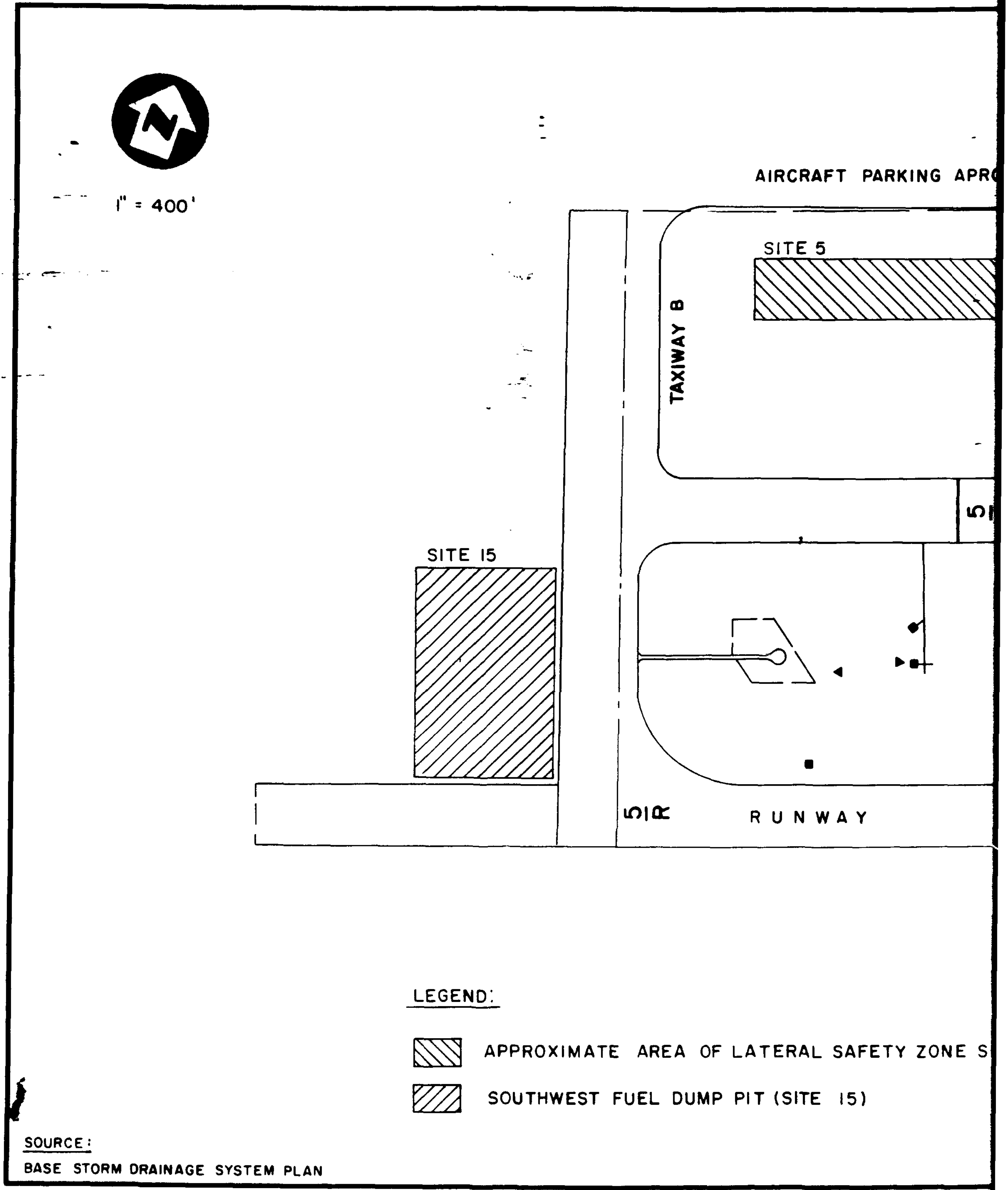
SITE 3
PUMPING STATION NO. 4
RICKENBACKER AIR NATIONAL GUARD BASE

FIGURE 1.7

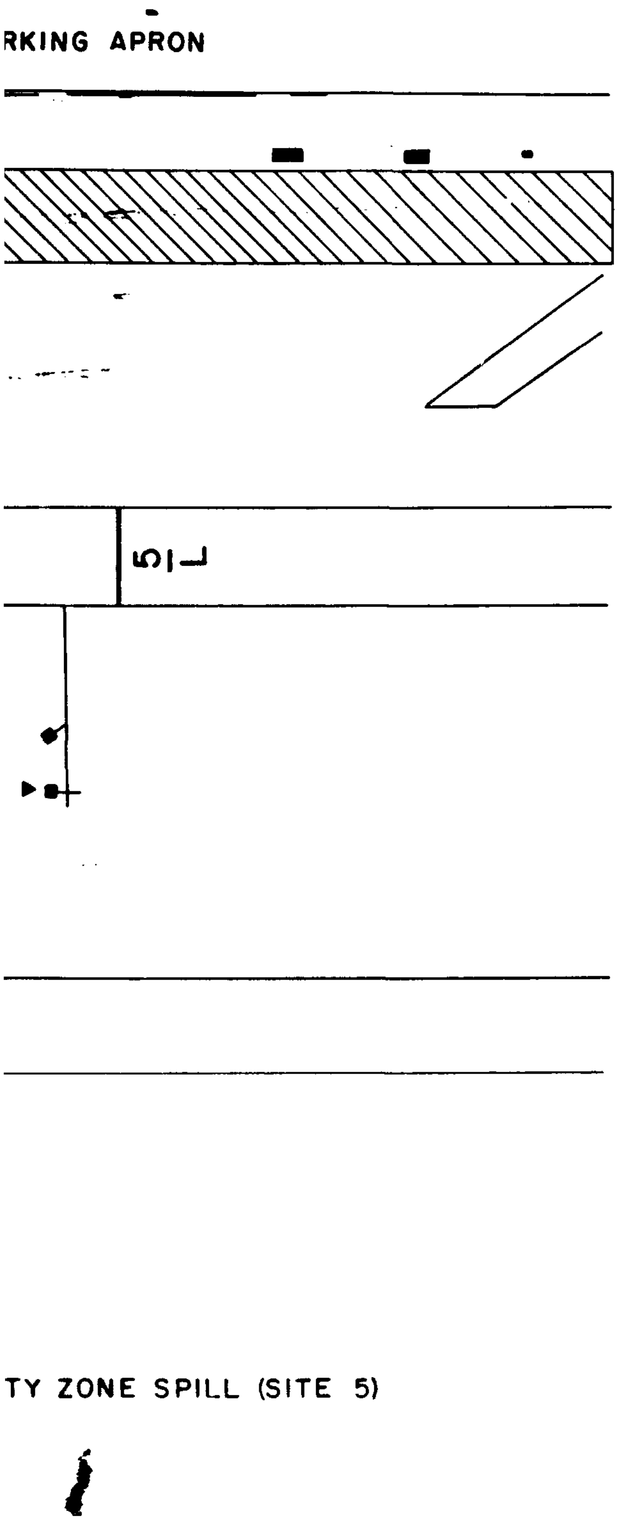


SOURCE: BASE DETAILED SECTIONAL MAP

SITE 4
PUMPING STATION NO. 5
RICKENBACKER AIR NATIONAL GUARD BASE

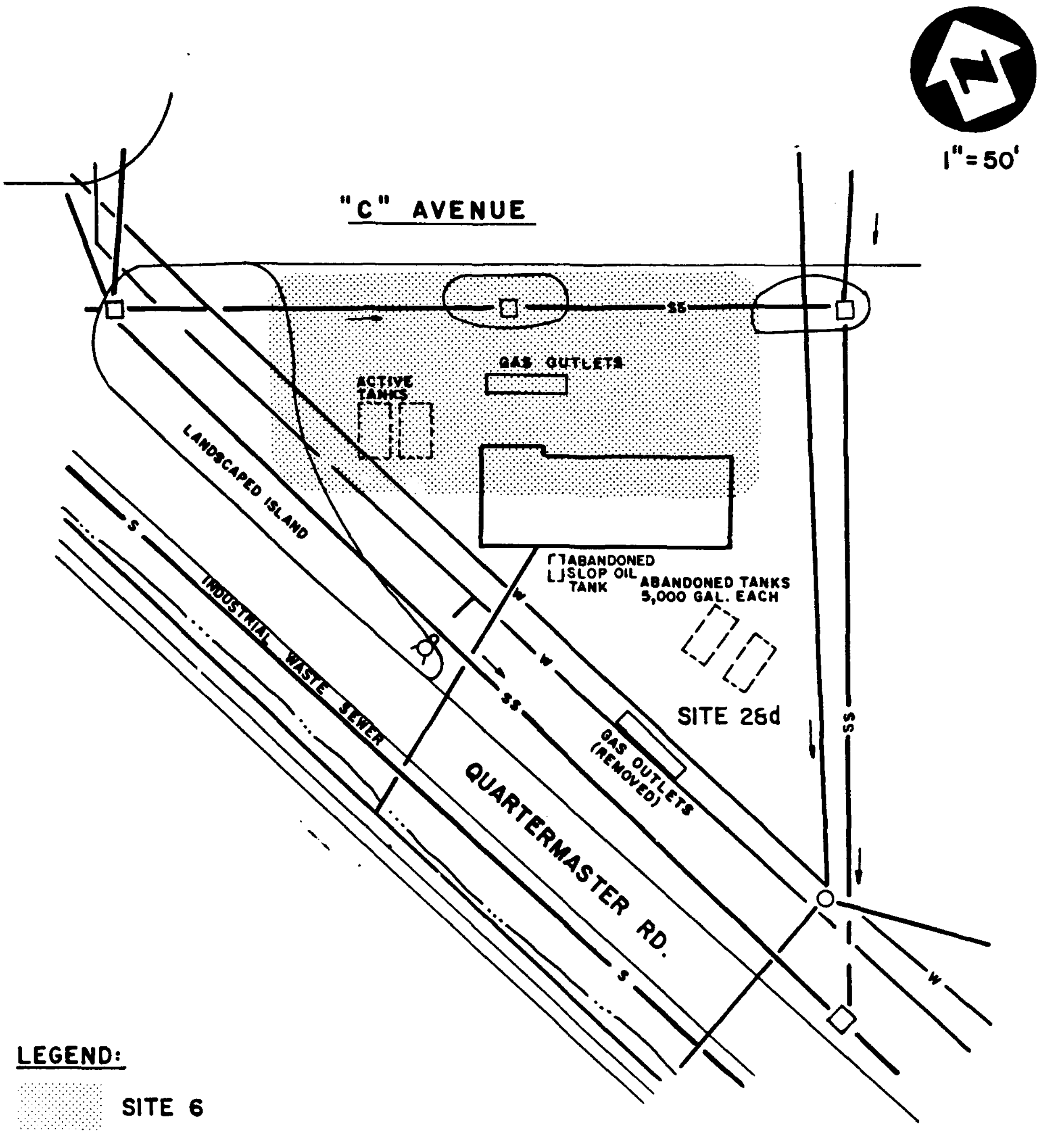


SOURCE:
BASE STORM DRAINAGE SYSTEM PLAN



SITES 5 AND 15
LATERAL SAFETY ZONE SPILL AND SOUTHWEST FUEL DUMP PIT
RICKENBACKER AIR NATIONAL GUARD BASE

FIGURE 1.9



LEGEND:

▨ SITE 6

SITE 6
BASE FILLING STATION
RICKENBACKER AIR NATIONAL GUARD BASE

SOURCE:
BASE DETAILED SECTIONAL MAPS.

fiberglass tanks were replaced with two new fiberglass tanks and the contaminated soils were removed. A tank pit monitoring well was installed in the backfill.

Two gasoline storage tanks and one slop oil tank located in the rear of the station will be investigated as part of the abandoned USTs investigation (Site 28).

Site 9: Salvage Yard, Facility No. 906 (Figure 1.10)

The HAS for this site is 55, ranking 13th of the 22 rated sites.

This site consists of a paved area with a small office shack adjacent to quonset hut foundations. The Salvage Yard is now inactive but had been used for storage of equipment, scrap material and drums. The drums reportedly contained a wide range of pesticides, herbicides and solvents including dieldrin, malathion, diazinon and chlordane. The only reported leakage at this site occurred in 1983 when pesticide drums caught fire and some of the contents were spilled while extinguishing the blaze. The quantity of contaminant released during the fire is estimated at less than two drums. However, the potential for previous and subsequent unreported releases at this site is high.

Site 10: JP-4 Fuel Line Rupture (Figure 1.11)

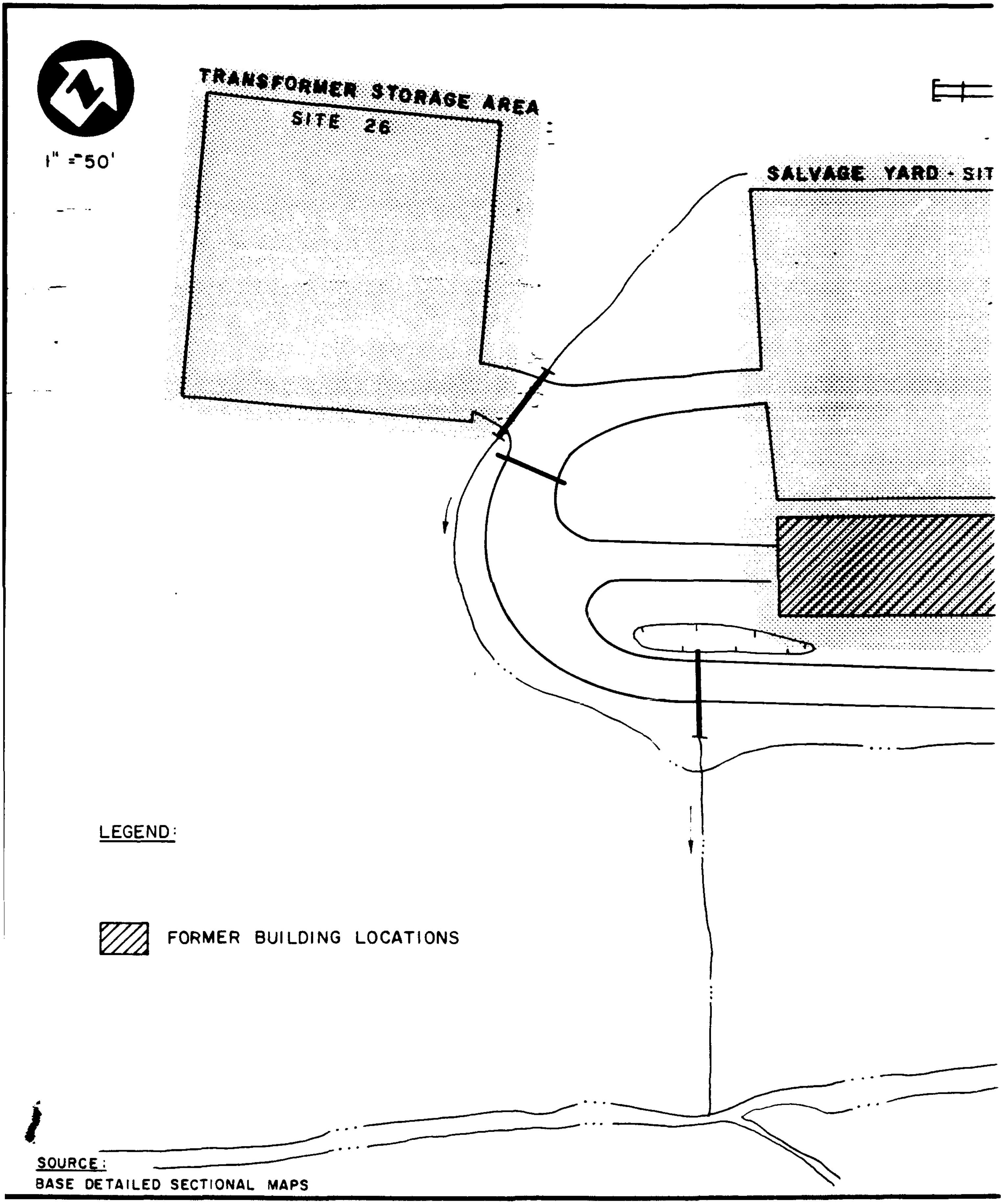
The HAS for this site is 56, ranking 11th of the 22 rated sites.

There is still some doubt as to the location of this site. Reportedly, a fuel line ruptured in 1982 spilling JP-4 on the ground for several days before being discovered. However, the location described in the PA Report has no above-ground fuel line passing through it. For the purposes of the Site Inspection, the area outlined in Figure 1.11 will be assumed correct.

Site 12: Old Drum Storage Area (Figure 1.12)

The HAS for this site is 46, ranking 22nd of the 22 rated sites.

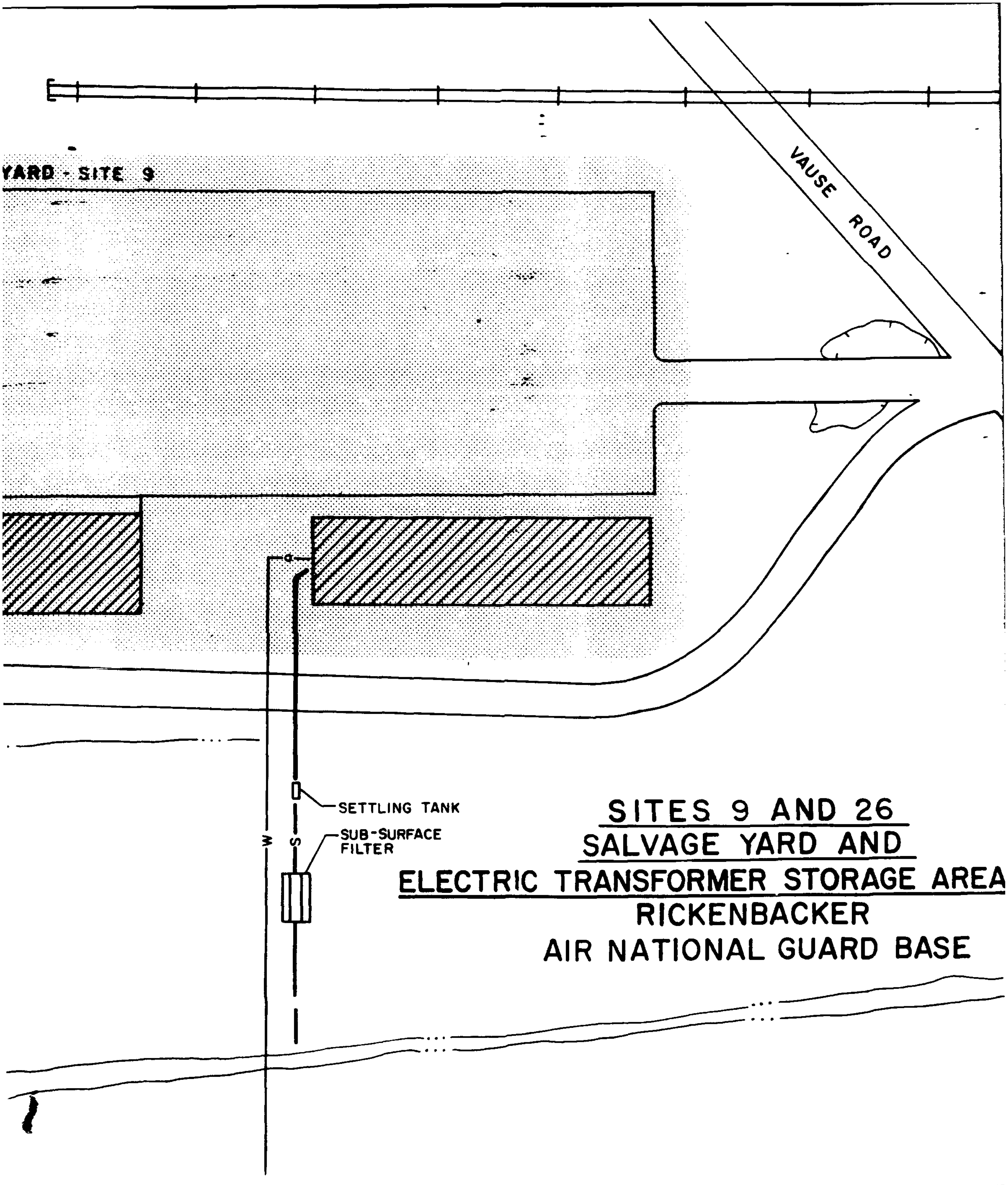
This site includes a concrete paved area and adjacent drainage ditch. The paved area was used as a storage area for drums. Most of the drums were empty when brought to the site. Samples taken from drums that did contain liquid reportedly contained methyl ethyl ketone and other solvents and paint strippers. Some drums of unknown content were dumped into the adjacent drainage ditch and any leakage onto the pavement would have been flushed into the ditch as well.



LEGEND:

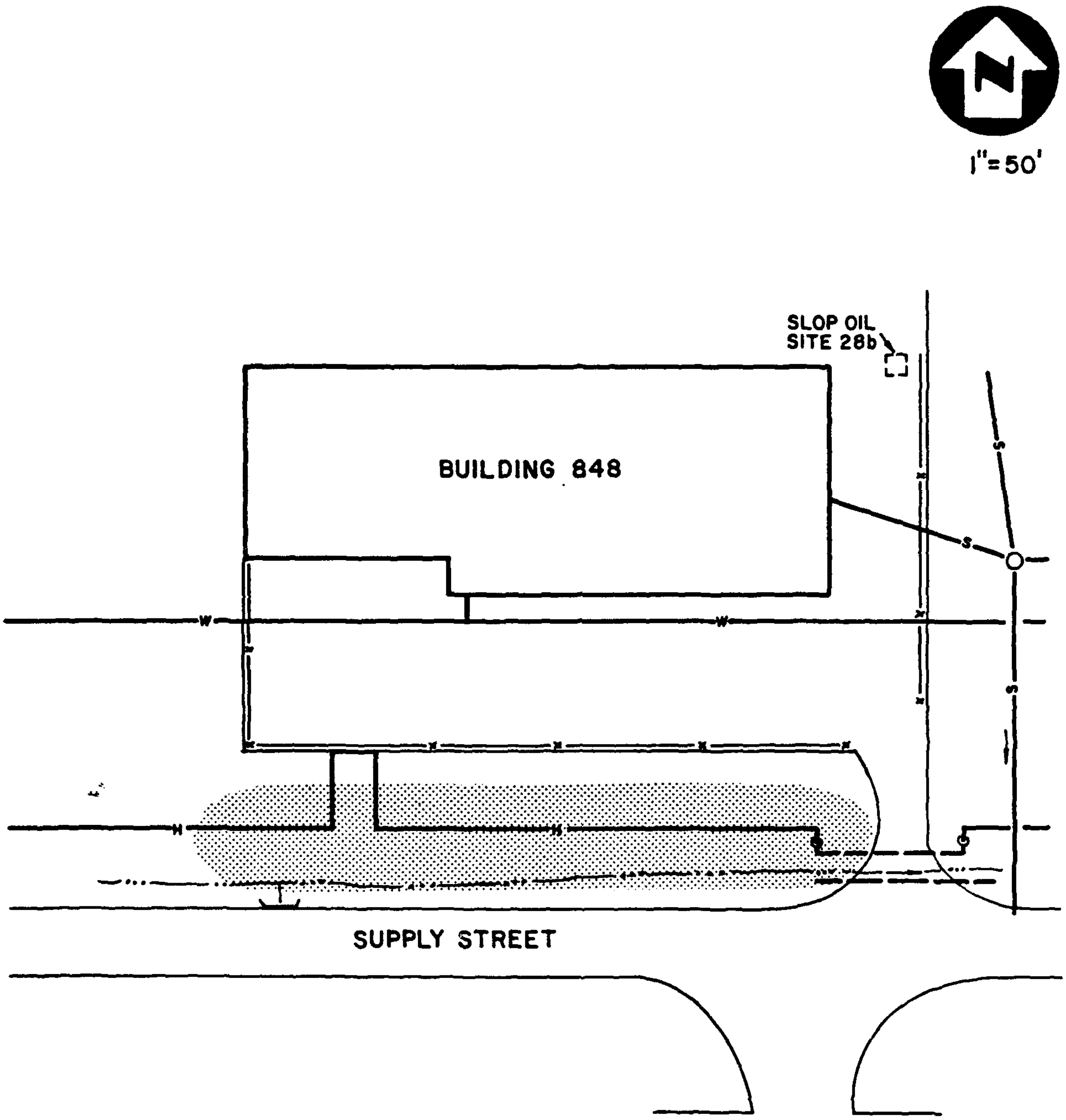
▨ FORMER BUILDING LOCATIONS

SOURCE:
BASE DETAILED SECTIONAL MAPS



SITES 9 AND 26
SALVAGE YARD AND
ELECTRIC TRANSFORMER STORAGE AREA
RICKENBACKER
AIR NATIONAL GUARD BASE

FIGURE 1.11



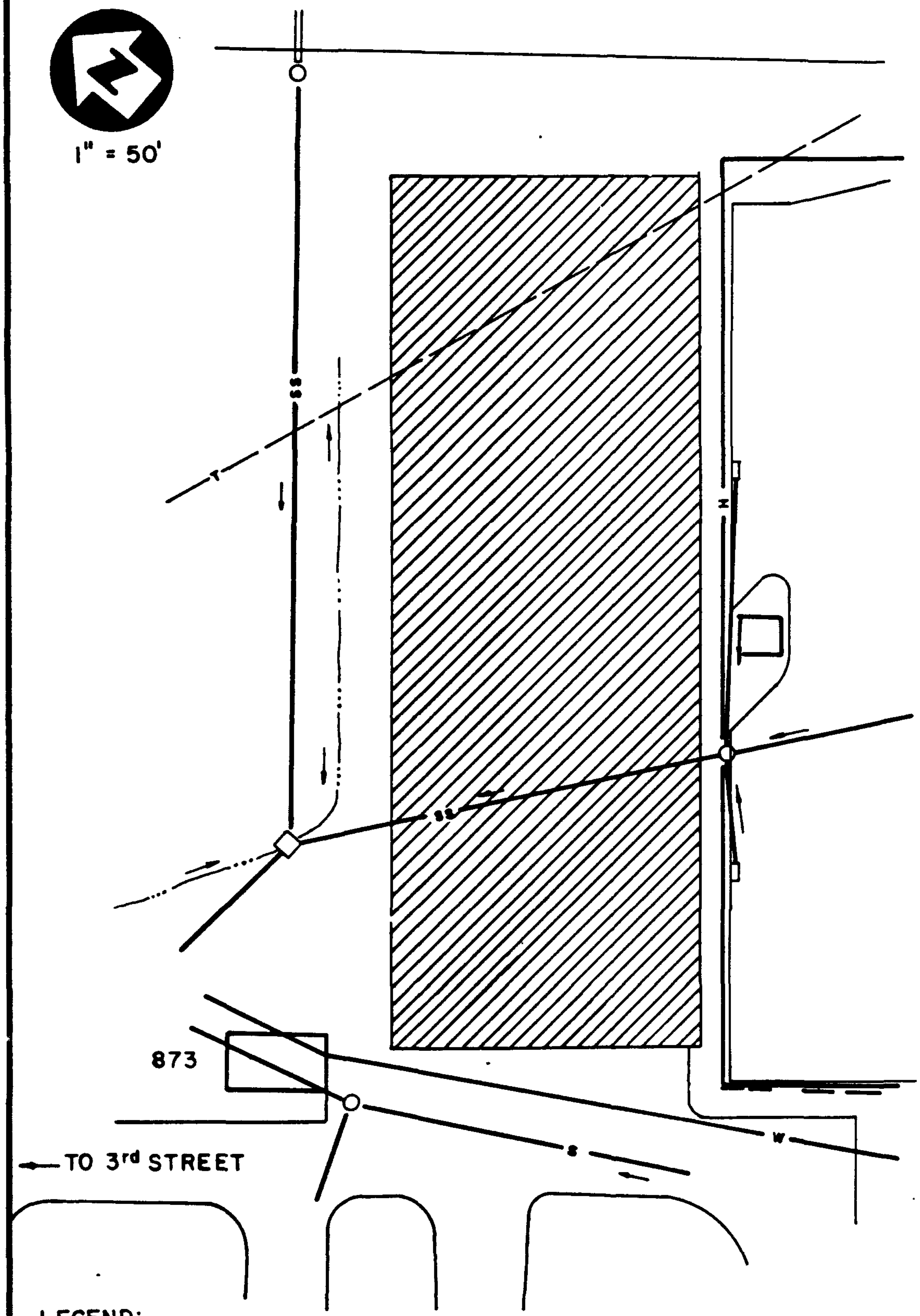
LEGEND:

▨ APPROXIMATE EXTENT OF SPILL

SITE 10
JP4 FUEL LINE RUPTURE
RICKENBACKER
AIR NATIONAL GUARD BASE

SOURCE:
BASE DETAILED SECTIONAL MAPS.

FIGURE 1.12



LEGEND:

▨ PAVED DRUM STORAGE (SITE 12)

SOURCE:
BASE DETAILED
SECTIONAL MAPS

SITE 12

OLD DRUM STORAGE AREA

RICKENBACKER
AIR NATIONAL GUARD BASE

Site 14: KC-135 Crash Site (Figure 1.13)

The HAS for this site is 63, ranking 8th of the 22 rated sites.

In 1960, two KC-135 refueling aircraft collided on the aircraft parking apron near Taxiway F. Up to 10,000 gallons of JP-4 reportedly spilled on the concrete pavement. The fuel probably flowed across the concrete into the grass area between Taxiways G and F or into a nearby catch-basin which is connected to an open drainage ditch in the same grass area.

Sites 15 and 16: Fuel Dump Pits at Ends of Runways (Figures 1.8 and 1.13)

The HAS for these sites are 53, tied for the rank of 17th of the 22 rated sites.

These sites were reportedly designated fuel dumping areas for aircraft to relieve themselves of fuel before entering the hangers for repairs or after an alert. No first-hand accounts of fuel dumping were reported. The practice began in the 1940s. Potentially large quantities of fuel could have been dumped at these sites.

Site 17: Old Entomology Laboratory (Figure 1.14)

The HAS for this site is 56, ranking 12th of the 22 rated sites.

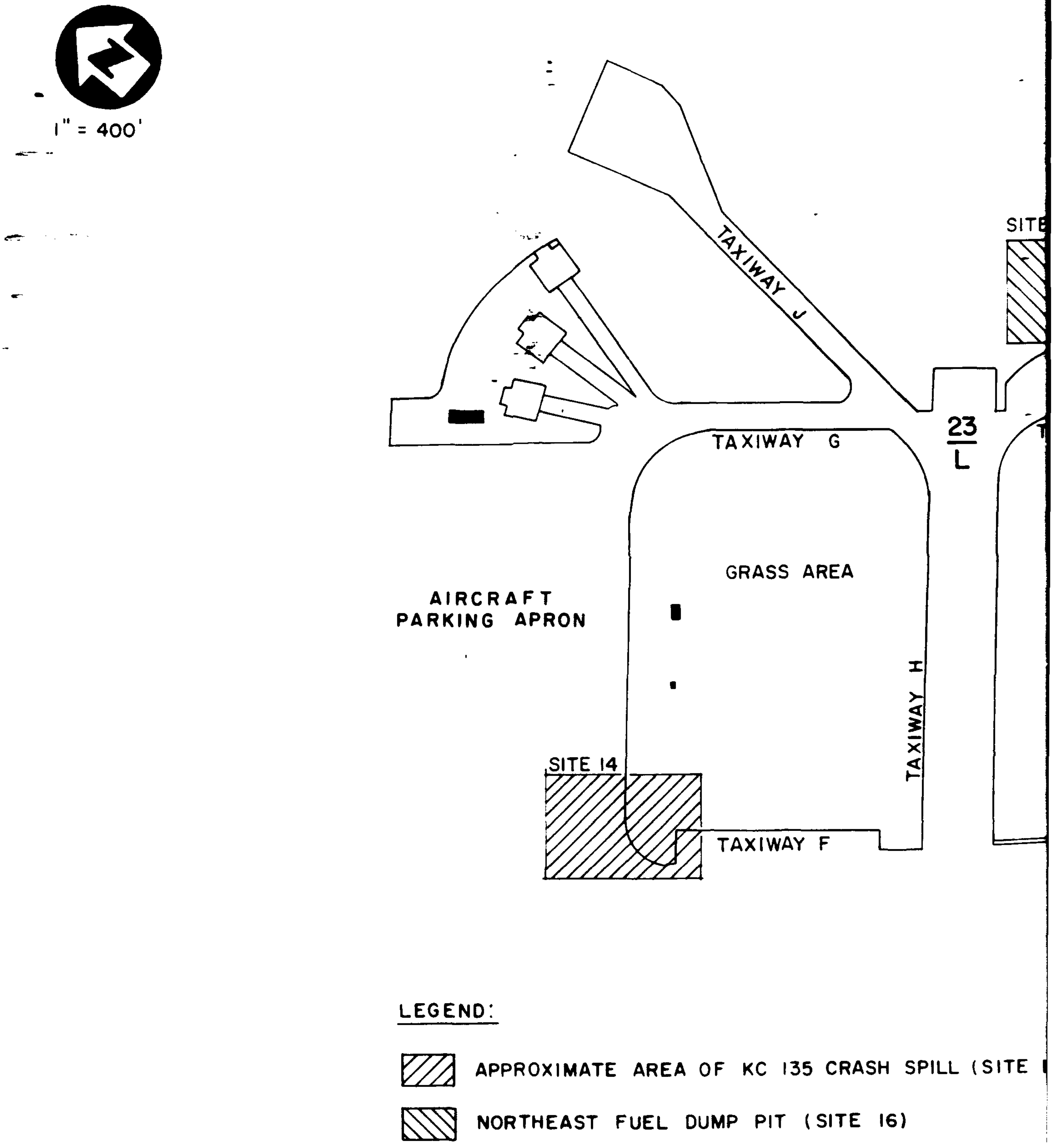
The PA Report described this site as the location of a building where pesticide spraying equipment was cleaned and stored. The building was reportedly destroyed by fire and some malathion may have leaked from some drums during the fire.

A review of records by Base personnel contradicts this account. The only site used as an entomology lab is reportedly the northwest end of Building 422. A nearby building (426) was destroyed in a fire, but it had not been the location of the entomology lab. Further investigation of this discrepancy will be done prior to field activities.

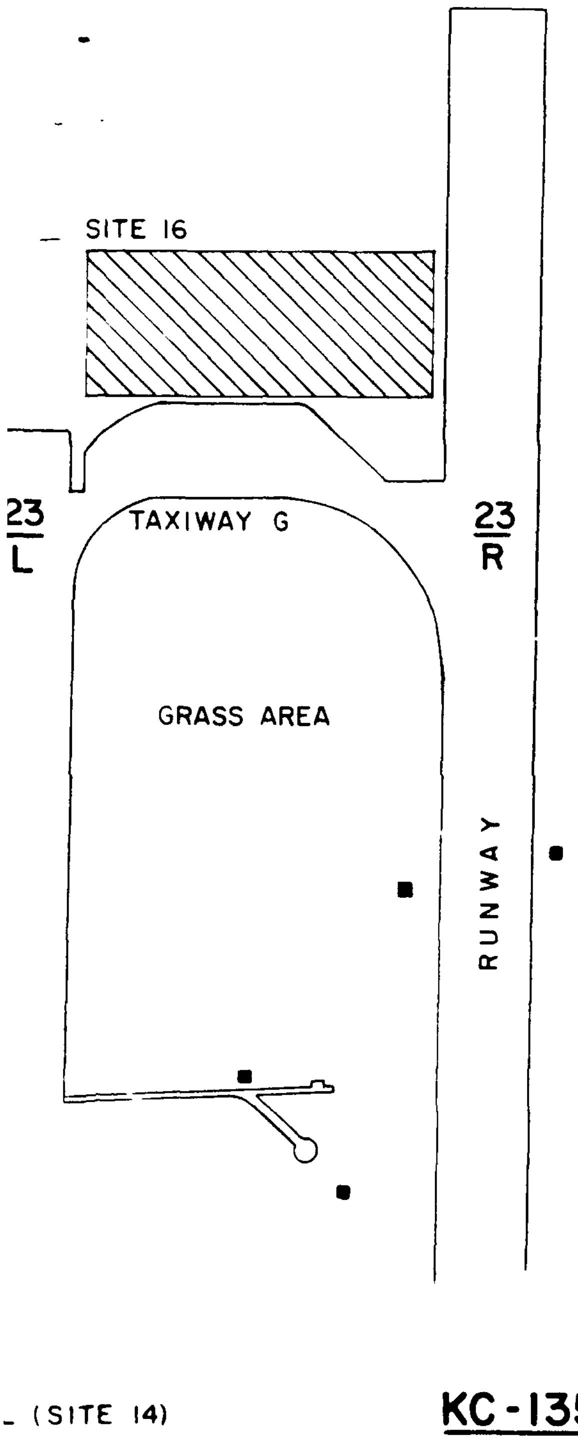
Sites 19 and 20: North and South Coal Piles (Figures 1.15 and 1.16)

The HAS for these sites are 64, tied for the rank of 4th of the 22 rated sites.

The North Coal Pile (Figure 1.15) is a concrete slab capable of containing 6,000 tons of coal. The South Coal Pile (Figure 1.16) is an asphaltic concrete slab capable of containing 4,000 tons of coal. Both coal storage areas are surrounded by drainage ditches which receive runoff from the piles and empty into the storm drain network.

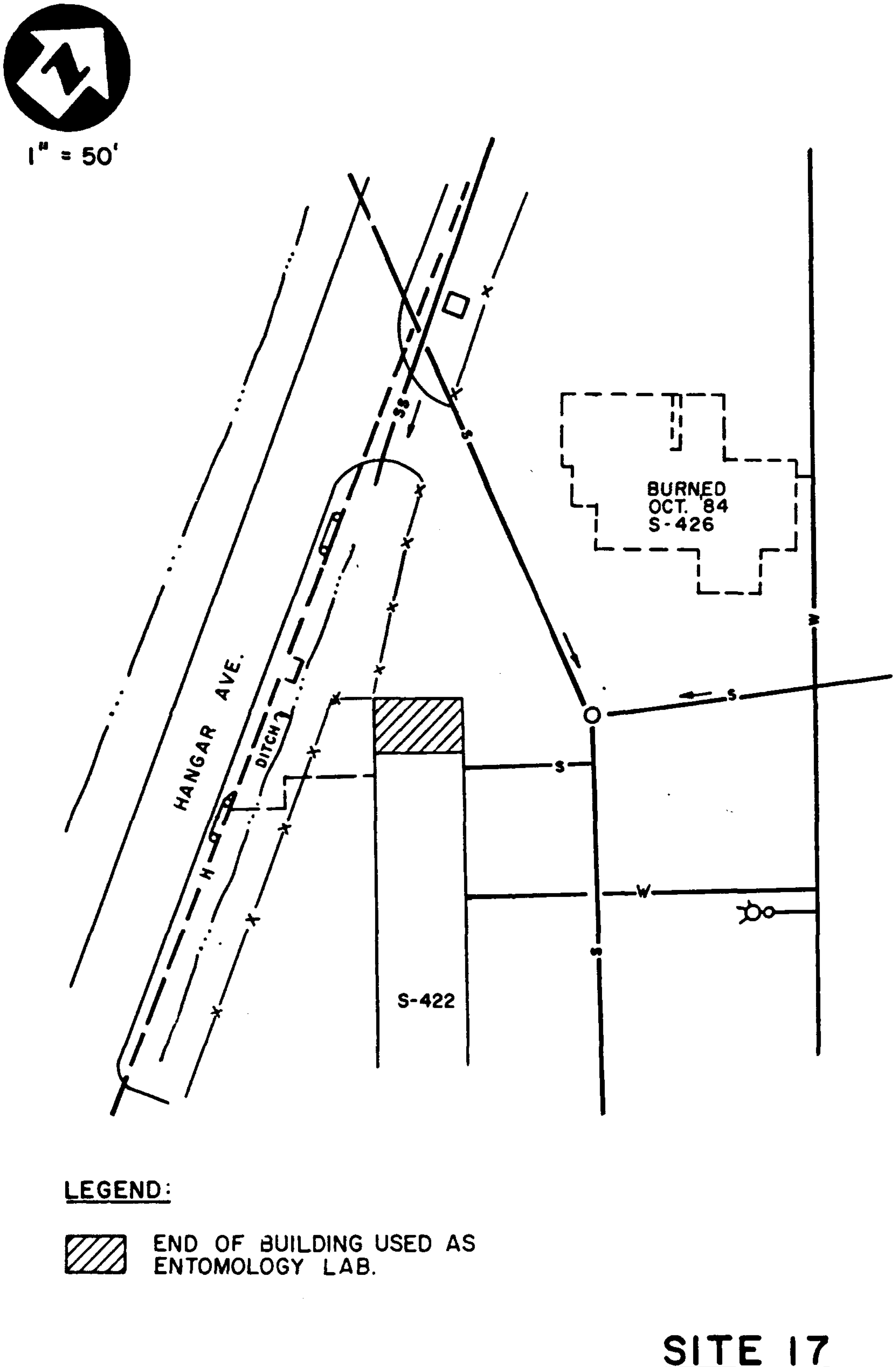


SOURCE:
BASE STORM DRAINAGE SYSTEM PLAN



SITES 14 & 16
KC-135 CRASH SITE AND NORTHEAST FUEL DUMP PIT
RICKENBACKER
AIR NATIONAL GUARD BASE

FIGURE 1.14

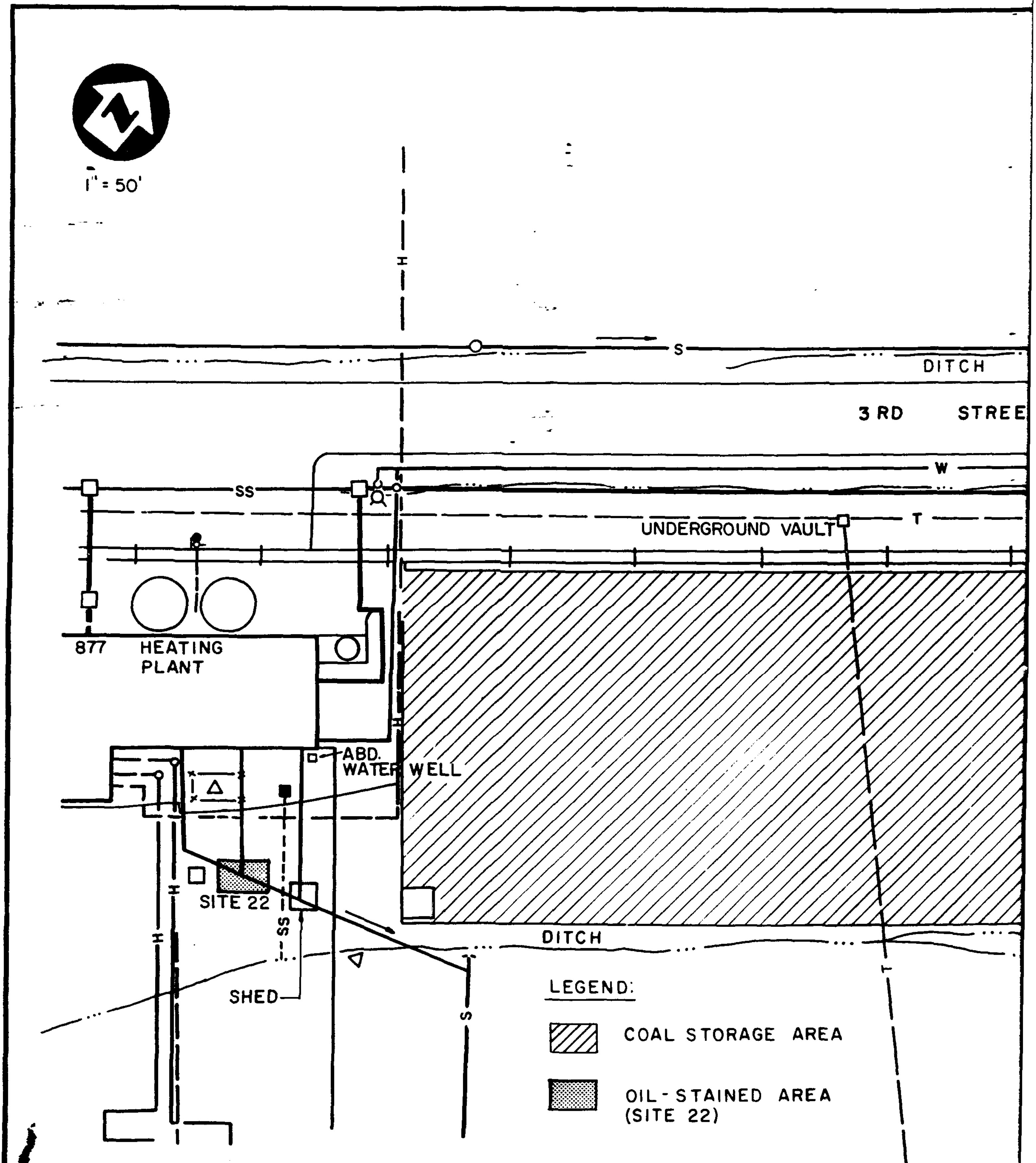


LEGEND:

▨ END OF BUILDING USED AS ENTOMOLOGY LAB.

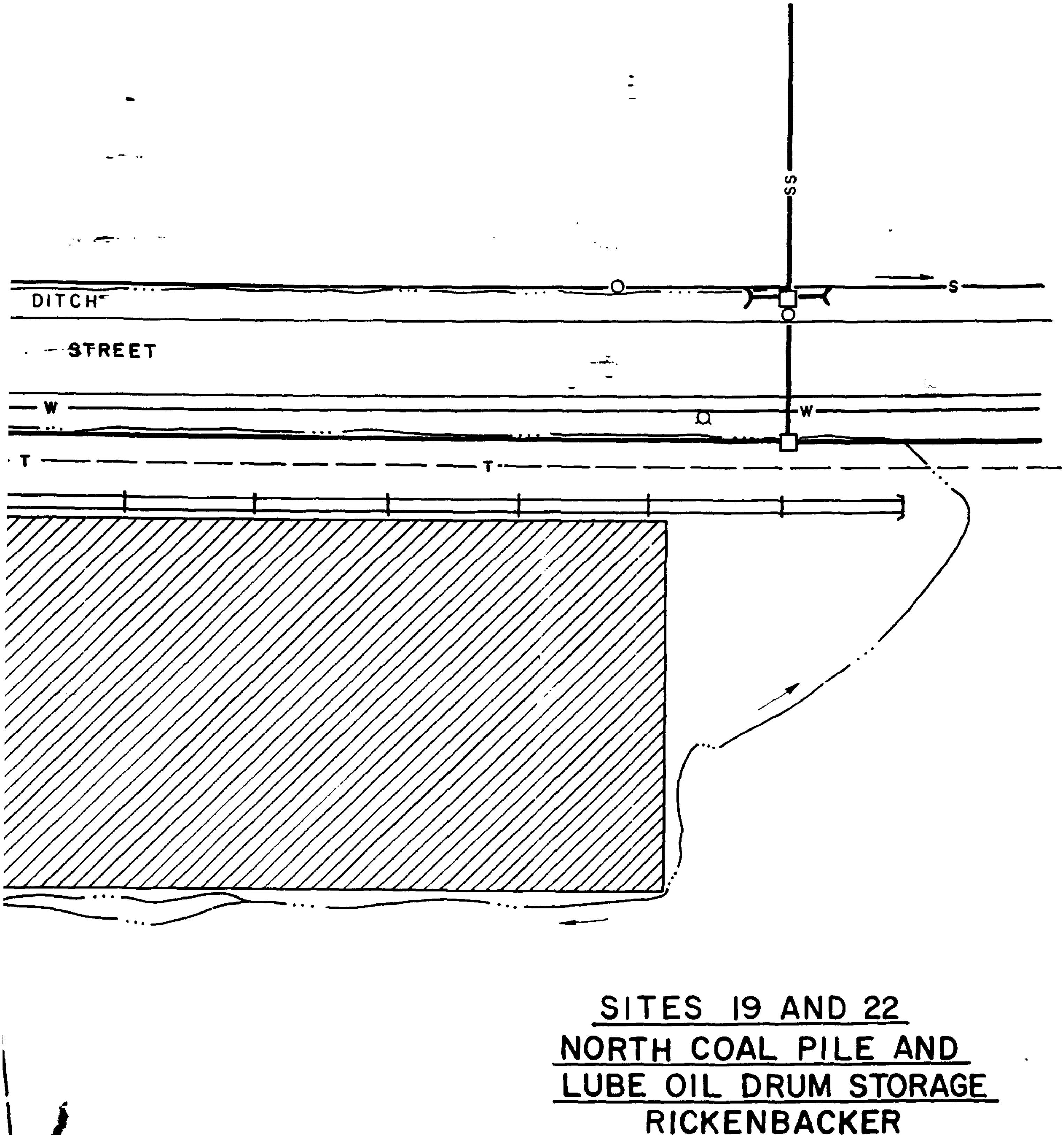
SITE 17
OLD ENTOMOLOGY LAB
RICKENBACKER
AIR NATIONAL GUARD BASE

SOURCE:
BASE DETAILED SECTIONAL MAPS.

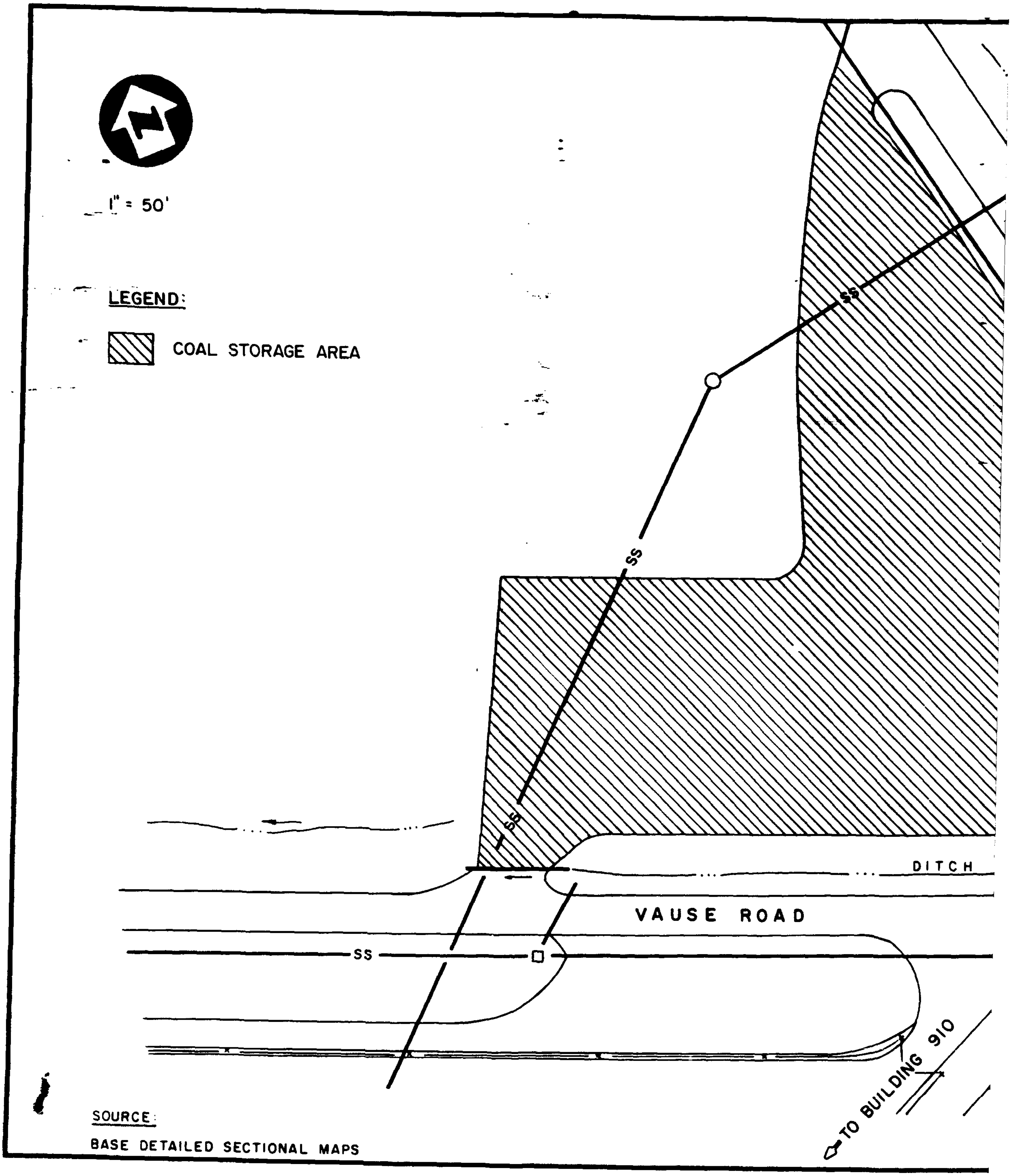


SOURCE:
BASE DETAILED SECTIONAL MAPS

FIGURE 1.15



SITES 19 AND 22
NORTH COAL PILE AND LUBE OIL DRUM STORAGE
RICKENBACKER AIR NATIONAL GUARD BASE



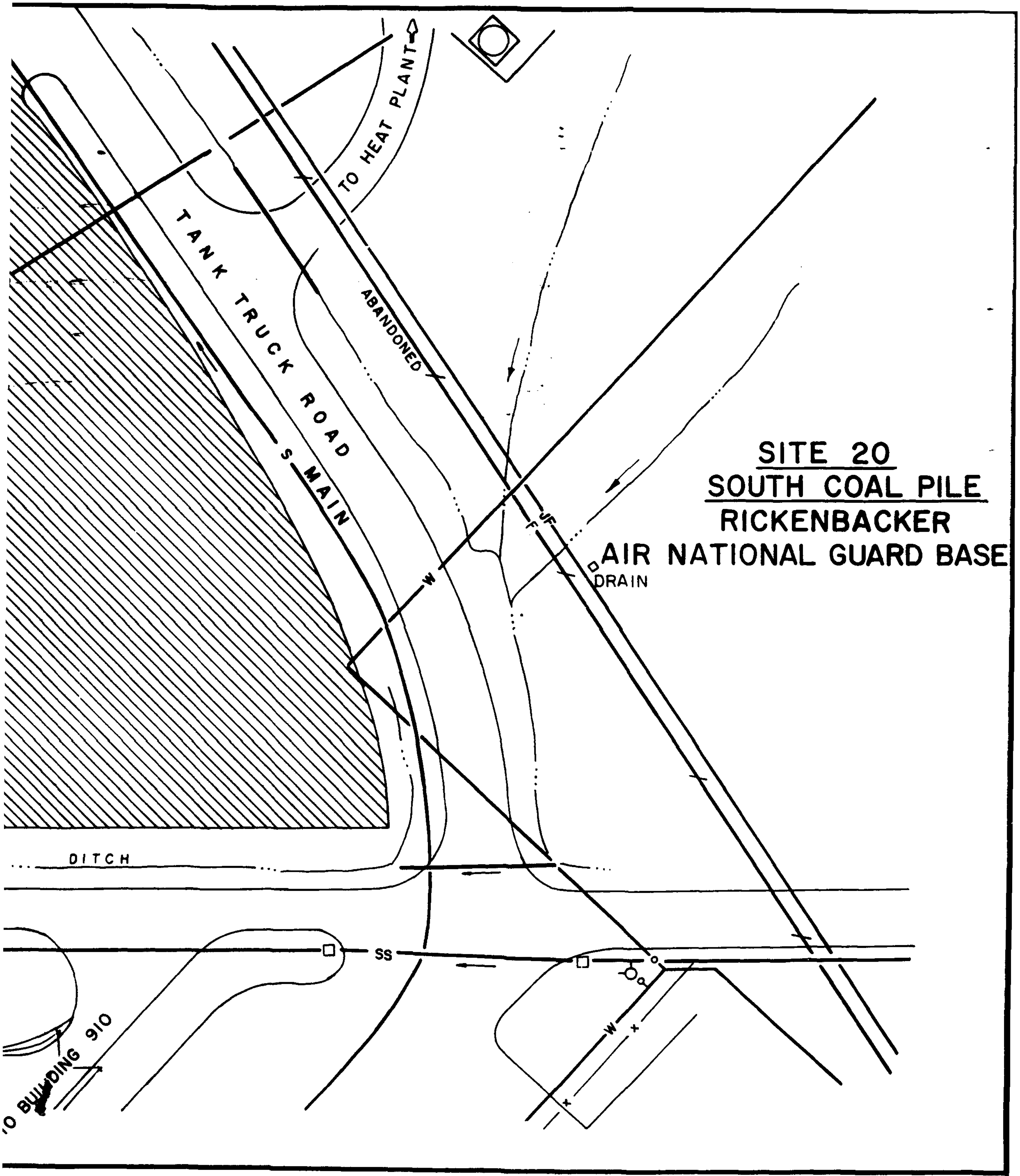
1" = 50'

LEGEND:

▨ COAL STORAGE AREA

SOURCE:

BASE DETAILED SECTIONAL MAPS



SITE 20
SOUTH COAL PILE
RICKENBACKER
AIR NATIONAL GUARD BASE

The coal stored at both piles is high in sulfur content (4%) and was, in the past, soaked with fuel oil to improve ignition and combustion. There is some doubt as to whether present operations include soaking the coal. Further investigation of coal handling practices will be conducted during the SI. Both coal piles have been in use since 1953, the year the heating plant went into operation. Discolored water and stressed vegetation are apparent in the drainage ditches and around the perimeter of the slabs.

Site 21: Leaking Drum & Oil Change Area at Water Treatment Plant (Figure 1.17)

The HAS for this site is 54, ranking 16th of the 22 rated sites.

This site includes: 1) approximately 50 square feet of oil-stained soil surrounding a barrel of WD-30 lubricating oil within the fenced area surrounding the water treatment plant and 2) approximately 100 square feet of oil-stained gravel and soil adjacent to the RV and boat storage yard where crankcase oils have been drained.

Site 22: Heating Plant Lube Oil Drum Storage Area (Figure 1.15)

The HAS for this site is 51, ranking 19th of the 22 rated sites.

This site is a gravel covered area behind the heating plant, adjacent to the North Coal Pile (Site 19). Approximately 50 square feet of oil-stained gravel and some stressed vegetation is apparent between the drums and the adjacent drainage ditch.

Site 23: Fire Training Area (Figure 1.18)

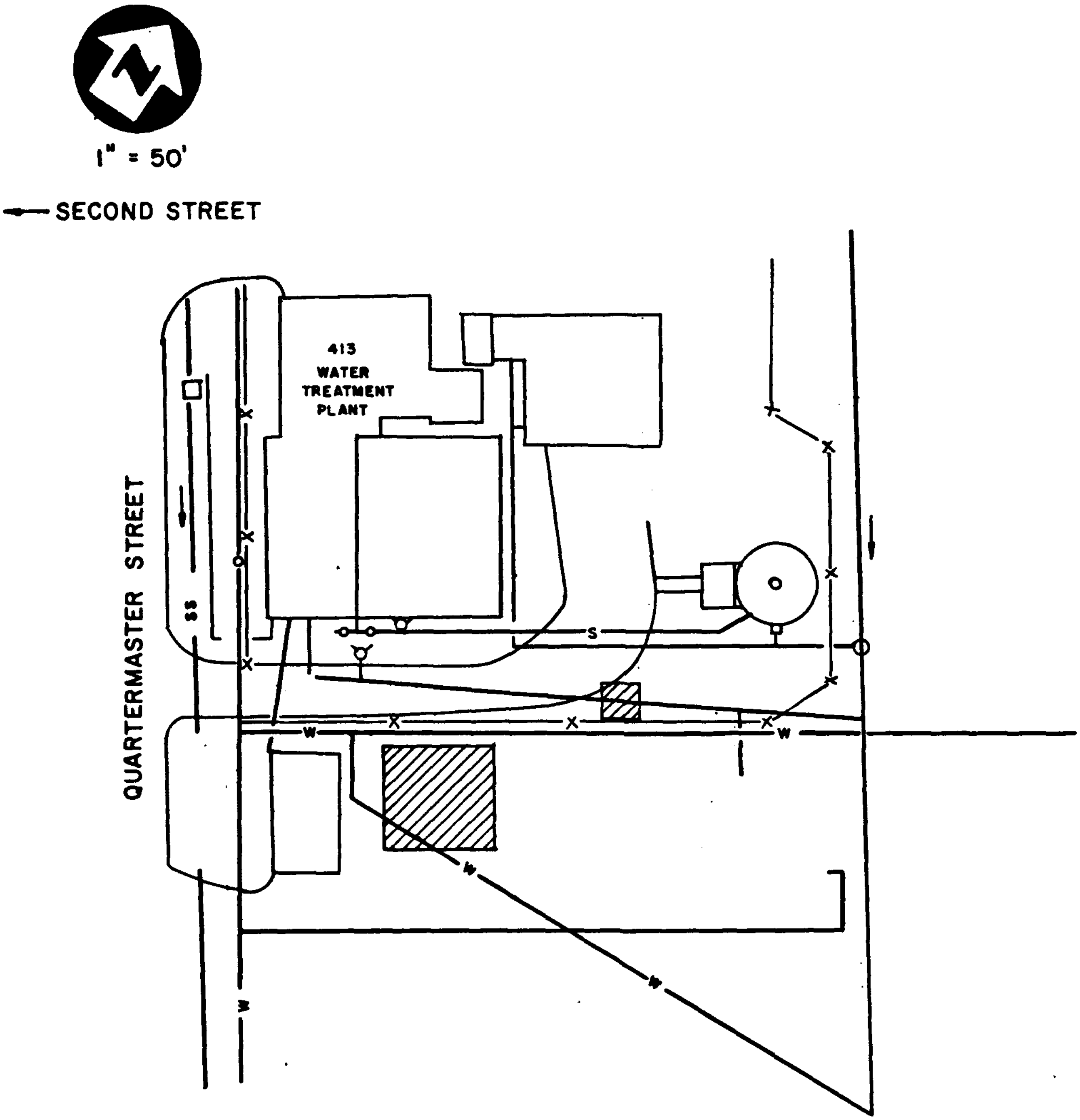
The HAS for this site is 63, ranking 6th of the 22 rated sites.

This site consists of three loosely-packed, earth dikes intended to contain flammable liquids which are ignited for fire-training purposes. The diked areas range in size from 4,000 to 22,000 square feet. The dikes rest on top of an old runway surface which reportedly is constructed of three inches of asphalt over twelve inches of reinforced concrete. A strong odor of petroleum products is apparent in the diked areas and much of the dike material is oil-stained. Surface runoff from this area that escapes the confinement of the dikes would enter the storm drain network underlying the grass area to the east.

Site 24: Sanitary Sewage Treatment Plant Sludge Beds (Figure 1.19)

The HAS for this site is 50, ranking 20th of the 22 rated sites.

This site includes the sludge beds west of the sewage treatment plant



LEGEND:

▨ AREAS OF OIL-STAINED SOILS

—X— FENCE

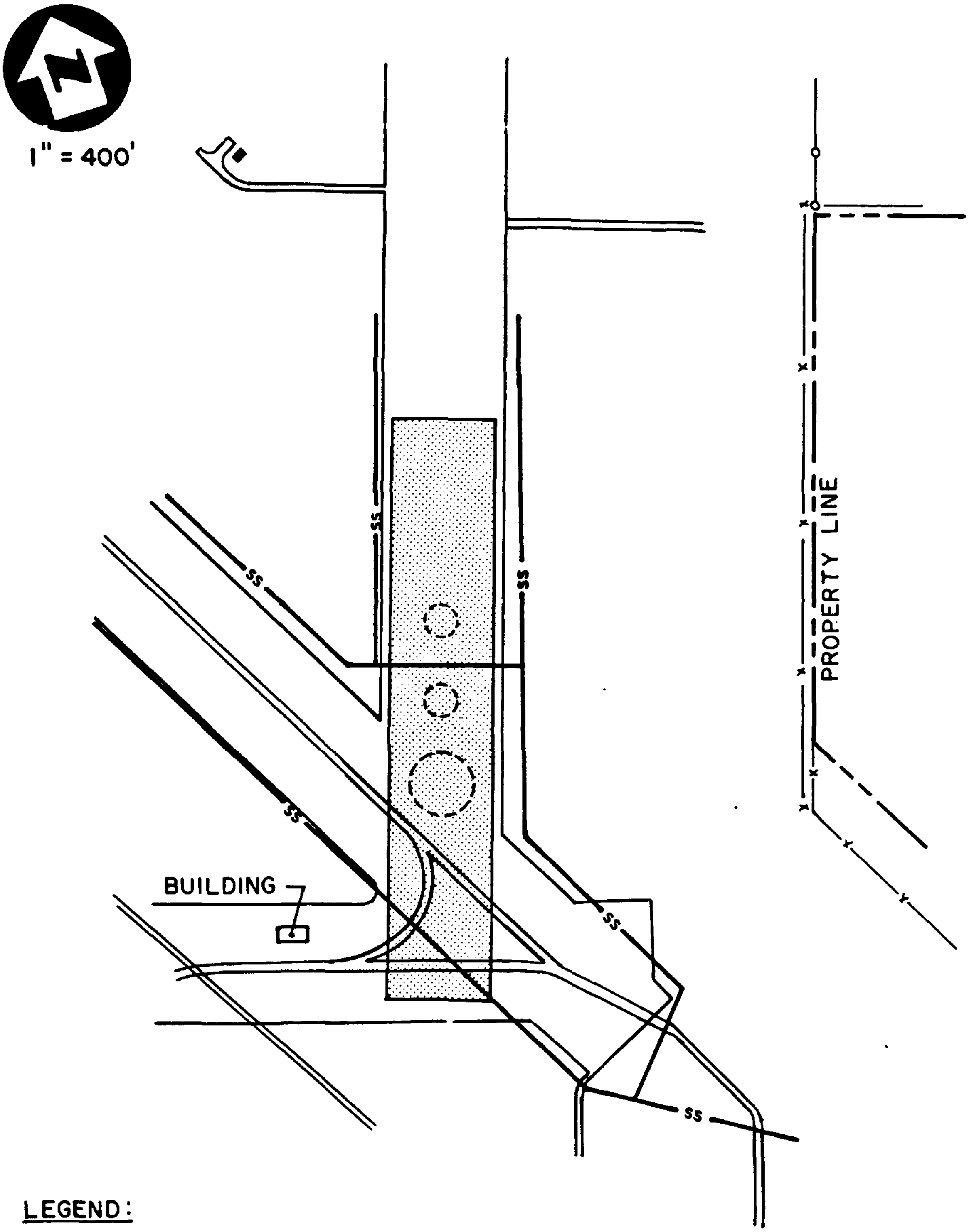
SITE 21

LEAKING DRUM AND OIL CHANGE AREA

RICKENBACKER AIR NATIONAL GUARD BASE

SOURCE:
BASE DETAILED
SECTIONAL MAPS

FIGURE 1.18



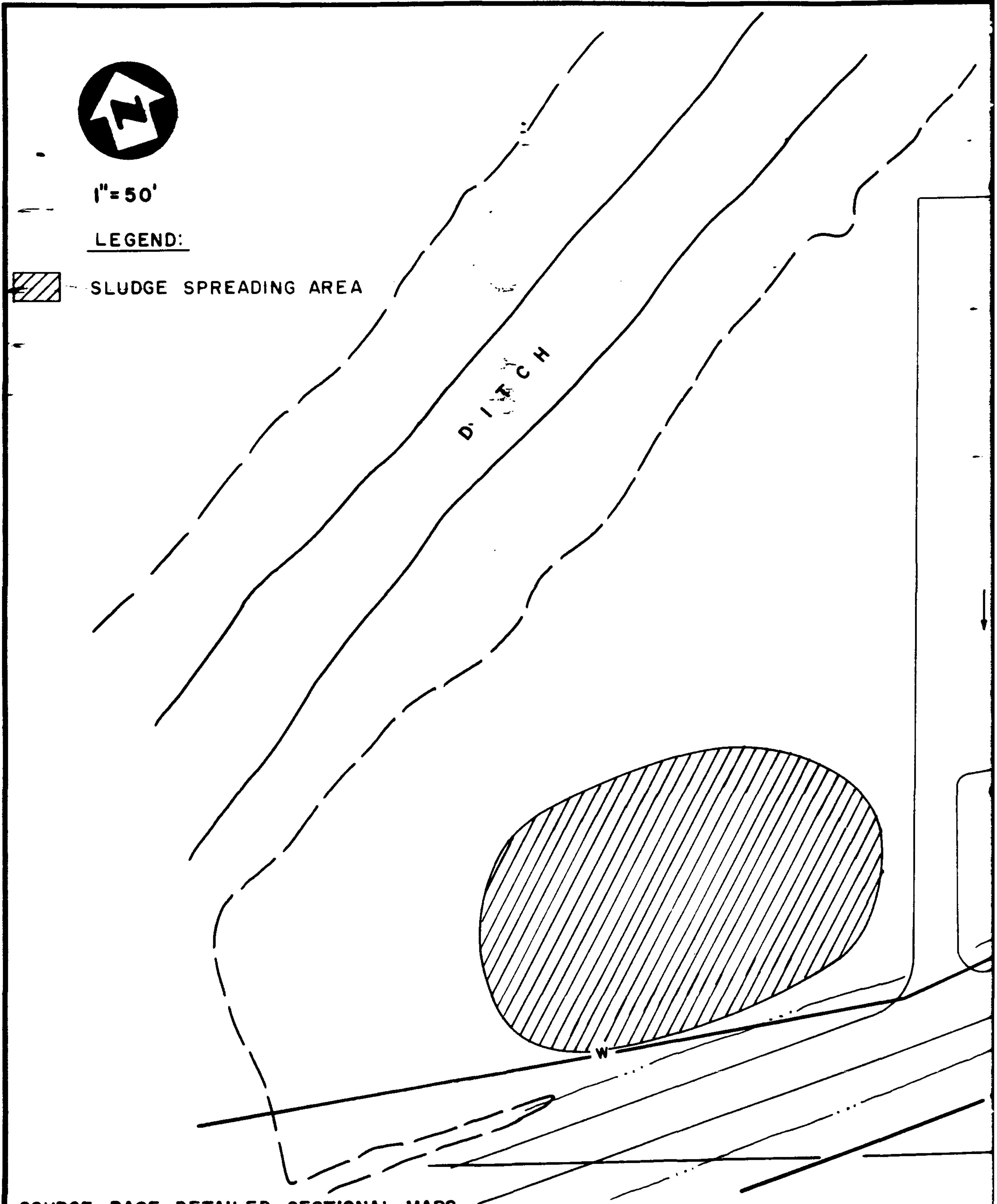
LEGEND:

▨ AREA USED FOR FIRE TRAINING

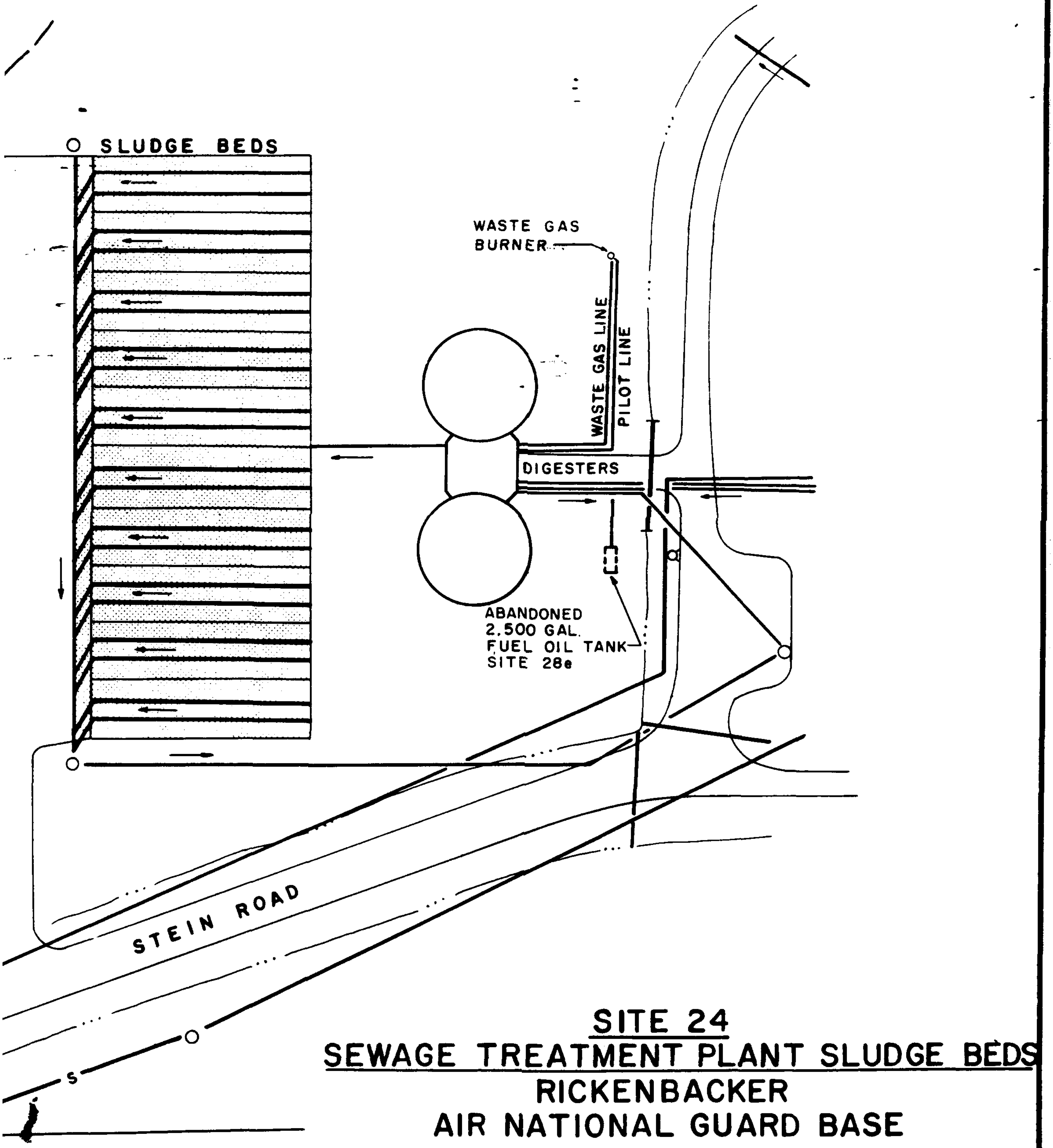
◌ DIKED AREA

SITE 23
FIRE TRAINING AREA
RICKENBACKER AIR NATIONAL GUARD BASE

SOURCE: BASE STORM DRAINAGE SYSTEM PLAN



SOURCE: BASE DETAILED SECTIONAL MAPS



SITE 24
SEWAGE TREATMENT PLANT SLUDGE BEDS
RICKENBACKER
AIR NATIONAL GUARD BASE

and the sludge disposal area southwest of the sludge beds. The sewage treatment plant was active from the late 1950s until 1983, treating sewage from the entire Base community. The Base was connected to the Columbus Municipal Sewage System in 1983. While in operation, the sludge beds were filled periodically to allow the sludge to dewater and the partially dried sludge was either transported off-Base or deposited in the sludge disposal area as a soil enhancer for a community garden plot. Residual dried sludge remains in the beds. The beds are constructed of concrete and probably inhibit migration of leachate derived from the sludge.

<u>Site 25: Storm Drainage Ditch System</u> (Figure 1.20)

The HAS for this site is 70, ranking first of the 22 rated sites.

This site includes all of the open drainage ditches throughout the Base. During the long history of operations at Rickenbacker, various solvents and fuels from aircraft maintenance areas and shops have been spilled into drains connected to the Base storm-drain network which eventually leads into open ditches and finally into the oil water separators located at the Base boundaries. Figure 1.20 shows the open drainage ditches and associated separators which will be the primary focus of the investigations. Most shop drains are now connected to the sanitary sewer system which is tied into the City of Columbus Wastewater Treatment System. All surface runoff continues to pass through the drainage ditch system.

<u>Site 26: Electrical Transformer Storage</u> (Figure 1.10)

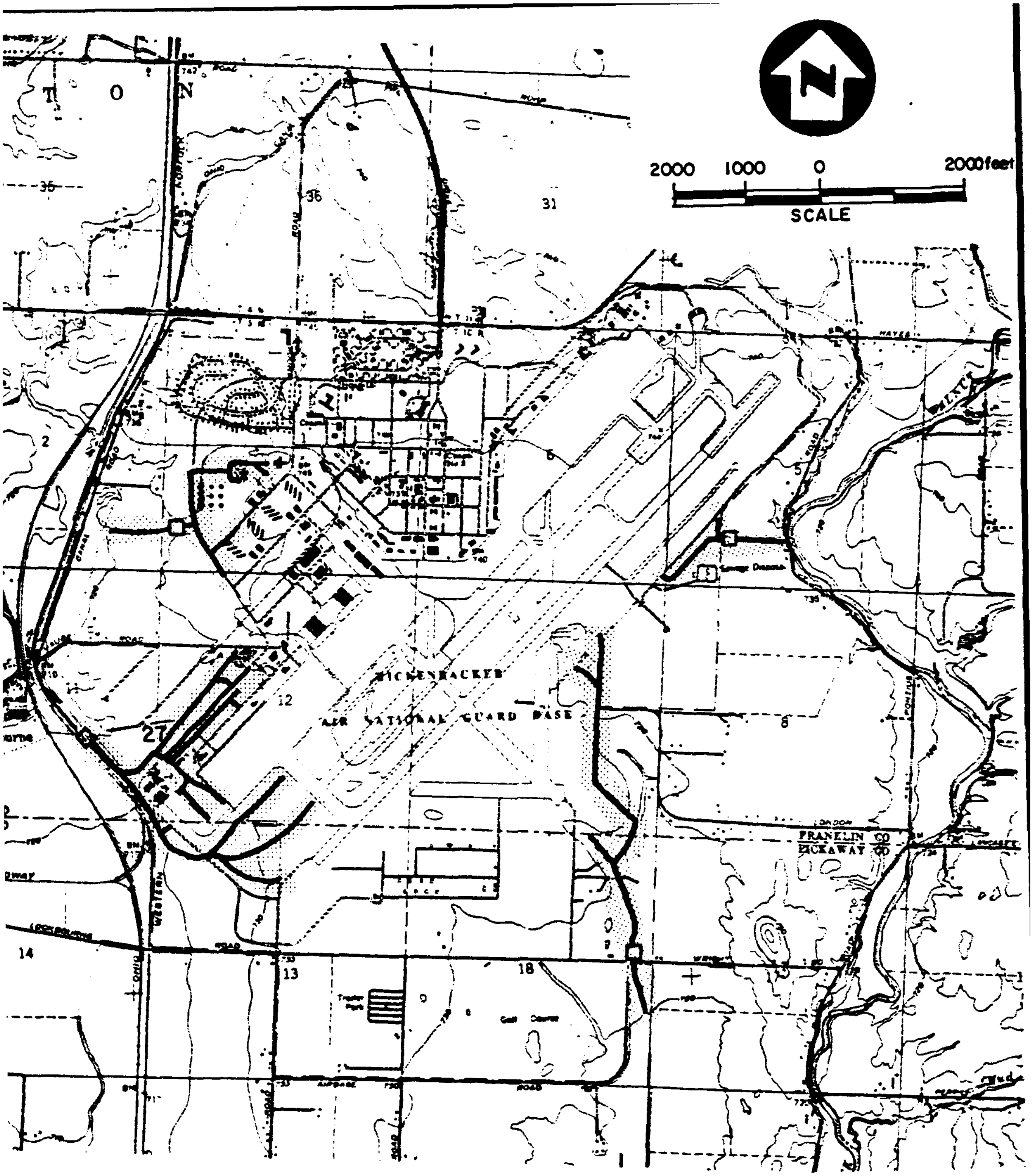
The HAS for this site is 48, ranking 21st of the 22 rated sites.

This site is a gravel covered, open storage yard at the southwest end of the Salvage Yard (Site 9). This location contradicts the Phase I Report, but is based on a recent review of records by Base personnel. The area was used to store electrical transformers until 1975. Twenty-five to thirty transformers were stored at any time. No dielectric fluid leaks have been documented and there is no record of whether the transformers contained polychlorinated biphenyls (PCBs).

<u>Site 27: Drainage Ditch Near Landfill</u> (Figure 1.20)

The HAS for this site is 59, ranking 9th of the 22 rated sites.

The site includes the drainage ditch adjacent to the landfill gate. On 20 August 1982, an unidentified "milky white liquid" was observed in the ditch. A sample collected at that time was analyzed by CTL Engineering,



LEGEND:

□ OIL-WATER SEPARATOR

— OPEN DRAINAGE DITCH

27 SITE 27

SITES 25 & 27
DRAINAGE DITCH NETWORK
AND DITCH NEAR LANDFILL GATE
RICKENBACKER
AIR NATIONAL GUARD BASE

SOURCE:
USGS, LOCKBOURNE, OHIO
7.5 MIN. QUADRANGLE

Inc., and found to contain a series of alkylbenzenes, and low molecular weight olefins as head-space gas and terpene hydrocarbons, alkyl benzenes and alkyl naphthalenes as extractable organic compounds (CTL Letter Report, 2 September 1982). The white color was attributed to inorganic compounds, probably paint pigments. Bags of activated carbon were placed downstream of the spill in an attempt to reduce dispersion of contaminants. Investigation of efficacy of the carbon and its disposal will be conducted.

Site 28: Abandoned Underground Tank Investigation

This site was not rated because it was added to the Scope of Work after completion of the PA Report.

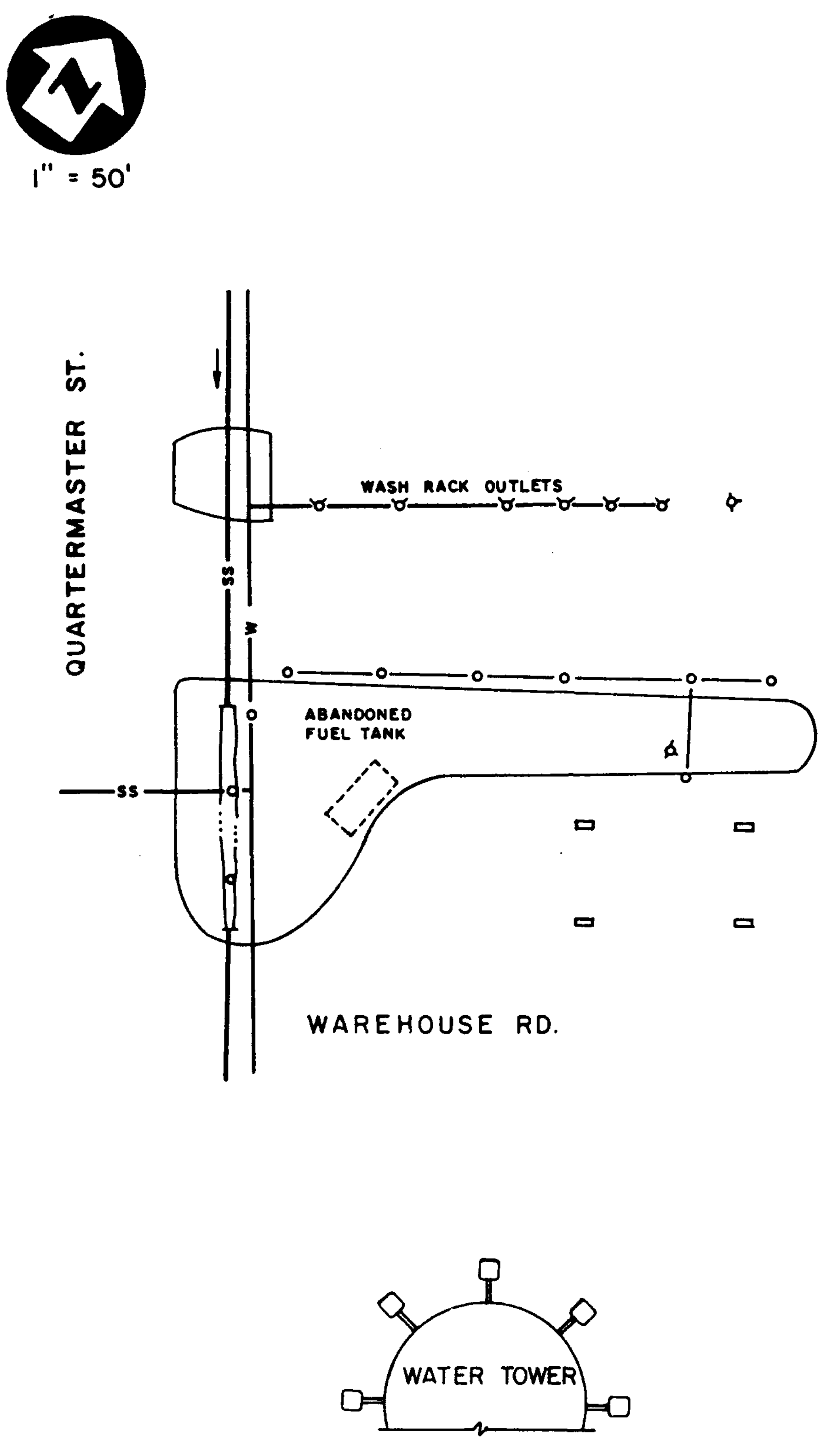
This site includes abandoned underground storage tanks at five sites. Site 28a (Figure 1.21) includes one abandoned underground gasoline tank at an abandoned filling station site adjacent to the Base water tower.

Site 28b (Figure 1.22) is the underground slop oil tank adjacent to the automotive hobby shop (Building 848). The tank was a repository for waste oils generated by the automotive shop and other shops in the area, but is currently not in use.

Site 28c (Figure 1.23) includes four abandoned underground diesel fuel storage tanks along the railroad siding near the hazardous waste storage area (Site 1).

Site 28d (Figure 1.24) includes two abandoned underground gasoline tanks and one abandoned underground slop oil tank behind the Base filling station (Site 6).

Site 28e (Figure 1.19) includes the abandoned 2,500 gallon underground fuel oil tank at the sewage treatment plant (Site 24).



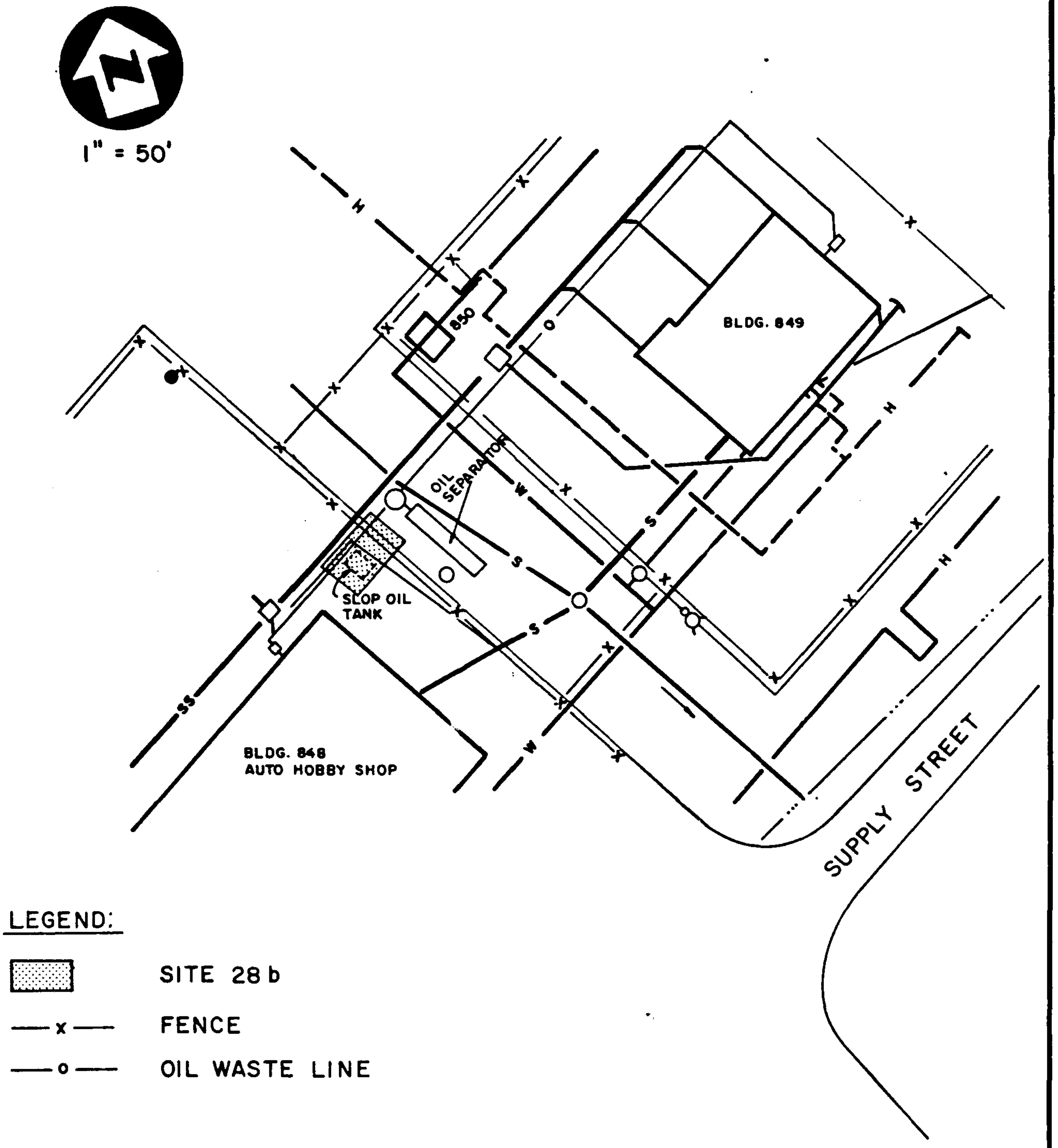
SITE 28a

ABANDONED GAS STATION

RICKENBACKER AIR NATIONAL GUARD BASE

SOURCE:
BASE DETAILED SECTIONAL MAPS

FIGURE 1.22



LEGEND:

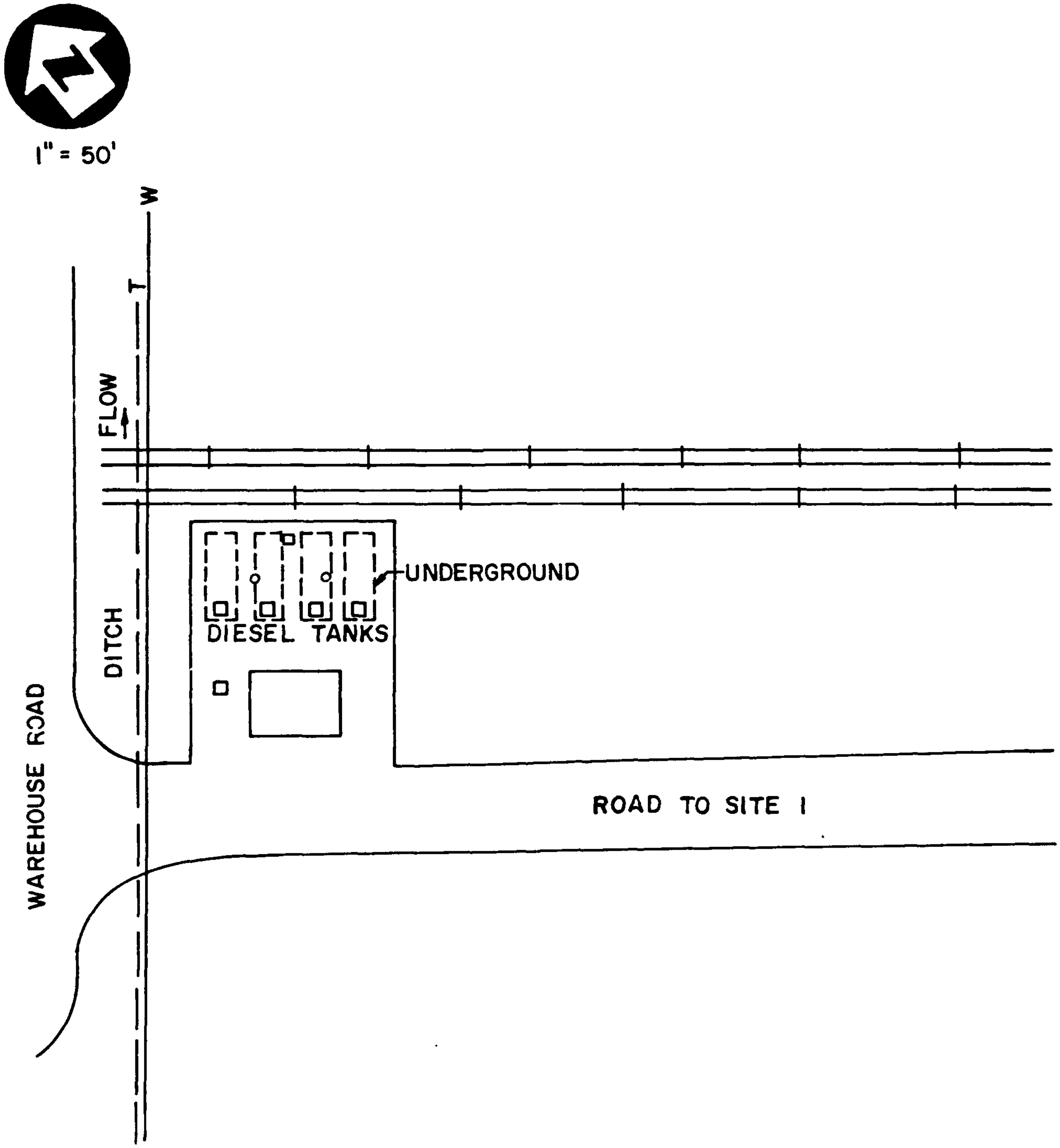
▨ SITE 28 b

—x— FENCE

—o— OIL WASTE LINE

SOURCE:
BASE DETAILED
SECTIONAL MAPS

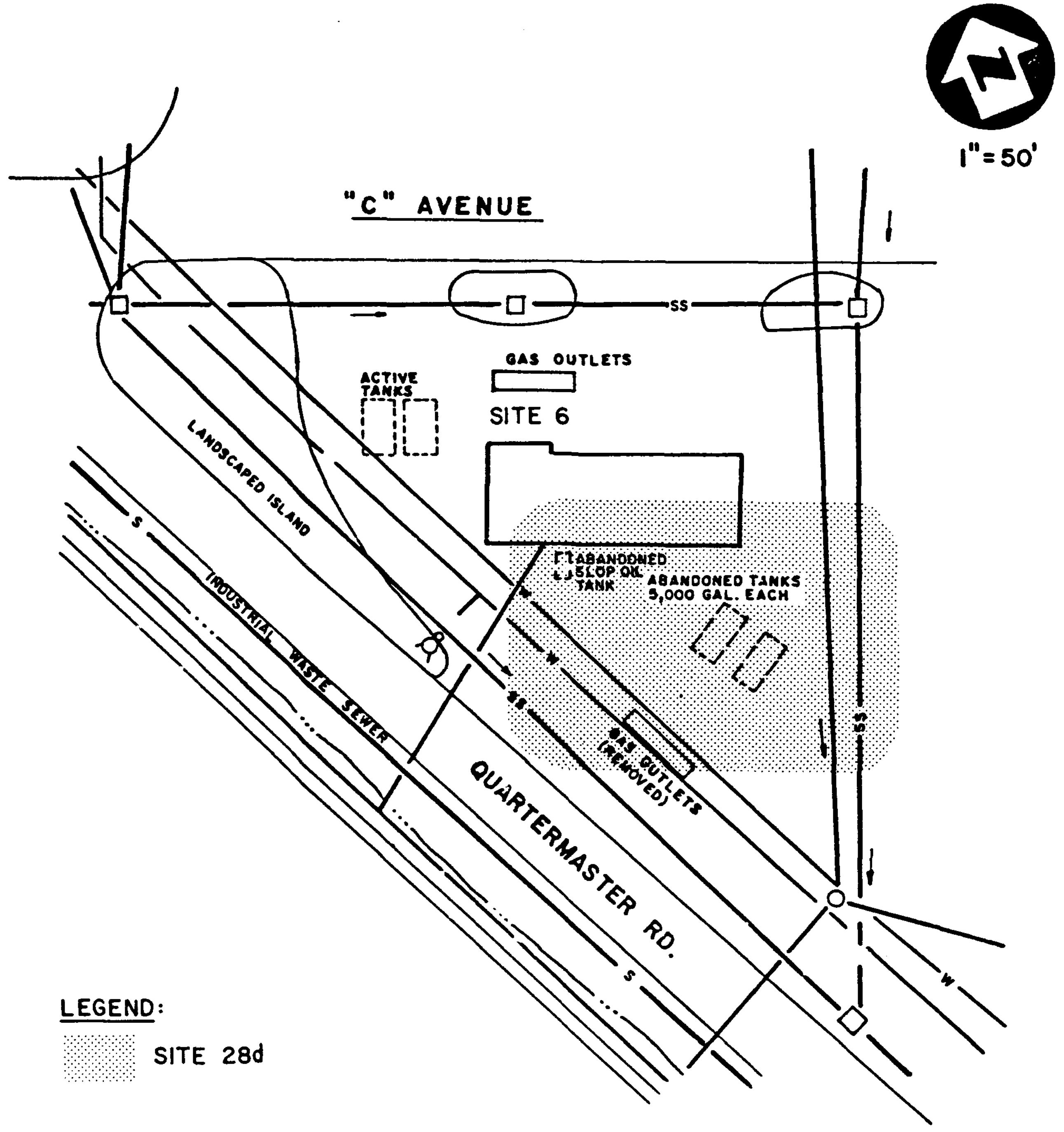
SITE 28b
SHOP SLOP OIL TANK
RICKENBACKER
AIR NATIONAL GUARD BASE



SITE 28c
ABANDONED DIESEL FUEL TANKS NEAR SITE 1
RICKENBACKER AIR NATIONAL GUARD BASE

SOURCE:
BASE DETAILED SECTIONAL MAPS

FIGURE 1.24



SITE 28d
ABANDONED USTs BEHIND
BASE FILLING STATION
RICKENBACKER
AIR NATIONAL GUARD BASE

SOURCE:
BASE DETAILED SECTIONAL MAPS.

SECTION 2

PROJECT WORK PROGRAM

This section presents the tasks which will be performed for implementation of the Site Inspection/Remedial Investigation/Feasibility Study/Remedial Design (SI/RI/FS/RD) for the 23 sites at Rickenbacker ANGB described in Section 1. The scope of work includes required tasks from preparation of the Work Plan through preparation of plans and specifications for selected remedial measures (if necessary).

TASK 1 - PREPARE PROJECT WORK PLAN

A Work Plan (this document) will be prepared which will include a scope of work, descriptions of each task, and the schedule for completion of the tasks. The Work Plan will also include a plan for implementation of the Site Inspection and Remedial Investigation, a Health and Safety Plan, a Laboratory Quality Assurance/ Quality Control (QA/QC) Plan, and a Short-Term Community Relations Plan.

TASK 2 - CONDUCT SITE INSPECTION

The scope of work for the Site Inspection (SI) is described in detail in Section 3 of this document. The purpose of the Site Inspection (SI) is to confirm the presence or absence of contamination of soils, sediment, surface water and groundwater and to assess the potential risks to the environment and human health and welfare. A Site Inspection Report will be prepared at the completion of the SI. This report will summarize the findings of the study and will present recommendations for further work in the Remedial Investigation to determine the extent of contamination.

TASK 3 - CONDUCT REMEDIAL INVESTIGATION

The scope of work for the Remedial Investigation is described in detail in Section 4 of this document. The purpose of the Remedial Investigation (RI) is to define the extent of contamination detected in the SI and to continue to assess risks to the environment and human health and welfare. A Remedial Investigation Report will be prepared at the completion of the RI. This report will summarize the findings of the study and will present recommendations for further work in the Feasibility Study.

TASK 4 - FEASIBILITY STUDY

Screen Control Measures

All control measures, including management methods and technologies relevant to remedying site problems identified in Task 3, will be screened on the basis of feasibility, cost, and environmental and public health effects. Control methods will not be eliminated solely due to non-compliance with regulatory standards because they may be used in conjunction with other control measures to comply with regulatory standards. Innovative, unique, or unproven technologies that are relevant to site problems will be brought to the attention of the NGB. An Alternatives Evaluation Report (AER) will be prepared to include control measures that passed the screening process. The report will also include a discussion of the rationale used for selecting and eliminating all candidate control measures. The report will also identify control measures that should be implemented immediately pending completion of the Feasibility Study Report (FSR), if site conditions warrant such actions. If additional field or technology performance information (including additional site characterization and treatability studies) requirements are identified during the control measure screening process, the NGB will be notified and they will assist in evaluating the additional data needs and will decide if additional studies are warranted.

Develop Detailed Alternatives

These alternatives will be described in sufficient detail to apply appropriate evaluation and selection criteria. Development of the No Action Alternative will be included. The descriptions of each detailed alternative will include at a minimum:

- Identification of technologies incorporated;
- Key design assumptions that will affect performance, implementability, environmental impact, or cost;
- Measures needed to ensure worker safety during implementation; and
- Identification of management methods incorporated, such as land use controls, right-of-way acquisition, personnel training and supervision, permanent relocations, and coordination with Federal, State, and local agencies.

Each detailed alternative will include estimates of capital cost, operation and maintenance (O&M) costs, and the results of a present worth analysis.

If additional field or technology performance information requirements are identified during the alternatives development process, the NGB shall be notified and will assist in evaluating the additional data needs.

Evaluate Detailed Alternatives

Each detailed alternative will be evaluated according to five criteria:

- Engineering feasibility;
- Cost analysis;
- Public health analysis;
- Environmental assessment; and
- Regulatory requirements.

A narrative matrix that presents the major conclusion of these evaluations will be prepared. An Alternative Evaluation Report (AER) will be prepared to summarize, in the form of a narrative matrix, the evaluation of the detailed alternatives. The AER will also include a table summarizing the cost analysis for each detailed alternative, and the recommended alternative with supporting rationale.

Describe Selected Alternative

The alternative which best meets NGB objectives will be determined and will be described in detail, including the following information.

Engineering Description

- Conceptual design criteria and rationale
- Operational description of process units or other facilities
- Description of operation and maintenance (O&M) requirements
- Types of equipment required, including approximate capacity, size, and construction materials
- List of additional engineering data required to proceed with design
- Preliminary project schedule
- Conceptual plan view drawing(s) of overall site showing general locations for project actions and facilities

Cost Analysis

- Capital cost estimates
- O&M cost estimates and duration of operating expenses

Regulatory Compliance

- Construction and environmental permit requirements

- Description of technical requirements for environmental mitigation measures
- Right-of-way requirements
- Operating permit requirements

The description will be comprehensive and sufficiently detailed to be used as a baseline document for design and construction of the selected remedial alternative.

Prepare Environmental Assessment

An Environmental Assessment will be prepared which documents all of the environmental analyses conducted in support of FSR preparation. The Environmental Assessment will include summary descriptions of detailed alternatives considered in the FSR, environmental impact analyses of each alternative, either references for all data cited or the actual data that support the analyses, and descriptions of mitigating measures appropriate for each detailed alternative.

Prepare Feasibility Study Report

A Feasibility Study Report (FSR) will be prepared which will document the results of the feasibility study. The FSR will undergo two revisions, an Internal Draft to be reviewed by NGB and Energy Systems and a Draft to be reviewed by regulatory agencies.

TASK 5 - REMEDIAL DESIGN AND TECHNICAL SUPPORT

Two phases of Remedial Design and Remediation Technical Support will be necessary on this project. The first Remedial Design phase will involve developing plans and specifications for abandoned underground tank removal. The second phase will follow completion of the Feasibility Study Report (FSR) or a decision document with a risk assessment which indicates that development of detailed engineering plans and specifications for site remediation should be initiated.

Abandoned Tank Removal Design and Specifications

Following determination of abandoned tank locations in the SI, plans and specifications (a bid specification package) will be prepared. The package will include plans for tank and associated piping removal, specifications for surrounding soil sampling to determine presence/absence of contamination and available options for disposal of any soils found to be contaminated.

To ensure compliance with the plans and specifications, on-site technical support during tank removal will be provided. This support will include assuring that the laboratory and analysis parameters selected by the Contractor are appropriate, observing and reporting on sampling techniques and reviewing the analytical results.

Remedial Design and Remediation Support

The final design package will include engineering drawings and technical specifications, a detailed construction bid-check estimate, health and safety plan requirements, field and analytical QA/QC requirements, identification of all required permits for completing the work, components of the construction bid package required by the Base Contracting Office, and a schedule for implementation. The design process will include provision for at least three design reviews and subsequent revisions before release of the finished documents. Support to the Base Contracting Officer for selection of the remediation contractor may be supplied if requested by the Energy Systems Project Manager and the Base.

To ensure compliance with the design documents and to assist in determining the correct response to unanticipated findings, if any, on-site technical support to the Base Contracting Office during the remediation process will be provided. This effort will include maintenance of a daily log of events and conditions encountered at the site, submission of periodic progress reports, and preparation of a final report at the conclusion of site activities. The report will summarize what was done and the results of analyses conducted. The report will also include recommendations for the disposition of the site and technical justification. The final report will undergo at least two revisions.

SECTION 3
SITE INSPECTION

The primary purpose of the Site Inspection (SI) is to confirm the existence or lack of contamination of the soils, sediments, groundwater and surface water at Rickenbacker Air National Guard Base (the Base) and to assess the potential risks the contamination poses to the environment and human health and welfare. To reach these stated goals, several subtasks are necessary, including evaluation of local hydrogeology, identifying potential receptors and evaluating levels of contamination in the context of federal, state and local standards.

The SI can be divided into three phases: 1) Data Collection, 2) Data Analysis and 3) Reporting. The data collection phase includes installation of monitoring wells, collecting soil and water samples for chemical analysis and conducting soil-gas surveys. Details of the scope and techniques of these investigations are included in this and subsequent sections of this Work Plan.

The data analysis phase overlaps with data collection as many field decisions will be made based on previous results. The goals of the data analysis phase are to: 1) make yes-no decisions on the existence of contamination at each site, 2) evaluate the effect of contamination on the environment and human health and welfare, and 3) reach a decision concerning the continuation of investigations at a site in a Remedial Investigation and/or Feasibility Study.

The reporting phase of the SI involves documenting all activities of the first two phases in a Site Inspection Report (SIR). Included in the SIR will be a water table contour map of the entire Base, estimates of the direction and rate of ground water flow, geologic profiles through several sites, a summary assessment of potential contaminant receptors and impacts and a recommendation for further investigations at specific sites during the RI. If a site is eliminated from the RI, a decision document, including preliminary risk assessments, will be prepared.

The general order of investigation in the data gathering phase of the SI will be: 1) magnetometer surveying, hand boring, ditch bottom and surface sediment sampling and surface water sampling, 2) soil boring and monitor well installation with soil-gas survey screening and 3) groundwater sampling and aquifer testing. Site by site descriptions of the proposed investigations are included later in this Section and summarized in Table 3.1. Detailed descriptions of investigation and sampling techniques are included in Sections 5 and 6 (Field Investigation Procedures and Sampling and Analytical Procedures).

The first part of the field investigations includes magnetometer surveying, hand boring, surface soil sampling, and ditch bottom sediment and surface water sampling. The magnetometer surveying will be done to determine the locations and approximate dimensions of underground storage tanks. Hand borings will be taken at points of visible contamination or vegetative stress and in areas where shallow soil contamination is expected (e.g., Lubricant Storage and Oil Change Area, Sites 21 and 22). Three samples will be collected from each hand boring. Surface soil sampling will be done at sites where surface contamination by compounds with low mobility is suspected (pesticides and PCBs at Sites 1 and 26). Ditch bottom sediment samples will be taken from drainage ditches where contamination is suspected. Surface water samples will be collected, whenever water is present, at the ditch bottom sampling locations (See Sections 5 and 6 for sampling details).

The second part of field investigations includes drilling soil borings, installing monitoring wells and conducting soil-gas surveys. Thirty-eight monitoring wells screened in the upper aquifer are planned for the 28 sites. The upper aquifer is defined as the shallowest saturated sediments encountered in a given boring which, in the judgment of the on-site geologist, are capable of transmitting water. Two soil samples from each well boring will be submitted for chemical analysis. Sections 5 and 6 contain sampling technique details.

Two additional monitoring wells will be installed within the Base water supply well field. One of the wells will be screened in the upper aquifer. The other will be screened in the second aquifer. The second aquifer will be determined in the field by the well-site geologist. No other second aquifer wells are planned for the SI. Investigation of possible contamination of aquifers below the upper aquifer will be done during the RI.

Because of a lack of data on the upper aquifer, 17 wells will be installed in an initial round of well drilling at 16 locations throughout the Base (Figure 3.1). These initial well locations have been selected with the objective of defining the ground-water gradient, so placement of subsequent "up" and "down" gradient wells can be done with greater confidence. The subsurface soil and hydrogeologic information obtained from the initial wells will also be utilized to design a soil-gas survey program.

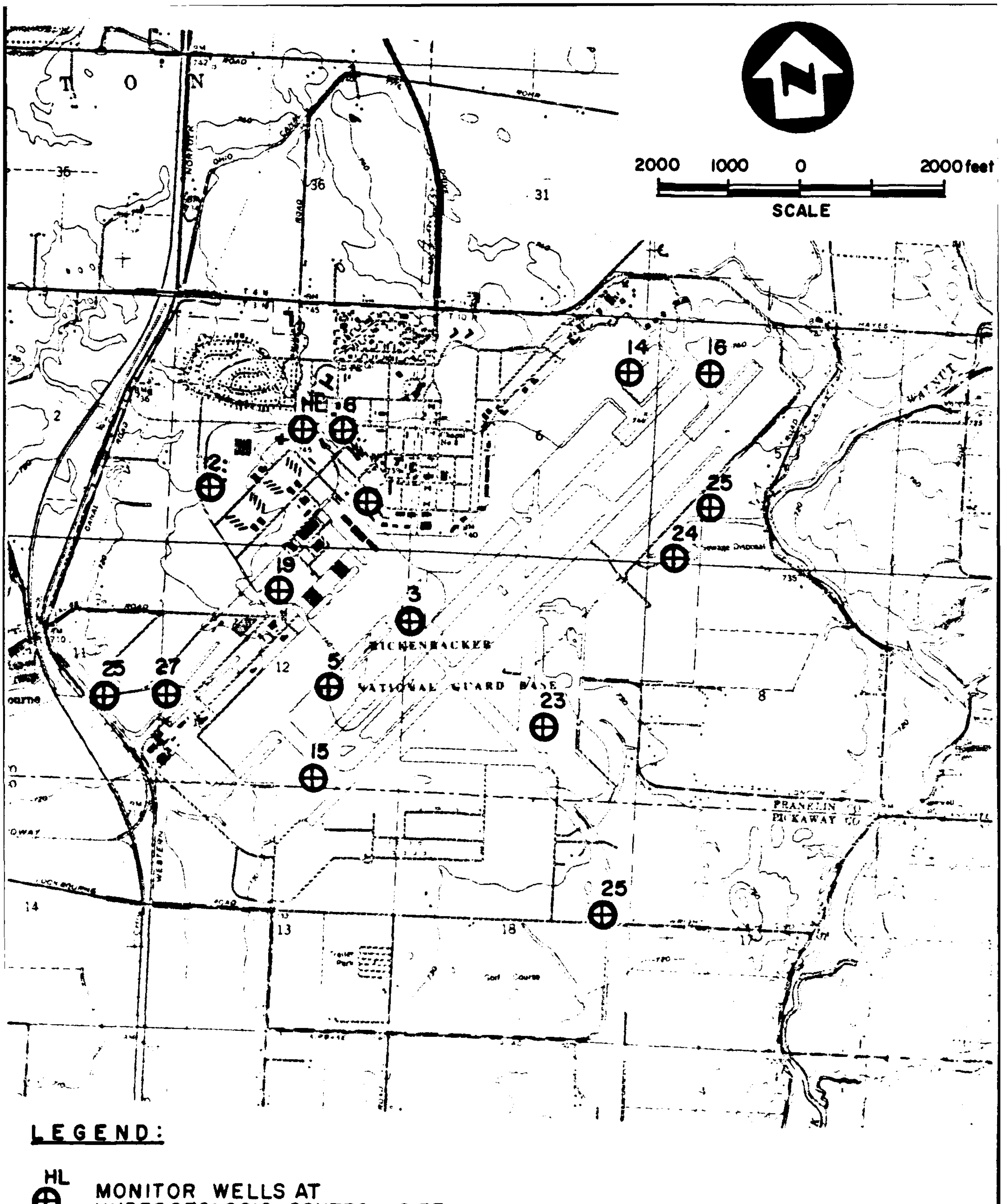
Several factors contribute to the validity of soil-gas survey results. Depth to contaminated water, shallow stratigraphy and the characteristics of the contaminant contribute to the observed soil-gas concentrations. Consequently, an understanding of the hydrogeology and expected contaminants at a site is necessary before designing a soil-gas survey program.

The volatile compounds of interest at the JP-4 spill sites (benzene, toluene and xylenes) are affected by biological degradation in shallow soils, sometimes resulting in false negative soil-gas survey results, especially with older contamination. Impermeable clay layers above contaminated water also can contribute to false negative results by trapping water which impedes the upward migration of volatile gases. At sites where more than one well is planned, the soil-gas and initial well results will be used to finalize additional well and boring locations.

Results of the surface sediment, hand boring and ditch sampling portion of the field investigation will also be used to maximize the effective placement of wells and borings. Well drilling, surveying and soil-gas surveying will be coordinated to reduce driller mobilization and standby time.

Ground water sampling will be done at each site with chemical analyses chosen based on expected contaminants. Justification for choice of analysis is included in the following site by site explanations and summarized in Table 3.1.

Slug tests will be performed on each well to determine hydraulic conductivity, estimate ground-water flow rates and make preliminary estimates of aquifer yields. The tests are planned for all wells in order to document lateral variability in the shallow aquifer.



LEGEND:

HL ⊕ MONITOR WELLS AT HYDROGEOLOGIC CONTROL SITE

6 ⊕ INITIAL MONITOR WELL LOCATION WITH SITE NUMBER

SOURCE:

USGS LOCKBOURNE, OHIO
7.5 MIN. QUADRANGLE

LOCATIONS OF INITIAL MONITOR WELLS
RICKENBACKER AIR NATIONAL GUARD BASE
COLUMBUS, OHIO

At sites where contamination is detected, an inventory of underground utility trenches and trench fill material will be done using Base records to identify potential contaminant migration pathways.

SITE BY SITE SCOPE OF SITE INSPECTION

Table 3.1 summarizes the activities and analyses described in the following descriptions. The site drawings (Figures 3.2 - 3.23) include the locations of underground utilities because the backfill around such utility lines often act as contaminant migration pathways. Table 3.2 is a legend for the utility drawings. Sections 5 and 6 include more detailed descriptions of field methods and sampling techniques.

SITE 1 - Hazardous Waste Storage Area: A magnetometer survey will be conducted over the entire area to determine the location and dimension of any UST. Surface soil samples will be collected from the drum storage area enclosed by the fence (Figure 3.2). Surface sampling is appropriate because the types of materials reportedly stored here (PCBs, pesticides and herbicides) are relatively immobile, tending to remain in the upper soil horizon. Soil samples from hand borings will be taken at areas where vegetative stress or surface staining suggests contamination may have penetrated deeper into the soil. These soil samples will be analyzed for pesticides, herbicides, PCB, priority pollutant metals and volatile and semi-volatile organics.

One monitor well to the shallow aquifer will be installed near the hazardous waste tanks to detect possible contamination from the tanks. A ten point soil-gas survey will be conducted after initial well installation. Two additional monitor wells will be installed at locations based on results of the shallow soil sampling, the soil-gas survey and the preliminary hydrogeologic evaluation. One well will be placed upgradient and one at the downgradient edge of the contaminant plume (if any) indicated by the preliminary surveys. Selected soil samples collected while drilling the wells and ground water sampled after well installation will be analyzed for priority pollutants including organic and inorganic constituents.

SITE 2 - JP-4 Tank Farm: The initial well at this site will be installed outside the southwest corner of the diked enclosure (Figure 3.3). This location was chosen because dike-water drainage from the tank cells is through the drainage ditch on the south side of the cells. A ten-point

TABLE 3.1
SUMMARY OF SITE INSPECTION PROGRAM

Site	Field Activity	# Field Samples	Matrix	Analyses*
#1	**Hazardous Waste Storage Area:**			
	- Magnetometer Survey to identify locations of underground tanks	--	--	--
	- Sixteen surface soil samples from the Drum Storage Area (Compositing adjacent samples)	8	Soil	BFGK
	- Six Hand-borings in the Drum Storage Area, samples from adjacent borings may be composited	18	Soil	A
	- Three 2" wells screened in the upper aquifer, near the Storage Building (Bldg. 560).	6	Soil	A
	- Ten soil-gas survey points	--	--	--
	- Ground-Water sampling	3	Water	A
	- Slug tests in three wells	--	--	--
#2	**JP-4 Tank Farm:**			
	- Three 2" wells to upper aquifer	6	Soil	E
	- Ten soil-gas survey points	--	--	--
	- Ground-Water sampling	3	Water	E
	- Slug tests in three wells	--	--	--
#3	**JP-4 Pumping Station 4**			
	- Two 2" wells to upper aquifer within spill area	4	Soil	E
	- One boring to water table or 15'	2	Soil	E
	- Ten soil-gas survey points	--	--	--
	- Ground-Water sampling	2	Water	E
	- Slug test two wells	--	--	--
#4	**JP-4 Pumping Station 5**			
	- One 2" well to upper aquifer	2	Soil	E
	- One boring to water table or 15' (or optional well)	2	Soil	E
	- Ten soil-gas survey points	--	--	--
	- Ground-Water sampling	1	Water	E
	- Slug tests of one well	--	--	--
#5	**Lateral Safety Zone Spill Area**			
	- Two 2" wells to upper aquifer	4	Soil	E
	- Two borings to water table or 15'	4	Soil	E
	- Thirty soil-gas survey points	--	--	--
	- Ground-Water sampling	2	Water	E
	- Slug tests in two wells	--	--	--

* EXPLANATION

A = Priority Pollutant Scan (Method 8240, 8270, 8080 & Metals)
B = Organochlorine Pesticides and Chlorinated Phenoxy Herbicides (Method 8080 & 8150)
C = Aromatic Volatile Organics (Method 8020)
D = Halogenated Volatile Organics (Method 8010)
E = Petroleum Hydrocarbons (Method 418.1)
F = Priority Pollutant Metals
G = PCB (Method 8080)
H = Sulfates (Method 9038), Alkalinity and Acidity
I = Lead (Method 7420/ 7421)
J = Methyl Ethyl Ketone as an additional compound in organic analyses
K = Semi-Volatile Organics (Base/ Neutral and Acid Extractables) (Method 8270)

TABLE 3.1
(continued)

SUMMARY OF SITE INSPECTION PROGRAM

Site	Field Activity	# Field Samples	Matrix	Analyses*
#6	**Underground Storage Tanks at the Base Filling Station:**			
	- One 2" well to upper aquifer	2	Soil	EI
	- Ten soil-gas survey points	--	--	--
	- Ground-Water sampling	1	Water	EI
	- Slug test in one well	--	--	--
#9	**Salvage Yard:**			
	- Ten Hand-Borings around the pavement and within old foundations	30	Soil	A
	- Two 2" wells to upper aquifer	4	Soil	A
	- Eight soil-gas survey points	--	--	--
	- Ground-Water sampling	2	Water	A
	- Slug tests in two wells	--	--	--
#10	**JP-4 Fuel Line Rupture:**			
	- One 2" well to upper aquifer (optional)	2	Soil	E
	- Six soil-gas survey points	--	--	--
	- Ground-Water sampling	1	Water	E
	- Slug test one well	--	--	--
#12	**Old Drum Storage Area:**			
	- Ten Hand-Borings along edges of pavement, composite by 2's	15	Soil	CDEJ
	- One 2" well to upper aquifer	2	Soil	CDEJ
	- Ten soil-gas survey points	--	--	--
	- Ground-Water sampling	1	Water	CDEJ
	- Slug tests in one well	--	--	--
#14	**KC 135 Crash Site:**			
	- One 2" well to upper aquifer	2	Soil	E
	- Three Borings to 15' or Water Table	6	Soil	E
	- Ten soil-gas survey points	--	--	--
	- Ground-Water sampling	1	Water	E
	- Slug test in one well	--	--	--

* EXPLANATION

A = Priority Pollutant Scan (Method 8240, 8270, 8080 & Metals)
B = Organochlorine Pesticides and Chlorinated Phenoxy Herbicides (Method 8080 & 8150)
C = Aromatic Volatile Organics (Method 8020)
D = Halogenated Volatile Organics (Method 8010)
E = Petroleum Hydrocarbons (Method 418.1)
F = Priority Pollutant Metals
G = PCB (Method 8080)
H = Sulfates (Method 9038), Alkalinity and Acidity
I = Lead (Method 7420/ 7421)
J = Methyl Ethyl Ketone as an additional compound in organic analyses
K = Semi-Volatile Organics (Base/ Neutral and Acid Extractables) (Method 8270)

TABLE 3.1
(continued)

SUMMARY OF SITE INSPECTION PROGRAM

Site	Field Activity	# Field Samples	Matrix	Analyses*
#15 & 16 Fuel Dump Pits:				
	- Four 2" wells to upper aquifer, two per pit	8	Soil	EI
	- Four borings to 15' or the water table, two per pit, if contamination is detected	8	Soil	EI
	- Twenty soil-gas survey points per pit	--	--	--
	- Ground-Water sampling	4	Water	EI
	- Slug tests in four wells	--	--	--
#17 Old Entomology Laboratory:				
	- Ten Hand-Borings around perimeter of building, composite by 2's	15	Soil	B
	- One 2" well to upper aquifer	2	Soil	B
	- Ground-Water sampling	1	Water	B
	- Slug test in one well	--	--	--
#19 & 20 North and South Coal Piles:				
	- Four 2" wells to upper aquifer located on margin	8	Soil	EFHK
	of adjacent drainage ditches	--	--	--
	- Eight Borings to 15' or the water table, four per pile	16	Soil	EFHK
	- Surface water sampling from ditches	4	Water	EFHK
	- Ditch bottom sediment samples	4	Soil	EFHK
	- Nineteen soil-gas survey points	--	--	--
	- Ground-Water sampling	4	Water	EFHK
	- Slug tests in four wells	--	--	--
#21 Leaking Drum and Oil Change Area at Water Treatment Plant:				
	- Six Hand-Borings at surface stained locations	18	Soil	CEF
#22 Heating Plant Lube Oil Drum Storage Area:				
	- Four Hand-Borings at surface stained locations	12	Soil	CDE

* EXPLANATION

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B = Organochlorine Pesticides and Chlorinated Phenoxy Herbicides (Method 8080 & 8150)
C = Aromatic Volatile Organics (Method 8020)
D = Halogenated Volatile Organics (Method 8010)
E = Petroleum Hydrocarbons (Method 418.1)
F = Priority Pollutant Metals
G = PCB (Method 8080)
H = Sulfates (Method 9038), Alkalinity and Acidity
I = Lead (Method 7420/ 7421)
J = Methyl Ethyl Ketone as an additional compound in organic analyses
K = Semi-Volatile Organics (Base/ Neutral and Acid Extractables) (Method 8270)

TABLE 3.1
(continued)

SUMMARY OF SITE INSPECTION PROGRAM

Site	Field Activity	# Field Samples	Matrix	Analyses*
#23	**Fire Training Area:**			
	- Four 2" wells to upper aquifer	8	Soil	A
	- Eight borings to 15' or the water table	16	Soil	A
	- Twenty soil-gas survey points	--	--	--
	- Ground-Water sampling	4	Water	A
	- Slug tests in four wells	--	--	--
#24	**Sewage Treatment Plant Sludge Beds:**			
	- Three 2" wells to upper aquifer	6	Soil	BGF
	- Four hand borings in sludge spreading area (composite by 2's)	6	Soil	BGF
	- Ground-Water sampling	3	Water	A
	- Slug tests in two wells	--	--	--
	- Sludge samples from each bed, composited by 2's	5	Soil	BGF
#25	**Storm Drainage Ditch System:**			
	- Four 2" wells to upper aquifer at separators	8	Soil	A
	- Thirty ditch-bottom sediment samples @ confluences of open drainage ditches & at sites of suspected contamination.	30	Soil	A
	- Surface water sampling at ditch-bottom sediment sampling sites	30	Water	A
	- One Hundred soil-gas survey points	--	--	--
	- Ground-Water sampling	4	Water	A
	- Slug tests in four wells	--	--	--
#26	**Electrical Transformer Storage Yard:**			
	- Twenty surface soil samples in equal spaced grid	20	Soil	G
#27	**Drainage Ditch Near Landfill:**			
	- One 2" well to upper aquifer	2	Soil	A
	- Two ditch-bottom sediment samples	2	Soil	A
	- Two surface water samples at ditch-bottom sampling locations	2	Water	A
	- Five soil-gas survey points	--	--	--
	- Ground-Water sampling	1	Water	A
	- Slug tests in one well	--	--	--

* EXPLANATION

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B = Organochlorine Pesticides and Chlorinated Phenoxy Herbicides (Method 8080 & 8150)
C = Aromatic Volatile Organics (Method 8020)
D = Halogenated Volatile Organics (Method 8010)
E = Petroleum Hydrocarbons (Method 418.1)
F = Priority Pollutant Metals
G = PCB (Method 8080)
H = Sulfates (Method 9038), Alkalinity and Acidity
I = Lead (Method 7420/ 7421)
J = Methyl Ethyl Ketone as an additional compound in organic analyses
K = Semi-Volatile Organics (Base/ Neutral and Acid Extractables) (Method 8270)

TABLE 3.1
(continued)

SUMMARY OF SITE INSPECTION PROGRAM

Site Field Activity	# Field Samples	Matrix	Analyses*
Additional Hydrogeologic Control (NW Quadrant of Base):			
- Two 4" wells in well field area, one to upper aquifer and one to second aquifer	4	Soil	AH
- Ground-Water sampling	2	Water	AH
- Slug test in two wells	--	--	--
- Installation of continuous water level recorders to monitor fluctuations associated w/Base water-supply well pumping.	--	--	--

* EXPLANATION

A = Priority Pollutant Scan (Method 8240, 8270, 8080 & Metals)
B = Organochlorine Pesticides and Chlorinated Phenoxy Herbicides (Method 8080 & 8150)
C =Aromatic Volatile Organics (Method 8020)
D = Halogenated Volatile Organics (Method 8010)
E = Petroleum Hydrocarbons (Method 418.1)
F = Priority Pollutant Metals
G = PCB (Method 8080)
H = Sulfates (Method 9038), Alkalinity and Acidity
I = Lead (Method 7420/7421)
J = Methyl Ethyl Ketone as an additional compound in organic analyses
K = Semi-Volatile Organics (Base/Neutral and Acid Extractables) (Method 8270)

TABLE 3.2

UTILITY LEGEND FOR SITE PLANS

RICKENBACKER AIR NATIONAL GUARD BASE
COLUMBUS, OHIO

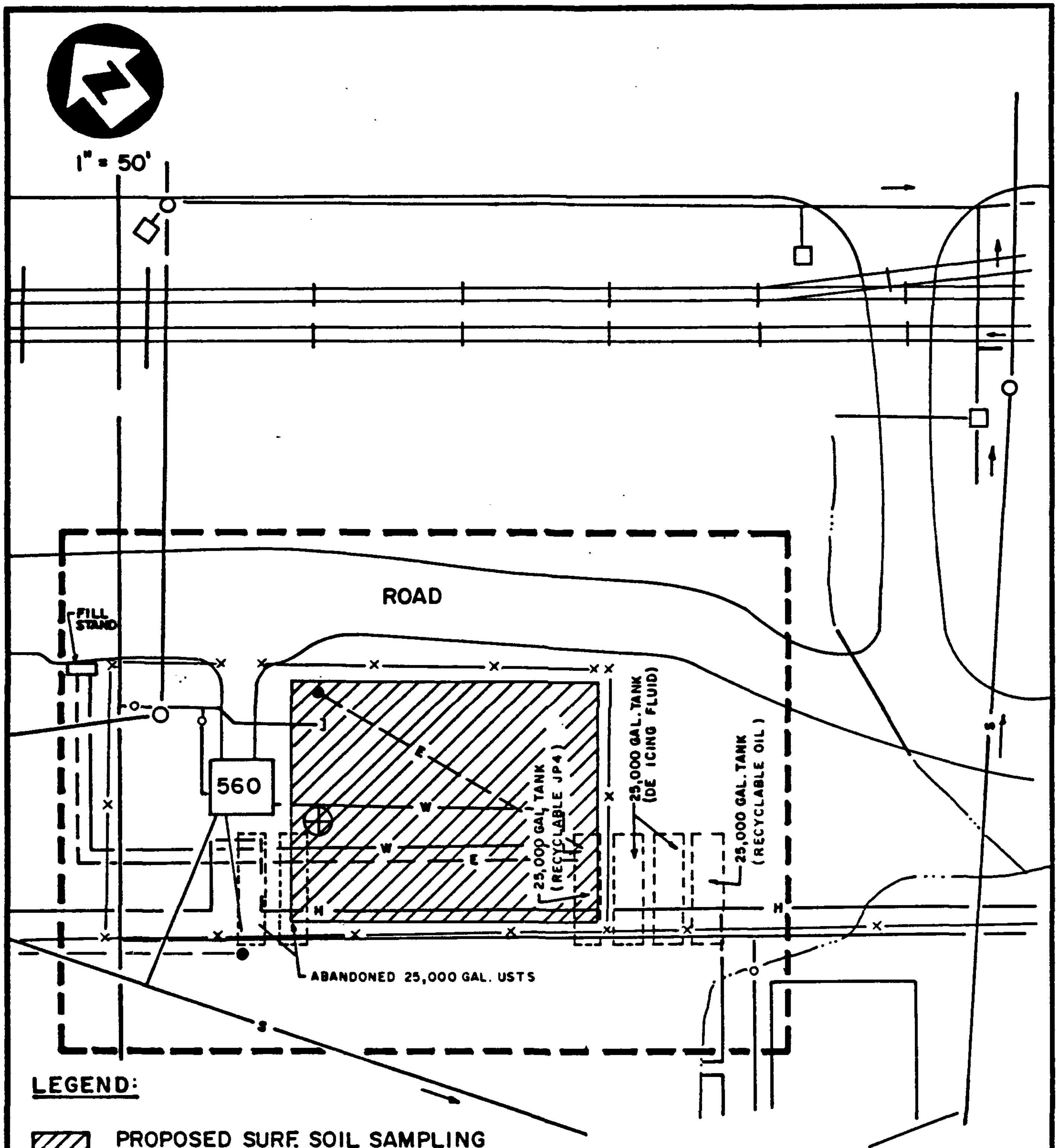
ABOVE GROUND UTILITIES AND FEATURES:

╪═╪═╪	RAILROAD
○	MANHOLE
o	VALVE
—x—	FENCE
◉	RUNWAY / TAXIWAY LIGHT
Ω	FIRE HYDRANT
—H—	HEAT LINE
—JF—	JET FUEL LINE
△	ELECTRICAL TRANSFORMER

UNDERGROUND UTILITIES:

– –H– –	HEAT LINE
– –JF– –	JET FUEL LINE
– –E– –	ELECTRIC LINE
– –T– –	TELEPHONE LINE
—W—	WATER LINE
—S—	SANITARY SEWER
—SS—	STORM SEWER
□	JUNCTION BOX

FIGURE 3.2



LEGEND:

▨ PROPOSED SURF. SOIL SAMPLING AND HAND BORING AREA

⌐-¬ APPROX. OUTLINE OF SOIL-GAS SURVEYS

⊕ PROPOSED MONITOR WELL

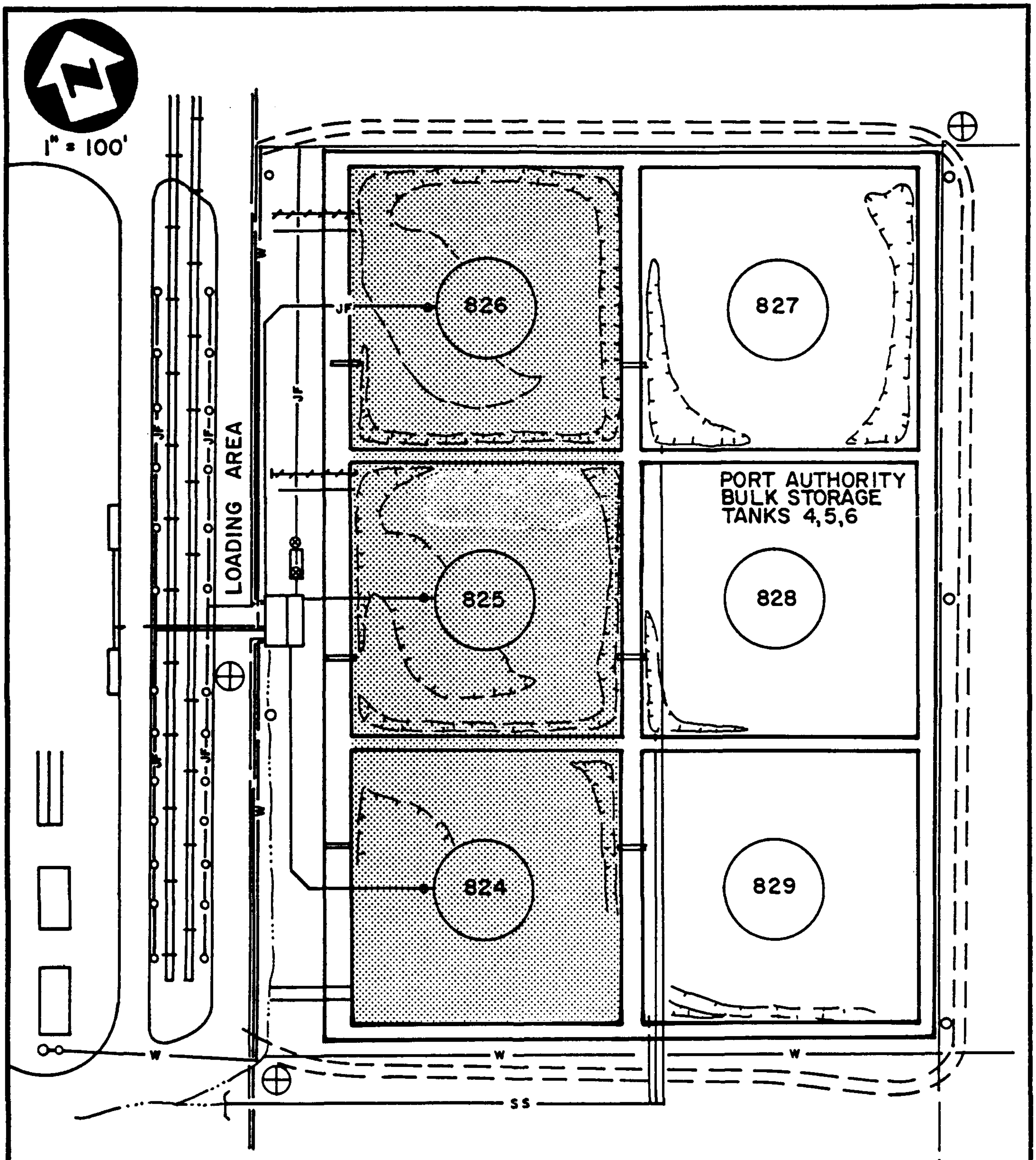
SITE I

HAZARDOUS WASTE STORAGE AREA

RICKENBACKER

AIR NATIONAL GUARD BASE

SOURCE:
BASE DETAILED
SECTIONAL MAPS



LEGEND:

▨ ANG TANK AREA

⊕ PROPOSED MONITOR WELL LOCATION

SITE INSPECTION PLAN
SITE 2
BULK STORAGE TANK FARM
RICKENBACKER
AIR NATIONAL GUARD BASE

SOURCE:
BASE DETAILED
SECTIONAL MAPS

soil-gas survey will be conducted over the site to estimate the extent of contamination (if any). Two additional wells will be installed following the soil-gas survey. One well will be placed in an upgradient position and one at the point of highest soil-gas contamination. If no contamination is detected during the soil-gas survey, the well will be placed at the fuel loading area, a likely location of fuel spills. JP-4 is the only reported potential contaminant at this site so analysis for petroleum hydrocarbons will be done on soil and ground-water samples.

SITE 3 - Fuel Pumping Station 4: An initial well will be installed in the area of reported fuel ponding on the ground surface (Figure 3.4). If no contamination is detected, a ten-point soil-gas survey will be conducted to support the conclusion that a clean condition exists. If contamination is detected in the well, the soil-gas survey will be used to define the extent of the plume. The second well will be installed at the point of highest soil-gas concentration. If the soil-gas indicates a clean condition, an additional boring will be made down-gradient from the USTs, a likely contamination location.

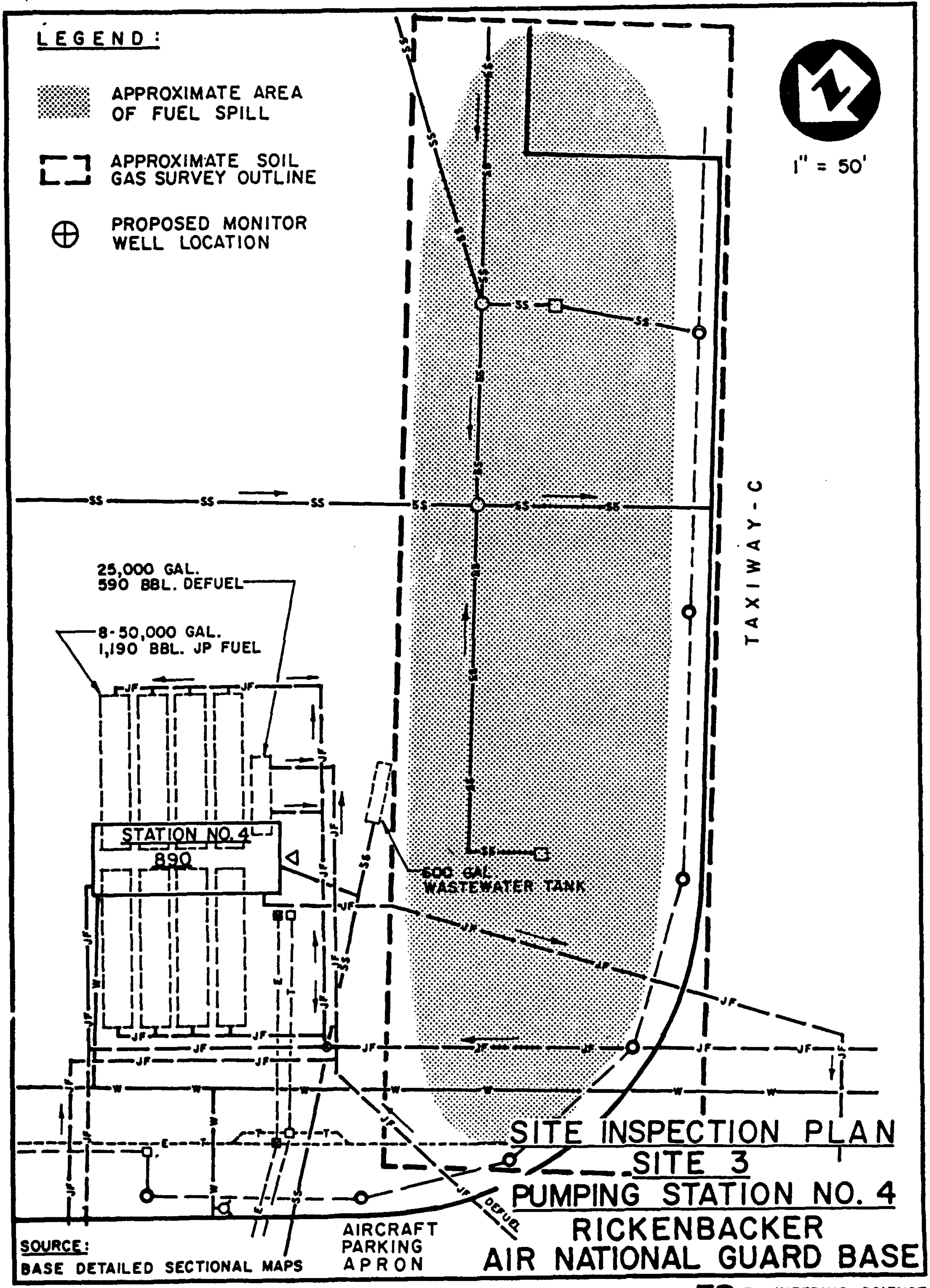
JP-4 is the only known potential contaminant at this site so the soil and ground-water samples will be analyzed for petroleum hydrocarbons.

SITE 4 - Fuel Pumping Station 5: A ten-point soil-gas survey will be conducted centering on the USTs where the reported over-fill loss occurred. A monitoring well will be installed, screened spanning the shallow aquifer, in the area of highest soil-gas response. If no contamination is indicated by soil-gas, the well will be located as indicated in Figure 3.5, down-gradient from the storage tanks, to detect possible contamination from the USTs. If contamination is detected in the first well, an additional well will be installed at a downgradient position.

JP-4 is the only known potential contaminant at this site so soil and ground-water samples will be analyzed for total petroleum hydrocarbons.

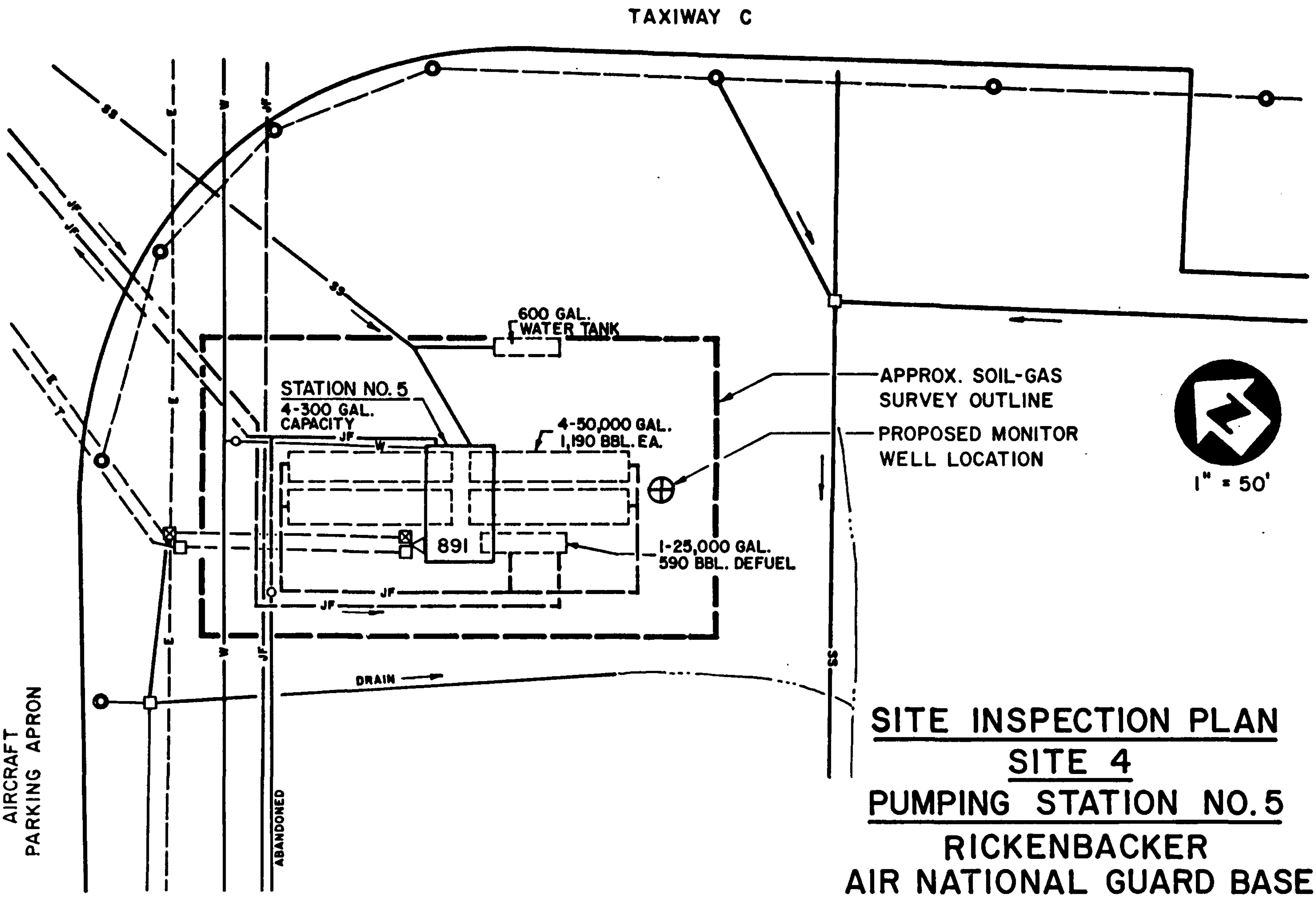
SITE 5 - Lateral Safety Zone Spill Area: An initial monitor well will be installed within the area where fuel reportedly ponded after the spill to evaluate the effect of the spill on soils and ground-water (Figure 3.6). Following installation of the initial well, a thirty-point soil-gas survey will be conducted to define a contaminant plume or substantiate a lack of contamination. If contamination is indicated by the soil-gas survey, an additional well and two borings will be placed to define the extent of soil

FIGURE 3.4

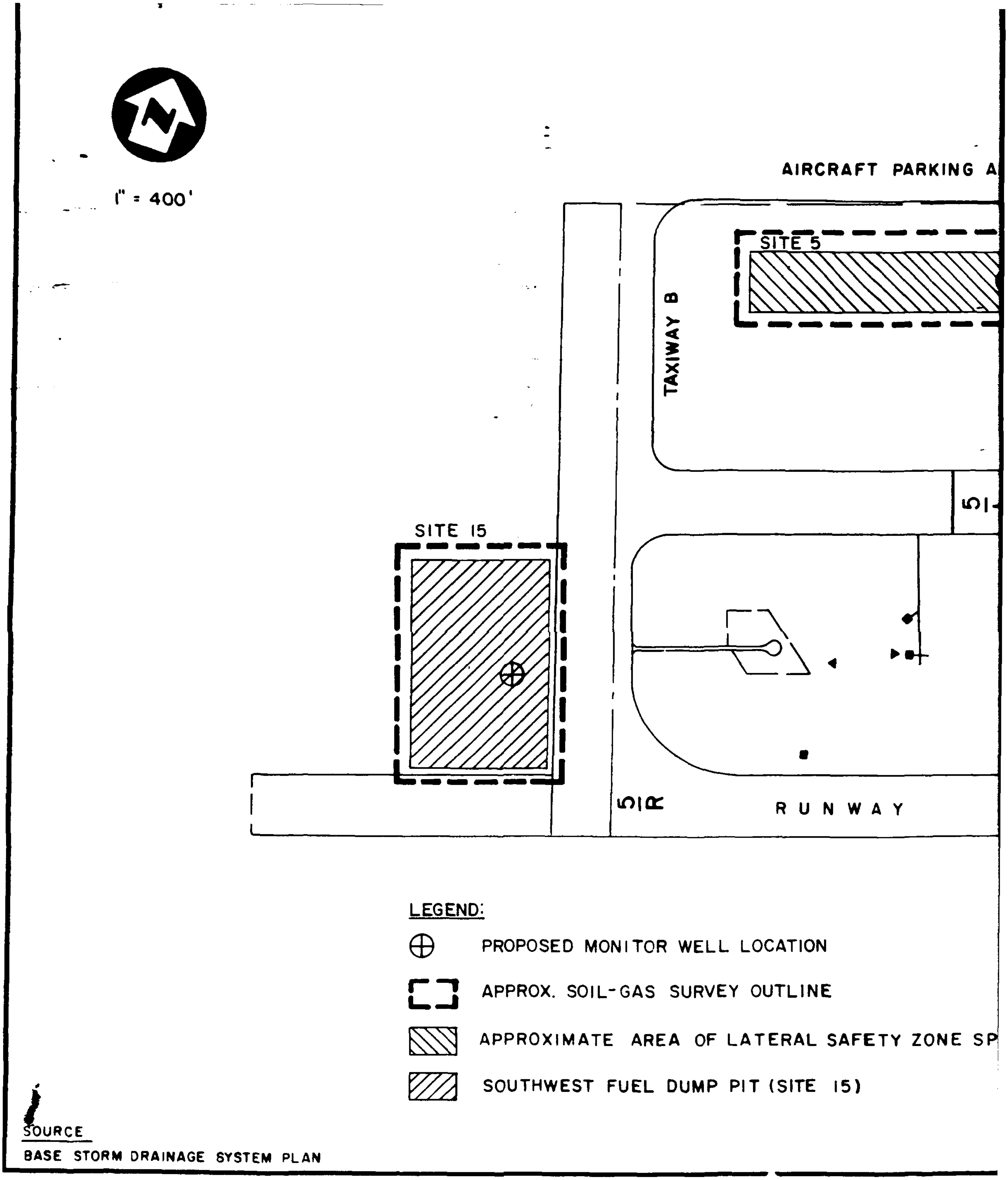


SITE INSPECTION PLAN
SITE 3
PUMPING STATION NO. 4
RICKENBACKER
AIR NATIONAL GUARD BASE

SOURCE: BASE DETAILED SECTIONAL MAP

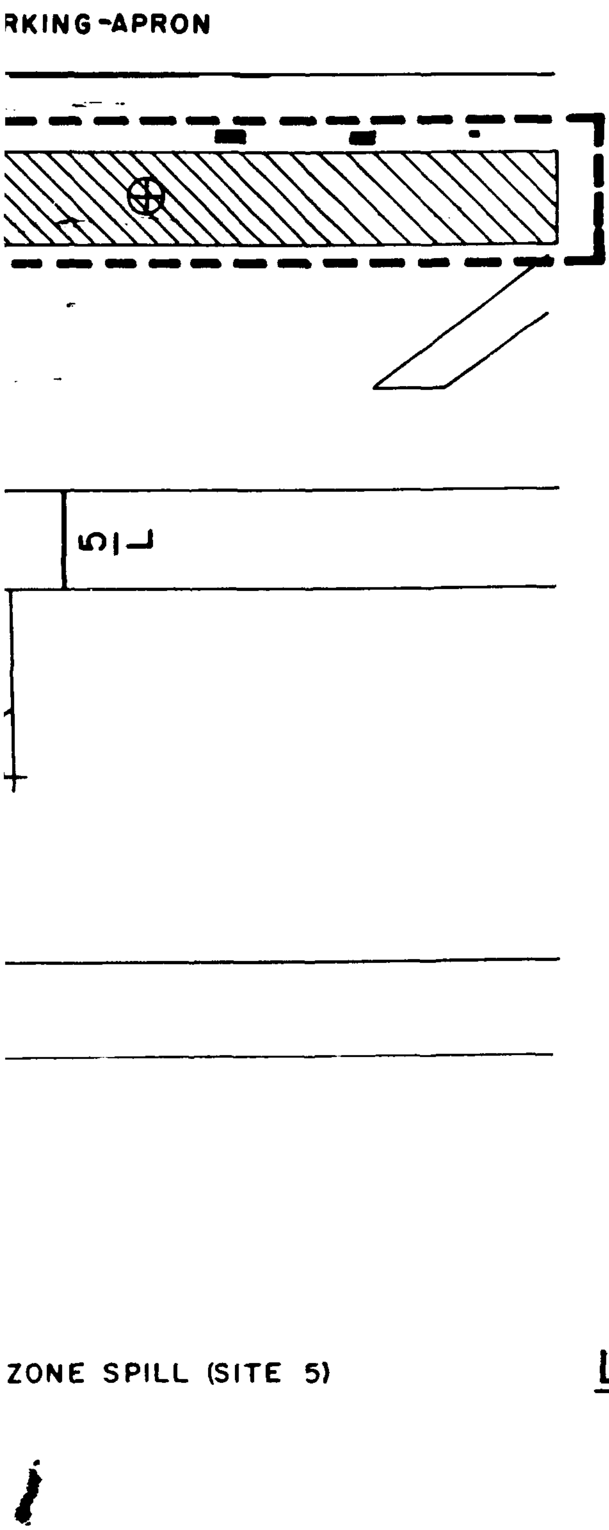


SITE INSPECTION PLAN
SITE 4
PUMPING STATION NO. 5
RICKENBACKER
AIR NATIONAL GUARD BASE



SOURCE
BASE STORM DRAINAGE SYSTEM PLAN

FIGURE 3.6



SITE INSPECTION PLAN
SITES 5 AND 15
LATERAL SAFETY ZONE SPILL AND SOUTHWEST FUEL DUMP PIT
RICKENBACKER AIR NATIONAL GUARD BASE

and ground-water contamination. If the soil-gas survey is negative, the borings and well will be placed along the length of the low portion of the spill area to verify the absence of contamination.

As in Sites 3 and 4, selected soil samples and ground water will be analyzed for petroleum hydrocarbons.

SITE 6 - *Underground Storage Tanks at the Base Filling Station*: An initial well will be installed between the active tank pit and the pump islands to detect soil and ground-water contaminantion from the tanks and gasoline lines (Figure 3.7). A ten-point soil-gas survey will be conducted to substantiate the results of the soil and water sampling. The tank pit monitoring well will be used as a point of control to determine presence or absence of petroleum product on the water table.

The past and current sale of leaded and unleaded gasoline at this site warrant analysis of selected soil samples and ground water for petroleum hydrocarbons and lead.

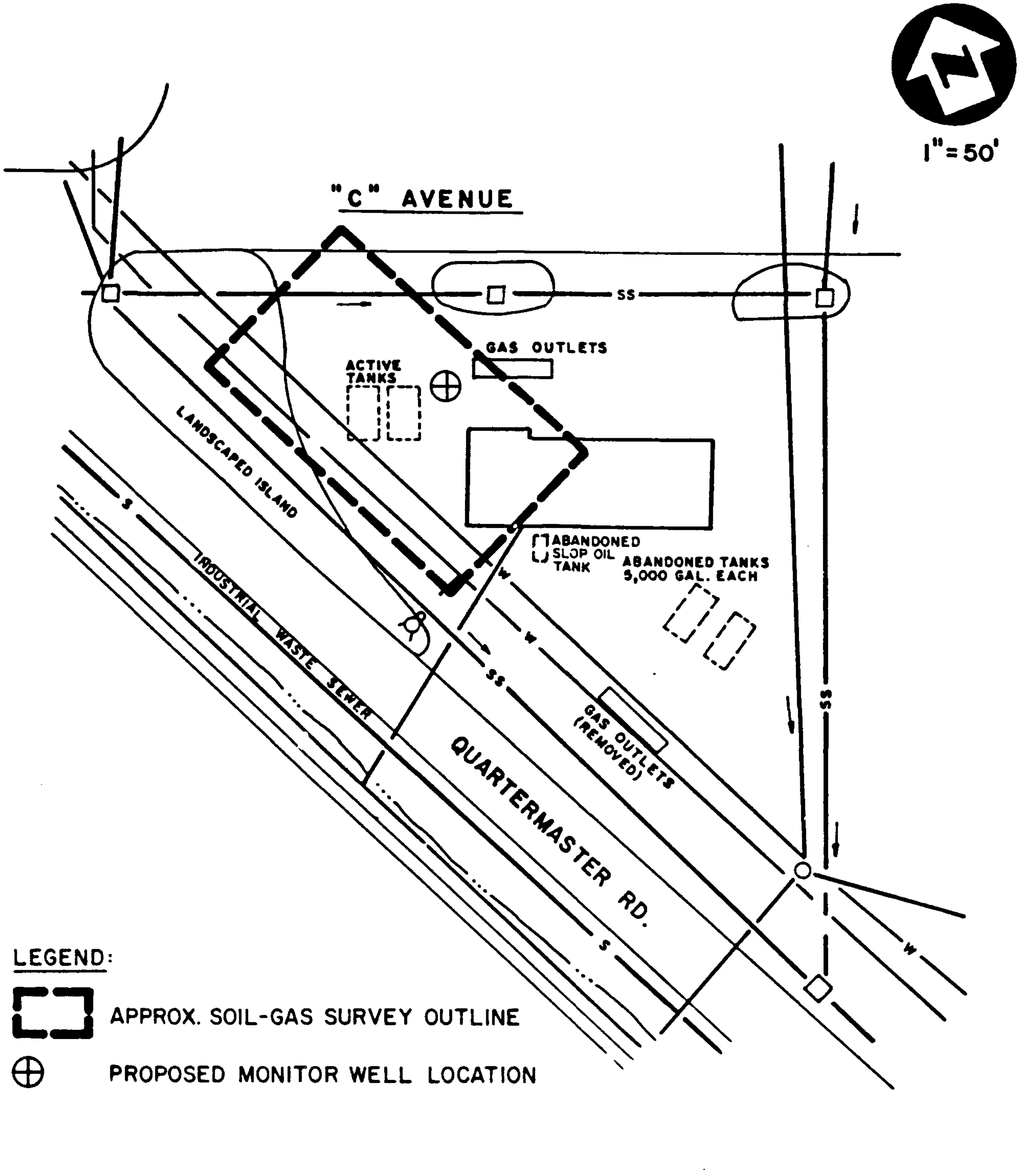
SITE 9 - Salvage yard: Ten hand borings will be made around the edges of the pavement and the old foundations to detect contaminants that may have washed onto the soil (Figure 3.8). One monitor well will be installed in the area of highest contamination as indicated by the hand boring samples to evaluate potential deeper soil and ground-water contamination. An eight-point soil-gas survey will be conducted to screen the area for contamination by volatile compounds. A second monitor well will be placed in an area of contamination indicated by the soil-gas results.

The selected soil samples and ground water samples will be subjected to a complete priority pollutant scan because of the wide variety of hazardous materials reportedly stored here in the past.

SITE 10 - JP-4 Fuel Line Rupture: A six-point soil-gas survey will be conducted to screen the area for volatile contamination (Figure 3.9). If volatile contamination is indicated by the soil-gas survey, one monitoring well will be installed at the point of highest soil-gas contamination to evaluate the impact of the spill on the soils and ground-water.

As JP-4 is the only reported contaminant in this area, the selected soil samples and ground water samples will be analyzed for petroleum hydrocarbons.

FIGURE 3.7



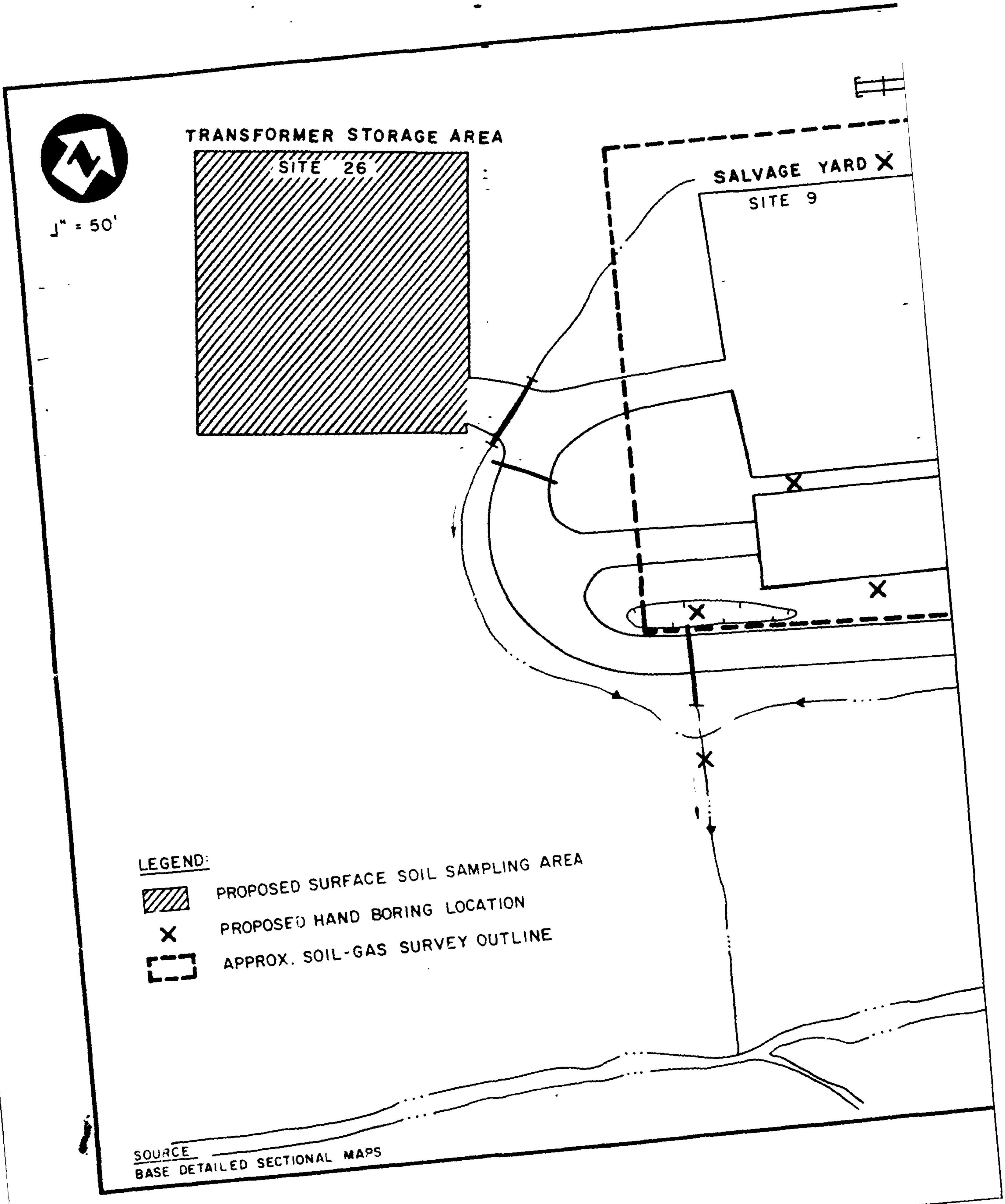
SITE INSPECTION PLAN

SITE 6

BASE FILLING STATION

RICKENBACKER
AIR NATIONAL GUARD BASE

URCE:
SE DETAILED SECTIONAL MAPS.



LEGEND:

▨ PROPOSED SURFACE SOIL SAMPLING AREA

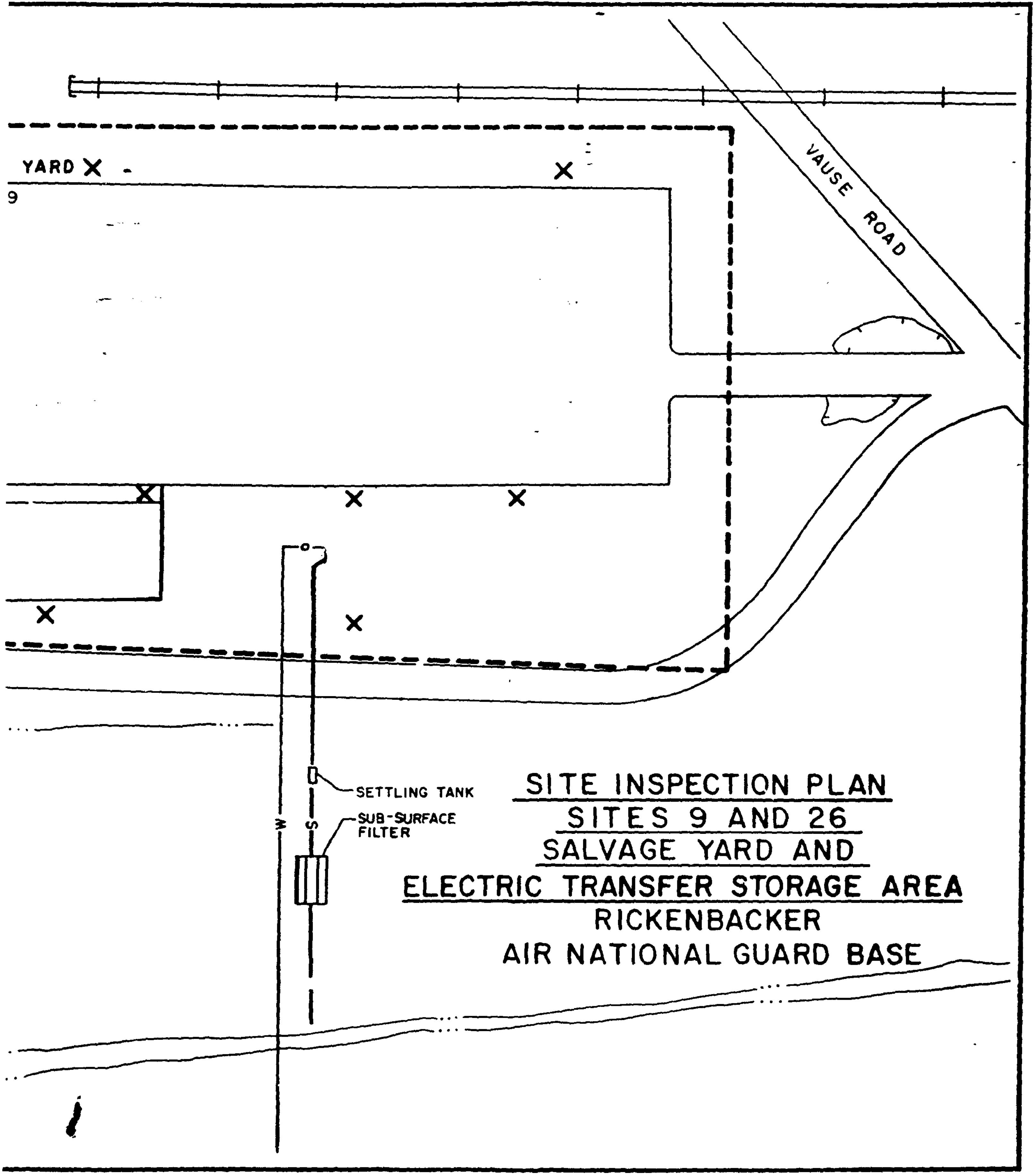
× PROPOSED HAND BORING LOCATION

⌐--¬ APPROX. SOIL-GAS SURVEY OUTLINE

SOURCE

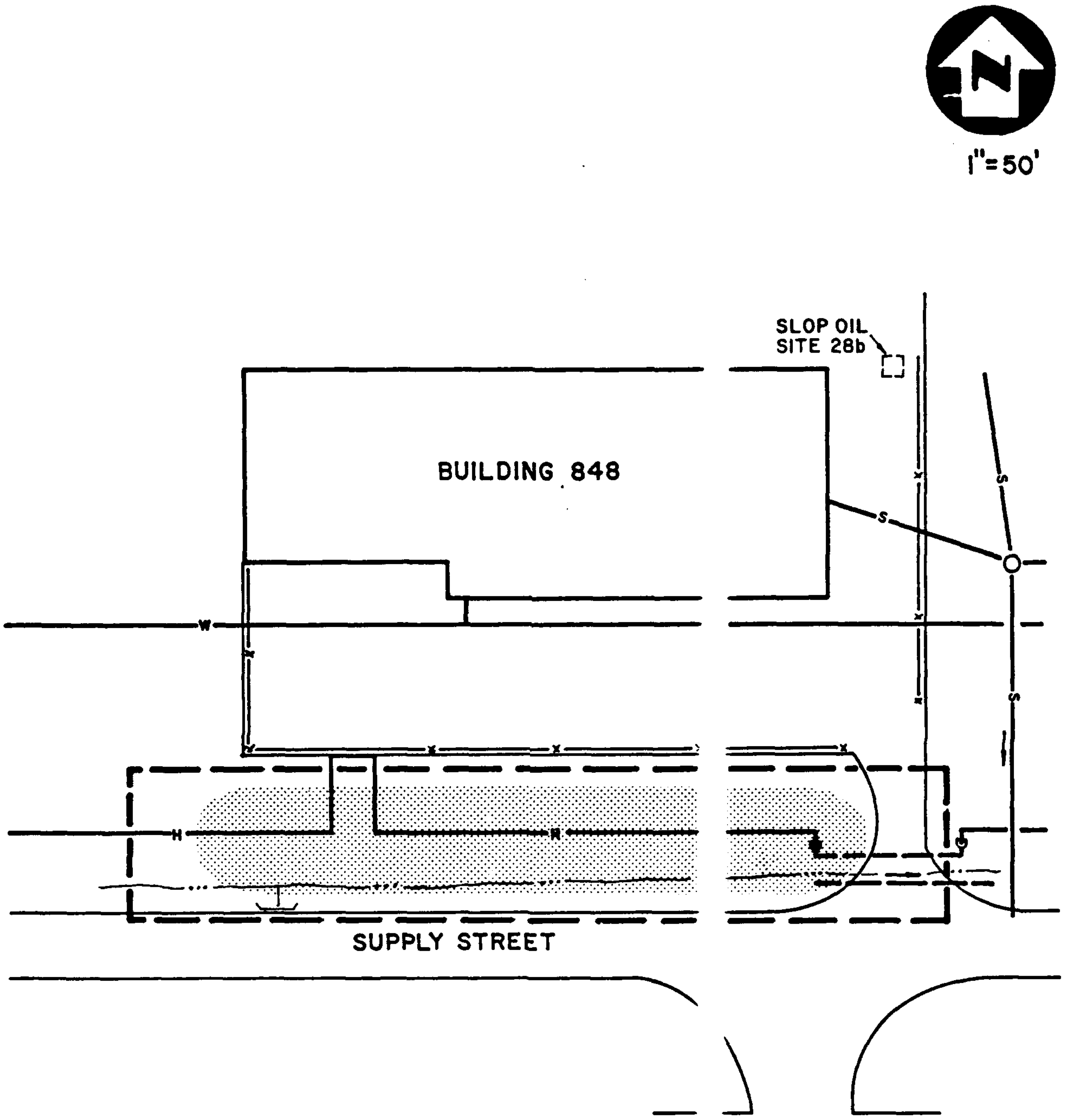
BASE DETAILED SECTIONAL MAPS

FIGURE 3.8



SITE INSPECTION PLAN
SITES 9 AND 26
SALVAGE YARD AND
ELECTRIC TRANSFER STORAGE AREA
RICKENBACKER
AIR NATIONAL GUARD BASE

FIGURE 3.9



LEGEND:

▨ APPROXIMATE EXTENT OF SPILL

⬚ APPROX. OUTLINE OF SOIL - GAS SURVEY

SITE INSPECTION PLAN
ITE 10
JP4 FUE LINE RUPTURE
RICKENBACKER
AIR NATIO AL GUARD BASE

SOURCE:
BASE DETAILED SECTIONAL MAPS.

SITE 12 - Old Drum Storage Area: Ten hand borings will be made around the edges of the pavement, concentrated along the northwest edge where surface runoff would have entered the soil, to evaluate potential shallow soil contamination (Figure 3.10). A ten-point soil-gas survey will be conducted to screen for volatile contamination. One monitor well will be installed in the area of highest contamination indicated by the hand boring samples and/or soil-gas survey results to evaluate potential ground-water and soil contamination.

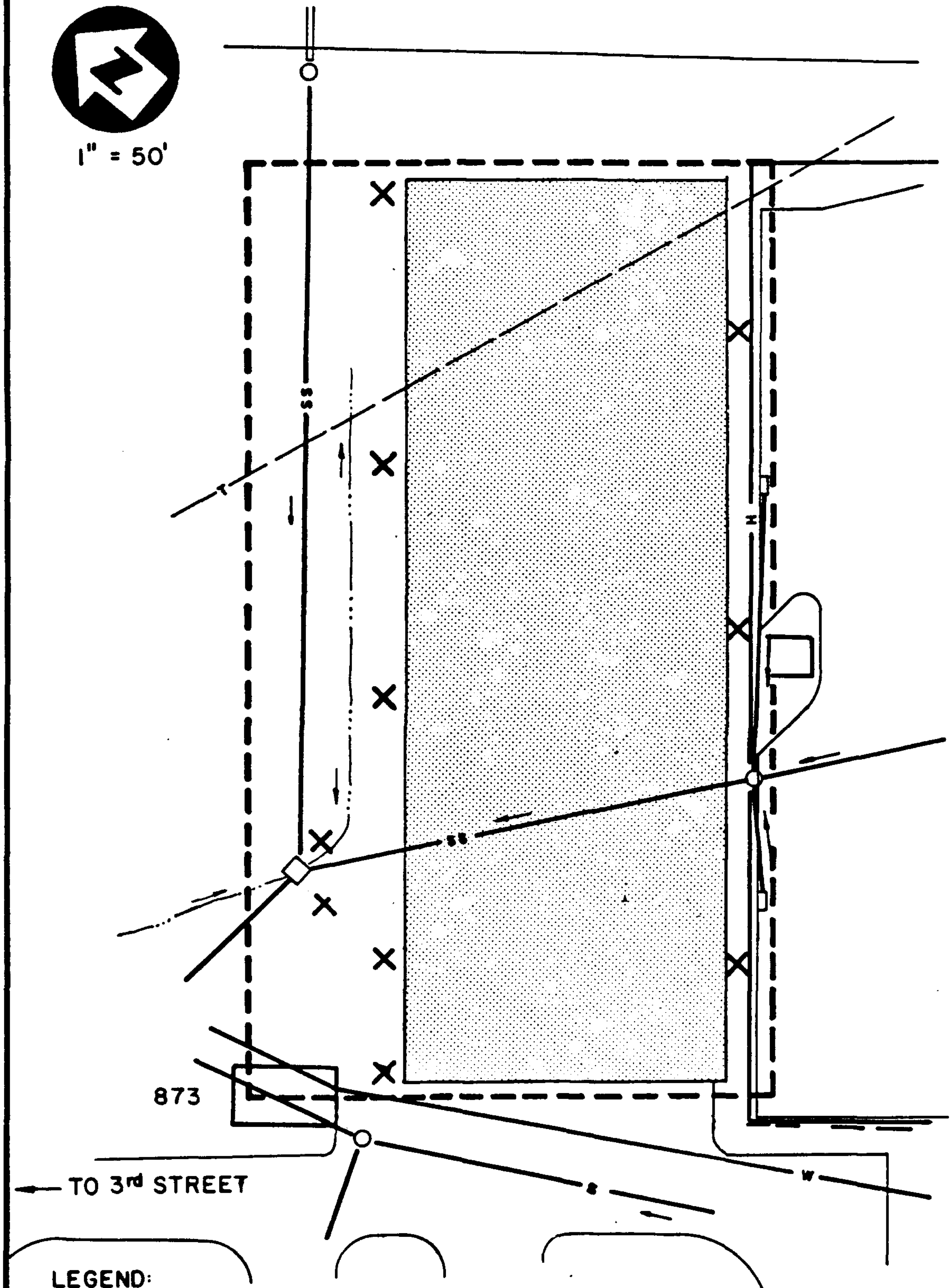
The drums stored here were usually empty, but had contained solvents and oils. The selected soil samples and ground water collected from this site will be analyzed for halogenated and aromatic volatile organics (including methyl ethyl ketone) and petroleum hydrocarbons.

SITE 14 - KC-135 Crash Site: An initial monitoring well will be installed at the reported location of fuel ponding to evaluate the impact of the spill on soil and groundwater (Figure 3.11). A ten-point soil-gas survey will be conducted to identify a contaminant plume or substantiate a "clean" condition. If contamination is detected, three soil borings will be made at the point of highest contamination and on two of the plume edges as defined by the soil-gas survey. One of the borings may be completed as a monitoring well if contamination is detected while drilling. As at other JP-4 spill sites, the soils and groundwater will be analyzed for petroleum hydrocarbons.

SITES 15 and 16 - Fuel Dump Pits: An initial monitor well will be installed in the topographic low of each pit to evaluate potential soil and ground-water contamination from fuel dumping (Figures 3.6 and 3.11). A twenty-point soil-gas survey of each pit will be conducted to substantiate the results of the initial well installations. If contamination is detected, a second well will be placed in the area of highest soil vapor concentration and two borings in each pit will be placed at the downgradient plume edge and half way between the second well and plume edge boring. If no contamination is detected, the second well will be installed downgradient of the first well to investigate the possibility of contaminant migration.

The reported dumping at this site involved leaded fuel. The selected soil samples and ground water will be analyzed for petroleum hydrocarbons and lead.

FIGURE 3.10

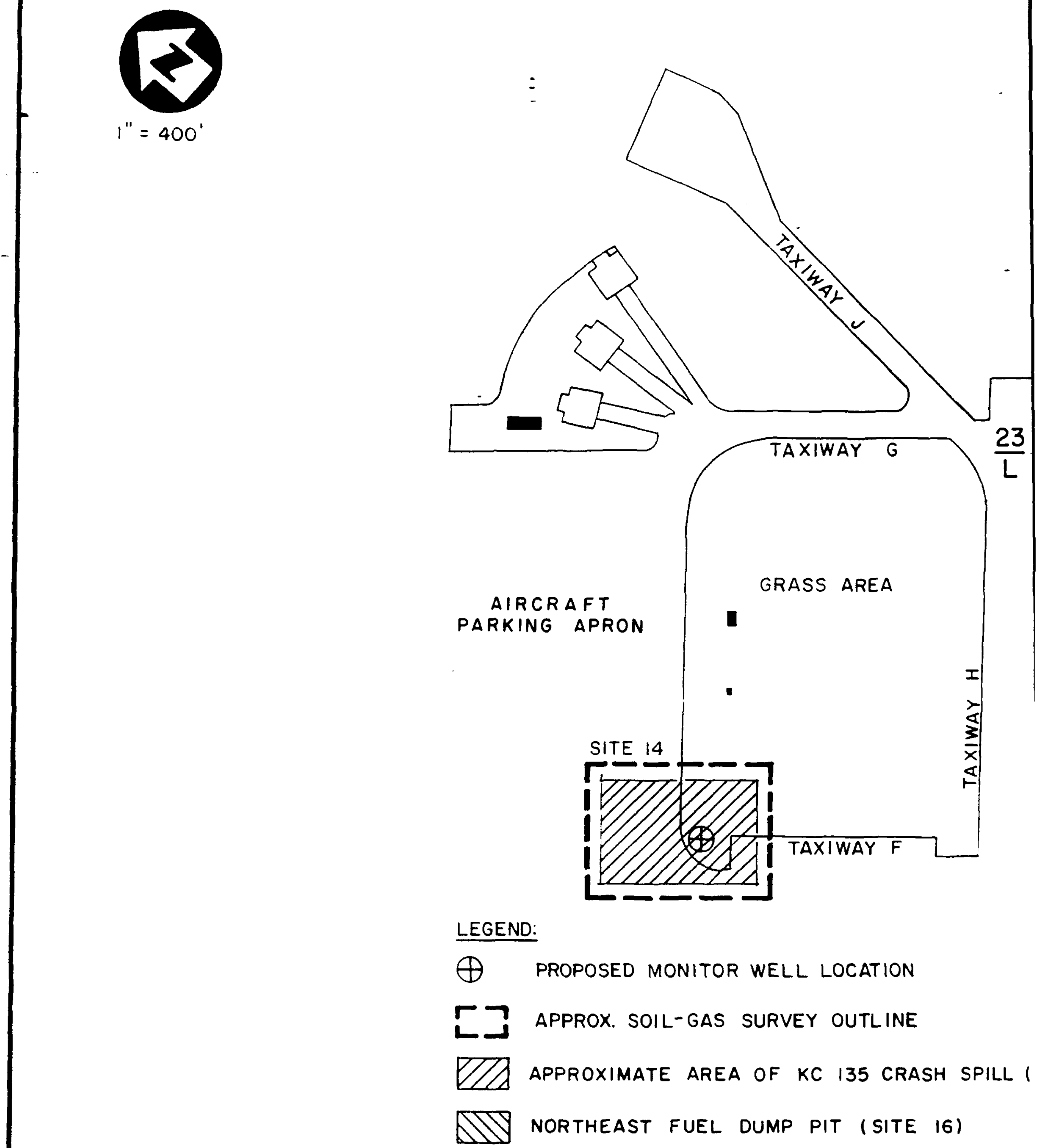


LEGEND:

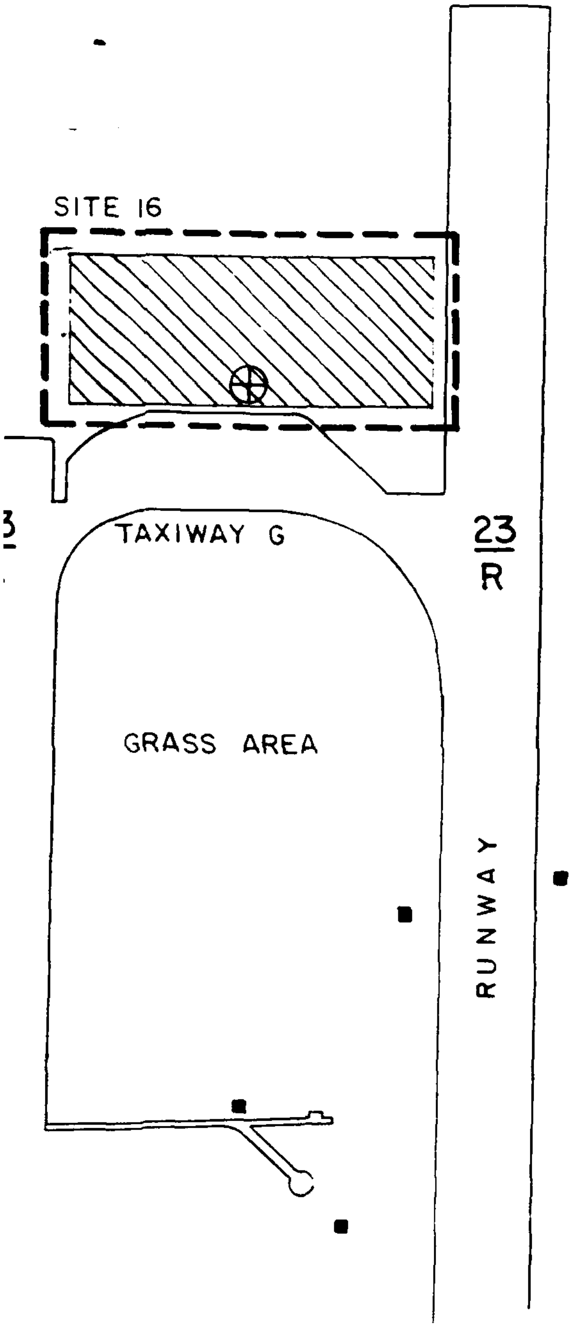
×	PROPOSED HAND BORING LOCATION
⬚	APPROX. SOIL-GAS SURVEY OUTLINE
☐	PAVED DRUM STORAGE AREA (SITE 12)

SOURCE:
BASE DETAILED
SECTIONAL MAPS

SITE INSPECTION PLAN
SITE 12
OLD DRUM STORAGE AREA
RICKENBACKER
AIR NATIONAL GUARD BASE



SOURCE:
BASE STORM DRAINAGE SYSTEM PLAN



(SITE 14)

SITE INSPECTION PLAN
SITES 14 & 16
KC-135 CRASH SITE AND NORTHEAST FUEL DUMP PIT
RICKENBACKER
AIR NATIONAL GUARD BASE

SITE 17 - Old Entomology Laboratory: Ten hand borings will be made around the exterior of the end of the building where the laboratory was located and near the burned building to detect potential soil contamination (Figure 3.12). A monitor well will be placed at the location of highest detected shallow soil contamination. A soil-gas survey is not warranted here as pesticides and herbicides are not reliably detected by soil-gas survey.

Because of historical use of pesticides and herbicides at this site, soil and ground-water samples will be analyzed for herbicides and pesticides.

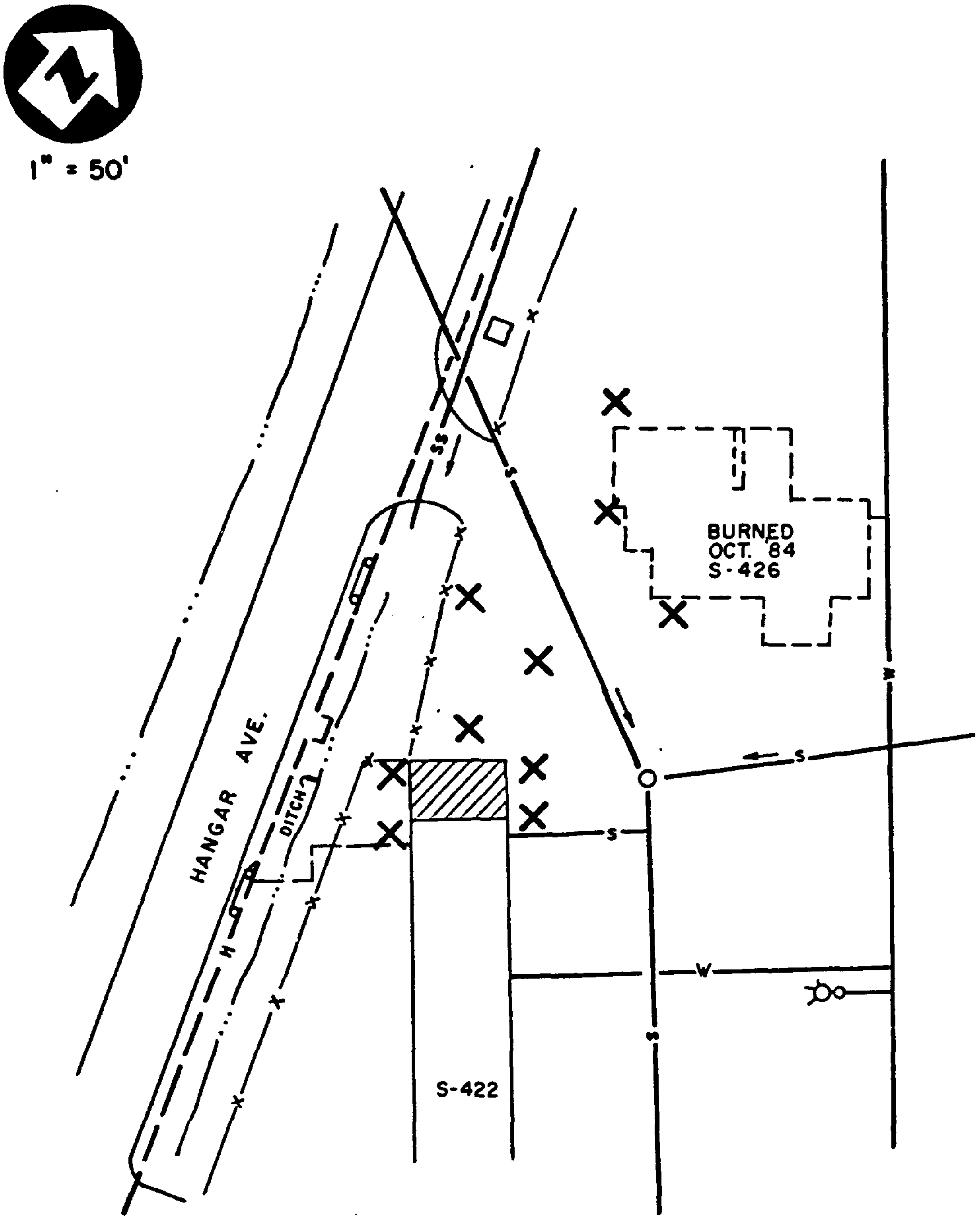
SITES 19 and 20 - North and South Coal Piles: Surface water samples will be taken from the standing water in the adjacent drainage ditches to determine the level of contamination of the surface water (Figures 3.13 and 3.14). Ditch bottom sediment samples and a soil sample from an area of stressed vegetation on the ditch bank will also be taken to determine the level of soil and sediment contamination.

An initial monitoring well will be installed adjacent to the drainage ditch at the southwest corner of each area to detect possible soil and ground-water contamination at these sites of likely ground-water recharge. Nineteen soil-gas survey points will be divided between the two piles to substantiate the soil and ground-water sampling results. The concrete/asphalt surface of the storage pad will not be penetrated for sampling. An additional well and four borings will be placed around each pile to better define contaminant plumes indicated by the soil-gas survey.

The practice of dousing the coal with fuel oil and the typical constituents of coal pile runoff warrant analysis of soil and water samples for petroleum hydrocarbons, priority pollutant metals, sulfates, alkalinity, acidity and semi-volatile organics.

SITE 21 - Leaking Drum and Oil Change Area at Water Treatment Plant: Six hand borings will be made at the surface stained locations at these sites to evaluate the horizontal and vertical extent of soil contamination (Figure 3.15). The soils collected from the Oil Change Area will be analyzed for aromatic volatile organics, petroleum hydrocarbons and priority pollutant metals, common constituents of used motor oil. The same analyses, except metals will be performed on samples from the leaking Oil Drum Area.

FIGURE 3.12



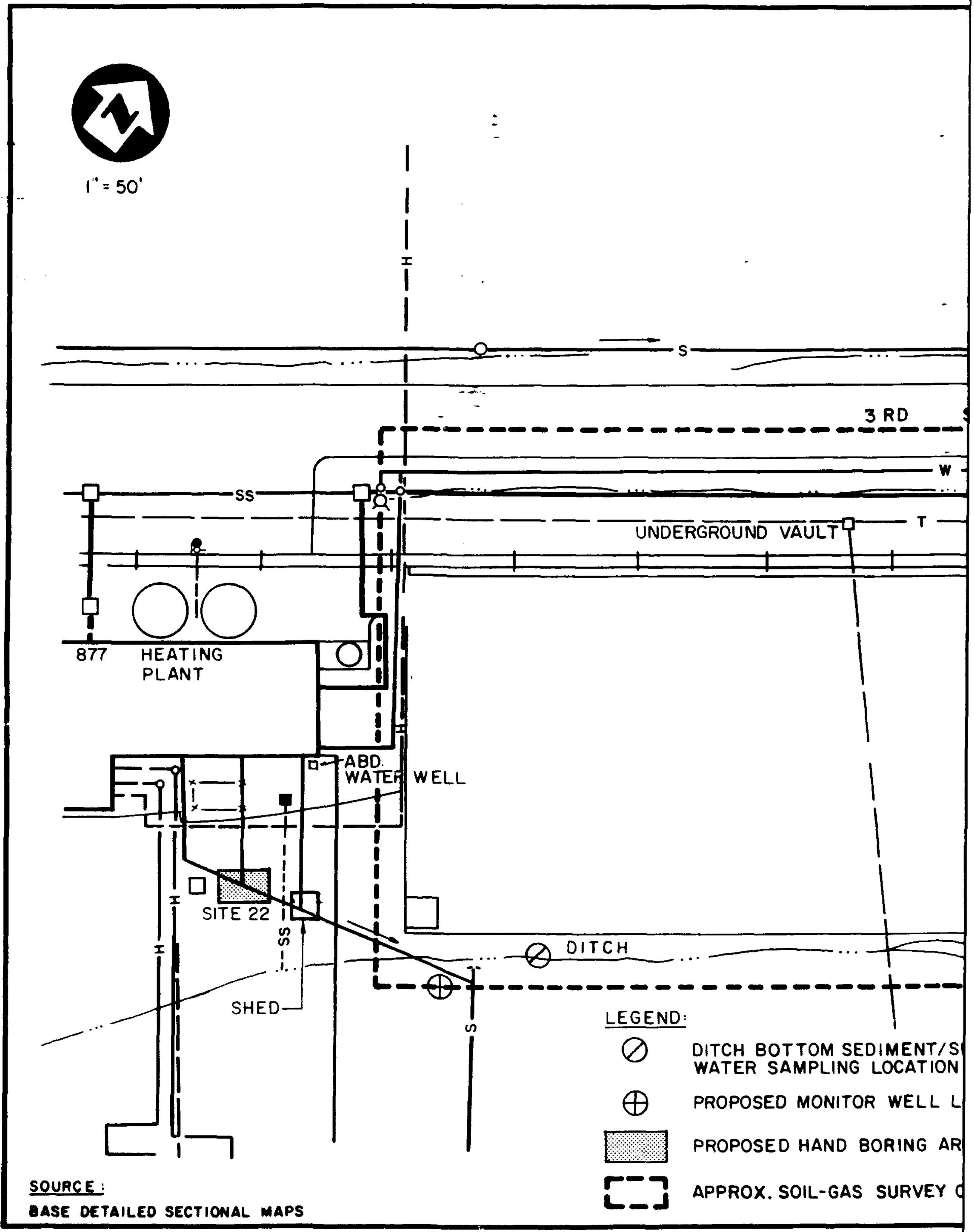
LEGEND:

▨ END OF BUILDING USED AS ENTOMOLOGY LAB.

X PROPOSED HAND BORING LOCATION

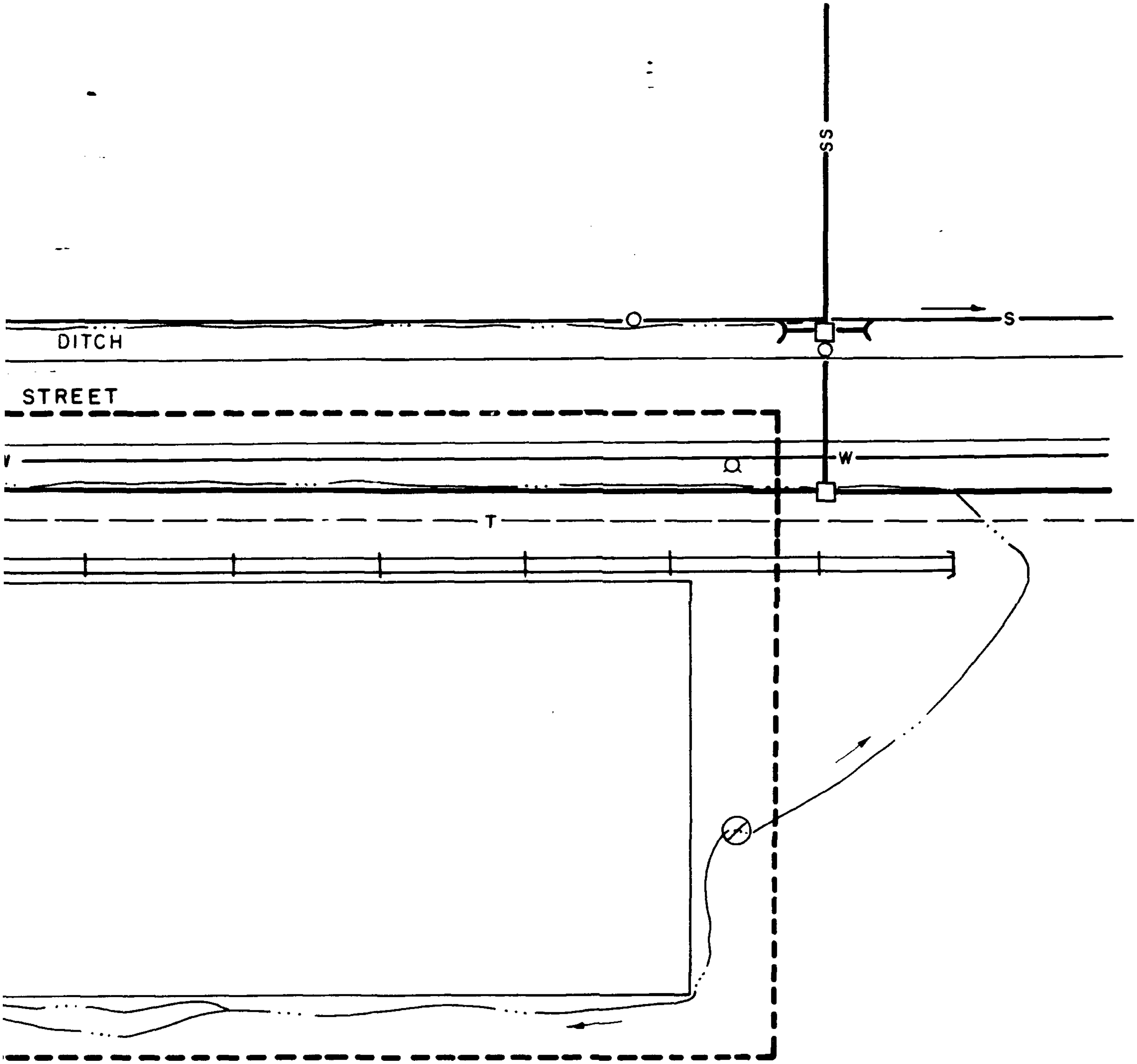
SITE INSPECTION PLAN
SITE 17
OLD ENTOMOLOGY LAB
RICKENBACKER AIR NATIONAL GUARD BASE

SOURCE:
BASE DETAILED SECTIONAL MAPS.

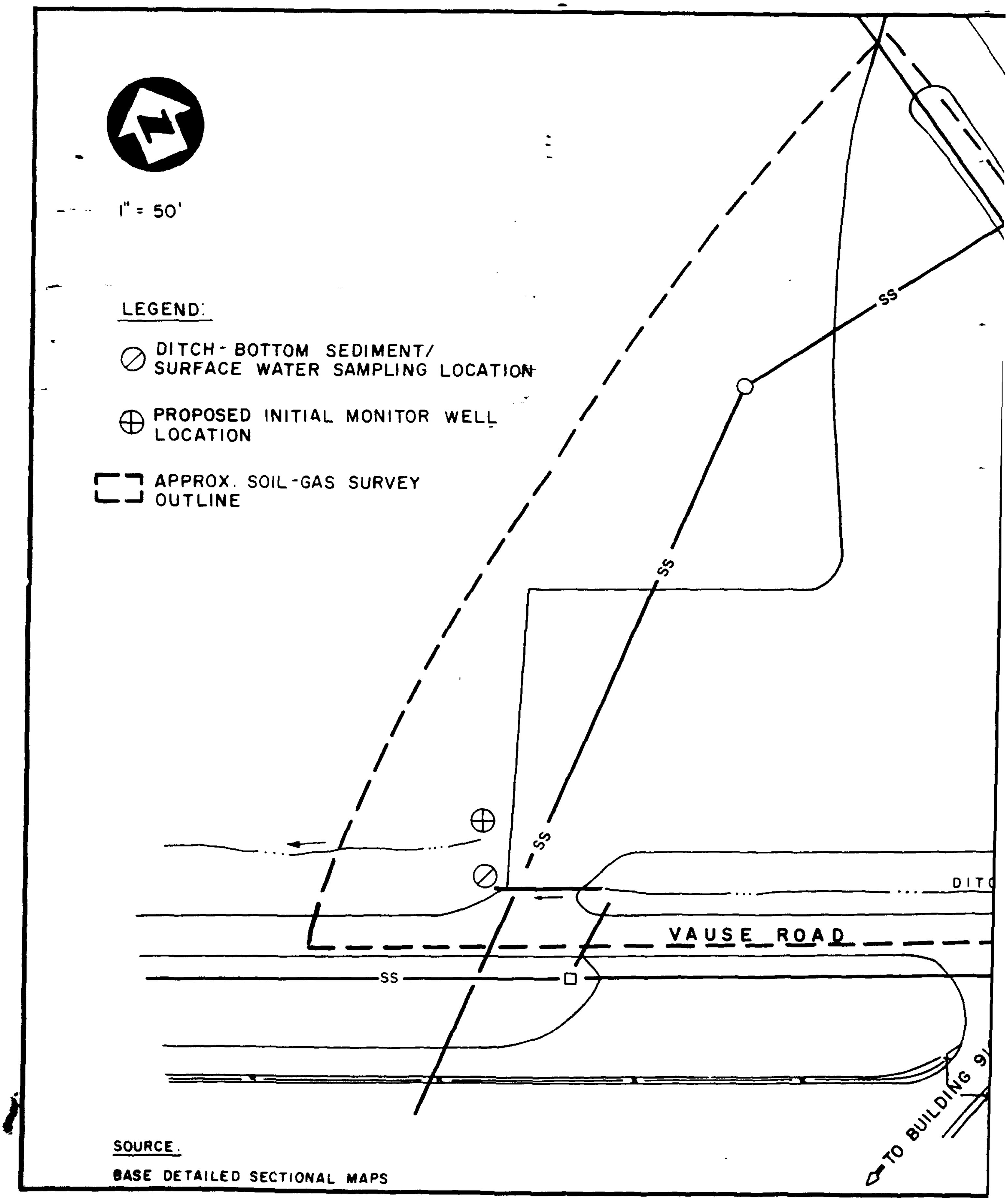


SOURCE:
BASE DETAILED SECTIONAL MAPS

FIGURE 3.13



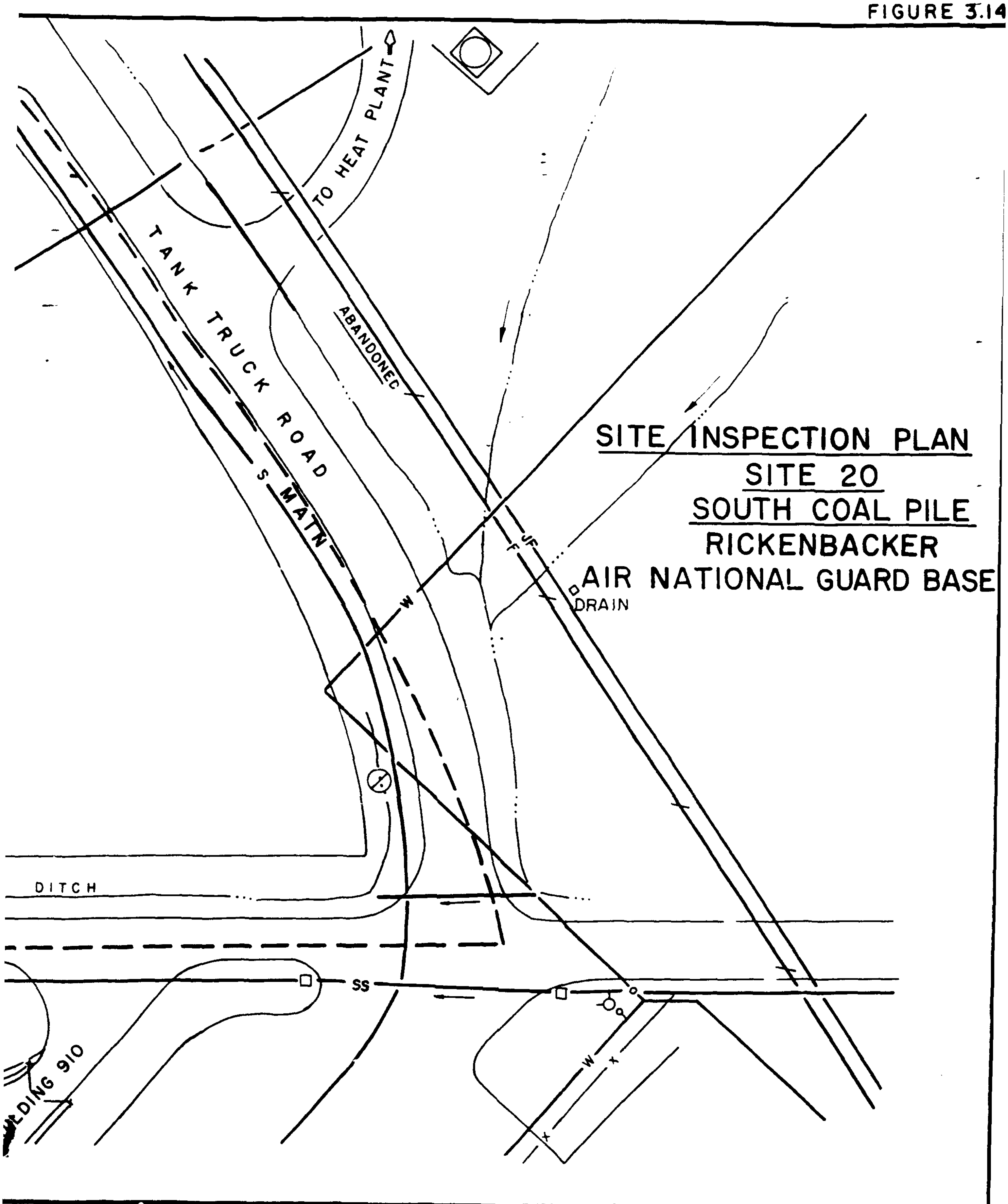
SITE INSPECTION PLAN
SITES 19 AND 22
NORTH COAL PILE AND
LUBE OIL DRUM STORAGE
RICKENBACKER
AIR NATIONAL GUARD BASE



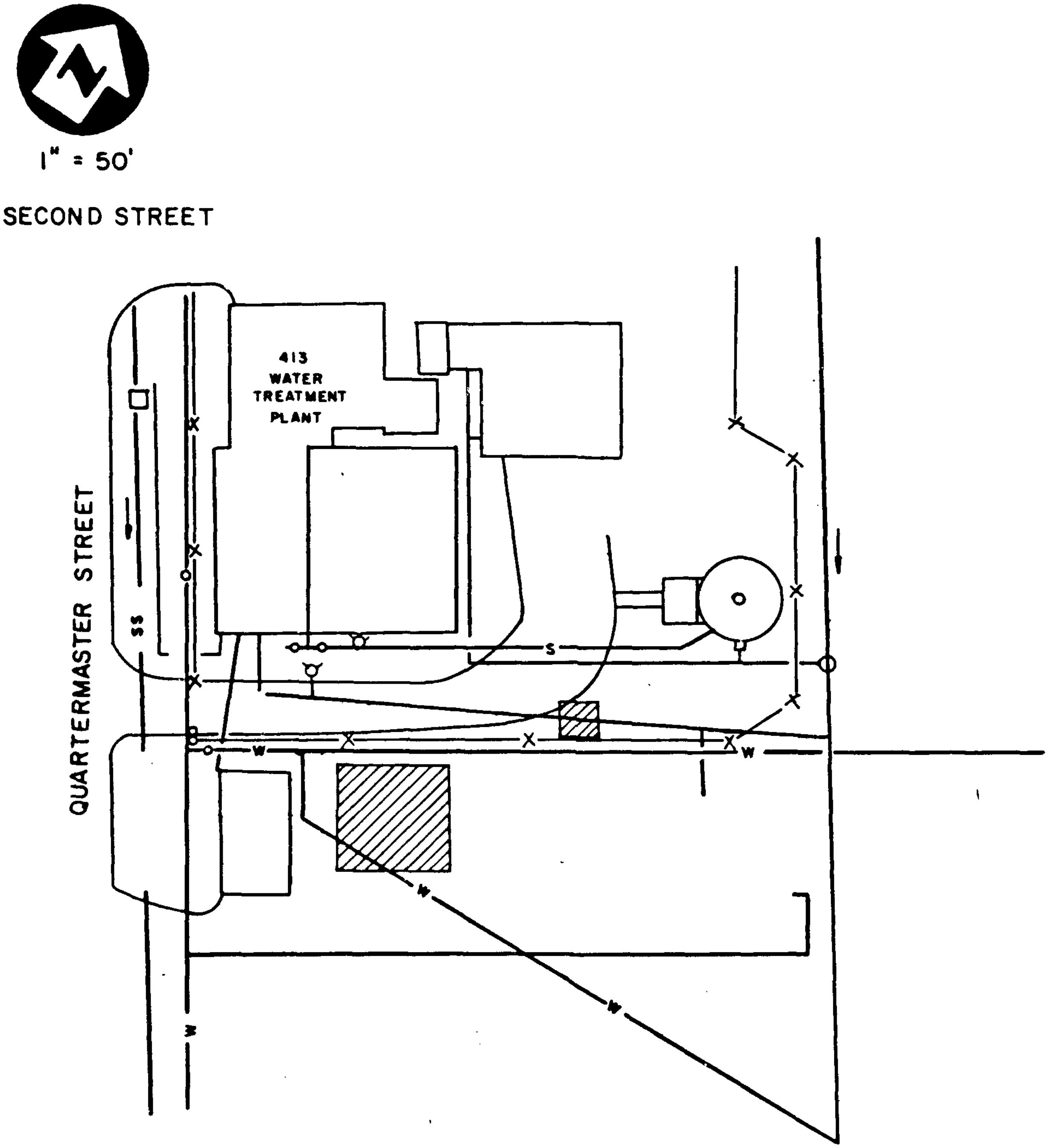
SOURCE:

BASE DETAILED SECTIONAL MAPS

FIGURE 3.14



SITE INSPECTION PLAN
SITE 20
SOUTH COAL PILE
RICKENBACKER
AIR NATIONAL GUARD BASE



LEGEND:

▨ PROPOSED HAND BORING AREA

—X— FENCE

SITE INSPECTION PLAN
SITE 21
LEAKING DRUM AND OIL CHANGE AREA
RICKENBACKER
AIR NATIONAL GUARD BASE

SOURCE:
BASE DETAILED
SECTIONAL MAPS

SITE 22 - Lube Oil Storage Area: Four hand borings will be made at oil-stained locations adjacent to the storage pad and around the foundation of a nearby shed to evaluate the horizontal and vertical extent of contamination (Figure 3.13). The soils will be analyzed for aromatic and halogenated volatile organics and petroleum hydrocarbons.

SITE 23 - Fire Training Area: An initial monitor well will be installed due east of the largest dike ring at the east edge of the pavement surface to evaluate the effect of surface runoff from the site on soil and ground-water quality (Figure 3.16). If the thick runway pavement has remained intact, it would probably have minimized the migration of contamination directly to the soil and the surface drainage away from the fire rings to the east would more likely be impacted. A twenty-point soil-gas survey will be conducted to approximate the extent of volatile contamination. Three additional wells and eight borings will be placed to evaluate contamination centers and edges as defined by the soil-gas survey.

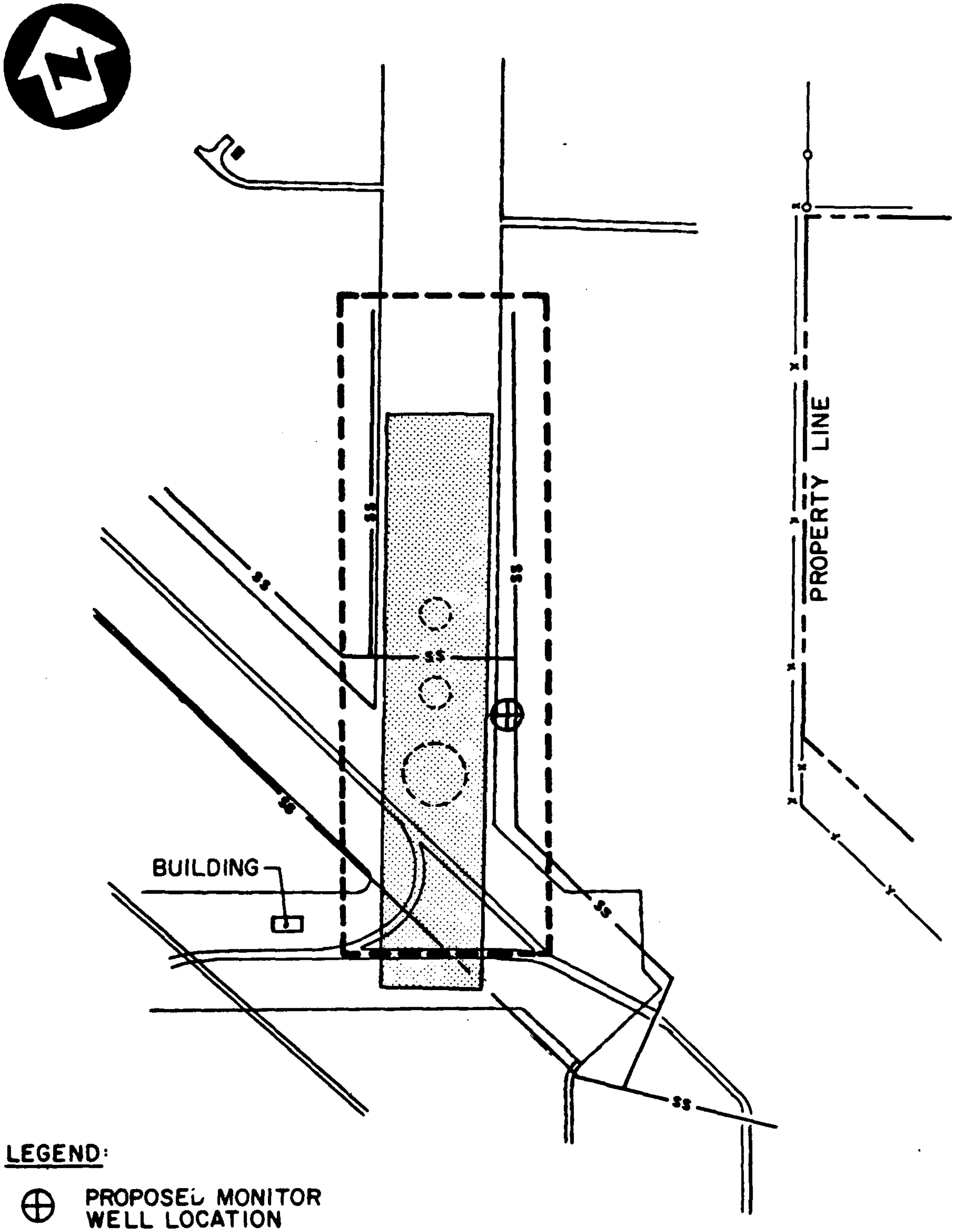
Because of the wide range of solvents, fuels and other unidentified materials that were burned at this site, a complete priority pollutant scan will be performed on the soil and water samples.

SITE 24 - Sewage Treatment Plant Sludge Beds: A sludge sample will be collected from each bed and composited with a sample from the adjacent bed (Figure 3.17) to determine contaminant levels in the sludge. An initial monitor well will be installed at the sludge-bed outfall pipe junction (southwest corner of the sludge beds) because water runoff was routed toward that corner and it is a likely location for accumulation of contaminants.

Two additional wells will be located following determination of ground-water gradient using the 17 initial wells. One well will be placed upgradient of the sludge beds and one downgradient. Tentative locations of these wells are identified on Figure 3.17. Four hand borings will be made within the sludge spreading area west-southwest of the treatment plant to evaluate the impact of the sludge on the soils. Equivalent depth samples will be composited from pairs of borings.

All discharges from Base sources into the sanitary sewer system, including solvents, waste oil, pesticides, etc., would have passed through the sewage treatment plant. Consequently, the soil and sludge samples collected at this site will be analyzed for priority pollutants except

FIGURE 3.16

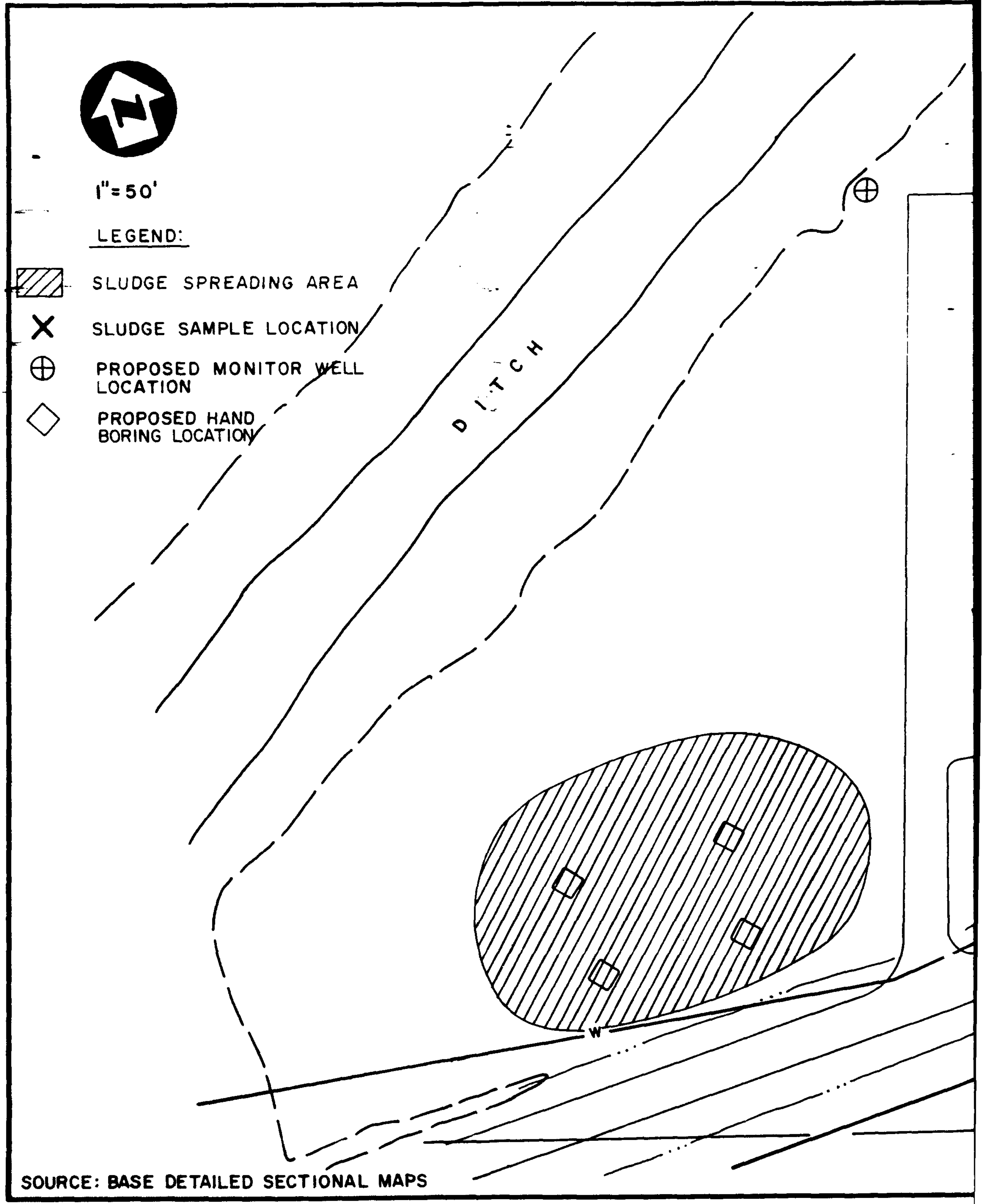


LEGEND:

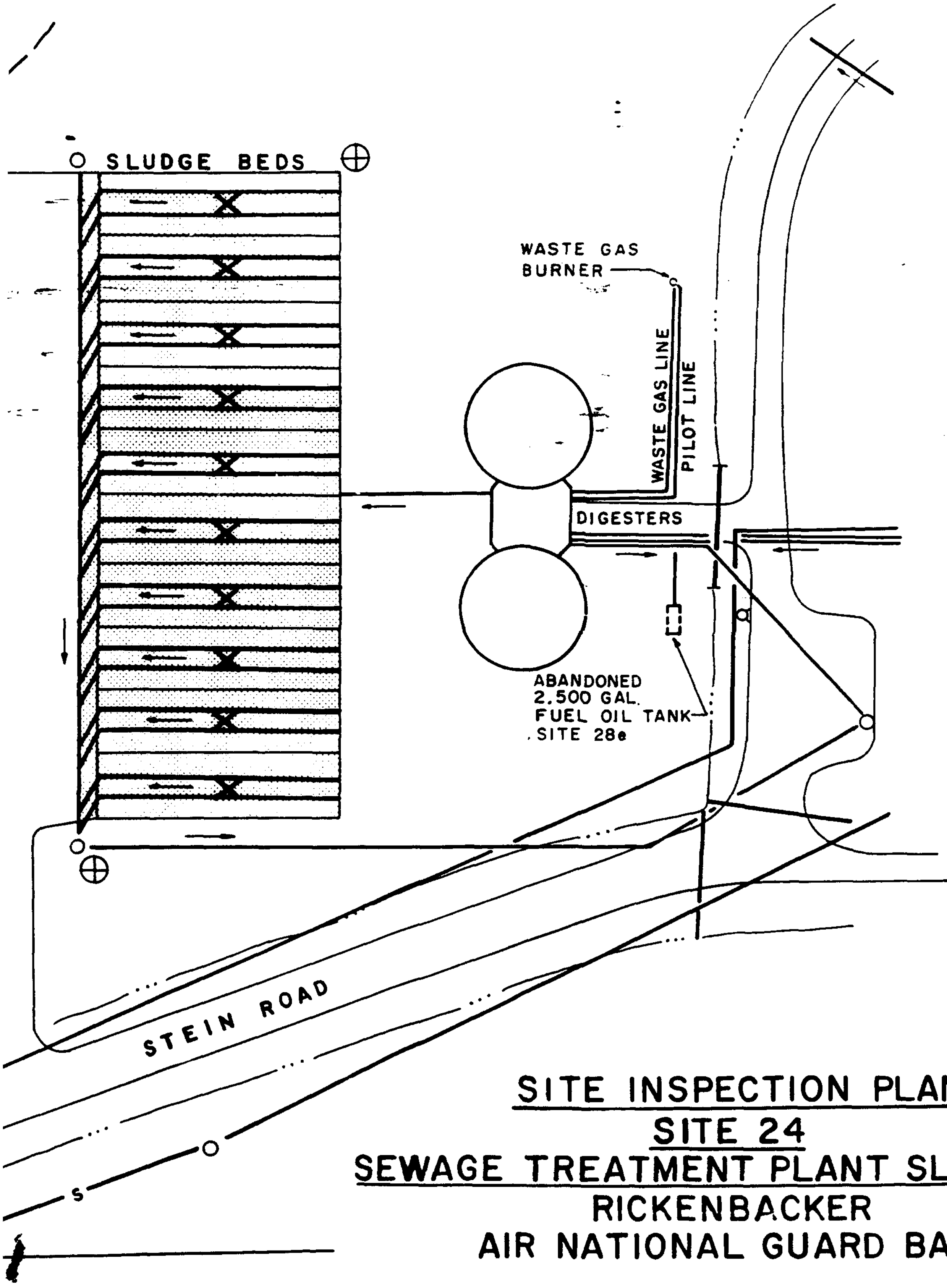
- ⊕ PROPOSED MONITOR WELL LOCATION
- ⌜ ⌟ APPROX. SOIL-GAS SURVEY OUTLINE
- ◌ DIKED AREA
- ▨ AREA USED FOR FIRE TRAINING

SOURCE: BASE STORAGE DRAINAGE
SYSTEM PLAN

SITE INSPECTION PLAN
SITE 23
FIRE TRAINING AREA
RICKENBACKER
AIR NATIONAL GUARD BASE



SOURCE: BASE DETAILED SECTIONAL MAPS



SITE INSPECTION PLAN
SITE 24
SEWAGE TREATMENT PLANT SLUDGE BEDS
RICKENBACKER
AIR NATIONAL GUARD BASE

volatiles. Volatiles in the sludge and soils are not anticipated as the sludge handling process and the long period of time since plant operations, would have resulted in their volatilization. Ground-water samples will be analyzed with a priority pollutant scan (including volatiles) to detect contamination which may be residual from plant operations.

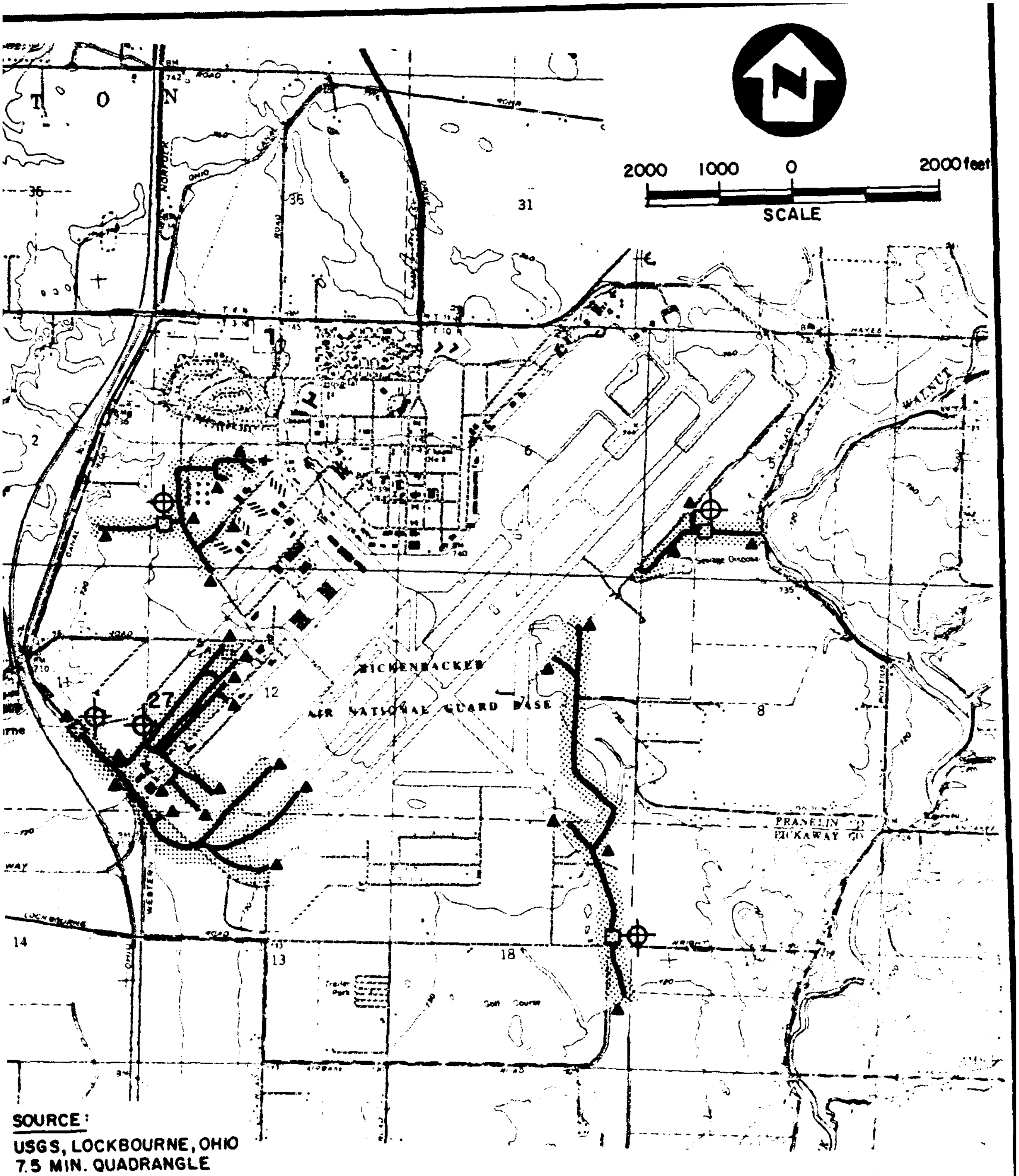
SITE 25 - Storm Drainage Ditch System: The storm drainage ditch system is extensive and although no specific spill or loss events were documented (other than Site 27). Any of the potential contaminants identified at other sites could have been discharged to the drainage network. The approach in the SI is to divide the system up into major segments and test "intersections" of ditches to identify areas of concern and to backtrack to potential source areas and minor outfalls by a process of elimination. Twenty-eight ditch bottom sediment and coincident surface water samples will be collected at the confluences of drainage ditch segments (Figure 3.18). Two additional samples will be taken at suspected point source locations identified while sampling.

The separator at the mouth of each major drainage network is a potential site of contamination concentration. An initial well will be installed near each of the separator structures to evaluate the impact of the contaminants, which were periodically contained by the separators, on the soils and ground water. A one-hundred point soil-gas survey will be conducted along the entire drainage network, concentrating on areas where no surface water or ditch bottom sediment contamination was detected in an effort to substantiate the "clean" nature of a particular ditch segment.

Because of the wide variety of contaminants which could have potentially entered the drainage network, a complete priority pollutant scan will be performed on the selected soil sediment and water samples.

SITE 26 - Electrical Transformer Storage Yard: Twenty surface soil samples will be collected in an equally spaced grid over the site and analyzed for PCB contamination to evaluate the lateral extent of possible contamination from electrical transformers which may have leaked dielectric fluid at this site (Figure 3.8).

SITE 27 - Drainage Ditch Near Landfill: Ditch bottom sediment and surface water samples will be collected in the center of the documented spill area (Figure 3.18) and at a distance approximately 100 feet downstream. A monitoring well will be installed adjacent to the most



SOURCE:
USGS, LOCKBOURNE, OHIO
7.5 MIN. QUADRANGLE

LEGEND:

□ OIL-WATER SEPARATOR
▬ OPEN DRAINAGE DITCH
27 SITE 27
⌖ PROPOSED MONITOR WELL LOCATION
▲ DITCH BOTTOM SEDIMENT AND SURFACE WATER SAMPLING LOCATION

SITE INSPECTION PLAN
SITE 25 & 27
DRAINAGE DITCH NETWORK AND DITCH NEAR LANDFILL GATE
RICKENBACKER AIR NATIONAL GUARD BASE

contaminated ditch bottom sediment sample location to evaluate the impact of the spill on adjacent soils and ground water.

A five-point soil-gas survey will be conducted along both sides of the ditch to investigate possible lateral and downstream volatile contaminant migration. Selected soil samples and water samples will be subjected to a complete priority pollutant scan.

SITE 28 - Abandoned Underground Storage Tank Investigation: A magnetometer survey will be conducted at each abandoned underground storage tank site to determine the location of the tanks. No soil sampling or monitoring well installations will be conducted at the UST sites during the Site Inspection.

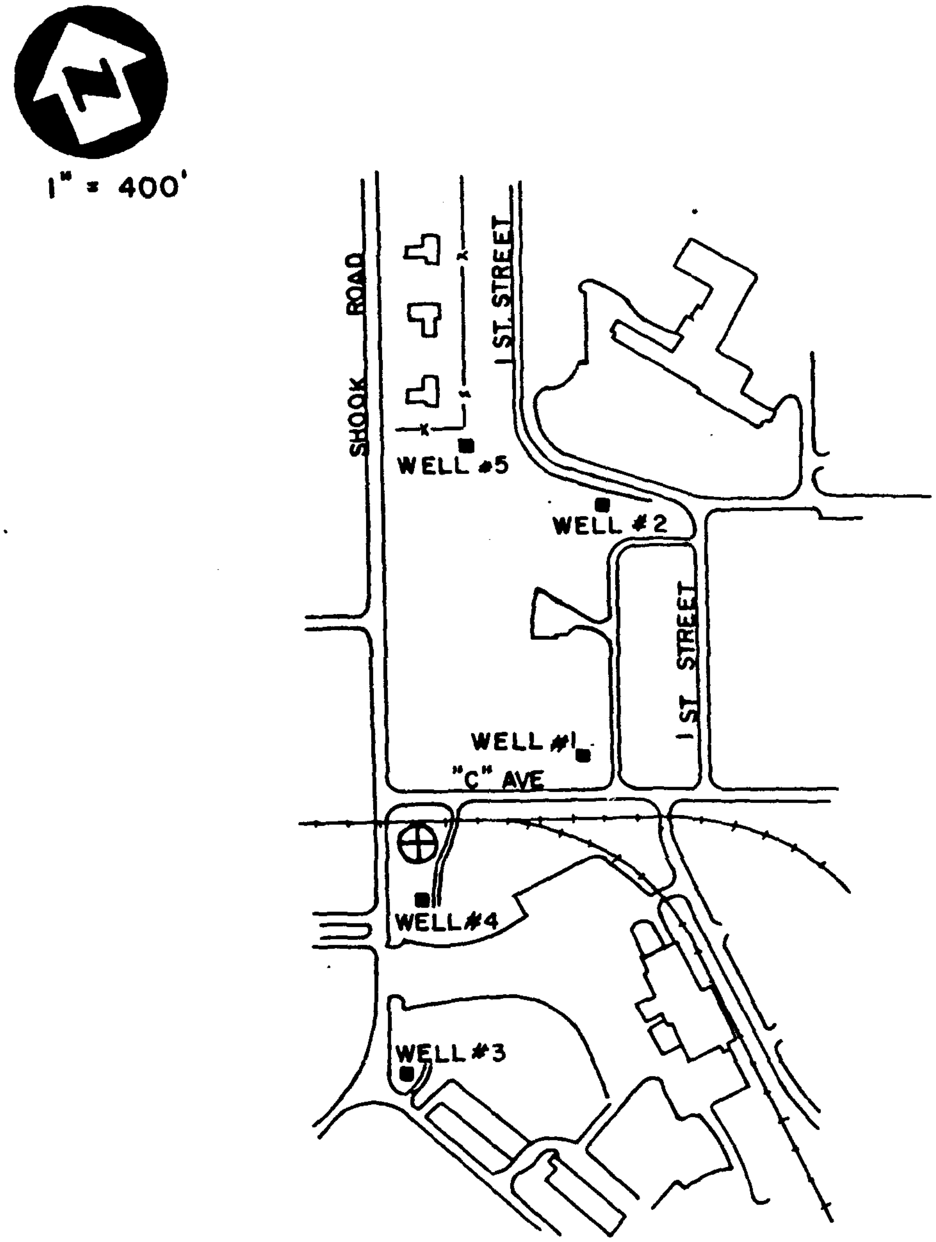
Following the magnetometer survey, plans and specifications for tank removal will be prepared (see Section 2, TASK 5).

ADDITIONAL HYDROGEOLOGIC CONTROL

Two observation wells equipped with continuous water level recorders will be installed as a nested pair near the Base water supply wells (Figure 3.19). One well will be screened in the shallow aquifer and the other will be screened in the second aquifer, as determined while drilling. Base pumping records will be reviewed in conjunction with the water level records to attempt a quantification of the interconnectedness of the Base water supply aquifer and the shallow aquifer.

A composite soil sample collected while drilling and a ground water sample from each well will be submitted for priority pollutant, sulfate, alkalinity and acidity analyses to establish "background" conditions for the Base soils and shallow and second aquifers. If the soils and/or water from these two wells are determined to be unsuitable as "background" samples, off-Base background wells will be installed.

FIGURE 3.19



LEGEND:

⊕ PROPOSED MONITOR WELL PAIR EQUIPPED WITH WATER LEVEL RECORDERS

ADDITIONAL HYDROGEOLOGIC CONTROL IN VICINITY OF WATER SUPPLY WELLS

RICKENBACKER AIR NATIONAL GUARD BASE

SECTION 4

REMEDIAL INVESTIGATION

The purpose of the Remedial Investigation (RI) is to define the extent of environmental contamination detected in the Site Inspection (SI) and to continue to assess the potential risks of the contamination to the environment and human health and welfare.

The first step of the RI will be updating this Work Plan to reflect new data gathered during the SI. The second phase of the RI will be field investigations similar to those conducted in the SI, to define the extent of contamination. Geophysical and other investigative techniques not used in the SI may be used during the RI. The third and final phase of the RI is the data analysis and reporting phase which will include preparation of an RI Report which in addition to a summary of RI activities and results will include preparation of risk assessments to determine the appropriateness of additional activities at the individual sites and ultimately be used to obtain regulatory concurrence on the decision documents.

At this time, it is not possible to accurately predict which of the twenty-three sites will require further analysis during the Remedial Investigation. However, for planning and budgetary reasons, the sites which are most likely to need additional study have been identified and additional, non-dedicated wells, borings, soil-gas survey points, etc., to cover other miscellaneous sites have been included.

Table 4.1 summarizes the scope of work anticipated. A detailed description of investigations for each site would be premature, as boring and well placement, etc., will vary depending on SI results.

TABLE 4.1

SUMMARY OF REMEDIAL INVESTIGATION PROGRAM

Site	Field Activity	# Field Samples	Matrix	Analyses*
#1	Hazardous Waste Storage Area:			
	- One Hundred soil-gas survey points	--	--	--
	- Eight hand borings	12	Soil	A
	- Four 15' borings	8	Soil	A
	- Three wells screened in the upper aquifer	6	Soil	A
	- Five wells screened in the second aquifer	10	Soil	A
	- Ground-Water Sampling	11	Water	A
#2	JP-4 Tank Farm:			
	- Sixty soil-gas survey points	--	--	--
	- Four wells screened in the upper aquifer	8	Soil	E
	- One well screened in the second aquifer	2	Soil	E
	- Ground-Water Sampling	8	Water	E
#19&20	North and South Coal Piles:			
	- Fifty soil-gas survey points	--	--	--
	- Six ditch bottom sediment samples	6	Soil	EFHK
	- Surface water sampling in ditches	4	Water	EFHK
	- Four 15' borings (2 per pile)	8	Soil	EFHK
	- Eight wells screened in the upper aquifer	16	Soil	EFHK
	- Four wells screened in second aquifer	8	Soil	EFHK
	- Ground-Water Sampling	16	Water	EFHK
#23	Fire Training Area:			
	- One Hundred and Forty soil-gas survey points	--	--	--
	- Eight 15' soil borings	16	Soil	A
	- Five wells screened in the upper aquifer	10	Soil	A
	- Four wells screened in second aquifer	8	Soil	A
	- Ground-Water Sampling	13	Water	A

*EXPLANATION
A = Priority Pollutant Scan (Method 8240, 8270, 8080 & Metals)
B = Organochlorine Pesticides and Chlorinated Phenoxy Herbicides (Method 8080 & 8150)
C = Aromatic Volatile Organics (Method 8020)
D = Halogenated Volatile Organics (Method 8010)
E = Petroleum Hydrocarbons (Method 418.1)
F = Priority Pollutant Metals
G = PCB (Method 8080)
H = Sulfates (Method 9038), Acidity and Alkalinity
I = Lead (Method 7420/7421)
J = Methyl Ethyl Ketone as an additional compound in organic analyses
K = Semi-Volatile Organics (Base/Neutral and Acid Extractables) (Method 8270)

TABLE 4.1
(continued)

SUMMARY OF REMEDIAL INVESTIGATION PROGRAM

Site	Field Activity	# Field Samples	Matrix	Analyses*
#24	Sewage Treatment Plant Sludge Beds:			
	- Twenty hand borings in sludge disposal area	20	Soil	BFG
	- Four 15' soil borings	8	Soil	BFG
	- Three wells screened in the upper aquifer	6	Soil	BFG
	- Three wells screened in the second aquifer	6	Soil	BFG
	- Ground-Water Sampling	9	Water	A
#25	Storm Drainage Ditch System:			
	- One Hundred and Fifty soil-gas survey points	--	--	--
	- Fifteen ditch bottom sediment samples	15	Soil	A
	- Fifteen surface water samples from ditches	15	Water	A
	- Six 15' soil borings	12	Soil	A
	- Twelve wells screened in the upper aquifer	24	Soil	A
	- Six wells screened in the second aquifer	12	Soil	A
	- Ground-Water Sampling	22	Water	A
Miscellaneous Other Sites:				
	- One Hundred soil-gas survey points			
	- Ten hand borings	15	Soil	A/E/CDF
	- Four 15' soil borings	8	Soil	A/E/CDF
	- Six borings to bedrock	1	Soil	A/E/CDF
	- Ten wells screened in upper aquifer	20	Soil	A/E/CDF
	- Four wells screened in second aquifer	8	Soil	A/E/CDF
	- Ground-Water Sampling	24	Water	A/E/CDF
Aquifer Evaluation:				
	- Three 6" wells for pumping tests of various portions of the aquifers. Locations to be determined after the SI.			
	- Perform 24-hour pump tests on three pumping wells and one of the Base water-supply wells.			

*EXPLANATION
A = Priority Pollutant Scan (Method 8240, 8270, 8080 & Metals)
B = Organochlorine Pesticides and Chlorinated Phenoxy Herbicides (Method 8080 & 8150)
C = Aromatic Volatile Organics (Method 8020)
D = Halogenated Volatile Organics (Method 8010)
E = Petroleum Hydrocarbons (Method 418.1)
F = Priority Pollutant Metals
G = PCB (Method 8080)
H = Sulfates (Method 9038), Acidity and Alkalinity
I = Lead (Method 7420/7421)
J = Methyl Ethyl Ketone as an additional compound in organic analyses
K = Semi-Volatile Organics (Base/Neutral and Acid Extractables) (Method 8270)

SECTION 5
FIELD INVESTIGATION TECHNIQUES

Field investigation techniques that will be utilized in the Site Inspection and Remedial Investigation include soil borings, installation of ground water monitoring wells and soil-gas surveys. The methods for performing these techniques in the study at Rickenbacker ANGB will be discussed in this section. Technique details related to the collection of samples for chemical analysis, including decontamination and other sampling protocols are covered in Section 6, the Sampling and Analytical Plan.

MAGNETOMETER SURVEY

Magnetometer surveys will be conducted at sites where the location of underground storage tanks is unclear. The survey will consist of determining magnetic field at points on an equal-spaced grid above the reported tank location. Grid spacing will be ten feet on center. The magnetic field readings will be used to construct a map delineating the edges of the underground tanks.

HAND-BORING AND SURFACE SOIL SAMPLING

The purpose of hand-boring and surface soil sampling is to determine the presence or absence and, if present, the extent of contamination in the upper soil horizons at sites where surface spills from drums or transformers were reported or suspected (e.g., Sites 9 and 26) or surface contamination is apparent (e.g., Sites 21 and 22).

Soil boring samples will be taken using a hand or power driven stainless steel auger or soil sampler to a depth of four feet. The four feet of sample will be divided into three discrete-depth samples. At some sites, equivalent-depth samples from adjacent hand borings will be composited. Whether or not compositing will be done at a site is detailed in Section 3.

Surface soil samples will be collected using a stainless steel trowel. Compositing of adjacent surface soil samples will be done at several sites.

DRILLING PROGRAM

The objectives of the drilling program at Rickenbacker ANGB are to obtain samples for lithologic descriptions and stratigraphic correlation, to obtain samples of soil for chemical analysis, and to install groundwater monitoring wells. The monitoring wells will be used for hydrologeologic characterization of the shallow and second aquifer beneath the base and to obtain samples for evaluation of groundwater quality in both aquifers. Monitoring well drilling and construction will be performed by an experienced driller. All drilling sites will be screened with a metal detector to verify the location of underground pipelines and tanks before commencing drilling.

Drilling Procedures

Soil borings drilled for collection of soil samples and for installation of monitoring wells will be advanced using 4.25 inch inside diameter (ID) continuous flight hollow-stem augers (approx. 6 inch diameter boring). A stainless steel split-spoon sampler will be used for collection of samples continuously from the 17 initial well borings and at intervals of five feet or at lithologic changes in subsequent borings, using ASTM Method D-1586. Deep borings to bedrock will be drilled during the RI using hollow-stem auger techniques to a depth of approximately 60 feet, temporary casing will be installed/driven to 60 feet and the hole continued using air-rotary drilling methods or other methods appropriate to the expected lithology and environmental concerns.

Where desirable, the deep borings will be filled with a cement/ bentonite grout (94 pounds of cement/4 pounds of granular bentonite/6 gallons of water) (4.08 percent) to an appropriate depth using a tremie pipe and completed as a monitoring well. If not made into a well, the boring will be filled to grade with the grout mixture.

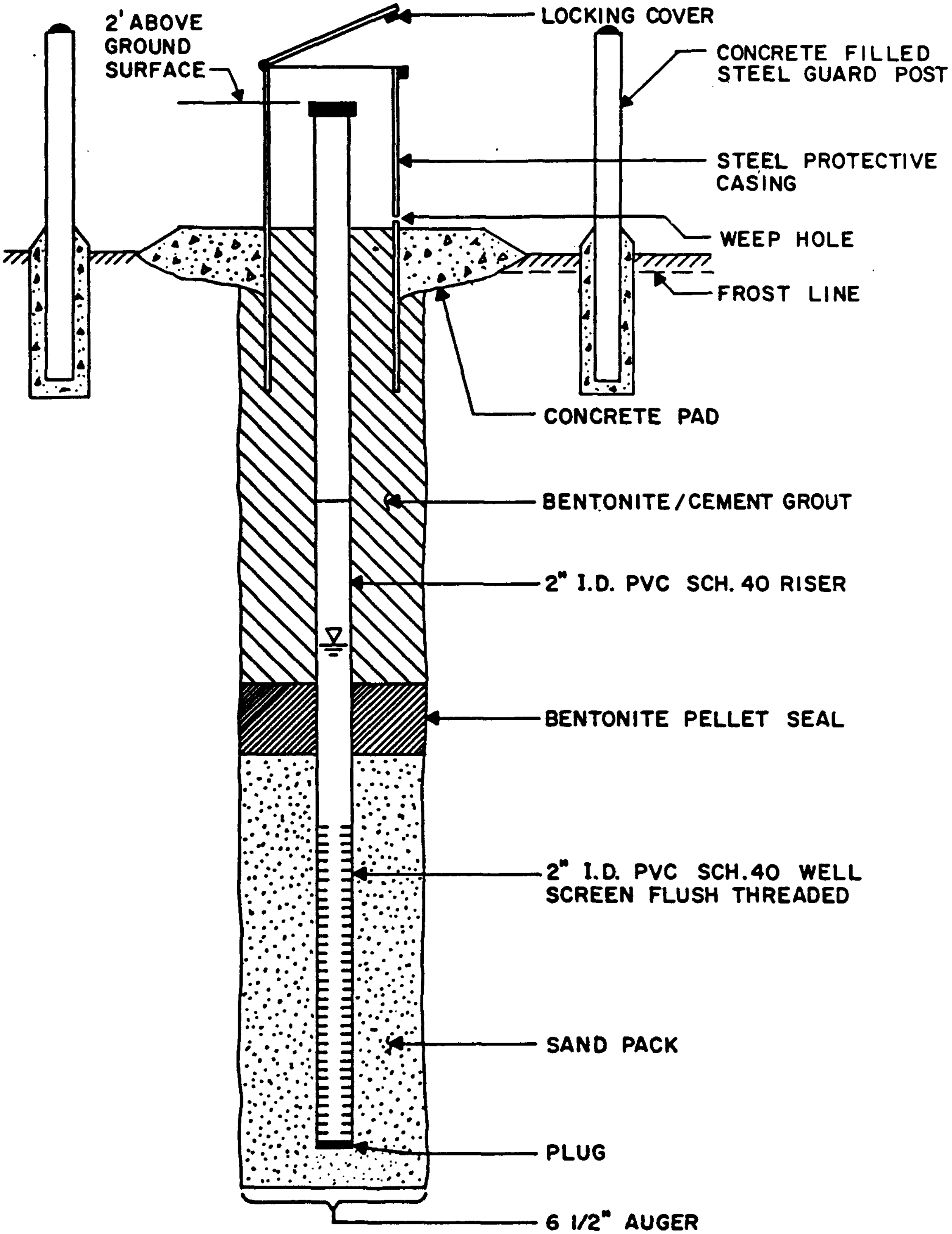
Several shallow borings will be drilled to a depth of fifteen feet or to the water table. These borings will be made with a 3.25 inch ID hollow-stem auger and sampled every five feet using a stainless steel split-spoon sampler. Following drilling, these borings will be filled to grade with a cement/bentonite grout using a tremie pipe.

Monitoring Well Construction, Completion and Development

The wells installed to monitor the shallow aquifer at the 23 sites will consist of 2-inch ID Schedule 40 PVC casing and screen. The wells for additional hydrogeologc control will be constructed of 4-inch ID PVC. The casing and screen will have threaded, flush joints and a threaded bottom cap. A ten-foot screen, machine slotted with 0.010 inch openings will be set spanning the water table to detect floating contaminants and to allow for seasonal water table fluctuations. The screen and casing will be installed through the inside of the augers. A sand pack consisting of No. 30 x 40 washed and bagged Ottawa sand or equivalent will be placed around the screen while the augers are slowly withdrawn to prevent bridging of the sand. The sand pack will extend two to three feet above the screen or in accordance with the State of Ohio well construction regulations. A minimum two-foot thick bentonite pellet seal will be placed above the sand pack. A cement/bentonite grout mixture will be placed using a tremie pipe from the top of the bentonite seal to six inches below the ground surface. A typical monitoring well construction diagram for wells to be installed in the shallow aquifer is presented in Figure 5.1.

The wells installed during the RI and the deep well for hydrogeologic control to monitor the second aquifer will be constructed in the same way as the shallow aquifer wells with the addition of steel casing to isolate the shallow aquifer (Figure 5.2). Upon drilling through the shallow aquifer into the underlying clay, a steel casing will be installed and held in place by a cement/bentonite grout. After the grout has set, drilling will continue into the second aquifer and the well will be installed (Figure 5.2).

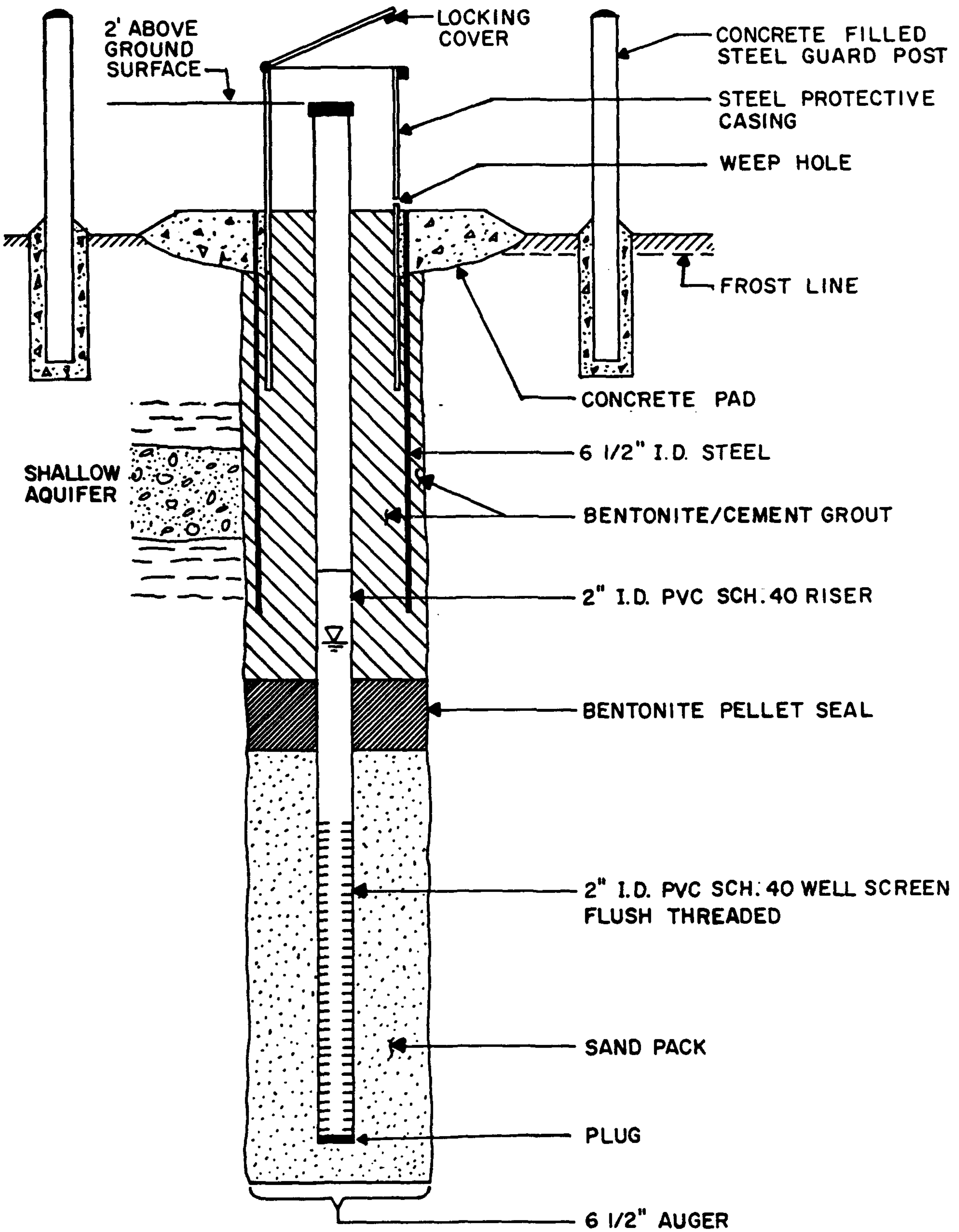
Most of the wells will be completed with two feet of casing extending above the ground surface. A protective steel casing (six feet long) equipped with a locking cap will be set into the cement grout to a depth below the frost line and a minimum 6 inch thick concrete pad will be installed around the riser pipe of the above-grade wells. The well number will be imprinted on the well cover lid. Three steel guard posts will be erected around each of the protective steel casings, each set four feet deep in separate footings. Wells in vehicle traffic areas will be cut off six inches below grade. A locking protective lid consisting of a cast iron valve box assembly will be installed in a concrete mixture above the cement grout. The top of the valve box will be finished with a slight crest to facilitate runoff away from the well. The well number will be imprinted



TYPICAL MONITORING WELL CONSTRUCTION

FOR SHALLOW AQUIFER WELLS

FIGURE 5.2



TYPICAL
MONITORING WELL CONSTRUCTION
FOR SECOND AQUIFER WELLS

on the valve box lid. Protective casings and valve box lids will be painted a bright color. Each below-grade well will be fitted with a water-tight cap with a 1/8" vent hole.

The monitoring wells will be developed by bailing or pumping until the pH and conductivity has stabilized to ±10 percent. Water level recovery will be monitored after final well development to complement slug test results.

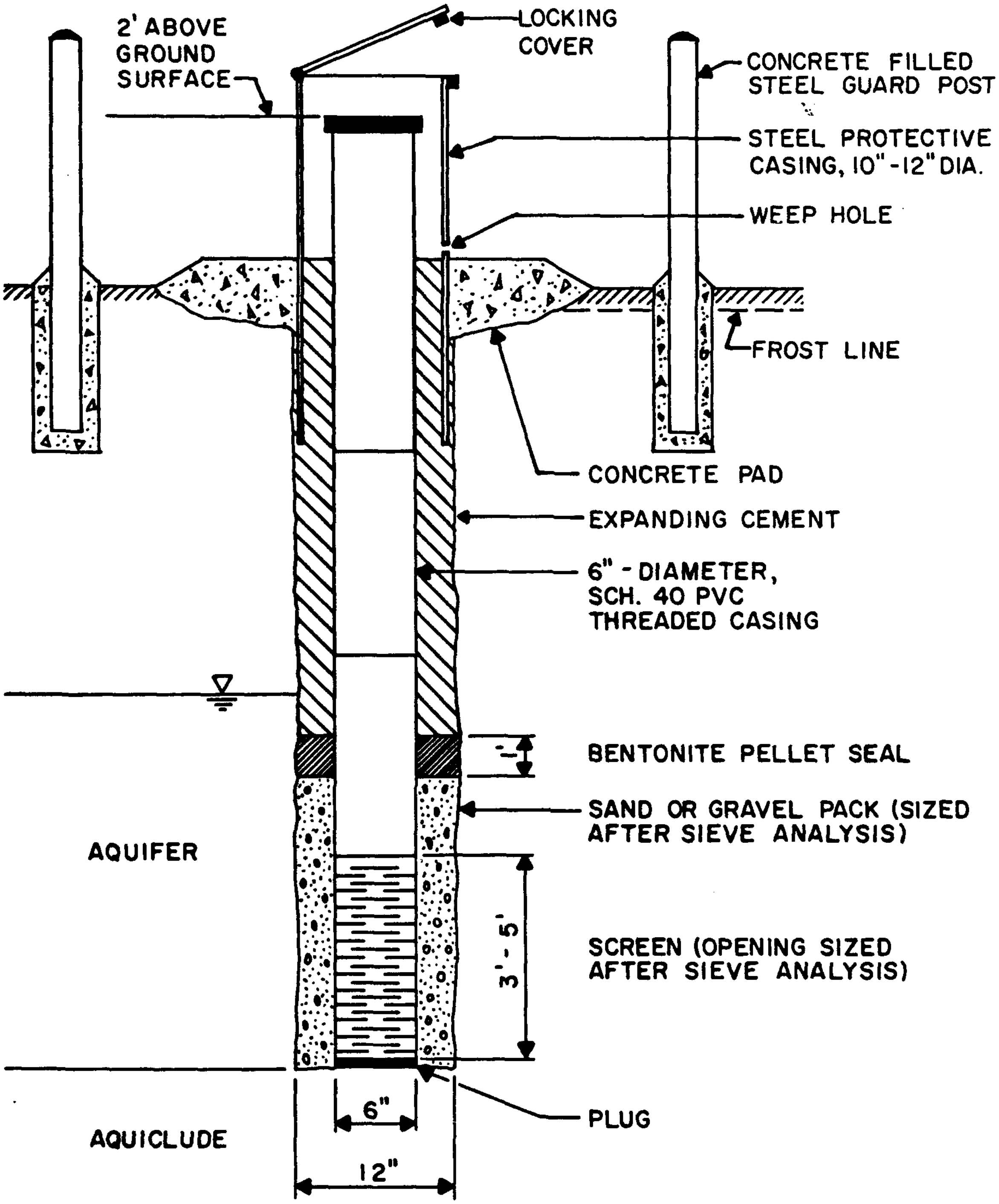
Pumping-Well Drilling and Installation

Up to three 6 inch diameter wells to be used for pumping tests are planned for the RI. The actual locations and design of the wells will be decided during the RI based on contaminant distribution and aquifer variability. If contaminated sites are widely spaced and aquifer variability is great, all three pumping wells may be needed. The following is a general description of the planned wells.

The boring for the 6-inch well will be made to the base of the aquifer of interest by hollow-stem auger or other well drilling techniques and reamed to a 12 inch diameter. The well will be constructed in a similar manner as the monitoring wells except that screen slot size and sand pack grain-size will be determined based on sieve analysis of aquifer sediments (Figure 5.3).

SOIL-GAS SURVEYING

Soil-gas surveying will be conducted during the SI and RI at selected sites. The soil-gas method for detecting subsurface contamination involves the collection of gas samples from the unsaturated zone and testing the sample for organic compounds. Collection of the gas is accomplished by driving a probe into the ground to a depth of 5 to 15 feet and withdrawing an air sample. A measured volume of the gas is drawn into a glass or stainless steel bulb or Tedlar® bag using a vacuum pump. The gas in the sample container is then screened for total volatile organic concentration using a PID. The sampling is then repeated and the sample analyzed for specific compound concentrations on-site using a portable gas chromatograph (GC). The results of the survey can be used to map concentrations of organic soil vapors and aid in defining a plume of contamination. At sites covered by concrete or asphalt paving, a pilot hole will be drilled through the pavement.



GENERALIZED PUMPING WELL CONSTRUCTION

Depth of soil-gas sample collection will be based on two evaluation criteria. The log of the well boring nearest the soil-gas survey area will be reviewed to identify lithologic characteristics that may impede vertical gas migration, e.g., a perched water layer. If no impediments to a reliable survey are noted, the survey will be conducted. If an impediment is identified, the possible ramifications on the validity of a soil-gas survey will be evaluated and discussed with the HAZWRAP Project Manager before proceeding.

The initial soil-gas survey point at each site will be located where contamination is expected. Soil-gas samples will be collected at two to five foot intervals to a total depth approximately two feet above the water table or 15' (whichever is less). From this soil-gas profile, the depth from which soil-gas samples will be collected for the rest of the survey will be determined.

AQUIFER MONITORING AND TESTING

The nested pair of monitoring wells designated for Additional Hydrogeologic Control will be drilled to the shallow aquifer and the second aquifer within the Base well field *early in the SI. The wells will be* equipped with continuous water-level recorders. The recorders will operate for one year after installation and the resulting records compared to pumping records of the Base wells to attempt an evaluation of aquifer interconnectedness and to monitor seasonal water level fluctuation.

Rising-head (slug) tests will be performed on all monitoring wells installed during the SI to estimate aquifer characteristics. The tests will follow protocol for field determination of hydraulic conductivity set out in EPA Method 9100. The slug tests will be performed in conjunction with well development and presampling purging. Following water withdrawal for sampling or development, water level recovery will be monitored using an electric water level indicator.

The data collected during the slug tests will be used to calculate hydraulic conductivity which will be used to estimate transmissivity and water flow velocity through the tested aquifer.

Pumping tests will be performed on the six-inch wells installed during the RI and possibly on a Base water-supply well. A submersible (or other suitable) pump will be used to remove water from the wells. The tests will be run for a minimum of 24 hours. Pump discharge will be measured by a flow meter and checked periodically by volumetric measurement. Existing two-inch monitoring wells will be used to monitor water table fluctuations throughout the tests. Pressure transducer measuring devices equipped with a recorder will be used to monitor water levels in the pumping well and the nearest two-inch wells. Electric water level indicators will be used at other monitor wells in the vicinity. Hydraulic conductivity, storage coefficient and transmissivity of the aquifer will be determined from pumping test data.

SITE SURVEYS

All hand-boring, surface soil, ditch sediment, soil boring and monitoring well locations will be identified on maps provided by Base personnel. The horizontal locations of the soil borings and monitoring wells will be surveyed by a licensed surveyor to an accuracy of one foot. The vertical location of a clearly marked measuring point on the top of each monitoring well will also be surveyed with reference to U.S. Geological Survey or U.S. Geodetic Survey benchmarks with an accuracy of ±0.01 foot. Accurately locating the hand-boring and surface soil sampling sites will be accomplished by tape and compass orientation with respect to a local structure or roadway which appears on Base plans.

FIELD MEASUREMENTS

Field measurements of temperature, pH, and specific conductance will be performed on water samples at the time of sample collection. Details of sampling techniques are included in Section 6.

Temperature and pH Measurement

The temperature and pH of each water sample will be measured using an automatic temperature compensating pH probe. The probe will be calibrated using buffer solutions of the appropriate range for expected values of pH. The meter will also be re-calibrated according to manufacturer's instructions.

Conductivity Measurement

The specific conductance of each water sample will be measured with a portable conductivity meter. Standard potassium chloride solutions will be used to calibrate the instrument prior to use. The meter will also be re-calibrated periodically according to manufacturer's instructions.

DECONTAMINATION AREA

An equipment decontamination area will be designated. A decontamination pad will be constructed consisting of a concrete base with curbing covered with plastic. The base and curbing will be designed so that all wash water and soils will be contained on the pad and drain into a sump. Waste from the sump will be pumped into drums for temporary storage until final disposition is determined. All drums will be labeled as to date of collection.

The decontamination pad will be of sufficient size to contain the largest drill rig which will be used at the site. Exact specifications of the pad will be determined after coordinating with Base personnel about the location of the pad and decontamination activities.

CONTAMINATED MATERIALS MANAGEMENT

All excess soil, development water, purge water, pump test discharge water and decontamination waste water will be collected and stored on-site pending receipt of results of chemical analysis of representative samples. The source and date of collection of the waste material in each container will be clearly marked on the outside of the container. Soil and ground water analyses for samples collected from the wells from which the contaminated material came will be used to establish chemical properties of the waste and determine disposal needs. If waste containers include material from several wells, a composite sample will be collected from the container and analyzed for the parameters detected in the source wells.

Materials will be staged at a common secure location, identified and separated by type of material. The containers will be segregated by contaminant and contaminant concentrations. Base personnel will be informed of ongoing status of the materials management. ES will determine proper disposal procedures and arrange for proper transport and disposal. All waste manifests will be signed by ANG personnel.

SECTION 6

SAMPLING AND ANALYTICAL PLAN

Soil, sediment, ground-water, surface water, and soil-gas samples will be collected at Rickenbacker ANGB, Columbus, Ohio to confirm the presence or absence of contamination at sites suspected of having environmental contamination because of past hazardous waste disposal practices, spills or leakage. This section presents the procedures for collection of the various media and the methods that will be used to analyze the samples.

SOIL SAMPLING

Surface soil samples will be collected with a stainless steel trowel to a maximum depth of six inches. Hand boring samples will be collected using a stainless steel auger or soil sampler to a depth of four feet and divided into three equal segments. Some compositing of equivalent-depth samples from adjacent borings will be done at sites where determination of lateral extent of contamination is not imperative.

During drilling operations, soil samples will be collected continuously in the initial 17 wells and at five foot intervals and at lithologic changes in subsequent borings with a split-spoon sampler using the Standard Penetration Test (ASTM D-1586). Soils will be classified with respect to type, by the visual-manual procedure (ASTM D-2488) noting mineralogy, color, odor, staining, etc. The samples will also be checked for the presence of organic vapors. The test for vapors will involve placing a portion of the sample, not intended for volatile analysis at the laboratory, in a jar, sealing the jar with aluminum foil, allowing the sample to equilibrate for five minutes, then measuring the concentration of organics in the headspace of the jar using a meter with a photoionization detector (PID).

In the event that the air temperature is below 40°F, the samples designated for vapor screening will be set aside and at the end of the day placed in a heated room for one hour and then checked for vapors using the PID. This step is taken because PIDs are less accurate below 40°F.

Selected soil samples from drilling, and all surface soil and hand boring samples will be packaged and shipped to a laboratory for chemical analysis. Soil samples selected for chemical analysis for non-volatile constituents will be removed from the sampler and placed in a stainless steel bowl. The sample will be broken apart by means of a stainless steel spoon and split among the various containers for shipment to the laboratory. This same mixing procedure will be used to composite surface and hand boring soil samples. Samples for volatile analysis will be placed in bottles as quickly as possible to minimize volatilization. The sample bottle types that will be used for soil samples are presented in Table 6.1.

All drilling equipment will be decontaminated between boreholes to prevent cross-contamination. The drill rig and out of hole equipment (wrenches, auger head, etc.) will be steam-cleaned. All downhole drilling tools (auger flights, bits and center rods) will be decontaminated with steam cleaning followed by a detergent wash, a clean-water rinse, a deionized organic free water rinse and an isopropyl rinse. The equipment will be allowed to air dry prior to its next use. All tools used for soil sampling and packaging (trowels, soil samplers, split-spoon samplers, stainless steel mixing bowls, and stainless steel mixing spoons) will be decontaminated after the collection of each sample. This will consist of a detergent wash, clean-water rinse, deionized organic-free water rinse and an isopropyl rinse. After the final rinse, the sampling equipment will be allowed to air dry before being re-used.

DITCH BOTTOM SEDIMENT SAMPLING

Sediment samples will be collected from the upper two to six inches of the ditch bottom. The samples will be collected using a dip sampler by inverting the sampler, immersing it to the bottom of the stream, and slowly filling it.

The water from above the sediment will be decanted before the sample is placed in sample bottles for shipment to the laboratory. The types of bottles that will be used for sediment samples are presented in Table 6.1. The equipment used for collecting and compositing sediment samples will be decontaminated prior to each use. The decontamination procedures will consist of a detergent wash, clean-water rinse, deionized organic free water rinse, and an isopropyl rinse. The equipment will then be allowed to air dry before its next use.

TABLE 6.1

RICKENBACKER ANGB, COLUMBUS, OHIO
ANALYTICAL METHODS AND COLLECTION SPECIFICATIONS FOR SOIL & SEDIMENT SAMPLES

Parameter	Analytical Method (1)	Sample Container	Preservation Method	Holding Time
Halogenated Volatile Organics	8010/8240	4 oz (120 ml) widemouth glass w/Teflon® liner	Cool, 4°C	14 days
Aromatic Volatile Organics	8020/8240	8 oz, widemouth glass w/Teflon® liner	Cool, 4°C	14 days
Pesticides/PCBs	8080	8 oz, widemouth glass w/Teflon® liner	Cool, 4°C	Samples must be extracted within 14 days and extracts analyzed within 40 days
Herbicides	8150	8 oz, widemouth glass w/Teflon® liner	Cool, 4°C	
Semi-Volatile Organics	8270	8 oz, widemouth glass w/Teflon® liner	Cool, 4°C	
Petroleum Hydrocarbons	EPA 418.1(2)	4 oz, widemouth glass w/Teflon® liner	Cool, 4°C	28 days
Metals:	6010 or:	8 oz, widemouth glass w/Teflon® liner	Cool, 4°C	6 months (except Mercury; 28 days)
Antimony	7040/7041			
Arsenic	7060/7061			
Beryllium	7090/7091			
Cadmium	7130/7131			
Chromium	7190/7191			
Copper	7210			
Lead	7420/7421			
Mercury	7470/7471			
Nickel	7520			
Selenium	7740/7741			
Silver	7760			
Thallium	7840/7841			
Zinc	7950			
Sulfate	9038	8 oz, widemouth glass w/Teflon® liner	Cool, 4°C	28 days

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1. Source unless otherwise noted: SW 846, Test Methods for Evaluating Solid Wastes, U.S. EPA, November 1986.
2. USEPA, Methods for Chemical Analysis of Water and Wastes, March 1983.

GROUNDWATER SAMPLING

Prior to sampling each monitoring well, the static water level will be measured, and pH temperature and conductivity of the water will be determined. The well will be purged by pumping or bailing until the total well water volume (TWWV) has been removed and pH, conductivity and temperature have stabilized (±10%) or the well is dry. The TWWV includes water in the screen, riser and sand pack. The TWWV will be calculated for each well after measuring static water level and will be recorded in the field log book. Plastic ground covering will be used at each well site to prevent contamination of down-well sampling devices from surface soils.

The bailers and pumps used for purging will be constructed of Teflon®, stainless steel and PVC. Samples will be collected using a Teflon® Bailer with dedicated line. The first sample withdrawn will be put in a container for volatile analysis. Other sample bottles will be filled with the remaining water. Appropriate preservatives will be added to the sample bottles after sample collection. Vials used for containing samples to be analyzed for volatile organics will be checked to assure that no air bubbles are present before the samples are packaged for shipment. A summary of the types of sample bottles and preservatives that will be used for water samples is presented in Table 6.2.

The bailers, pump, and tip of the water level indicator used at each well will be decontaminated before use at the next sampling location. The decontamination procedure will consist of a detergent wash, clean-water rinse, a deionized, organic free water rinse, and an isopropyl rinse. The bailer will be allowed to air dry completely before subsequent use. The probe of the pH wand and the conductivity meter will be rinsed with deionized, organic free water after each use.

SURFACE WATER SAMPLING

Surface water samples will be collected from the drainage ditches by inverting the sample bottle, immersing it below the water surface, and slowly filling it as it is removed from the water. If water depth is greater than three feet, samples will be collected from the water surface, the base of the water column and mid-depth. The three discrete-depth samples will be composited into one sample bottle containing appropriate preservatives (Table 6.2).

TABLE 6.2

RICKENBACKER ANGB, COLUMBUS, OHIO
ANALYTICAL METHODS AND COLLECTION SPECIFICATIONS FOR WATER SAMPLES

Parameter	Analytical Method (1)	Sample Container	Preservation Method	Holding Time
Halogenated Volatile Organics	8010/8240	40 ml, glass, Teflon®-lined septum cap	Cool, 4°C	14 days
Aromatic Volatile Organics	8020/8240	40 ml, glass, Teflon®-lined septum cap	HCL(4 drops), (8020 only) Cool, 4°C	14 days
Pesticides/PCBs	8080	1 Liter, glass, Teflon®-lined septum cap	Cool, 4°C	Samples must be extracted within 14 days and extracts analyzed within 40 days
Herbicides	8150	1 Liter, glass, Teflon®-lined septum cap	Cool, 4°C	
Semi-Volatile	8270	1 Liter, amber glass w/Teflon® liner	Cool, 4°C	
Petroleum Hydrocarbons	EPA 418.1 (2)	2 liter, glass	HCl to pH <2, Cool, 4°C	28 days
Total Metals:	6010 or:	2 liter plastic or glass	HNO_3 to pH<2	6 months (except Mercury; 28 days)
Antimony	7040/7041			
Arsenic	7060/7061			
Beryllium	7090/7091			
Cadmium	7130/7131			
Chromium	7190/7191			
Copper	7210			
Lead	7420/7421			
Mercury	7470/7471			
Nickel	7520			
Selenium	7740/7741			
Silver	7760			
Thallium	7840/7841			
Zinc	7950			
Sulfate	9038	500 ml, plastic or glass	Cool, 4°C	28 days

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1. Source (unless otherwise noted): USEPA SW 846, Test Methods for Evaluating Solid Wastes, November 1986.
2. USEPA, Methods for Chemical Analysis of Water and Wastes, March 1983.

SOIL-GAS SURVEYING

Soil-gas samples will be withdrawn from depths of five to fifteen feet (dependent on drilling results) using a vacuum pump attached to a stainless steel probe. A stainless steel or glass sample bulb or Tedlar® bag will be in the vacuum line between the pump and probe. Two probe volumes of air will be purged from the probe and a volume of soil vapor will be contained. The sampling probe and bulb will be decontaminated between sampling points using air and/or methanol.

Soil-gas samples will be analyzed within one hour of collection using a Photovac, portable gas-chromatograph (GC) Model 10S50 or equivalent. The GC will be calibrated using a gas standard daily before running the first analysis, the calibration will be checked at mid-day and at the end of the day using the gas standard. Components of the standard will be determined based on suspected contaminants at each site.

SAMPLE CUSTODY AND DOCUMENTATION

The sample custody and documentation procedures described in this section will be followed during collection of soil, sediment, ground-water and surface water samples at Rickenbacker ANGB, Columbus, Ohio. Personnel involved in Chain of Custody and transfer of samples will be trained in these procedures prior to implementation of the field program at the Base.

Field Log Books

Bound field log books will be maintained by the field team leader and other team members. Information pertinent to the field survey and/or sampling will be recorded in the log books. These will be bound books, with consecutively numbered pages. Waterproof ink will be used in making all entries. Entries in the log book will include at least the following:

- Name and title of author, date and time of entry, and physical/ environmental conditions during field activity;
- Purpose of sampling activity;
- Name and address of field contact;
- Name and title of field crew;
- Name and title of any site visitors;
- Type of sampled media (e.g., soil, sediment, groundwater, etc.);
- Sample collection method;

- Number and volume of sample(s) taken;
- Description of sampling point(s);
- Date and time of collection;
- Sample identification number(s);
- Sample distribution (e.g., laboratory);
- References for all maps and photographs of the sampling site(s);
- Field observations;
- Any field measurements made, such as pH, temperature, water level, etc.; and
- Weather conditions.

If an error is made in a log book, the person who made the entry should make the correction simply by crossing a line through the error and entering the correct information. The erroneous information should not be obliterated. All entries will be signed and dated and all corrections initialed and dated.

Sample Tags

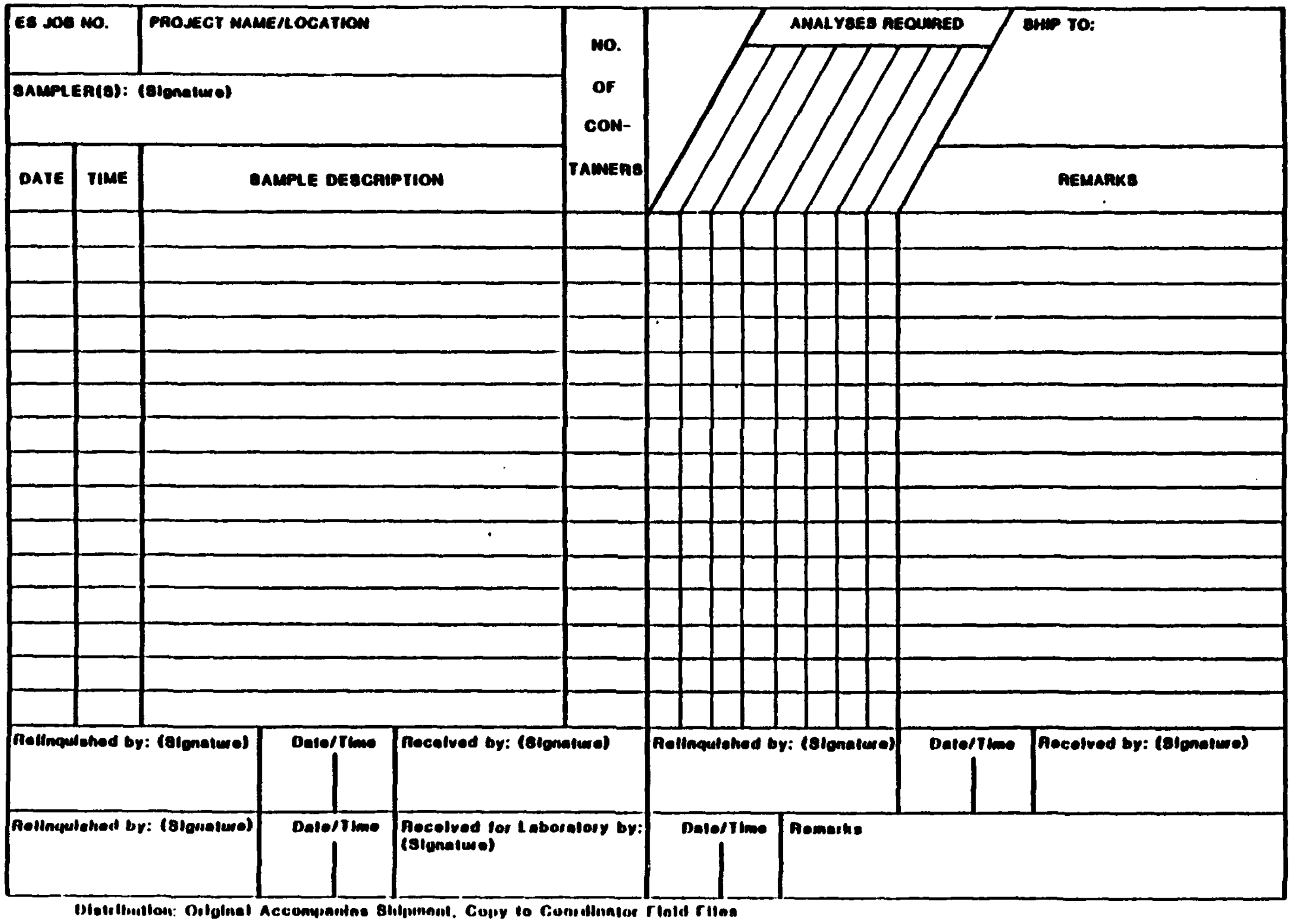
All physical samples obtained at the site will be placed in an appropriate sample container for shipment to the laboratory. Each sample bottle will be identified with a separate identification tag. The information on the tag will include the following information:

- Project identification;
- Sample identification;
- Preservatives added;
- Date of collection;
- Time of collection; and
- Required analytical method numbers.

Sample Numbering System

Each sample will be assigned a unique sample identification number that describes where the sample was collected. Each number will consist of a group of letters and numbers, separated by hyphens. The sample numbering system is presented in Table 6.3.

CHAIN OF CUSTODY FORM



ENGINEERING-SCIENCE

CHAIN OF CUSTODY RECORD

ES JOB NO.

PROJECT NAME/LOCATION

SAMPLER(S): (Signature)

ANALYSES REQUIRED

SHIP TO:

DATE	TIME	SAMPLE DESCRIPTION	NO. OF CON-TAINERS									REMARKS

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks	

Distribution: Original Accompanies Shipment, Copy to Coordinator Field Files

TABLE 6.3

SAMPLE NUMBERING SYSTEM
RICKENBACKER ANGB, COLUMBUS, OHIO

Project Identification:	RB
Site Identification and Number:	Site Number: 1 through 27
Sample Source Number (sequential):	
MW ______	Monitor Well #
HB ______	Hand Boring #
AB ______	Auger Boring #
SU ______	Surface Sediment Sampling Location #
DS ______	Ditch Sampling Location #
Sample Number:	
GW ______	Ground Water
SW ______	Surface Water
SS ______	Soil Sample (Split-Spoon or HB)
GS ______	Surface Soil Grab Sample
BS ______	Ditch-Bottom Sediment Sample

Example:

RB-06-MW1-SS1
First soil sample from Monitor Well #1 drilled at the Base Filling Station at Rickenbacker ANGB.

Chain of Custody Records

All samples will be accompanied by a Chain of Custody Record (Fig. 6.1). A Chain of Custody Record will accompany the sample from sample collection and shipment to the laboratory and through the laboratory. If samples are split and sent to different laboratories, a copy of the Chain of Custody Record will be sent with each split.

The "Remarks" column will be used to record specific considerations associated with sample acquisition such as: sample type, container type, sample preservation methods, and method number of analyses to be performed. When transferring samples, the individuals relinquishing and receiving will sign, date and note the time on the record.

Two copies of this record will follow the samples to the laboratory. The laboratory maintains one file copy, and the completed original will be returned to the project manager as a part of the final analytical report to document sample custody transfers. Shipments will be sent by air express courier.

SAMPLE HANDLING, PACKAGING AND SHIPMENT

Precleaned sample bottles are obtained from a commercial supplier. The bottles are stored in their original unopened packages until used at the collection site, with the exception of the bottles used for trip blanks and sampling blanks. These bottles are filled with organic free water at the laboratory where the analyses will be performed and resealed prior to shipment to the field.

Individual sample bottles will be wrapped in bubble pack and placed in sealed plastic bags to prevent breakage in shipment to the laboratory. The packages will be placed in insulated shipping coolers with a plastic bag of ice. A Chain of Custody Record describing the contents of the cooler will be placed in a sealed plastic bag and taped to the upper inside lid of the cooler. The shipping coolers will be taped shut with security labels taped over opposite ends of the lid. The coolers will then be shipped for overnight delivery to the laboratory.

QUALITY ASSURANCE SAMPLES

Quality Assurance (QA) samples wil be submitted to the laboratory with the ground water, soil, surface water and sediment samples. Blind duplicate samples will be submitted for soil, sediment and water samples. These duplicate samples will be given a false sample number similar to the true sample

identity. The true sample numbers will be recorded in field records, but will not appear on the sample bottle labels or the Chain-of-Custody Records. The purpose of the duplicate samples is to provide a check on laboratory analytical accuracy. The frequency of the duplicate samples will be one for each ten soil and surface water samples and one for each twenty ground water samples submitted for each analysis. Duplicate samples will be collected for analysis at areas where contamination is suspected based on odor, discoloration, the presence of organic vapors or anomalous pH or conductivity measurements.

Additional QA samples for water samples will consist of: one field blank (deionized organic free water in appropriately preserved sample bottles) from each sampling period or water source, one equipment wash blank (deionized organic free water poured through the decontaminated bailer into the appropriately preserved sample bottles) for every other day of sampling, and one trip blank (VOA vials filled by the laboratory with deionized, organic free water) in each cooler transporting samples for volatile organic analyses. The purpose of the trip blank is to monitor for sample contamination that might occur during shipping and handling or from improperly cleaned sample bottles. The purpose of the field blank is to verify the quality of the deionized, organic free water used for decontamination. The purpose of the equipment wash blanks is to test the effectiveness of decontamination procedures.

ANALYTICAL METHODS

The samples of soil, sediment, groundwater and surface water will be analyzed for the parameters listed in Tables 6.1 and 6.2. The target compounds for methods using gas chromotography (GC) and gas chromatography/mass spectrometry (GC/MS) are listed in Tables 6.4 and 6.5, respectively. Second column confirmation will be performed for GC analyses when target compounds are present above detection limits. Confirmation will be required before positive values will be reported. Quantification of the compounds that are detected will be based on the first column results. The samples will be submitted to the ES laboratory in Berkeley, CA.

DETECTION LIMITS

The detection limits for organic compounds determined by GC or GC/MS methods are published in the respective methods (SW 846). These method detection limits (MDL) are determined using laboratory prepared standard solutions. The actual detection limit obtainable for an environmental sample may be higher due to the sample matrix. The practical quantitation limits published in the methods are used as a guideline for establishment of the lower limit for quantitation.

The minimum detection limits for the requested metals analyses are published for the respective methods. The minimum reporting limits for these metals are shown in Table 6.6.

The detection limit for petroleum hydrocarbons in soil is 100 mg/Kg.

The detection limit for sulfate in soil is 100 mg/Kg.

TABLE 6.4

LIST OF COMPOUNDS FOR GC METHODS
RICKENBACKER ANGB, COLUMBUS, OHIO

SW 8020 - Aromatic Volatile Organics

Benzene
Chlorobenzene
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
Ethyl Benzene
Toluene
Xylenes (Dimethyl benzenes)

SW8010 - Halogenated Volatile Organics

Bis(2-chloroethoxy)methane
Bis(2-chloroisopropy)ether
Bromobenzene
Bromodichloromethane
Bromoform
Carbon tetrachloride
Chloroacetaldehyde
Chlorobenzene
Chloroethane
Chloroform
1-Chlorohexane
2-Chloroethyl vinyl ether
Chloromethane
Chlorotoluene
Dibromochloromethane
Dibromomethane
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
Dichlorodifluoromethane
1,1-Dichloroethane
1,2-Dichloroethane
1,1-Dichloroethylene
trans-1,2-Dichloroethylene
Dichloromethane
1,2-Dichloropropane
trans-1,3-Dichloropropylene
1,1,2,2-Tetrachloroethane
1,1,1,2-Tetrachloroethane
Tetrachloroethylene
1,1,1-Trichloroethane
1,1,2-Trichloroethane
Trichloroethylene
Trichlorofluoromethane
Trichloropropane
Vinyl chloride

SW8080 - Organochlorine Pesticides and PCBs

Aldrin
a-BHC
-BHC
-BHC
-BHC (Lindane)
Chlordane
4,4'-DDD
4,4'-DDE
4,4'-DDT
Dieldrin
Endosulfan I
Endosulfan II
Endosulfan sulfate
Endrin
Endrin aldehyde
Heptachlor
Heptachlor epoxide
Kepone
Methoxychlor
Toxaphene
PCB-1016 (Aroclor-1016)
PCB-1221 (Aroclor-1221)
PCB-1232 (Aroclor-1232)
PCB-1242 (Aroclor-1242)
PCB-1248 (Aroclor-1248)
PCB-1254 (Aroclor-1254)
PCB-1260 (Aroclor-1260)

SW8150 - Chlorinated Herbicides

2,4-D
2,4-DB
2,4-5-T
2,4-5-TP (Silvex)
Dalapon
Dicamba
Dichloroprop
Dinoseb
MCPA
MCPP

TABLE 6.5

LIST OF COMPOUNDS FOR GC/MS METHODS
RICKENBACKER ANGB, COLUMBUS, OHIO

SW8270 - Base/Neutral Extractables

Acenaphthene
Acenaphthylene
Anthracene
Aldrin
Benzo(a)anthracene

Benzo(b)fluoranthene
Benzo(k)fluoranthene
Benzo(a)pyrene
Benzo(ghi)perylene
Benzyl butyl phthalate

b-BHC
d-BHC
Bis(2-chloroethyl)ether
Bis(2-chloroethoxy)methane
Bis(2-ethylhexyl)phthalate

Bis(2-chloroisopropyl)ether
4-Bromophenyl phenyl ether
Chlordane
2-Chloronaphthalene
4-Chlorophenyl phenyl ether

Chrysene
4,4'-DDD
4,4'-DDE
4,4'-DDT
Dibenzo(a,h)anthracene

Di-n-butylphthalate
1,3-Dichlorobenzene
1,2-Dichlorobenzene
1,4-Dichlorobenzene
3,3'-Dichlorobenzidine

Dieldrin
Diethyl phthalate
Dimethyl phthalate
2,4-Dinitrotoluene
2,6-Dinitrotoluene

Di-n-octylphthalate
Endosulfan sulfate
Endrin aldehyde
Fluoranthene
Fluorene
Heptachlor
Heptachlor epoxide
Hexachlorobenzene
Hexachlorobutadiene
Hexachloroethane

Indeno(1,2,3-cd)pyrene
Isophorone
Naphthalene
Nitrobenzene
N-Nitrosodi-n-propylamine

PCB-1016
PCB-1221
PCB-1232
PCB-1242
PCB-1248

PCB-1254
PCB-1260
Phenanthrene
Pyrene
Toxaphene
1,2,4-Trichlorobenzene

Acid Extractables

4-Chloro-3-methylphenol
2-Chlorophenol
2,4-Diichlorophenol
2,4-Dimethylphenol
2,4-Dinitrophenol

2-Methyl-4,6-dinitrophenol
2-Nitrophenol
4-Nitrophenol
Pentachlorophenol
Phenol
2,4,6-Trichlorophenol

TABLE 6.5
(continued)

LIST OF COMPOUNDS FOR GC/MS METHODS
RICKENBACKER ANGB, COLUMBUS, OHIO

SW8240 - Volatile Organics

Benzene
Bromobenzene
Bromodichloromethane
Bromoform

Carbon tetrachloride
Chloroacetaldehyde
Chlorobenzene
Chloroethane
Chloroform
1-Chlorohexane
2-Chloroethyl vinyl ether
Chloromethane
Chlorotoluene
Dibromochloromethane
Dibromomethane
1,2-Dichlorobenzene
1,3-Dichlorobenzene

1,4-Dichlorobenzene
Dichlorodifluoromethane
1,1-Dichloroethane
1,2-Dichloroethane
1,1-Dichloroethylene
trans-1,2-Dichloroethylene

Dichloromethane
1,2-Dichloropropane
trans-1,3-Dichloropropylene
Ethyl Benzene
1,1,2,2-Tetrachloroethane
1,1,1,2-Tetrachloroethane
Tetrachloroethylene
Toluene
1,1,1-Trichloroethane
1,1,2-Trichloroethane
Trichloroethylene
Trichlorofluoromethane
Trichloropropane
Vinyl chloride
Xylenes (Dimethyl benzenes)

TABLE 6.6

MINIMUM REPORTING LIMITS

METAL	ANALYSIS METHODS	WATER ug/L	SOIL mg/Kg
Antimony	6010/7040	100	10
Arsenic	7061	10	1
Beryllium	6010/709	5	0.5
Cadmium	6010/7130/7131	10	1
Chromium	6010/7190	50	5
Copper	6010/7210	25	2.5
Lead	6010/7240/7421	20	10
Mercury	7470/7471	0.2	20
Nickel	6010/7520	40	4
Selenium	7741	10	1
Silver	6010/7760	50	5
Thallium	6010/7840/7841	100	10
Zinc	6010/7950	20	2

SECTION 7

LABORATORY ANALYTICAL QUALITY ASSURANCE/QUALITY CONTROL(QA/QC) PLAN

RESPONSIBILITY

The Engineering-Science (ES) Project Manager shall have overall responsibility for the coordination of field sample collection, sample shipping and handling, chemical analyses, and report preparation, all in accordance with this Laboratory Analytical QA/QC Plan.

The Project Quality Assurance Officer (PQAO) shall report to the Project Manager, and will have direct responsibility to implement and ensure compliance with this Laboratory Analytical QA/QC Plan. To accomplish these objectives, the PQAO will have responsibility and authority to conduct quality assurance audits and implement corrective measures as required to comply with the QA/QC Plan.

PARAMETERS, ANALYTICAL METHODS, SAMPLE CONTAINERS AND HOLDING TIMES

The parameters, analytical methods, sample containers, and sample holding times for this project are presented in Table 7.1 for water samples and Table 7.2 for soil and sediment samples. Analyses will be performed within the holding times presented in these tables.

PRECISION AND ACCURACY OF ANALYTICAL DATA

The validity of the data produced will be assessed for precision and accuracy based on results of analysis of QA and QC samples. The procedures to be used for assessing precision and accuracy of the data are in accordance with 44 FR 69533 "Guidelines Establishing Test Procedures for the Analyses of Pollutants, Appendix III - Example Quality Assurance and Quality Control Procedures for Organic Priority Pollutants", December 3, 1979. These procedures, and guidelines for determining when corrective actions are required to maintain analytical quality control, are discussed below.

Precision

The term precision refers to the relative percentage difference (RPD) in values obtained for two duplicate samples. Precision is calculated as follows:

TABLE 7.1

RICKENBACKER ANGB, COLUMBUS, OHIO
ANALYTICAL METHODS AND COLLECTION SPECIFICATIONS FOR WATER SAMPLES

Parameter	Analytical Method (1)	Sample Container	Preservation Method	Holding Time
Halogenated Volatile Organics	8010/8240	40 ml, glass, Teflon®-lined septum cap	Cool, 4°C	14 days
Aromatic Volatile Organics	8020/8240	40 ml, glass, Teflon®-lined septum cap	HCL(4 drops) (8020 only), cool, 4°C	14 days
Pesticides/PCBs	8080	1 Liter, glass, Teflon®-lined septum cap	Cool, 4°C	Samples must be extracted within 14 days and extracts analyzed within 40 days
Herbicides	8150	1 Liter, glass, Teflon®-lined septum cap	Cool, 4°C	
Semi-Volatile	8270	1 Liter, amber glass w/Teflon® liner	Cool, 4°C	
Petroleum Hydrocarbons	EPA 418.1 (2)	2 Liter, glass	HCl to pH <2, Cool, 4°C	28 days
Total Metals:	6010 or:	2 Liter plastic or glass	HNO_3 to pH<2	6 months (except Mercury; 28 days)
Antimony	7040/7041			
Arsenic	7060/7061			
Beryllium	7090/7091			
Cadmium	7130/7131			
Chromium	7190/7191			
Copper	7210			
Lead	7420/7421			
Mercury	7470/7471			
Nickel	7520			
Selenium	7740/7741			
Silver	7760			
Thallium	7840/7841			
Zinc	7950			
Sulfate	9038	500 ml, plastic or glass	Cool, 4°C	28 days

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1. Source (unless otherwise noted): USEPA SW 846, Test Methods for Evaluating Solid Wastes, November 1986.
2. USEPA, Methods for Chemical Analysis of Water and Wastes, March 1983.

TABLE 7.2

RICKENBACKER ANGB, COLUMBUS, OHIO
ANALYTICAL METHODS AND COLLECTION SPECIFICATIONS FOR SOIL & SEDIMENT SAMPLES

Parameter	Analytical Method (1)	Sample Container	Preservation Method	Holding Time
Halogenated Volatile Organics	8010/8240	4 oz (120 ml) widemouth glass w/Teflon® liner	Cool, 4°C	14 days
Aromatic Volatile Organics	8020/8240	8 oz, widemouth glass w/Teflon® liner	Cool, 4°C	14 days
Pesticides/PCBs	8080	8 oz, widemouth glass w/Teflon® liner	Cool, 4°C	Samples must be extracted within 14 days and extracts analyzed within 40 days
Herbicides	8150	8 oz, widemouth glass w/Teflon® liner	Cool, 4°C	
Semi-Volatile Organics	8270	8 oz, widemouth glass w/Teflon® liner	Cool, 4°C	
Petroleum Hydrocarbons	EPA 418.1(2)	4 oz, widemouth glass w/Teflon® liner	Cool, 4°C	28 days
Metals:	6010 or:	8 oz, widemouth glass w/Teflon® liner	Cool, 4°C	6 months (except Mercury; 28 days)
Antimony	7040/7041			
Arsenic	7060/7061			
Beryllium	7090/7091			
Cadmium	7130/7131			
Chromium	7190/7191			
Copper	7210			
Lead	7420/7421			
Mercury	7470/7471			
Nickel	7520			
Selenium	7740/7741			
Silver	7760			
Thallium	7840/7841			
Zinc	7950			
Sulfate	9038	8 oz, widemouth glass w/Teflon® liner	Cool, 4°C	28 days

1. Source unless otherwise noted: SW 846, Test Methods for Evaluating Solid Wastes, U.S. EPA, November 1986.
2. USEPA, Methods for Chemical Analysis of Water and Wastes, March 1983.

$$\text{Relative Percentage Difference (RPD)} = \frac{2\,(C_1 - C_2)}{C_1 + C_2} \times 100$$

where:

C_1, C_2 = The two values obtained by analyzing duplicate samples

Acceptable levels of precision vary according to the sample matrix, the specific analytical method, and the analytical concentration relative to the method detection limit.

The precision obtained for metals analyses shall be evaluated based upon a control limit of 20 RPD for values greater than 5 times the detection limit. A control limit of 2 times the detection limit will be used for values less than 5 times the detection limit. If either value is less than the detection limit, a RPD is not calculated.

Since specific RPD criteria have not been established for inorganic ions and inorganic water quality parameters, as defined in EPA 600/4-79-020 or EPA SW 846 methods, the same values used for metals will be used (as advisory limits only) for these parameter determinations.

The precision obtained for the analyses of volatile halogenated compounds and volatile aromatic compounds will be evaluated upon the basis of the RPD calculated for quantitation on a single column. The EPA methods for these analyses provide statistical precision data as a function of concentration for individual compounds. These values will be used as a guideline to access the precision of duplicate analyses.

Accuracy

The term accuracy refers to the correctness of the value obtained from analysis of a sample, and is determined by analyzing a given sample and its corresponding matrix spike sample. Accuracy is expressed as percentage recovery (PR) and is calculated using the following formula.

$$\text{Percentage Recovery (PR)} = \frac{S_s - S_o}{S} \times 100$$

value:

S_o = Background value, the value obtained by analyzing the sample before spiking;

S = Concentration corresponding to the spike addition to the sample; and

S_s = Value obtained by analyzing the matrix spike sample with the spike added.

The degree of accuracy, or percentage recovery (PR), to be expected is dependent upon the sample matrix, specific analytical method, and the concentration of the analyte relative to its detection limit. The closer the measured value is to the detection limit, the lower the accuracy of analysis. Metals and other inorganic water quality parameters are normally determined within the range of 70 to 125 percent or as specified by ES Laboratory Control Charts.

The procedures for spiking samples to be analyzed by gas chromotography methods 8010, 8020, 8240, 8080, 8270 and 8150 are described in each respective method. The expected range for recoveries of each compound are also provided in the method descriptions.

INTERNAL QUALITY CONTROL SAMPLES AND PROCEDURES

Internal quality control samples will be run routinely throughout the project. These will consist of duplicate samples, matrix spike samples, surrogate spike samples, and reagent blanks. The number of quality control samples will be dependent on the total number of samples received for each sample matrix (soil, water, etc.) and the frequency of sample shipments. A minimum of one blank, one matrix spike, and one duplicate will be analyzed for each ten field samples received. Quality control samples will be analyzed with each set of samples analyzed.

Duplicate Samples

Whenever possible, internal duplicate samples will be generated for analysis by splitting randomly-selected samples to obtain two identical samples. For some analyses and sample types it is not possible to obtain identical duplicates in this manner. External field duplicates must then be collected to determine precision. An example of this includes water samples collected for oil and grease analysis.

Matrix/Spike Duplicate Samples

Each set of samples or 20 samples of similar matrix which are analyzed by EPA Methods 8240 and 8270 are prepared/analyzed with both a matrix spiked sample (MS) and a matrix spike duplicate sample (MSD). The acceptance criteria for percentaged recovery and relative percentaged difference for the MS and MSD are as published in the methods. These matrix spikes and duplicates will be prepared using reagent grade salts, pure compounds, or certified stock solutions whenever possible. Concentrated solutions will be used to minimize differences in the sample matrix resulting from dilution. The final concentration after spiking should be within the same range as the samples being analyzed to avoid the need for dilution, attenuation of instrument outputs, or other required alterations in the procedure which might affect the instrument response and determination of accuracy.

Surrogate Spike Samples

Surrogate compounds are used to determine the efficiency of the sample preparation/analysis process. The surrogate compounds, selected for their similarity of physical and chemical properties to the target compounds, are spiked into both environmental samples and quality control samples. The surrogate compounds used for specific tests are listed in Table 7.3. The percentage recovery range used for evaluation of the data is as published for the method. For tests that have not had this criteria established by the U.S. EPA, the laboratory control charts are utilized. The laboratory maintains control charts for the percentage recovery of surrogate compounds in water and soil. A warning limit of two standard deviations from the mean, and a control limit of three standard deviations from the mean are used for evaluation of data quality.

Reagent Blanks

To verify that the procedures used do not introduce contaminants that affect the analytical results, reagent blanks will be run for all appropriate analyses.

The reagent blank will be prepared by addition of all reagents to a substance of similar matrix as the sample. It will then undergo all of the procedures required for sample preparation. The resultant solution will be analyzed with the field samples prepared under identical conditions. An analyte concentration of two times the reporting limit in Tables 7.1 and 7.2 will be used as an advisory limit, and results greater than five times the reporting limit will require re-analysis of the samples prepared with the blank for those parameters where the contaminant is an analyte of interest.

Calibration Procedures and Frequency

Instruments and equipment used to gather, generate, or measure environmental data will be calibrated with sufficient frequency and in such

TABLE 7.3

SURROGATE SPIKING COMPOUNDS FOR ORGANIC ANALYSES

TEST	EPA METHOD NUMBER	SURROGATE COMPOUND	CONCENTRATION ug/L	CONCENTRATION ug/Kg
Volatile Halogenated Compounds	8010	1-Chloro-2-bromopropane	15	15
Volatile Aromatic Compounds	8020	a,a,a-Trifluorotoluene	15	15
Organchlorine Pesticides	8080	Dibutyl chlorendate	1	33
Volatile Organic Compounds	8240	Toluene-d8	50	50
		p-Bromofluorobenzene	50	50
		1,2-Dichloroethane-d4	50	50
Semivolatile Organic Compounds	8270	4,4'-Dibromodiphenyl	100	333
		Nitrobenzene-d5	100	333
		p-Difluorobenzene	100	333
		Phenol-d5	200	667
		2-Fluorophenol	200	667
		2,4,6-Tribromophenol	200	667

a manner that accuracy and reproducibility of results are consistent with standards of the discipline. Calibration of instruments and equipment will be performed at intervals as specified by the manufacturer or the method, or more frequently as conditions dictate. Calibrations will be performed at the start of each test run and verified throughout the analysis. Such calibrations will also be re-initiated as a result of delay due to meals, work shift changes, or damage incurred to the equipment.

Where appropriate, reagent blanks will be prepared, as described in the previous section, for use in instrument and equipment calibration. Standards used for preparation of a calibration curve will be of a concentration range that brackets the concentrations of the prepared samples. Continuing concentration verification will be performed by reanalysis of a mid-range standard after analysis of a maximum of 15 samples. Internal calibration standards may be used for GC analyses and quantitation based upon relative response factors as described in the specific methods. Calibration standards used as reference standards will be traceable to the

National Bureau of Standards or USEPA whenever such standards are available.

DATA REDUCTION, VALIDATION, AND REPORTING

The Project Quality Assurance Officer (PQAO) will review all data and be responsible for reports of laboratory analyses and quality control results. The Laboratory Supervisor will review 10 percent of the raw data, calculations and QC analyses.

Data Reduction and Validation

The analytical and data reduction procedures specified in 44 FR 69559 Appendix IV, "Optical Emission Spectrometric Method for Trace Element Analysis of Water and Wastes" (EPA-600/4-79-020, "Methods for Chemical Analysis of Water and Wastes", Section 200; Metals) are used to qualify and quantify metals data analyses.

Other analytical procedures as specified from Methods for Chemical Analysis of Water and Wastes (EPA-600/4-79-020), Test Methods for Evaluating Solid Waste (EPA/SW-846), and Standard Methods for the Examination of Water and Wastewater, 16th Edition, are used to qualify and quantify these analyses.

The QA/QC practices used by the laboratory are consistent with the procedures recommended for the referenced methods. The EPA recommended acceptance criteria for QC data, published with the method, is used to determine the acceptability of the results for those tests where this information is available. The laboratory maintains control charts for each of the tests performed routinely. The control charts for percentage spike recovery and relative percentage difference of duplicate analyses are used to evaluate the quality of data obtained for the tests for which the EPA has not established recommended limits for these parameters.

The sample results associated with a QC sample for which the data is not consistent with the recommended acceptance criteria are reported with the "flag" prescribed in the procedure. If the corrective action specified is other than "flagging" the data, the recommended action is taken. Examples of such corrective action include: Analysis of an analytical spike of the prepared extract or digestate, serial dilution of the extract/digestate, analysis by the Method of Standard Additions, reextraction/redigestion of the affected samples and QC sample.

Preparation blanks are analyzed with each set of samples. If the blank is found to contain a concentration of the analyte(s) greater than the reporting value for the test, the data associated with the blank is flagged with "B", or the blank and the affected samples are reprepared and analyzed, depending upon the corrective action recommended in the method.

Data Reporting

Reporting of analytical results for this project will contain analytical results summaries and the results of analysis of QC samples. Analytical results reports will contain the following items.

- Project identification
- Field sample number
- Laboratory sample number
- Sample matrix description
- Date and time of sample collection
- Analytical method description and reference citation
- Individual parameter results
- Date of analysis (extraction, first run, and subsequent runs)
- Detection limits achieved
- Dilution or concentration factors
- Corresponding QC report.

Completed copies of the original chain-of-custody records for the appropriate samples will be included in the analytical results reports. The following units shall be used in reporting. Parameters determined in water samples will be reported in units of mg/L, except for specific organic compounds analyzed by GC or GC/MS, which will be reported in units of ug/L. Parameters determined in soil and sediment samples will be reported in units of mg/Kg dry weight. The percentage moisture will be presented with the results of the soil and sediment samples.

Quality control reports will be prepared which summarize the results of samples analyzed by the laboratory for quality control purposes. These reports will summarize all the quality control data results for the samples, including results for method blanks, duplicates, and matrix spikes. Spike concentrations, percent recoveries and relative percent differences will be reported. These reports will be used to prepare a project quality assurance report.

CORRECTIVE ACTIONS

The laboratory operates under the guidelines of the ES Laboratories Quality Assurance/Quality Control Manual and Standard Operating Procedures. These documents, supplemented as needed by the QC requirements contained in the referenced analysis method, contain descriptions of the acceptance criteria for quality control measurements. In the event a QC test does not meet the prescribed criteria, the analyst immediately notifies the Laboratory Supervisor. In the event the problem is not one readily identifiable by the analyst, the Laboratory Supervisor and the Quality Control Coordinator review all QC results. When a problem is encountered, the QC Coordinator and Laboratory Supervisor implement the corrective action required. The QC Coordinator notifies the Technical Manager for Laboratory Services (Corporate QA Manager for laboratories) of any QC problems and the corrective action taken. In the event of a question regarding the appropriate action required, the Technical Manager is consulted for recommendations.

The corrective actions may include, checking the calculations, flagging data in accordance with the procedures prescribed for the method, recalibration of the instrument, and/or re-analyses of the samples associated with the out of control limits QC data.

PERFORMANCE AND SYSTEM AUDITS

After the first set of samples is received at the laboratory, the Project Manager will visit the laboratory to review performance and procedures. Later in the project, the Martin Marietta Energy Systems Laboratory Quality Assurance Officer will visit the laboratory to conduct an audit.

SECTION 8
PROJECT SCHEDULE

The schedule for the project through submission of the Final Remedial Investigation Report (RIR) is presented in Figure 8.1. Table 8.1 lists the week following the Notice To Proceed (NTP) during which key milestones will be reached or deliverables submitted.

SITE INSPECTION/REMEDIAL INVESTIGATION

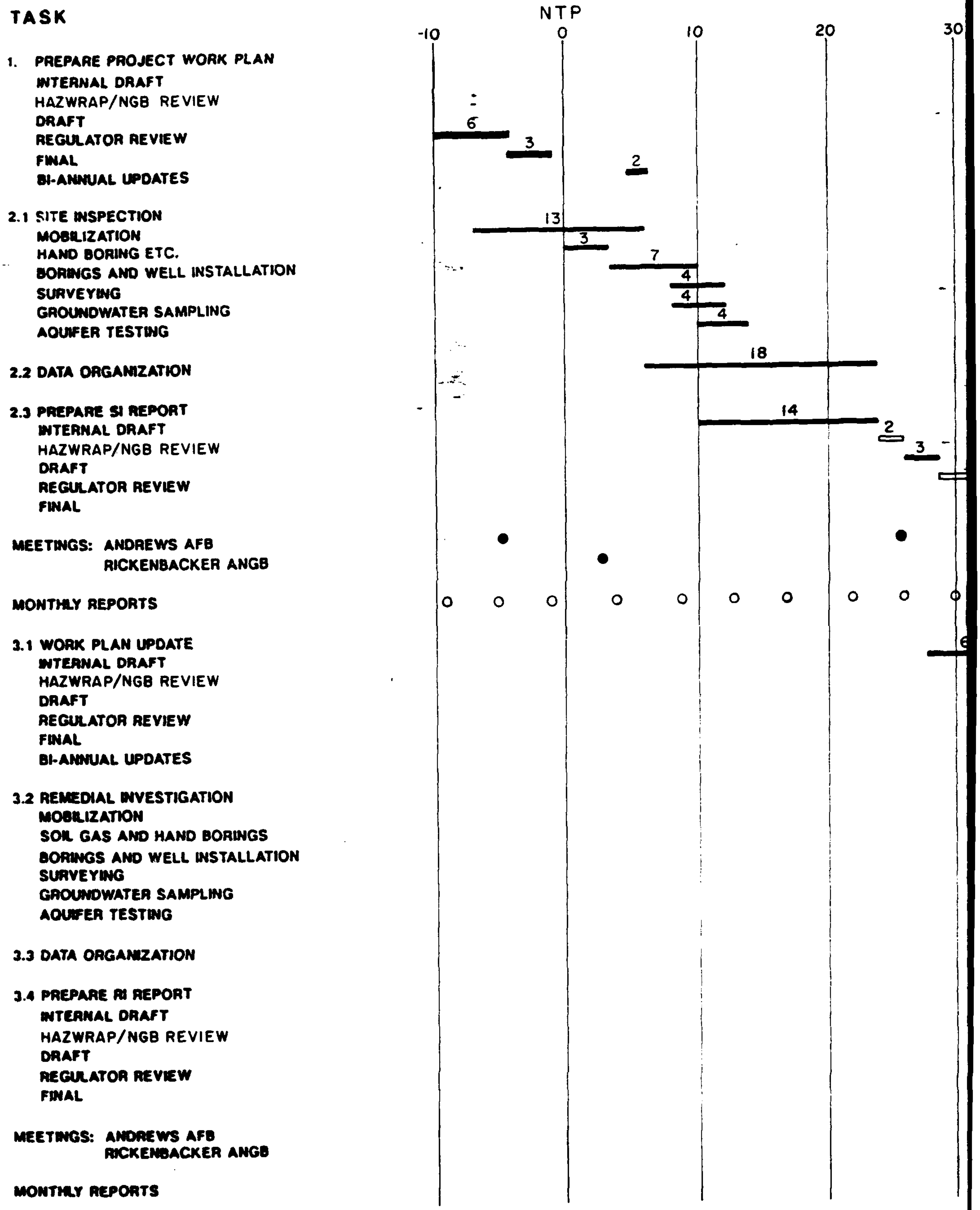


FIGURE 8.1

TIGATION SCHEDULE, RICKENBACKER ANGB

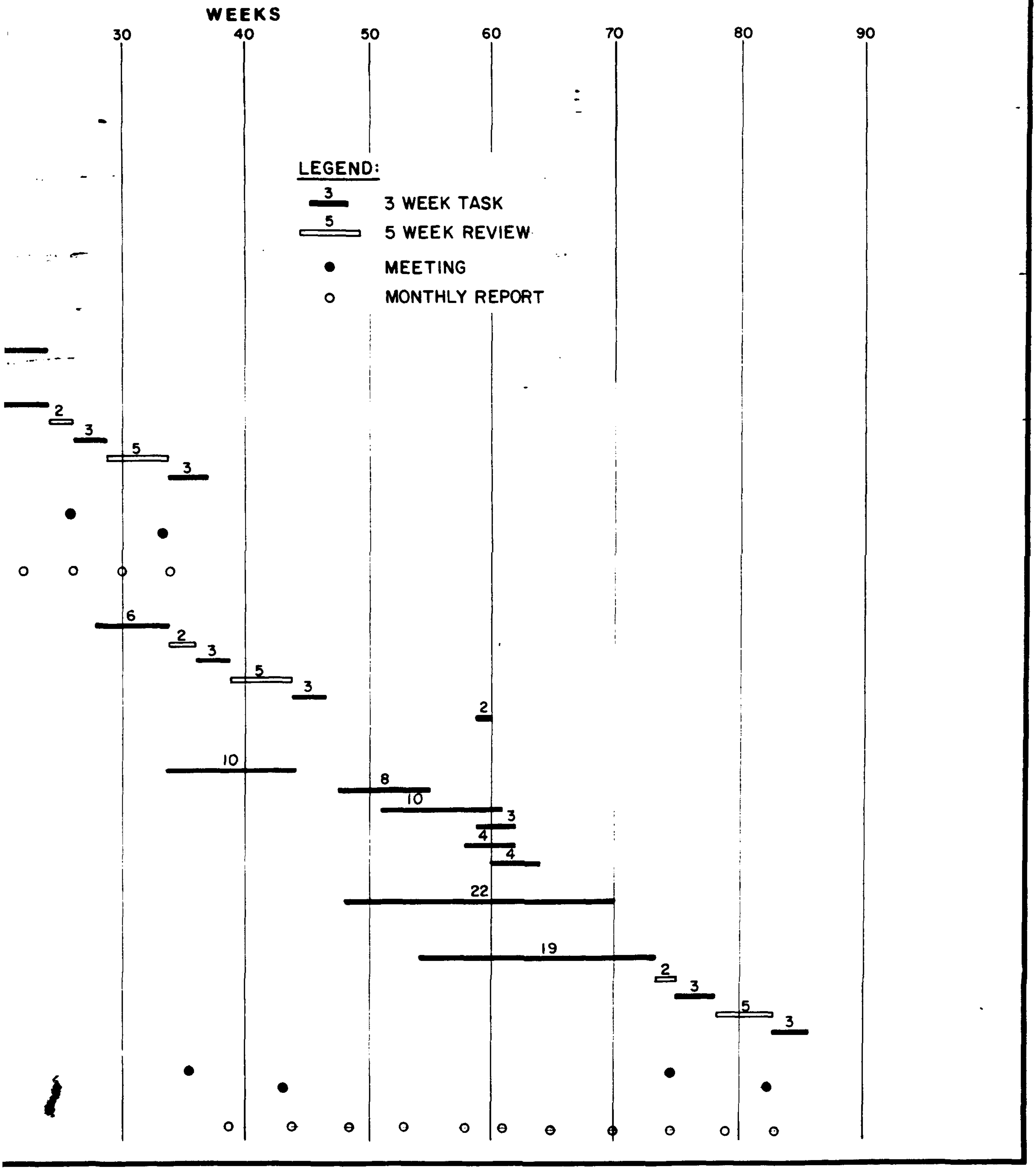


TABLE 8.1

MILESTONES AND DELIVERABLES SCHEDULE
RICKENBACKER AIR NATIONAL GUARD BASE
COLUMBUS, OHIO

Milestones or Deliverables	Weeks After Notice To Proceed
a) Submit Internal Draft Work Plan	
b) Submit Draft Work Plan	-10
c) Review Draft Work Plan with Regulators	-3
d) Submit Final Work Plan	-1
e) Begin Site Inspection Field Activities	0
f) Complete Site Inspection Field Activities	14
g) Submit Internal Draft Site Inspection Report	24
h) Submit Draft Site Inspection Report	29
i) Review Draft Site Inspection Report with Regulators	34
j) Submit Final Site Inspection Report	37
k) Submit Internal Draft Remedial Investigation Work Plan	34
l) Review Internal Draft Remedial Investigation Work Plan with NGB and HAZWRAP	36
m) Submit Draft Remedial Investigation Work Plan	39
n) Review Draft Remedial Investigation Work Plan with Regulators	44
o) Submit Final Remedial Investigation Work Plan	47
p) Begin Remedial Investigation Field Activities	48
q) Complete Remedial Investigation Field Activities	64
r) Submit Internal Draft Remedial Investigation Report	73
s) Review Internal Draft Remedial Investigation Report with NGB and HAZWRAP	75
t) Submit Draft Remedial Investigation Report	78
u) Review Draft Remedial Investigation Report with Regulators	83
v) Submit Final Remedial Investigation Report	86

Monthly Progress Reports will be submitted by the 7th of every month. The Project Work Plan will be updated every six months. Revised Work Plans will be submitted on or before 15 January and 15 July for each project year.

APPENDIX A

HEALTH AND SAFETY PLAN

HEALTH AND SAFETY PLAN

FOR

Rickenbacker Air National Guard Base

Columbus, Ohio

CL115

MARCH 1988

Prepared By:

J.E. Bishop, W.D. Hughes

Reviewed and Approved By:

	Name	Date
Project Manager	Christopher F [illegible]	6-1-88
Office Health and Safety Representative	Kathleen [illegible]	6/15/88
Corporate Health and Safety Manager *		

* If Levels A or B Protection are required

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1
PURPOSE AND POLICY

The purpose of this Plan is to establish personnel protection standards and mandatory safety practices and procedures. The Plan also provides for contingencies that may arise during field investigations and operations.

The provisions of this Plan are mandatory for all on-site investigations. All Engineering-Science (ES) personnel shall abide by this plan. Any supplemental plans used by subcontractors shall conform to this plan as a minimum. All personnel who engage in field investigation activities shall be familiar with this plan and comply with its requirements.

A Site Description and Scope of Work Summary for the project is provided in Chapter 2. Chapter 3 presents the project team organization, personnel responsibilities, and lines of authority. Site-specific training and medical monitoring requirements are contained in Chapter 4. Chapter 5 presents a safety and health risk analysis. Chapter 6 contains the site emergency response plan and a list of emergency contacts. Site-specific requirements for levels of protection are included in Chapter 7, and air monitoring procedures are provided in Chapter 8. Site control measures, including designation of site work zones, are contained in Chapter 9, while Chapter 10 provides decontamination procedures. Standard operating procedures are included in Chapter 11. Attachment A contains a Plan Acceptance Form, Accident Report Form, and respirator log forms. The remaining attachments contain the ES general standard operating guidelines for hazardous waste site investigations.

CHAPTER 2

SITE DESCRIPTION AND SCOPE OF WORK

The Rickenbacker Air National Guard Base (ANGB), Columbus, Ohio, is located south of the City of Columbus near the Village of Lockbourne. Rickenbacker ANGB, previously known as Lockbourne Air Force Base (AFB), has been active since 1942. Over the years, the types of military aircraft based and serviced at Rickenbacker ANGB have varied. Both past and present operations have involved the use of hazardous materials and disposal of hazardous wastes. Because of the use of hazardous materials and disposal of hazardous wastes at its installations, the Air National Guard (ANG) has implemented its Installation Restoration Program (IRP). The IRP is a three-phase program consisting of the following:

PRELIMINARY ASSESSMENT (PA)

The PA will identify past spill or disposal sites posing a potential and/or actual hazard to public health or the environment.

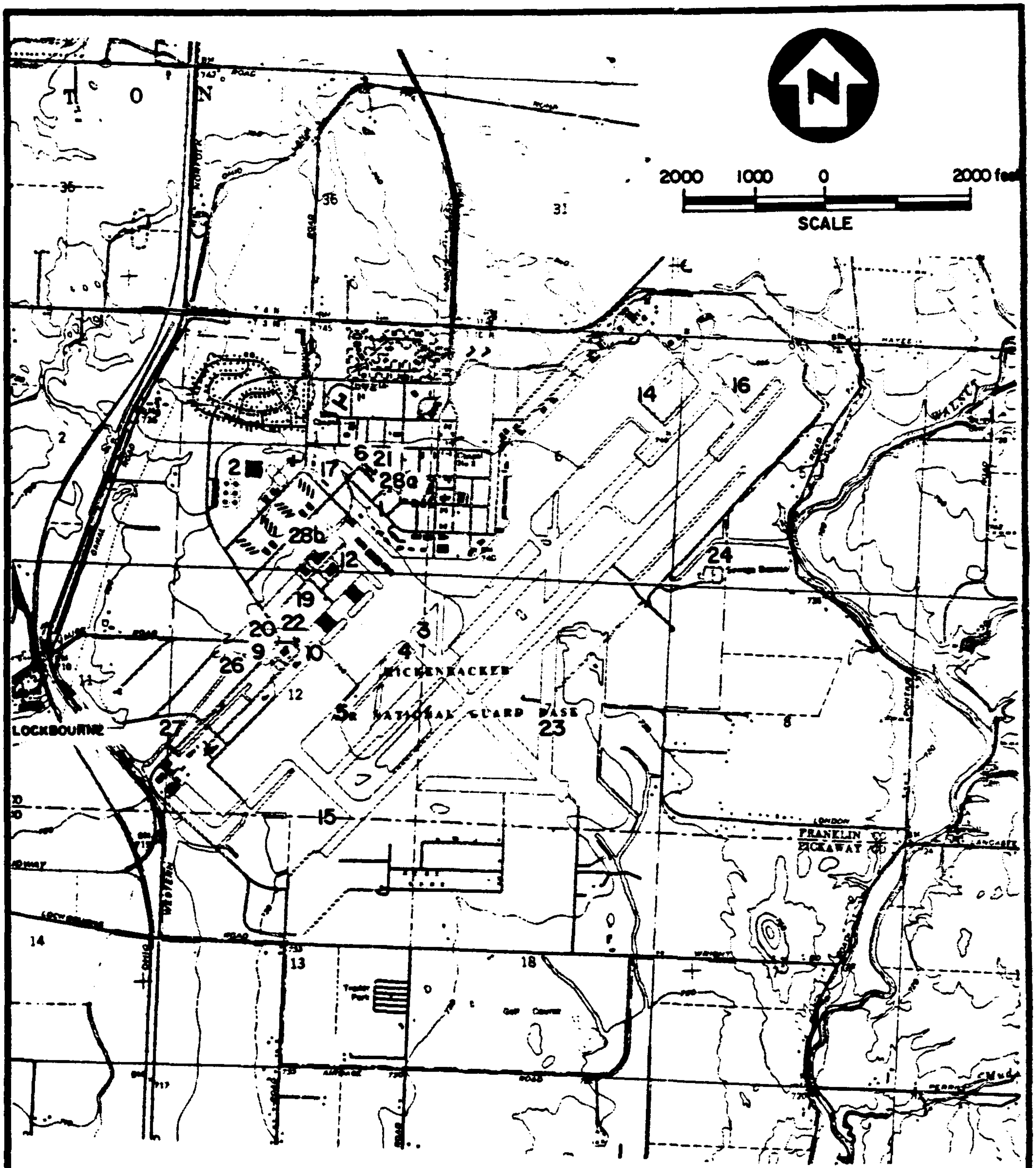
SITE INSPECTION/REMEDIAL INVESTIGATION (SI/RI)

The purpose of the SI/RI is to confirm the presence or absence of environmental contamination, quantify the levels of contaminants, determine the source and extent of the contamination, and to determine if remedial action is required.

FEASIBILITY STUDY/REMEDIAL DESIGN (FS/RD)

The purpose of the FS/RD is to prepare a Remedial Action Plan (RAP), to develop possible remedial actions where necessary, and to provide technical support to the Base during contractor selection and remediation activities.

Under Phase I, the Records Search, twenty-seven potential sites were identified and rated by the Hazardous Materials Technical Center (HMTC) in Rockville, Maryland. Of these, twenty-two (22) sites were recommended for follow-up Installation Restoration Program (IRP) work. The sites are shown on Figure 2.1. Specific details and history of each site are presented in Section 1 of this Work Plan.



EXPLANATION:
22 - SITE LOCATION

IRP SITE LOCATIONS
RICKENBACKER
AIR NATIONAL GUARD BASE

SOURCE:
USGS, LOCKBOURNE, OHIO
7.5 MIN. QUADRANGLE

The investigations at the Base will involve sediment and soil sampling, monitor well installation, water sampling, magnetometer surveying, and soil-gas surveying. Sections 2 through 6 include detailed descriptions of the intended scope of work and techniques to be used.

CHAPTER 3

PROJECT TEAM ORGANIZATION

The following personnel are designated to carry out the stated job function on-site (NOTE: One person may carry out more than one job function).

Project Manager:	Christopher F. Raddell, P.E.
Field Team Leader:	William D. Hughes, CPG
Project Health & Safety Officer:	William D. Hughes, CPG
Alternate Project Health & Safety Officer	Chris W. Viani
Field Team Members:	Lee Monnens Kevin A. Palombo Mark Schumacher Judith M. Stangl Mark W. Straub Chris W. Viani

Table 3.1 describes the responsibilities of all on-site personnel.

CHAPTER 4

EMPLOYEE TRAINING AND MEDICAL MONITORING REQUIREMENTS

Each field team member and subcontractor employee will have completed a forty hour safety training course or have equivalent experience as defined in 29 CFR 1910.120.

In addition, the Project Health and Safety Officer will be responsible for developing a training program to be presented to all personnel working on the site. The training will be conducted before beginning the work. The following topics will be included:

- Names of personnel responsible for site health and safety
- Acute effects of compounds at the site
- OSHA Regulations
- Safety, health and other hazards at the site
- Work practices by which employees can minimize risk from hazards
- Decontamination procedures
- Proper use of personnel protection equipment.

The Project Health and Safety Officer will conduct daily briefings to discuss specific procedures and hazards that will be encountered that day.

Heat Stress Monitoring

To monitor the body's recuperative ability to excess heat, one or more of the following techniques should be used as a screening mechanism. Monitoring of personnel wearing protective clothing should begin when the ambient temperature is 70° Fahrenheit (F) or above. Frequency of monitoring should increase as the ambient temperature increases or if slow recovery rates are indicated. When heavy physical activity is performed and temperatures exceed 80°F, workers should be monitored for heat stress after every 30 minute work period. A site safety officer should be present under these circumstances to conduct periodic monitoring.

- Heart rate (HR) should be measured by the radial pulse for 30 seconds as early as possible in the resting period. The HR at the beginning of the rest period should not exceed 110 beats per minute. If the HR is higher, the next work period should be shortened by 10 minutes (or 33 percent), while the length of the rest period stays the same. If the pulse rate is 100 beats per minute at the beginning of the next rest period, the following work cycle should be shortened by 33 percent.

- Body temperature should be measured orally with a clinical thermometer as early as possible in the resting period. Oral temperature (OT) at the beginning of the rest period should not exceed 99° F. If it does, the next work period should be shortened by 10 minutes (or 33 percent), while the length of the rest period stays the same. However, if the OT exceeds 99° F at the beginning of the next period, the following work cycle should be further shortened by 33 percent. OT should be measured again at the end of the rest period to make sure that it has dropped below 99° F. If not, the individual should be removed from duty until the OT drops below 99° F.

Cold Exposure Monitoring

The site safety officer should periodically monitor the field team members for signs of cold exposure. This should include visual inspection of the extremities and temperature monitoring.

CHAPTER 5

SAFETY AND HEALTH RISK ANALYSIS

The following substances are known or suspected to be on-site. The primary hazards for each are identified.

Substance	Primary Hazards
JP-4	Fire hazard, explosive hazard
POL (Petroleum oils and lubricants) including used engine oils, crankcase oil and No. 2 fuel oil	Dermal irritant, fire hazard
Unleaded gasoline	Fire hazard
Pesticides including:	
dieldrin	Poisonous
malathion	Poisonous
diazinon	Poisonous
chlordane	Poisonous
Solvents and paint strippers	Poisonous, fire hazard
PCBs	Toxic fumes when heated
Methyl Ethyl Ketone	Fire hazard, explosion hazard

Many of the above substances are generic and this project is intended to determine specific constituents. As substances are detected, the project health and safety officer will determine additional procedures or hazards and notify site personnel in the daily briefings.

There are several areas on Base which are designated or potentially have hazardous levels of noise. Personnel working in these areas will be provided proper ear protection.

Heat stress and cold exposure are also possible site hazards and employees should be monitored for the effects when applicable.

TABLE 5.1

SAFETY AND HEALTH RISK ANALYSIS - CONTAMINANTS OF CONCERN

Contaminant	IDLH	TLV	Route of Exposure	Symptoms of[c] Acute Exposure	Other Characteristics/Comments
JP-4	--	A TLV for JP-4 has not been established. The TLV for gasoline is 300 ppm.	Inhalation, dermal	Headache, blistering, eye irritant	Clear, aromatic, volatile liquid
Dieldrin	Ca	0.25 mg/m^{3a} 0.25 mg/m^{3b}	Oral, dermal, inhalation	Headache, nausea, vomiting, general malaise, dizziness, convulsions, coma.	Colorless to light tan solid with a mild, chemical odor.
Malathion	5000 mg/m^3	15 mg/m^{3a} 10 mg/m^{3b}	Oral, dermal, inhalation	Eye and skin irritation, tight chest, wheezing, nausea, vomiting	Colorless to brown liquid with a mild skunk-like odor.
Diazinon	--	0.1 mg/m^{3b}	Oral, dermal		Liquid with faint ester-like odor.
Chlordane	500 mg/1m^3	0.5 mg/m^{3a}	Oral, dermal, inhalation	Blurred vision, confusion, cough, abdominal pain, nausea, vomiting, convulsions	Thick, amber liquid with a chlorine-like color.
PCBs (42% Cl) (chlorodiphenyl) (54% Cl)	Ca Ca	1 mg/m^{3a} 0.5 mg/m^{3a}	Oral, dermal, inhalation	Eye irritant, chloracne, liver damage, jaundice	Colorless to dark brown liquid (42%) or pale yellow viscous liquid (54%) with mild, hydrocarbon odor.
Methylethyl Ketone (2-Butanone)	3000 ppm	200 ppm^{a} 590 mg/m^{3a}	Oral, dermal, inhalation	Eye and nose irritation, dizziness, vomiting, headache	Clear, colorless liquid with a fragrant, mint-like, moderately sharp odor.
Kerosene			Inhalation, ingestion	Headache, stupor, nausea, vomiting	Oral LD_{50} = 28 g/kg; iv LD_{50} = 180 mg/kg

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a. OSHA Permissible Exposure Limit (PEL), as found in 29 CFR 1910, Subpart Z, General Industry Standards for Toxic and Hazardous Substances. Exposure limits are 8-hour time-weighted average (TWA) concentrations.
b. Threshold Limit Values (TLVs) for Chemical Substances in Workroom Air Adopted by American Conference of Governmental Industrial Hygienists (ACGIH) for 1978. Exposure limits are 8-hour TWA concentrations.
c. Source: NIOSH Pocket Guide to Chemical Hazards.
-- = Not Available
Ca = NIOSH has recommended that the substance be treated as a potential human carcinogen; IDLHs are not listed for those substances.

CHAPTER 6

EMERGENCY RESPONSE PLAN

Chemical and physical hazards exist at Richenbacker ANGB. Chemical hazards occur in the form of exposure to substances listed in Table 5.1. The proper use of protective clothing and respiratory protection will minimize the chances of personnel exposure.

The major physical hazards are injuries occurring during drilling operations. Again, safe working habits will reduce the risk for these occurrences.

EMERGENCY PROCEDURES

In the event that an emergency develops on site, the procedures delineated herein are to be immediately followed. Emergency conditions are considered to exist if:

- o Any member of the field crew is involved in an accident or experiences any adverse effects or symptoms of exposure while on-site.
- o A condition is discovered that suggests the existence of a situation more hazardous than anticipated.

All emergency situations should first be reported to the appropriate Base response unit (Fire Department, Ambulance, etc.) using an emergency radio supplied by the Base or telephone. If personal injury is involved, a report should be made to the following:

Rickenbacker Base Civil Engineer Inspector	(614) 492-4673
Rickenbacker Base Safety Department	(614) 492-3206
Engineering-Science Project Manager	Chris Raddell/ 1-312-990-7200 or 420-8444

If a major accident occurs, the Base Disaster Preparedness Plan will be invoked by Base safety personnel.

CHEMICAL EXPOSURE

If a member of the field crew demonstrates symptoms of chemical exposure the procedures outlined below should be followed:

- o Another team member (buddy) should remove the individual from the immediate area of contamination, if possible without undue risk.

- Precautions, including work stoppage, should be taken to avoid exposure of other individuals to the chemical.
- If the chemical is on the individual's clothing, the clothing should be removed if it is safe to do so.
- If the chemical has contacted the skin, the skin should be washed with copious amounts of water, preferably under a shower.
- In case of eye contact, an emergency eye wash should be used. Eyes should be washed for at least 15 minutes.
- If necessary, the victim should be transported to the nearest hospital or medical center. An ambulance should be called to transport the victim, if necessary.

PERSONAL INJURY

In case of personal injury at the site, the following procedures should be followed:

- All field team members are trained in first-aid and can administer treatment to an injured worker.
- The victim should then be transported to the nearest hospital or medical center. If necessary, an ambulance should be called to transport the victim.
- For less severe cases, the individual can be taken to the site dispensary.
- The site manager is responsible for making certain that an accident report form (Attachment A) is completed. This form is to be submitted to the health and safety coordinator. Follow-up action should be taken to correct the situation that caused the accident.

Smoking, eating, and the application of contact lenses or cosmetics will not be permitted on site.

Evacuation Procedure

- An evacuation plan for field team members will be established for each work site.
- Evacuation of personnel is initiated by on-site supervisory personnel.
- All personnel in the contract work area should evacuate the area and meet in the common designated area for each work site.
- All personnel suspected to be in or near the contract work area should be accounted for and the whereabouts of missing persons determined immediately.
- Further instruction will then be given by the field team leader.

Procedures Implemented by the Contractor in the Event of a Major Fire, an Explosion, or On-Site Health Emergency Crisis

- Notify the Base Fire Department immediately;
- Notify the Base Emergency Ambulance Service immediately;

- Signal the evacuation procedure previously outlined and implement the entire procedure;
- Isolate the area;
- Stay upwind of any fire;
- Keep area surrounding the problem source clear after the incident occurs; and
- Complete accident report form and distribute to appropriate personnel.

EMERGENCY CONTACTS

In the event of any situation of unplanned occurrence requiring assistance, the appropriate contact(s) should be made from the list below. For emergency situations, contact should first be made with the Security Police or Fire Department, using the emergency radio supplied by the Base or a telephone. The location of the nearest telephone will be determined before work is begun at ech site. This emergency contacts list must be posted at the site.

Emergency Phone Numbers

Off-Base Telephone Prefix:	492
Security Police:	614-492-4727 or -4728 (on Base, call x4727 or x4728)
Fire Department:	614-492-4111 (on Base, call x4111)
Rocky Mountain Poison Control Center:	1-800-332-3073
Poison Control:	1-800-632-2727

Medical Emergency

Medical Aid Station:	614-492-4542 (on Base, call x4542)
Ambulance:	614-492-3200 (on Base, call x3200)
Hospital (see Figure 6.1):	Mount Carmel East
Address:	6001 East Broad Street
Emergency Phone Number:	1-614-225-5212

Directions: Go North on Alum Creek Drive to I-270. Go Northeast on I-270 for 9 miles, exit onto Route 16, go east to hospital on right (see Map, next page).

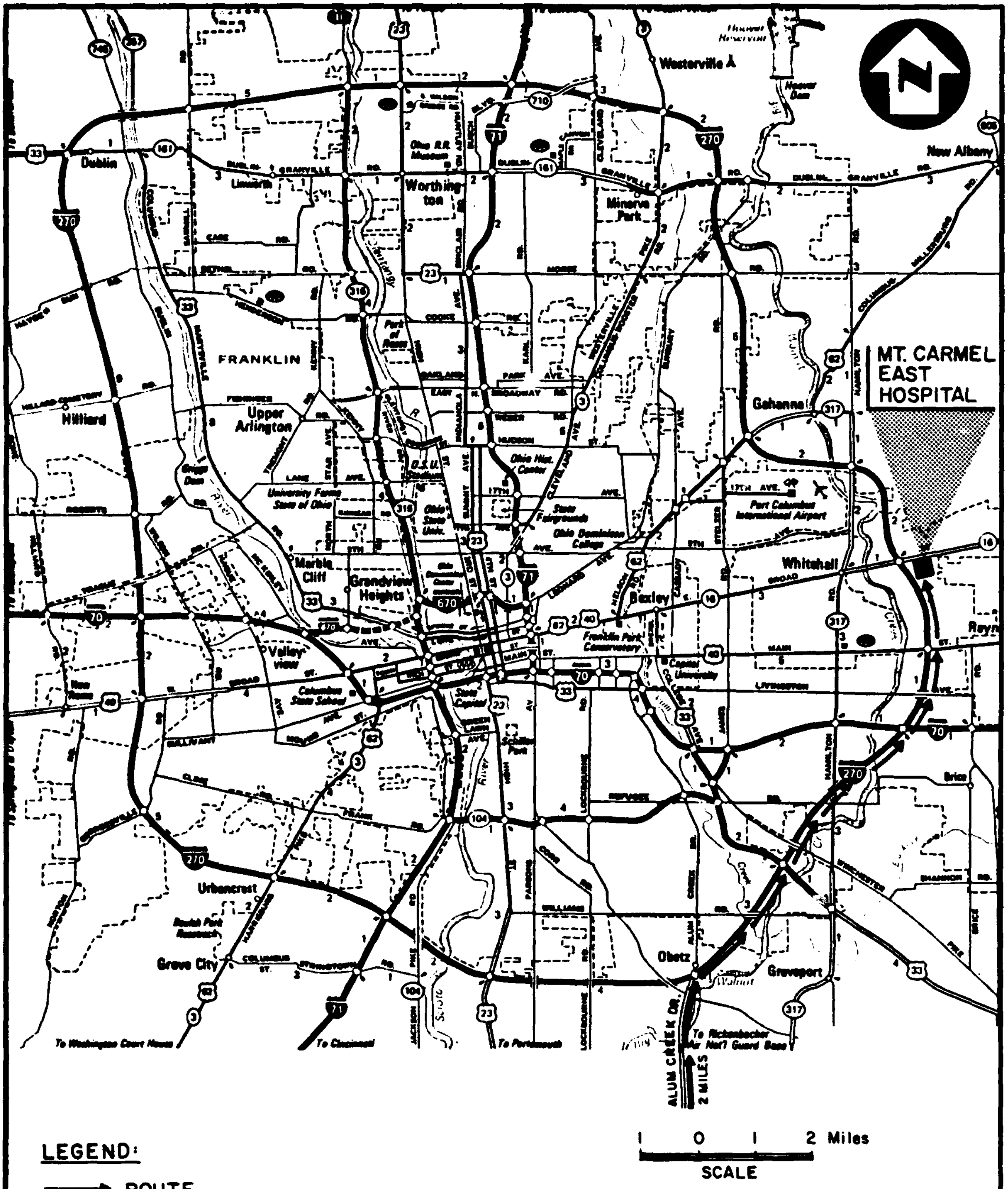
Rickenbacker ANGB Contacts

Base point of contact:	Mr. Alan Friedstrom
Address:	Building 910
Phone Number:	1-614-492-3358

Engineering-Science Contacts

ES Project Manager:	Mr. Christopher Raddell 1-321-990-7200 or 420-8444
ES Project Health and Safety Officer:	Mr. William Hughes 1-216-486-9005 or on-site

FIGURE 6.1



MAP OF ROUTE TO HOSPITAL
RICKENBACKER AIR NATIONAL GUARD BASE

ES Cleveland Office Health & Safety Officer:	Ms. Kathleen Scheutzow 1-216-486-9005
Corporate Health & Safety Manager	Mr. Phil Storrs (818) 440-6000
Deputy Corporate Health & Safety Manager:	Mr. Edward Grunwald 404-325-0770

Medical Monitoring

Euclid Clinic Attn: Industrial Medicine Section 18599 Lakeshore Boulevard Cleveland, OH 44119	Mr. William L. Kahl 1-216-383-6052

ACCIDENT PREVENTION

All field personnel will receive health and safety training prior to the initiation of any site activity. On a day-to-day basis, individual personnel should be constantly alert for indicators of potentially hazardous situations and for signs and symptoms in themselves and others that warn of hazardous conditions and exposures. Rapid recognition of dangerous situations can avert an emergency. Regular meetings will be held before daily work assignments,. Discussion will include:

- o Tasks to be performed.
- o Time constraints (e.g., rest breaks, cartridge changes).
- o Hazards that may be encountered, including their effects, how to recognize symptoms or monitor them, concentration limits, or other danger signals.
- o Emergency procedures.

Each phase (drilling, groundwater sampling) presents unique hazards of which the field team should be vigilent.

Drilling

Prior to any drilling activity efforts should be made to determine whether underground installations (i.e., telephone cables, sewer lines, fuel pipes, electric lines, etc.) will be encountered and, if so, where these installations are located. The project manager or field team leader must coordinate with the Base Civil Engineer to locate underground utilities prior to performing drilling activities. The field team leader and/or safety officer will provide constant on-site supervision of the drilling subcontractor to ensure that they are meeting the Health and Safety requirements. If deficiencies are found, work will be stopped and corrective action will be taken (i.e., retrain, purchase additional safety equipment). Reports of health and safety deficiencies and the corrective action taken will be forwarded to project safety officer. Periodic air monitoring will be performed by the safety officer to ensure that proper personal protection is being utilized.

Groundwater Sampling

Protective clothing will be worn while sampling. Periodic air monitoring will be conducted to determine whether atmospheric chemical conditions have changed from the initial air characterization. The field team will be trained in fire protection and emergency contingencies. Constant monitoring of field activities will be performed to ensure compliance with the safety plan.

HEAT AND COLD PROTECTIVE MEASURES

Introduction

Adverse weather conditions are important considerations in planning and conducting site operations. Hot or cold weather can cause physical discomfort, loss of efficiency, and personal injury.

Heat Stress

Heat stress may result when protective clothing decreases natural body ventilation and can occur even when temperatures are moderate. One or more of the following recommended actions can help reduce heat stress:

- Provide plenty of liquids to replace body fluids (water and electrolytes) lost due to sweating.
- Provide cooling devices to aid natural body ventilation. These devices, however, add weight, and their use should be balanced against worker efficiency.

- Long cotton underwear acts as a wick to help absorb moisture and protect the skin from direct contact with heat-absorbing protective clothing. It should be the minimum undergarment worn.
- Install mobile showers and/or hose-down facilities to reduce body temperature and cool protective clothing.
- In extremely hot weather, conduct non-emergency response operations in the early morning or evening.
- Ensure that adequate shelter is available to protect personnel against heat, cold, rain, snow, or other adverse weather conditions which decrease physical efficiency and increase the probability of accidents.
- In hot weather, rotate workers wearing protective clothing.
- Good hygienic standards must be maintained by frequent change of clothing and daily showering. Clothing should be permitted to dry during rest periods. Workers who notice skin problems should immediately consult medical personnel.

These recommendations should be implemented, as appropriate to site conditions, to reduce heat stress.

Effects of Heat Stress

If the body's physiological processes fail to maintain a normal body temperature because of excessive heat, a number of physical reactions can occur. They can range from mild reactions such as fatigue, irritability, anxiety, and decreased concentration, dexterity, or movement to death. Medical help must be obtained for the more serious cases of heat stress.

Heat-related problems include:

- Heat rash: Caused by continuous exposure to heat and humid air and aggravated by chafing clothes. Decreases ability to tolerate heat as well as being a nuisance.
- Heat cramps: Caused by profuse perspiration with inadequate fluid intake and chemical replacement, especially salts. Signs include muscle spasm and pain in the extremities and abdomen. The victim should be given water and firm pressure with warm, wet towels placed over the cramped area.

- Heat exhaustion: Caused by increased stress on various organs to meet increased demands to cool the body. Signs include shallow breathing; pale, cool, moist skin; profuse sweating; and dizziness and lassitude. The victim should be allowed to rest and be given cool liquids.
- Heat stroke: The most severe form of heat stress. Body must be cooled immediately to prevent severe injury and/or death. Signs include red, hot, dry skin; no persipiration; nausea; dizziness and confusion; strong, rapid pulse; and possibly, coma. Quickly cool the victim by any available means and seek medical help immediately.

Cold Exposure

Persons working outdoors in temperatures at or below freezing may suffer from cold exposure. During prolonged outdoor periods with inadequate clothing, effects of cold exposure may even occur at temperatures well above freezing. Cold exposure may cause severe injury by freezing exposed body surfaces (frostbite) or result in profound generalized cooling, possibly causing death. Areas of the body which have high surface area-to-volume ratios such as fingers, toes, and ears are the most susceptible to frostbite.

Two factors influence the development of a cold injury: ambient temperature and the velocity of the wind. Wind chill is used to describe the chilling effect of moving air in combination with low temperature. For instance, 10° F with a wind of 15 miles per hour (mph) is equivalent in chilling effect to still air at -18° F. Cold exposure is particularly a threat to the hazardous waste site worker if the body cools suddenly when chemical-protective equipment is removed and the clothing underneath is perspiration soaked. The presence of wind greatly increases the rate of cooling.

Local injury resulting from cold is included in the generic term frostbite. There are several degrees of damage. Frostbite of the extremities can be categorized into:

- Frost nip or incipient frostbite: characterized by sudden blanching or whitening of skin.
- Superficial frostbite: skin has a waxy or white appearance and is firm to the touch, but tissue beneath is resilient.

- <u>Deep frostbite:</u> tissues are cold, pale, and solid; extremely serious injury.

First aid for frostbite is to bring the victim indoors and rewarm the areas <u>quickly</u> in warm (not hot) water between 39° C and 40.5° C. Warm fluids such as water or soup should be given. The victim should not smoke. After soaking the area for 30 minutes it should be elevated and wrapped with sterile gauze. Medical help should be sought immediately.

Systemic hypothermia is caused by exposure to freezing or rapidly dropping temperature. Its symptoms are usually exhibited in five stages: (1) shivering; (2) apathy, listlessness, sleepiness, and (sometimes) rapid cooling of the body to less than 95° F; (3) unconsciousness, glassy stare, slow pulse, and slow respiratory rate; (4) freezing of the extremities; and (5) death. Hypothermia victims should be warmed and medical help should be obtained.

CHAPTER 7

LEVELS OF PROTECTION AND PERSONAL PROTECTIVE EQUIPMENT REQUIRED FOR SITE ACTIVITIES

Because of the low to moderate levels of contamination expected at RICKENBACKER ANGB, Level "D" personnel protection equipment will be used. The following items should be used:

1) Coveralls
2) Gloves
3) Work boots
4) Safety glasses
5) Hard hat - mandatory for drilling operations.

If screening methods outlined in Chapter 8, or results of preliminary sampling and analyses indicate more extensive contamination, the level of protection will be re-evaluated based on the criteria detailed in Attachments E, F and G.

CHAPTER 8

FREQUENCY AND TYPES OF AIR MONITORING

Air monitoring will be used to identify and quantify airborne levels of hazardous substances. The expected levels and types of contamination at Rickenbacker ANGB warrant air monitoring while drilling borings and monitoring wells. Table 8.1 summarizes the equipment and procedures that will be used. Tables 8.2 and 8.3 describe calibration procedures for the monitoring instruments. If, while conducting air monitoring, the TLV listed in Table 5.1 is exceeded, the respiratory protection level will be re-evaluated based on guidelines detailed in Attachment C.

In the event of discovery of additional potential air hazards, the monitoring program will be modified based on Attachment C.

TABLE 8.1

AIR MONITORING PROCEDURES

Type of Equipment	Calibration Check	Parameter(s) to be Measured	Sampling Frequency	Sampling Locations
HNU or TIP-PID	Daily	Organic Vapor Concentrations	Every 5 feet while advancing or withdrawing augers	Breathing zone near auger
LEL Meter	Daily, when drilling in an area of suspected petroleum hydrocarbon contamination	Lower Explosive Limit	Every 5 feet while advancing or withdrawing augers	Near auger at ground level

TABLE 8.2

CALIBRATION PROCEDURE FOR HNU PHOTOIONIZATION DETECTOR (PID)

---

1. Battery Check -- Turn the function switch to BATT. The needle should be in the green region. If not, recharge the battery.

2. Zero Set -- Turn the function switch to STANDBY. In this position, the lamp is OFF and no signal is generated. Set the zero point with the ZERO set control. The zero can also be set with the function switch on the X1 position and using a "Hydrocarbon-free" air. In this case, "negative" readings are possible if the analyzer measures a cleaner sample when in service.

3. 0-20 or 0-200 range -- For calibrating on the 0-20 or 0-200 range, only one gas standard is required. Turn the function switch to the range position and note the meter reading. Adjust the SPAN control setting as required to read the ppm concentration of the standard. Recheck the zero setting (Step 2). If readjustment is needed, repeat Step 3. This gives a two-point calibration; zero and the gas standard point. Additional calibration points can be generated by dilution of the standard with zero air is desired (See Section 8).

4. 0-2000 range -- For calibrating on the 0-2000 range, use of two standards is recommended. First calibrate with the higher standard using the SPAN control for setting. Then calibrate with the lower standard using the ZERO adjustment. Repeat these several times to ensure that a good calibration is obtained. The analyzer will be approximately linear to better than 600 ppm. If the analyzer is subsequently to be used on the 0-20 or 0-200 range, it must be recalibrated as described in Steps 2 and 3, above.

5. Lamp Cleaning -- If the span setting resulting from calibration is 0.0 or if calibration cannot be achieved, then the lamp must be cleaned.

6. Lamp Replacement -- If the lamp output is too low or if the lamp has failed, it must be replaced.

TABLE 8.3

FIELD CHECKING PROCEDURE FOR BACHARACH MODEL "L" (SNIFFER)

Normally, the SNIFFER should be checked for a response to a known gas sample before each day's operation.

NOTE: Use the slotted screw adjustment to mechanically zero the meter pointer with the power OFF before proceeding.

A quick and simple method for testing is to turn ON the instrument with the ZERO/ON-OFF control and adjust until meter pointer indicates at scale zero.

Obtain a cylinder of gas with a known concentration such as Bacharach Code 23-4007 (contains 2% methane-in-air) and connect a regulator valve to the cylinder. Open the regulator valve and direct a stream of gas from the cylinder towards the sample inlet fitting.

Squeeze the aspirator bulb several times and observe that the meter pointer deflects upscale. After checking response, flush thoroughly with air by again squeezing the aspirator bulb several times until meter pointer indicates at scale zero. The qualitative test just described provides that the indicator did respond to the presence of a combustible gas. If no response is observed, the instrument should be returned for calibration by an authorized technician.

CHAPTER 9

SITE CONTROL MEASURES

Site control measures are intended to minimize potential contamination of workers, protect the public from potential site hazards, and to prevent unauthorized access to the site.

Due to the low to moderate levels of contamination expected at the site, exclusion zones will be established around the drilling rig. Should subsequent investigation indicate a need for larger exclusion zones, this chapter will be revised according to guidelines described in Attachment D.

CHAPTER 10

DECONTAMINATION PROCEDURES

Personnel and equipment leaving the Exclusion Zone drilling site shall be thoroughly decontaminated.

Personnel decontamination will involve removal of gross soil contamination from clothing and boots and depositing it in the drums on-site for storage of auger cuttings. Hands and boots will be washed on-site with water and detergent to remove all residual soils. Soiled clothing will be removed as quickly as practicable and laundered. Each individual will bathe upon leaving the field to remove any residual contamination which penetrated the clothing.

Equipment decontamination will involve removal of gross soil contamination from augers, drill pipe and sampling equipment. All equipment will then be transported to the central equipment decontamination area for thorough cleaning as outlined in the Sampling Plan (Section 6).

The equipment decontamination area will be equipped with runoff-collecting devices to prevent the spread of contaminated liquids. Drums containing the collected decontamination liquids will be stored in a secure area until proper disposal can be accomplished.

If other levels of protection are warranted, the decontamination procedures outlined in Attachment H will be followed.

CHAPTER 11

STANDARD OPERATING PROCEDURES

The general standard operating procedures (SOPs) and forms for ES hazardous waste site investigations are presented in Appendix A. In addition, the following procedures specified by the Base Fire Department shall be followed:

1. FIRE PREVENTION PROCEDURES:

AFOSH Standards, ANGR 92-1, BR 92-1 and NFPA Codes must be followed in regards to fire prevention procedures.

2. WELDING/CUTTING OPERATIONS:

a. Only fully qualified workmen will perform welding or cutting operations.

b. Where practicable, move object to be welded or cut to a safe location.

c. If the object to be welded or cut cannot be moved, all combustible materials will be moved a safe distance away. Immovable combustibles shall be covered with a non-combustible shield to confine sparks. When possible, the protective cover will be dampened with water.

d. Before each welding, brazing, or cutting operation is started, the fire department must issue a permit (Ext. 4333). The fire department will decide if a standby truck is required. The Contractor is required to have proper fire extinguishers available.

3. PARKING OF EQUIPMENT:

a. At least 10 feet of clearance will be maintained between structures and construction materials.

b. Vehicles, equipment, materials and supplies shall not be placed in such a manner that obstructs access to fire hydrants, fire lanes and firefighting equipment.

4. FLAMMABLE/COMBUSTIBLE LIQUIDS:

a. All tanks, containers and pumping equipment used for the storage or handling of flammable liquids shall meet the recommendations of the National Fire Protection Association and the American Petroleum Institute.

b. Drums, barrels and other flammable liquid containers will be kept tightly capped. This applies to empty as well as filled containers. All containers shall be marked as to contents.

c. Gasoline or similar liquids will not be used for cleaning purposes (except the use of methanol in the designated decontamination area).

5. **FIRE PROTECTION EQUIPMENT/SYSTEMS:**

a. The use of fire hydrants by the Contractors as a source of water is prohibited if not approved by the Base Fire Department.

b. No vehicles will be driven over an unbridged fire hose or follow fire apparatus within 500 ft.

c. Upon approach of emergency vehicles with lights and sirens sounding, all traffic will immediately move to the right curb and stop until all emergency vehicles have passed. Driveways or stream intersections will not be blocked.

d. Fire extinguishers will not be moved or relocated from their installed positions except to combat a fire or when approved by the Base Fire Department for standby purposes.

e. Water mains, fire hydrant water main control valves and post indicator valves will not be turned off, or any maintenance performed that will interfere with the water supply without first notifying the Base Fire Department.

6. **OPEN FLAMES:**

a. Smoking is prohibited in all areas where flammable or combustible materials are stored, such as warehouses, repair shops, paint and carpenter shops, and other hazardous areas, except locations specifically provided for such purposes and approved by the Base Fire Department.

b. The burning of rubbish and similar materials will not be allowed at anytime.

7. Tarpots and kettles will be safely located outside of the building at least 25 feet away and will not be placed on any combustible roofs. Flare posts will not be used on the flight line or in POL areas. Approved type electrical lanterns will be used in hazardous areas.

8. All contractor personnel will be familiar with the fire reporting procedures. To report a fire, call 492-411 or Ext. 4111 from a Base phone. On the flight line, there are direct lines to the fire station, but they are for emergency use only.
9. Any fire hazard or potential fire hazard not specifically covered by the foregoing paragraphs will be brought to the attention of the Base Fire Chief or his designated representative, or the CE Inspector.
10. If there are any questions concerning fire procedures on Rickenbacker ANGB, contact the Fire Prevention Section, Ext. 4303 or 4305.

The following procedures specified by the Base Safety Manager shall be followed:

1. The following traffic regulations must be understood and obeyed by all contractor personnel:
   a. Alert vehicles with yellow flashing lights have the right-of-way. During an alert exercise, the intersection lights will flash and vehicles must pull to the right and stop until the lights quit flashing.
   b. Vehicles are not allowed on the flight line unless specifically authorized.
2. If contractor operations require vehicles on the flight line, the Contractor must receive a special flight line briefing from the Chief of Airfield Management, 492-4288 or Ext. 4288 from the Base.
3. For any welding operation, the Fire Department must be notified so a welding permit is issued prior to starting.
4. All flammable storage must be approved by the Base Fire Marshal.
5. Contractors must furnish personal protective equipment for their employees and insure they use the equipment when a job creates hazards to the employees. This personal protective equipment must meet the OSHA standards. There are several areas on Base which are designated as hazardous noise areas, so personnel working in these areas must be furnished proper ear protection.
6. Digging permits are required for excavating or anytime the earth is penetrated more than four inches. The sides or all excavation five feet or more deep will be guarded by shoring or sloping of the ground so employees working in trenches will not be endangered by moving earth.

HEALTH AND SAFETY PLAN

ATTACHMENT A
FORMS

JOB SAFETY & HEALTH PROTECTION

The Occupational Safety and Health Act of 1970 provides job safety and health protection for workers by promoting safe and healthful working conditions throughout the Nation. Requirements of the Act include the following:

Employers

All employers must furnish to employees employment and a place of employment free from recognized hazards that are causing or are likely to cause death or serious harm to employees. Employers must comply with occupational safety and health standards issued under the Act.

Employees

Employees must comply with all occupational safety and health standards, rules, regulations and orders issued under the Act that apply to their own actions and conduct on the job.

The Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor has the primary responsibility for administering the Act. OSHA issues occupational safety and health standards, and its Compliance Safety and Health Officers conduct jobsite inspections to help ensure compliance with the Act.

Inspection

The Act requires that a representative of the employer and a representative authorized by the employees be given an opportunity to accompany the OSHA inspector for the purpose of aiding the inspection.

Where there is no authorized employee representative, the OSHA Compliance Officer must consult with a reasonable number of employees concerning safety and health conditions in the workplace.

Complaint

Employees or their representatives have the right to file a complaint with the nearest OSHA office requesting an inspection if they believe unsafe or unhealthful conditions exist in their workplace. OSHA will withhold, on request, names of employees complaining.

The Act provides that employees may not be discharged or discriminated against in any way for filing safety and health complaints or for otherwise exercising their rights under the Act.

Employees who believe they have been discriminated against may file a complaint with their nearest OSHA office within 30 days of the alleged discrimination.

Citation

If upon inspection OSHA believes an employer has violated the Act, a citation alleging such violations will be issued to the employer. Each citation will specify a time period within which the alleged violation must be corrected.

The OSHA citation must be prominently displayed at or near the place of alleged violation for three days, or until it is corrected, whichever is later, to warn employees of dangers that may exist there.

Proposed Penalty

The Act provides for mandatory penalties against employers of up to $1,000 for each serious violation and for optional penalties of up to $1,000 for each nonserious violation. Penalties of up to $1,000 per day may be proposed for failure to correct violations within the proposed time period. Also, any employer who willfully or repeatedly violates the Act may be assessed penalties of up to $10,000 for each such violation.

Criminal penalties are also provided for in the Act. Any willful violation resulting in death of an employee, upon conviction, is punishable by a fine of not more than $10,000, or by imprisonment for not more than six months, or by both. Conviction of an employer after a first conviction doubles these maximum penalties.

Voluntary Activity

While providing penalties for violations, the Act also encourages efforts by labor and management, before an OSHA inspection, to reduce workplace hazards voluntarily and to develop and improve safety and health programs in all workplaces and industries. OSHA's Voluntary Protection Programs recognize outstanding efforts of this nature.

Such voluntary action should initially focus on the identification and elimination of hazards that could cause death, injury, or illness to employees and supervisors. There are many public and private organizations that can provide information and assistance in this effort, if requested. Also, your local OSHA office can provide considerable help and advice on solving safety and health problems or can refer you to other sources for help such as training.

Consultation

Free consultative assistance, without citation or penalty, is available to employers, on request, through OSHA supported programs in most State departments of labor or health.

More Information

Additional information and copies of the Act, specific OSHA safety and health standards, and other applicable regulations may be obtained from your employer or from the nearest OSHA Regional Office in the following locations:

Atlanta, Georgia
Boston, Massachusetts
Chicago, Illinois
Dallas, Texas
Denver, Colorado
Kansas City, Missouri
New York, New York
Philadelphia, Pennsylvania
San Francisco, California
Seattle, Washington

Telephone numbers for these offices, and additional area office locations, are listed in the telephone directory under the United States Department of Labor in the United States Government listing.

Washington, D.C.
1985
OSHA 2203

William E. Brock, Secretary of Labor

U.S. Department of Labor
Occupational Safety and Health Administration

Under provisions of Title 29, Code of Federal Regulations, Part 1903.2(a)(1) employers must post this notice (or a facsimile) in a conspicuous place where notices to employees are customarily posted.

ES ENGINEERING-SCIENCE COMPANIES

ACCIDENT REPORT FORM

Page 1 of 3

Project: ________________________

EMPLOYER

1. Name: ________________________

2. Mail Address: ________________________
(No. and Street) (City or Town) (State)

3. Location, if different from mail address: ________________________

____

INJURED OR ILL EMPLOYEE

4. Name: ________________________ Social Security Number: __________
(First) (Middle) (Last)

5. Home Address: ________________________
(No. and Street) (City or Town) (State)

6. Age: ________ 7. Sex: Male ( ) Female ( )

8. Occupation: ________________________
(Specific job title, not the specific activity employee was performing at time of injury)

9. Department: ________________________
(Enter name of department in which injured persons is employed, even though they may have been temporarily working in another department at the time of injury)

THE ACCIDENT OR EXPOSURE TO OCCUPATIONAL ILLNESS

10. Place of accident of exposure: ________________________
(No. and Street) (City or Town) (State)

11. Was place of accident or exposure on employer's premises? Yes ( ) No ( )

12. What was the employee doing when injured? ________________________
(Be specific - Was employee

____
using tools or equipment or handling material?)

____

13. How did the accident occur? ____________________
(Describe fully the events that resulted in the
____
injury or occupational illness. Tell what happened and how. Name objects
____
and substances involved. Give details on all factors that led to accident.
____
Use separate sheet for additional space.)

14. Time of accident: ____________

15. ES WITNESS TO ACCIDENT

(Name)	(Affiliation)	(Phone No.)
(Name)	(Affiliation)	(Phone No.)
(Name)	(Affiliation)	(Phone No.)

OCCUPATIONAL INJURY OR OCCUPATIONAL ILLNESS

16. Describe injury or illness in detail; indicate part of body affected:
____
____

17. Name the object or substance that directly injured the employee. (For example, object that struck employee; the vapor or poison inhaled or swallowed; the chemical or radiation that irritated the skin; or in cases of strains, hernias, etc., the object the employee was lifting, pulling, etc.).
____
____

18. Date of injury or initial diagnosis of occupational illness ____________
(Date)

19. Did the accident result in employee fatality? Yes ( ) No ( )

ES ENGINEERING-SCIENCE COMPANIES

ACCIDENT REPORT FORM

Page 3 of 3

OTHER

20. Name and address of physician ______________________________

____

21. If hospitalized, name and address of hospital ____________________

____

Date of report __________ Prepared by ______________________________

Official position ______________________

ES ENGINEERING-SCIENCE COMPANIES

PLAN ACCEPTANCE FORM

PROJECT HEALTH AND SAFETY PLAN

I have read and agree to abide by the contents of the Health and Safety Plan for the following project:

____

____
Signed

____
Date

Return to Office Health and Safety Representative before starting to work on subject project work site.

ES ENGINEERING-SCIENCE COMPANIES

SCBA RESPIRATOR LOG

SITE: ______________________________

LOCATION: ______________________________

DATES OF INVESTIGATION: ______________________________

User	Date of Use	SCBA #	Satisfactory Checkout (Yes/No - Initials)	Date Cleaned

SCBA Performance Comments:

____

Project Health and Safety Officer or ES Project Manager   Date

Return to Office Health and Safety Representative at the completion of field activities.

ES-COR-14(4/87)

ES ENGINEERING-SCIENCE COMPANIES

AIR PURIFYING RESPIRATOR LOG

SITE: ______________________________

LOCATION: ______________________________

DATES OF INVESTIGATION: ______________________________

User	Date of Use	Cleaned and Inspected Before Use (Initials)	Cartridges Changed Before Use (Yes, No, N/A)	Total Hours on Cartridge

____

Project Health and Safety Officer or
ES Project Manager

Date

Return to Office Health and Safety Representative at the completion of field activities.

ES-COR-15(4/87)

HEALTH AND SAFETY PLAN

ATTACHMENT B
MEDICAL EXAMINATION

ATTACHMENT B

MEDICAL EXAMINATION

EXAMINATION CONTENT

Each participant in the ES medical program will receive a comprehensive base-line examination with periodic screening exams thereafter. These periodic exams may include an interim medical and occupational history review, a physical exam, laboratory blood and urine test, and a physician's evaluation. The periodic examinations will be supplemented by procedures and special tests as warranted by exposure to specific hazards.

MEDICAL HISTORY

Each participant will complete an occupational and medical history form before seeing a physician. When completed, the form will be turned over to the physician or the physician's designee.

The confidential occupational and medical history form is designed to elicit general and specific information concerning employee health. While this information is essential in determining health status, it also represents an opportunity for the employee to express concern regarding his occupational environment. Responses given will allow the medical staff to determine those test and procedures most appropriate to that work situation.

SAMPLE PRE-PLACEMENT PHYSICAL

Occupational and Medical History

Perform a complete medical history emphasizing these systems: nervous, skin, lung, blood-forming, cardiovascular, gastrointestinal, genitourinary, and reproductive.

Physical Examination

Physical examination include at least the following:

- Height, weight, temperature, pulse, respiration, and blood pressure.
- Head, nose, and throat.
- Eyes. Include vision tests that measure refraction, depth perception, and color vision. These tests should be administered by a qualified technician or physician. Vision quality is essential to safety, the accurate reading of instruments and labels, the avoidance of physical hazards, and for appropriate response to color-coded labels and signals.
- Ears. Include audiometric tests, performed at 500; 1,000; 2,000; 3,000; 4,000; and 6,000 hertz (Hz) pure tone in an approved booth (see requirements listed in 29 CFR Part 1910.95, Appendix D). Test should be administered by a qualified technician, and results read by a certified audiologist or a physician familiar with audiometric evaluation. The integrity of the eardrum should be established because perforated eardrums can provide a route of entry for chemicals into the body. The physician evaluating employees with perforated eardrums should consider the environmental conditions of the job and discuss the possible specific safety controls with the Office or Laboratory Health and Safety Representative before deciding whether such individuals can safely work.
- Chest (heart and lungs).
- Peripheral vascular system.
- Abdomen and rectum (including hernia exam).

- Spine and other components of the musculoskeletal system.
- Genitourinary system.
- Skin.
- Nervous system.

Test

- Blood.
- Urine.
- A 14 by 17-inch posterior/anterior view chest x-ray, with lateral or oblique views. The x-ray should be taken by a certified radiology technician and interpreted by a board-certified or board-eligible radiologist. Check x-rays taken in the last 12-month period, as well as the oldest chest x-ray available, should be obtained and used for comparison. Chest x-rays should not be repeated more than once a year, unless otherwise determined by the examining physician.

Ability to Perform While Wearing Protective Equipment

To determine a worker's capacity to perform while wearing protective equipment, additional test may be necessary, for example:

- Pulmonary function testing: Measurement should include forced expiratory volume in 1 second (FEV$_1$), forced vital capacity (FVC), and FEV$_1$-to-FVC ratio, with interpretation and comparison to normal predicted values corrected for age, height, race, and sex. A permanent record of flow curves should be placed in the worker's medical records. The tests should be conducted by a certified technician and the results interpreted by a physician.
- Electrocardiogram (EKG). A standard, 12-lead resting EKG should be performed.

The above physical is recommended by OSHA for employees who routinely handle toxic substances; however, not all test are applicable for each ES division. For example, ES laboratory personnel do not encounter noise exposure above 85 dBA, thus an audiometric test may not be necessary. A tetanus immunization will be required every 5 years for personnel working at waste water and sewage treatment plants. This immunization is recommended for personnel who perform hazardous waste operation. The Office or Laboratory Health and Safety Representative must consult with the examining physician to tailor the pre-employment physical specifically to the individual's job description.

SAMPLE PERIODIC MEDICAL EXAMINATION

Interval Medical History

Interval medical history should be performed focusing on changes in health status, illnesses, and possible work-related symptoms. The examining physician should have information about the worker's interval exposure history, including exposure monitoring results (if performed).

Physical Examination

- Height, weight, temperature, pulse, respiration, and blood pressure.
- Head, nose, throat.
- Vision tests that measure refraction, depth preception, and color vision.
- Chest (heart and lungs).
- Peripheral vascular system.
- Abdomen and rectum (including hernia exam).
- Spine and other components of the musculoskeletal system.
- Genitourinary system.
- Skin.
- Nervous system.
- Blood test.
- Urine test.

Additional Tests

Additional medical testing may be performed, depending on available exposure information, medical history, and examination results. Testing should be specific for the possible medical effects of the worker's exposure. Multiple testing for a large range of potential exposures is not always useful; it may involve invasive procedures (e.g., tissue biopsy), be expensive, and may produce false-positive results.

Pulmonary Function

Pulmonary function test should be administered if the individual uses a respiratory, has been or may be exposed to irritating or toxic substances, or if the individual has breathing difficulties, especially when wearing a respirator.

Audiometric Tests

Annual retest are required for personnel subject to high noise exposures (an 8-hour, time-weighted average of 85 dBA or more), those required to wear hearing protection, or as otherwise indicated.

Electrocardiogram

An electrocardiogram (EKG) will be performed annually for those over 40 and every three years for all others. The EKG will be the standard 12-lead resting type.

Chest X-Rays

Chest x-rays will be performed when clinically indicated or every three years. The x-ray should be at least 14 by 17-inch P-A (posterior/anterior).

Blood and Urine Test

Blood and urine test frequently performed by occupational physicians include:

Blood Test

- Complete blood count with differential and platelet evaluation
- White cell count
- Red blood cell count

- Hemoglobin
- Hermatocrit
- Reticulocyte count
- Total protein
- Albumin
- Globulin
- Total bilirubin
- Alkaline phosphatase
- Gamma glutamyl transpeptidase (GGTP)
- Lactic dehydrogenase (LDH)
- Serum glutumigoxaloacetic transaminase (SGOT)
- Serum glutamic-pyruvic transaminase (SGPT)
- Blood urea nitrogen (BUN)
- Creatinine
- Uric Acid

Urinalysis

- Color
- Specific gravity
- pH
- Qualitative glucose
- Protein
- Bile
- Acetone
- Microscopic examination of cetrifuged sediments

HEALTH AND SAFETY PLAN

ATTACHMENT C
PRINCIPLES OF AIR MONITORING

ATTACHMENT C

PRINCIPLES OF AIR MONITORING

PURPOSE

OSHA, in 29 CFR Part 1910.120 (h), requires air monitoring to be used to identify and quantify airborne concentrations of hazardous substances. The purpose of this guideline is to establish fundamental air monitoring principles that can be used to evaluate potential risks at a site.

GUIDELINE

Various dangers may exist when working at a hazardous waste site. Explosive vapors, oxygen deficient atmospheres, and a variety of toxic gases and vapors can be encountered with lethal properties.

When first approaching a waste site, the potential hazards must be recognized and exposure risks evaluated. This can be done by a methodical initial site survey. To perform initial site surveys and subsequent monitoring, various portable instruments must be available. The types of air monitoring that can be performed and the interpretation of the results of this monitoring are presented in the following paragraphs.

Oxygen-Deficient Atmospheres

At sites where oxygen depletion or displacement is anticipated, oxygen levels must be monitored by the use of a portable oxygen detector. A typical oxygen detector measures the percent oxygen in the immediate atmosphere using a galvanic cell. Terrain variations in the land and unventilated rooms or areas often do not contain enough oxygen to support life, making these instruments invaluable to response personnel. The normal ambient oxygen concentration is 20.8 percent.

The National Institute for Occupational Safety and Health (NIOSH) requires that if oxygen levels in the ambient air become less than 19.5 percent supplied air, respirators must be worn. Oxygen-enriched atmospheres (oxygen greater than 25 percent) increase the potential for fire or explosion; no work or testing should ever be performed under such conditions.

Limitations

The operation of oxygen detectors depends on the absolute atmospheric pressure. The concentration of natural oxygen (not manufactured or generated oxygen) is a function of the atmospheric pressure at a given altitude.

At sea level, where the weight of the atmosphere is greatest, more oxygen molecules are compressed into a given volume than at higher elevations. As elevation increases, this compression decreases, resulting in fewer oxygen molecules being "squeezed" into a given volume. Consequently, an oxygen indicator calibrated at sea level and operated at an altitude of several thousand feet will falsely indicate an oxygen-deficient atmosphere (less than 19.5 percent).

Combustible Gases/Vapors

The presence or absence of combustible vapors or gases must be evaluated at a waste site. A typical combustible gas detector determines the concentration of combustible vapors and gases present in an atmosphere. The level is recorded as a percentage of the Lower Explosive Limit (LEL), which is measured as the change in electrical resistance in a wheatstone bridge circuit.

The LEL of a combustible gas or vapor is the lowest concentration by volume in air that will explode, ignite, or burn when there is an available ignition source.

The NIOSH has established the following guidelines concerning working in an explosive environment:

1. If explosivity readings are detected between 10 to 25 percent LEL, work activities in the area should be limited to those that do not generate sparks.

2. If the explosivity reading on the combustible gas indicator is above 25 percent, operations will stop and the on-site area must be immediately evacuated until appropriate action can be taken to eliminate the hazard.

Once a site has been evacuated, the resumption of on-site activities cannot occur until project personnel have consulted with personnel experienced in fire or explosion hazards. On-site activities around enclosed spaces and material containers should be carefully monitored for the presence of combustible gases and vapors. Around well drilling and welding operations, the air above the borehole also needs to be monitored for combustible/explosive gases and vapors.

Limitations

The combustible gas detector cannot be used to test the vapors of leaded gasoline, halogens, and sulfur compounds. These substances interfere with the filament unit, reducing the instruments sensitivity. Compounds containing silicone will also destroy the platinum filament.

The combustible gas detector can only be used in normal atmospheres, not oxygen enriched or deficient. Oxygen concentrations that are less than or greater than normal may cause erroneous readings.

Organic Vapor/Gases

The initial survey of a site should always include measurements for organic vapors. Sufficient data should be obtained during the initial entry to screen the site for various levels of organic vapors. These gross measurements can be used on a preliminary basis to (1) determine levels of personnel protection, (2) establish site work zones, and (3) select candidate areas for more thorough qualitative and quantitative studies.

Organic vapor concentrations at a site can be determined by the use of a photoionization detector (PID) or a flame ionization detector (FID).

Photoionization Detector

Photoionization instruments (HNU® for example) use an ultraviolet (uv) light to ionize chemical compounds. The photoionization process can be illustrated as:

$$RH + hv \longrightarrow RH^{+} + e-$$

where RH is an organic or inorganic molecule and hv represents a photon of uv light. The photon has energy equal to or greater than the molecules ionization potential and causes the emission of an electron e-.

The PID consists of a chamber containing a pair of electrodes. When a positive potential is applied to one electrode, the field created drives any ions formed by the absorption of uv light to the collector electrode, where the current (proportional to the concentration) is measured.

Limitations

Compounds with high ionization potentials will not be detected if the lamp used does not have the sufficient energy required to ionize the compound (HNU® manufactures three uv lamps with different ionization energies).

The response to a gas or vapor may radically change when the gas or vapor is mixed with other materials. As an example, a PID calibrated to ammonia and surveying an atmosphere containing 100 ppm ammonia would indicate 100 on the meter. Likewise, an instrument calibrated to benzene would record 100 in an atmosphere containing 100 ppm benzene. However, in an atmosphere containing 100 ppm of each compound, the instrument could indicate considerably less or more than 200 ppm, depending on how it was calibrated.

Flame Ionization Detector

The flame ionization detector (FID) uses ionization as the detection method much the same as in the PID, except that the ionization is caused by a hydrogen flame, rather than a uv light. The flame has enough energy to ionize any organic molecule with an ionization potential of 15.4 ev or less.

Inside the instrument's detection chamber, the sample is exposed to a hydrogen flame that ionizes the organic vapors. As the organic vapors burn, positively charged, carbon-containing ions are produced and collect on a negatively charged electrode. As the positive ions accumulate, a current proportional to the hydrocarbon concentration is generated on the input electrode.

Limitations

Flame ionization detectors do not detect inorganic gases and vapors and many synthetic compounds. Similar to the PID, the FID responds differently to different compounds. For example, an FID that has been calibrated to methane will read 100 ppm methane in an atmosphere containing 100 ppm methane. However, this instrument may only register 10 ppm of carbon tetrachloride in an atmosphere actually containing 100 ppm of that compound. The relative sensitivity to various compounds must be considered when using this instrument.

Calorimeteric Indicator Tubes

Often, while evaluating a hazardous waste site, the need arises to quickly measure a specific gases. Direct-reading calorimetric indicator tubes can successfully fill that need. These tubes are usually calibrated in parts per million (ppm) or percent concentration for easy interpretation.

Calorimetric indicator tubes consist of a glass tube impregnated with an indicator chemical. A known volume of contaminated air is drawn through the tube at a predetermined rate. The contaminant reacts with the indicator chemical in the tube, producing a discoloration that is proportional to the chemicals concentration. Detector tubes are chemical specific and must be selected before leaving for the site.

Limitations

Several indicator chemicals may be able to measure the concentration of a particular gas or vapor. Each chemical operates on a different chemical principle and is affected in varying degrees by temperature, air volume pulled through the tube, and interference from other gases or vapors. A "true" concentration versus the "measured" concentration may vary considerably among and between tube manufacturers.

A major limitation of this apparatus involves the process by which the operator "reads" the endpoint. The jagged edge where contaminant meets indicator chemical makes it difficult to get accurate results from this seemingly simple test. However, a diligent and experienced operator should be able to accurately read the endpoint.

Radiation Survey Instrument

Although radiation monitoring is usually not necessary, it should be incorporated into the initial survey where radioactive materials may potentially be present.

Normal gamma radiation background is approximately 0.01 to 0.02 mR/hr (millirem per hour) on a gamma survey instrument. Work can continue with slightly elevated radiation exposure rates; however, if the exposure rate increases to 3 to 5 times above gamma background, the Project Health and Safety Officer should be consulted. At no time should work continue with an exposure rate of 10 mR/hr or above.

The absence of gamma readings above background should not be interpreted as the complete absence of radioactivity. Radioactive materials emitting low-energy gamma, alpha, or beta radiation may be present, but for a number of reasons may not cause a response on the instrument. Unless airborne, these radioactive materials should present minimal hazard. More thorough surveys should be conducted as site operations continue, to document the absence of radioactive materials.

Limitations

Radiation survey meters must only be used by persons who have been trained in the proper interpretation of their readings. The meters require frequent calibration and checking to ensure that the readings are accurate.

PERSONAL MONITORING

Selective monitoring of high risk workers (i.e., those closest to the source of contamination generation) is recommended during cleanup activities. This methodology is based on the rationale that the probability of significant exposure varies with distance from the source. If workers closest to the source of contamination are not significantly exposed, the all other workers are supposedly not exposed and do not need to be monitored.

Personal monitoring samples should be collected in the breathing zone. These samples represent the inhalation exposure of workers who are not wearing respiratory protection. "Full shift" or 8-hour air samples are analyzed in a laboratory. Full shift air samples may be collected using passive dosimeters, or by a pump that draws air onto a sorbent or filter. It is best to use pumps that maintain a constant flow rate to collect samples, because it is difficult to adjust the pump with protective equipment on. Table C.1 lists some sampling and analytical techniques used at a hazardous waste site.

PERIODIC MONITORING

The monitoring surveys made during the initial site entry phase are for a preliminary evaluation of atmospheric hazards. In some situations, the information obtained may be sufficient to preclude additional monitoring. However, because site activities and weather conditions change during the course of a day, a program to periodically monitor atmospheric changes must be implemented (see Table C.2 for action levels).

PERIPHERAL MONITORING

Monitoring along the site perimeter where personal protective equipment is no longer required, measures the contamination away from the site and enables the Project Health and Safety Officer to evaluate the intergrity of the site's clean area.

TRAINING

It is imperative that personnel using monitoring instruments be thoroughly familiar with their use, limitations, and operating characteristics. All instruments have inherent constraints in their

TABLE C.1

SAMPLE COLLECTION AND ANALYTICAL METHODS

Substance	Collection Device[a]	Analytical Method[b]	Typical Detection Limit of Analytic Instrument (ug)
Anions:	Prewashed silica gel tube	Ion chromatography	
Bromide			10
Chloride			5
Fluoride			5
Nitrate			10
Phosphate			20
Sulfate			10
Aliphatic Amines	Silica gel	GC/NPD	10
Asbestos	MCEF	PCM	100[c]
Metals	MCEF	ICP-AES	0.5
Organics	Charcoal tube	GC/MS	10
Nitrosamines	Thermosorb/N	GC/TEA	0.01
Particulates	MCEF	Gravimetric	
PCBs	GF filter and florisil tube	GC-ECD	0.001
Pesticides	13-mm GF filter and chromosorb 102 Tube	GC/MS	0.05

[a] MCEF = mixed cellulose ester filter.
GF = glass fiber filter.

[b] GC/NPD = gas chromatography and nitrogen/phosphorus detector; PCM = phase contrast microscopy; ICP-AES = inductivitely coupled plasma atomic emission spectrometry; GM/MS = gas chromatography and mass spectrometry; GC/TEA = gas chromatography using thermal engergy analyzer; GC-ECD = gas chromatography using an electrical conductivity detector.

[c] Units in fibers per mm^2 of filter (Method No. 7400 from the NIOSH Manual of Analytical Methods, 3rd edition).

Source: NIOSH, OSHA, USCGG, EPA. (1985). Occupational Safety and Health Guidance Manual for Hazardous Waste Activities.

TABLE C.2

ATMOSPHERIC HAZARD GUIDELINES

Monitoring Equipment	Hazard	Ambient Level	Action
Combustible gas indicator	Explosive atmosphere	<10% LEL	Continue investigation.
		10% to 25%	Continue onsite monitoring with extreme caution as higher levels are encountered.
		>25% LEL	Explosion hazard; withdraw from area immediately.
Oxygen concentration meter	Oxygen	<19.5%	Monitor, wearing self-contained breathing apparatus (SCBA). Note: Combusible gas readings are not valid in atmospheres with <19.5% oxygen.
		19.5% to 21%	Continue investigation with caution. SCBA not needed, based on oxygen content only.
		>25%	Discontinue inspection; fire hazard potential.
Radiation	Radiation	<1 mR/hr	Continue investigation. If radiation is detected above background levels, this signifies the presence of possible radiation sources; at this level, more thorough monitoring is advisable. Consult with the Project Health and Safety Officer.
		>10 mR/hr	Potential radiation hazard; evacuate site.
Colorimetric tubes	Organic and inorganic vapors/ gases	Depends on species	Consult standard reference manuals for air concentrations/toxicity data.

TABLE C.2 (Continued)

Monitoring Equipment	Hazard	Ambient Level	Action
Photoionization Detector	Organic vapors/ gases	Depends on species	Consult standard reference manuals for air concentrations/toxicity data.
		Total response mode	Consult Engineering-Science Guidelines for the selection of appropriate level of protection.
Flame Ionization Detector	Organic	Depends on species	Consult standard reference manuals for air concentrations/toxicity data.
		Total response mode	Consult Engineering-Science Guidelines to the selection of appropriate level of protection.

ability to detect and/or quantify the hazard for which they were designed. Unless trained personnel use the instruments properly and accurately assess the data readout, air hazards can be grossly misinterpreted, endangering the health and safety of field personnel.

INSTRUMENT SENSITIVITY

Although the measurement of total vapor/gas concentrations can be a useful adjunct to professional judgment in the selection of an appropriate level of protection, caution should be used in the interpretation of the readout of the measuring instrument. The response of an instrument to a gas or vapor cloud containing two or more substances does not provide the same sensitivity as measurements involving the individual, pure constituents. Hence, the instrument readout may overestimate or underestimate the concentration of an unknown composite cloud. This same type of inaccuracy could also occur in measuring a single unknown substance with the instrument calibrated to a different substance. The idiosyncrasies of each instrument must be considered in conjunction with the other parameters in selecting the protection equipment needed. Using the total vapor/gas concentration to determine levels of protection should provide protection against concentrations greater than the readout of the instrument. However, when the upper limits of Levels C and B are approached, serious consideration should be given to selecting a higher level of protection. Cloud constituents must be identified as rapidly as possible and levels of protection based on the toxic properties of the specific substances identified.

HEALTH AND SAFETY PLAN

ATTACHMENT D
PRINCIPLES OF SITE CONTROL

ATTACHMENT D

PRINCIPLES OF SITE CONTROL

PURPOSE

OSHA requires (29 CFR Part 1910.120[d]) that a site control program be developed before the initiation of hazardous waste operations. The purpose of this guideline is to establish site control principles that will minimize potential contamination for ES employees and protect the public from the sites hazards.

GUIDELINE

The activities required during hazardous waste operations involve the movement of materials (contaminants) from the site to unaffected areas. ES personnel working and equipment used around hazardous substances may become contaminated and carry the materials into clean areas. Materials may become airborne because of its volatility, or the disturbance of contaminated soil may cause it to become wind blown. To reduce the transfer of hazardous substances from the site contamination control procedures are needed.

Several site control procedures can be implemented to reduce worker and public exposure to chemical, biologic, physical, and safety hazards:

- o Compile a site map.
- o Establish work zones.
- o Use the buddy system when necessary.
- o Establish and strictly enforce decontamination procedures for both personnel and equipment (see Appendix H).
- o Establish site security measures as needed.
- o Set up communication networks.
- o Enforce safe work practices.

Site Map

A site map indicating topographical features, prevailing wind direction, and the location of containers, impoundments, pits, ponds, and building is helpful in:

- Planning activities.
- Assigning personnel.
- Identifying access routes, evacuation routes, and problem areas.
- Identifying areas of the site that require use of personal protective equipment.
- Supplementing the daily safety and health briefings of the field team.

This map should be prepared before site activities.

Site Work Zones

One method of preventing or reducing the migration of contamination is to delineate zones on the site where prescribed operations occur. Movement of personnel and equipment between zones and onto the site itself would be limited by access control points. By these means, contamination would be expected to be contained within certain relatively small areas on the site and its potential for spread minimized. Three contiguous zones (Figure D.1) are recommended.

Exclusion Zone

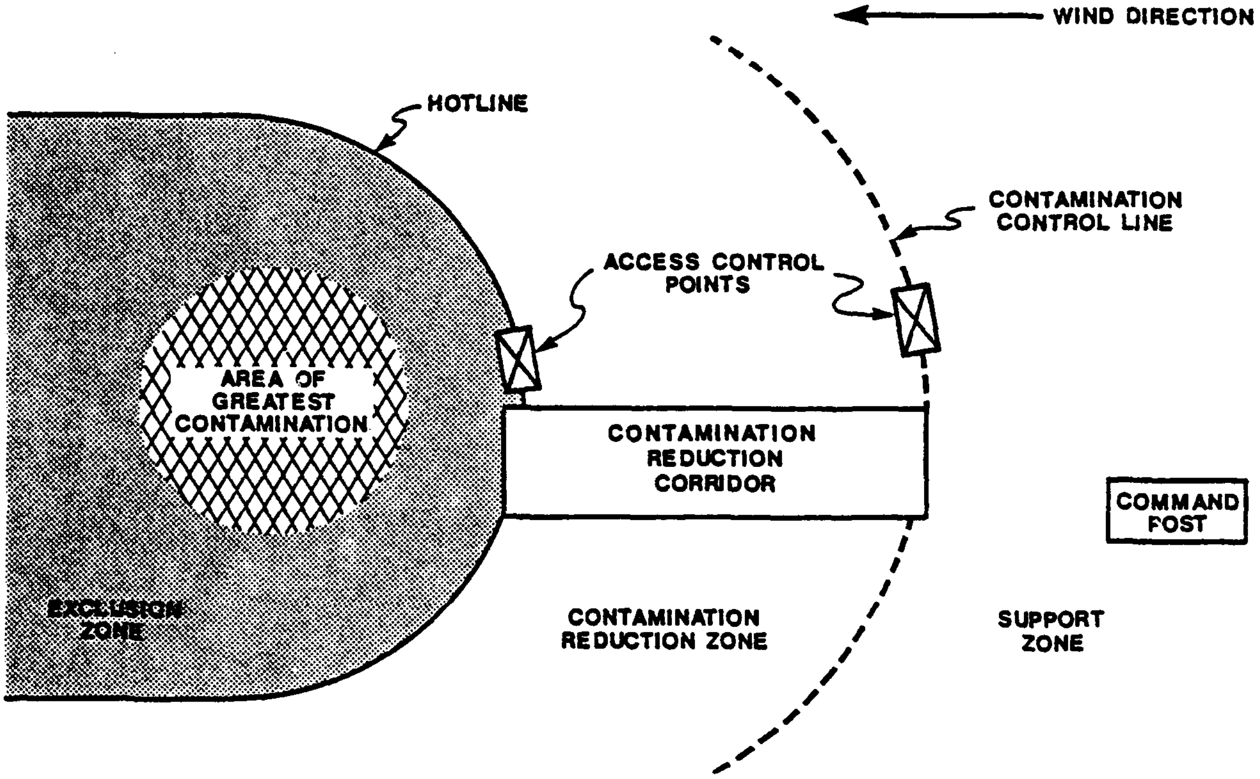
The Exclusion Zone is an area where contamination does or could occur. Major activities that are performed in the Exclusion Zone include:

- Site characterization, such as mapping, photographing, and sampling.
- Installation of wells for groundwater monitoring.
- Cleanup work, such as drum movement, drum staging, and materials bulking.

All people entering the Exclusion Zone must wear prescribed levels of protection. An entry and exit check point must be established at the periphery of the Exclusion Zone to regulate the flow of personnel and

FIGURE D.1

DIAGRAM OF SITE WORK ZONES



equipment in and out of the zone and to verify that the procedures established to exit and enter are followed.

The outer boundary of the Exclusion Zone, the Hotline, is initially established by visually surveying the immediate environs of the incident and determining where the hazardous substance involved are located; where any drainage, leachate, or spilled material is; and whether any discolorations are visible. Guidance in determining the boundaries is also provided by data from the initial site survey indicating the presence of organic or inorganic vapors/gases or particulates in air, combustible gases, and radiation, or the results of water and soil sampling.

Additional factors that should be considered include the distances needed to prevent fire or an explosion from affecting personnel outside the zone, the physical area necessary to conduct site operations, and the potential for contaminants to be blown from the area. Once the Hotline has been determined, it should be physically secured, fenced, or well-defined by landmarks. During subsequent site operations, the boundary may be modified and adjusted as more information becomes available.

Contamination Reduction Zone

The Contamination Reduction Zone (CRZ) is located between the contaminated area and clean area. This zone is designed to reduce the probability that the clean Support Zone will become contaminated and/or affected by other hazards on site. The distance between the Exclusion Zone and Support Zone provided by the CRZ, together with decontamination of workers and equipment, limits the physical transfer of hazardous chemicals into clean areas. The degree of contamination in the CRZ decreases as one moves from the Exclusion Zone to Support Zone because of the distance and the decontamination procedures.

The boundary between the Support Zone and the CRZ, the Contamination Control Line, separates the possibly low contamintion area from the clean Support Zone. Access to the CRZ from the Support Zone is through a control point. Personnel entering there would wear the prescribed personnel protective equipment, if required, for working in the CRZ. Entering the Support Zone requires removal of any protective equipment worn in the CRZ.

Support Zone

The Support Zone, the outermost part of the site, is considered noncontaminated or clean area. The Support Zone is the location of the administrative and other support functions necessary to maintain smooth operations in the Exclusion Zone and CRZ. Personnel may wear normal work clothes in this area. Any potentially contaminated equipment or clothing must be decontaminated before entry into this area.

The location of the Support Zone depends on a number of factors including:

- Accessibility: topography; open space available; locations of highways, railroad tracks; or other limitations.
- Wind direction: preferably the support facilities should be located upwind of the Exclusion Zone. However, shifts in wind direction and other conditions may be such that an ideal location based on wind direction alone does not exist.
- Resources: adequate roads, power lines, water, and shelter.

The Buddy System

All activities in contaminated areas must be conducted with a partner (buddy) who can:

- Provide his or her partner with assistance.
- Observe his or her partner for signs of chemical or heat exposure.
- Periodically check the integrity of his or her partner's protective clothing.
- Notify the Field Team Leader or others if emergency help is needed.

Site Security

Site security at a hazardous waste site is necessary to:

- Prevent the exposure of unauthorized, unprotected people to the site hazards.

- Prevent theft.
- Avoid interference with safe working procedures.

During the work day, site security can consist of:

- Assign responsibility for enforcing authority for entry and exit requirements.
- Maintain security in the Support Zone and at Access Control Points.
- If the site is not fenced, post signs around the perimeter.
- Have the Field Team Leader approve all visitors to the site. Make sure they have a valid purpose for entering the site. Have trained site personnel accompany visitors at all times.

During off-duty hours, site security can consist of:

- If needed, use security guards to patrol the site boundry. Guards must be fully apprised of the hazards at the site.
- Secure the equipment.

Site Communication

Two communication systems should be established during hazardous waste operations; an internal communication among personnel on site, and an external communication between on-site and off-site personnel.

Internal communication at site is used to:

- Alert personnel to emergencies.
- Convey safety information (e.g., amount of time left in air tanks, heat stress check, etc.).
- Communicate changes in the work to be performed.
- Maintain site control.

Often at a site, communications can be impeded by background noise and the use of personal protective equipment. For communications to be effective, commands must be pre-arranged. In addition, audio or visual cues can aid in conveying the message. Some common internal communication devices are: two-way radios, noisemakers (e.g., bells, whistle, compressed air horn, etc.), and visual signals (e.g., flags, hand signals, and lights). Radios used in the Exclusion Zone must be intrinsically safe and not capable of sparking.

An external communication system between on-site and off-site personnel is necessary to:

- Report to management.
- Coordinate emergency response.
- Maintain contact with essential off-site personnel.

The primary means of external communication is the telephone. If a telephone is not present at the site, all team members must know where the nearest phone is located. The correct change and necessary phone number should be readily available.

Safe Work Practices

To ensure a strong safety awareness during hazardous waste operations, a list of standing orders stating the practices that may never occur in contaminated areas should be developed. Sample standing orders for personnel entering an Exclusion Zone may include:

- No smoking, eating, drinking, or application of cosmetics in this zone.
- No matches or lighters in this zone.
- Check in at the entrance Access Control Point before you enter this zone.
- Check out at the exit Access Control Point before you leave this zone.
- Always have your buddy with you in this zone.
- Wear an air purifying respirator in this zone.
- If you discover any signs of radioactivity, explosivity, or unusual conditions such as dead animals at the site, exit immediately and report this finding to your supervisor.

Standing orders should be posted conspicuously at the site.

In addition to standing orders, employees should be briefed on the chemical information of the site contaminant at the beginning of the project. Daily site safety meetings should be held for employees.

Working with tools and heavy equipment is a major hazard at sites. Injuries can result from equipment hitting personnel, impacts from flying objects, burns from hot objects, and damage to protective equipment such as supplied-air respirator systems. The following precautions will help prevent injuries because of such hazards:

- Keep all heavy equipment that is used in the Exclusion Zone in that zone until the job is done. Completely decontaminate such equipment before moving it into the clean zone.
- Train personnel in proper operating procedures.
- Install appropriate equipment guards and engineering controls on tools and equipment.
- Where portable electric tools and appliances can be used (i.e., where there is no potential for flammable or explosive conditions), use three-wire grounded extension cords to prevent electric shocks.
- Keep all non-essential people out of the work area.
- Prohibit loose-fitting clothing around moving machinery.
- Do not exceed the rated load capacity of a vehicle.
- Do not operate cranes or derricks within 10 feet of power lines.

HEALTH AND SAFETY PLAN

ATTACHMENT E
GUIDELINES FOR THE SELECTION OF APPROPRIATE RESPIRATORY PROTECTION

ATTACHMENT E

GUIDELINES FOR THE SELECTION OF APPROPRIATE RESPIRATORY PROTECTION

PURPOSE

The purpose of this guideline is to aid Engineering-Science (ES) personnel in the selection of respiratory protection equipment needed to conduct hazardous waste site investigations.

GUIDELINE

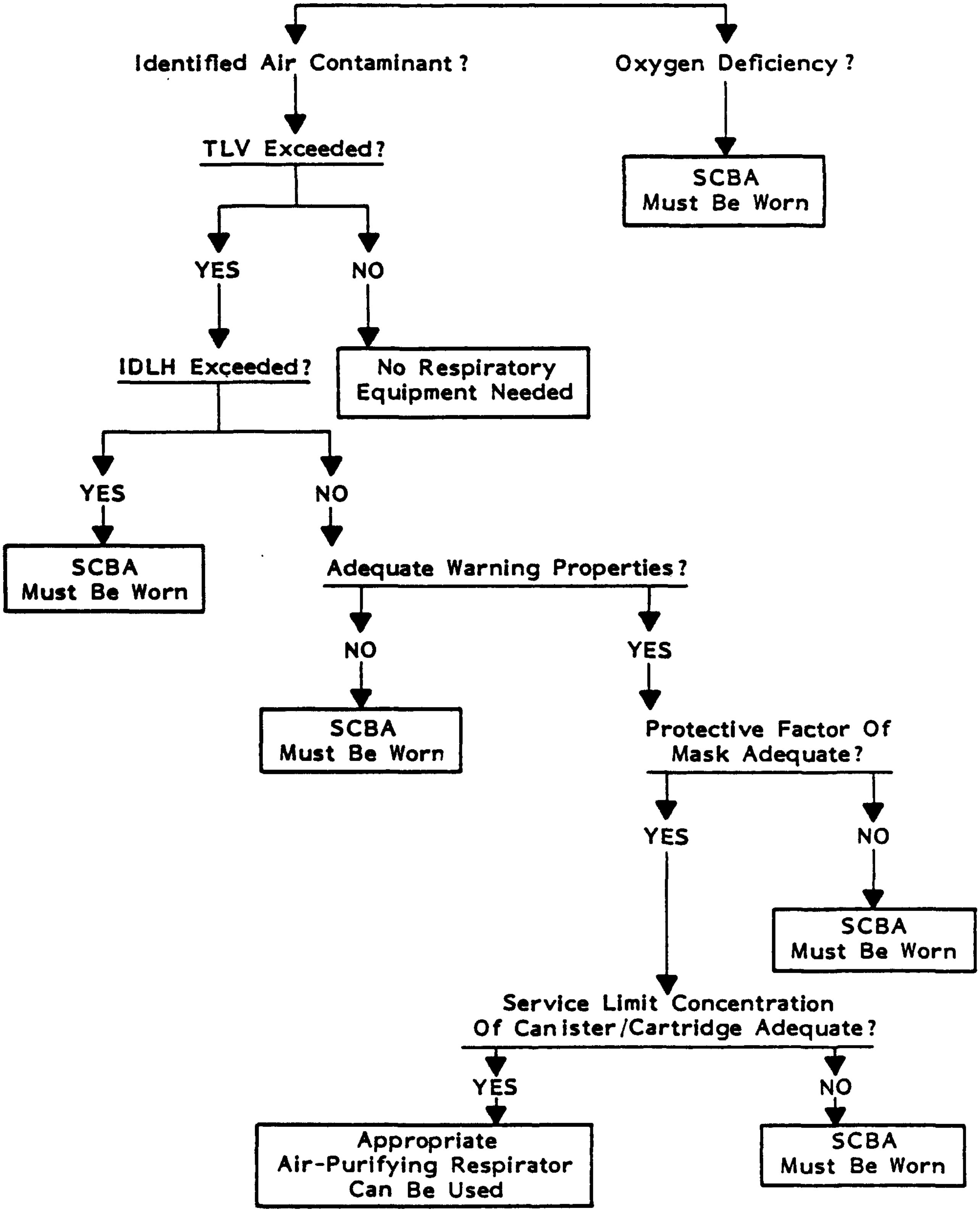
The investigation of hazardous waste sites presents workers with a number of environmental conditions, some of which are better defined than others. It is not the purpose of this document to provide precise decision logic criteria encompassing every environmental situation in which one may be faced with. Each situation is unique. This document recognizes that many respiratory decisions involve aspects of risk assessment. This guideline ensures that all relevant data are considered in the process of conducting respiratory risk assessments resulting in the selection of specific respiratory equipment items for protection against hazardous chemical exposure. Steps to take include:

1. Assimilate all available information pertaining to the hazard, including:
    a. Past activities.
    b. Suspected materials.
    c. Historical information.
    d. Land use.
    e. Analytical data.
    f. Nature of current activities, etc.

2. Evaluate the relevancy and timeliness of the data to determine the appropriate protective level needed for the task:
   a. Is the analytical data relevant?
   b. Was the past sampling or monitoring conducted during the same season as is anticipated. for the activities planned? If not what implication might this hold?
   c. Was past sampling or monitoring conducted from a medium that is pertinent to evaluate hazards associated with the activities specified in the task work plan?
3. Identify substances present at the work area.
4. Using the subject areas listed below, evaluate any of the known or suspected chemicals on site. Topics requiring elaboration are detailed in the decision logic criteria subsection (see Figure E.1).
   a. Permissible exposure limits (PEL), threshold limit values (TLVs).
   b. Eye irritation potential for substance (see decision logic criteria subsection).
   c. Warning properties of substance (see decision logic criteria subsection).
   d. Immediately dangerous to life and health (IDLH) (see decision logic criteria subsection)?
   e. Any possibility of poor sorbent efficiency at IDLH concentrations and below?
   f. Is there a possibility of severe skin irritation resulting from contact of the skin with corrosive gases (see decision logic criteria subsection)?
   g. The vapor pressure of the substance.
   h. Any possibility of high heat of reaction with sorbent material in cartridge or canister (see decision logic criteria subsection)?
   i. Is there a possibility of shock sensitivity of chemical being sorbed onto the cartridge or canister (see decision logic criteria subsection)?

FIGURE E.1

DECISION LOGIC FLOW CHART ON CHOOSING APPROPRIATE RESPIRATOR



5. Determine the physical state(s) of the substance as it is likely to be encountered at the hazardous waste site. It will be either:
    a. A gas or vapor.
    b. Particulate (dust, fume, or mist).
    c. A combination of a and b.
6. Oxygen deficient atmospheres (ANSI Z88.2-1980) — air-purifying respirators shall not be worn in environments deficient in oxygen (less than 19.5 percent by volume or partial pressure less than 100 mm of mercury).

Decision Logic Criteria

Skin Adsorption and Irritation

A supplied-air suit may provide skin protection from extremely toxic substances that may be absorbed through the skin or cause severe skin irritation. Most information concerning skin irritation is not quantitative but rather is presented in commonly used descriptive terms, such as "a strong skin irritant, highly irritating to the skin" and "corrosive to the skin." Decisions made concerning skin irritation are judgmental and are often based on this nonquantitative information. As a guideline for the use of the supplied-air suit for substances that are sorbed through the skin, a single skin penetration LD_{50} of 2 g/kg for any animal species is used.

Poor Warning Properties

Air-purifying devices cannot be used to protect against organic vapors with poor warning properties. Warning properties include odor, eye irritation, taste imparting characteristics, and respiratory irritation. Warning properties provide an indication to the wearer of possible cartridge exhaustion or of poor face piece fit. Adequate warning properties can be assumed when the substances odor, taste, or irritation effects are detectable and persistant at concentrations at or below the TLV.

If the odor or irritation threshold of a substance is more than three times greater than the TLV, this substance should be considered to have poor warning properties. If the substance odor or irritation threshold is slightly above the TLV (not in excess of three times the limit) and there is no ceiling limit, consideration should be given to whether undetected exposure in this concentration range could cause serious or irreversible health effects. Some substances have extremely low thresholds of odor and irritation in relation to the permissible exposure limit. These substances can be detected by a worker within the face piece of the respirator even when the respirator is functioning properly. These substances are considered to have poor warning properties (see Table E.1).

Although 30 CFR Part 11* does not specifically eliminate the use of air-purifying respirators for pesticides with poor warning properties, prudent practices dictate that a respirator should not be used to protect against any substance with poor warning properties.

Sorbents

There are certain limitations to the use of sorbent cartridge/ canister respirators. When the following conditions exist, a sorbent cartridge is not recommended:

- A cartridge/canister air-purifying respirator can never be used when evidence exists of immediate (less than 3 minutes) breakthrough time at or below the IDLH concentration.
- An air-purifying canister/cartridge respirator shall not be used when there is reason to suspect that the sorbent does not provide adequate efficiency against the removal of a specific contaminant(s) that may be encountered at the site.

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*The primary technical criteria for what constitutes a permissible respirator is determined by the technical requirements of 30 CFR Part 11 (Department of Interior, Bureau of Mines, Respiratory Protective Devices and Test for Permissibility).

TABLE E.1

COMPARISON OF SELECTED ODOR THRESHOLDS AND TLVs FOR CHEMICAL COMPOUNDS

Compounds	Odor Threshold (ppm)	TLV (ppm)
Group 1 - Odor Threshold and TLV Approximately the Same		
Acrylonitrile	21	20
Arsine	0.21	0.05
Cyclohexane	300	300
Cyclohexanol	100	50
Epichlorhydrin	10	5
Ethyl benzene	200	100
Ethylene diamine	11	10
Hydrogen chloride	10	5
Methyl acetate	200	200
Methylamine	10	10
Methyl chloroform	500	350
Nitrogen dioxide	5	5
Propyl alcohol	200	200
Styrene monomer	200	100
Turpentine	200	100
Group 2 - Odor Threshold from 2 to 10 Times the TLV		
Acrolein	0.2	0.1
Allyl alcohol	7	2
Carbon tetrachloride	75	10
Chloroform	200	25
1,2-Dichloroethylene	500	200
Dichloroethyl ether	35	5
Dimethyl acetamide	46	10
Hydrogen selenide	0.3	0.05
Isopropyl glycidyl ether (IGE)	300	50
Group 3 - Odor Threshold Equal to or Greater than 10 Times TLV		
Bromoform	530	0.5
Camphor (synthetic)	1.6-200	2
Chloroacetophenone	1	0.05
Chloropicrin	1	0.1
Crotonaldehyde	7	0.1
Diglycidyl ether (DGE)	5	0.5
Dimethylformamide	100	0
Ethylene oxide	500	50
Methyl formate	2000	100
Methanol	2000	200
Methyl cyclohexanol	500	50
Phosgene	1.0	0.1
Toluene 2,4-diisocyanate (TDI)	2	0.2

- Where there is reason to suspect that a sorbent has a high heat of reaction with a substance, use of that sorbent is not allowed.
- Where there is reason to suspect that a substance sorbed onto the surface of a cartridge or canister is shock sensitive, use of air-purifying respirators is prohibited.

Eye Irritation

The decision of whether to use a full-face respirator or a half or quarter-face respirator is often made by considering the chemical's potential for producing eye irritation or damage. The following guidelines deal with eye protection.

Any eye irritation is considered unacceptable for routine work activities. Therefore, only full-face respirators are permissible in contaminant concentrations that produce eye irritation. For escape, some eye irritation is permissible if it is determined that such irritation would not inhibit escape and such irritation is reversible.

In instances where quantitative eye irritation data cannot be found in literature references, and theoretical considerations indicate that the substance should not be an eye irritant, half-face piece respirators are allowed.

In instances where a review of the literature indicates a substance causes eye irritation, but no eye irritation threshold is specified, the full-face piece respirators can be used.

IDLH

The definition of IDLH provided in 30 CFR 11.3(t) is as follows:

> "'Immediately dangerous to life or health' means conditions that pose an immediate threat to life or health or conditions that pose an immediate threat of severe exposure to contaminants, such as radioactive materials, which are likely to have adverse cumulative or delayed effects on health."

The purpose of establishing an IDLH exposure concentration is to ensure that the worker can escape without injury or irreversible health effects in the event of failure of the respiratory protective equipment. The IDLH is considered the maximum concentration above which only a highly reliable positive-pressure self contained breathing apparatus is permitted. Because IDLH values are conservatively set, any approved respirator may be used up to its maximum use concentration below the IDLH.

In establishing the IDLH concentration the following factors are considered:

1. Escape without loss of life or irreversible health effects. Thirty minutes is considered the maximum permissible exposure time for escape.
2. Severe eye or respiratory irritation or other reactions that would prevent escape without injury.

IDLH should be determined from the following sources:

1. Specific IDLH concentration provided in the literature such as the AIHA Hygienic Guides.
2. Human exposure data.
3. Acute animal exposure data.
4. Acute toxicological data from analogous substances.

The following guidelines should be used to interpret toxicological data reported in the literature for animal species:

1. Where acute inhalation exposure data (30 minutes to 4 hours) are available for various animal species the lowest exposure concentration causing death or irreversible health effects in any species is determined to be the IDLH concentration.
2. Chronic exposure data may have little relevance to the acute effects and should not be used in determining the IDLH.

Protection Factors

The protection factors of respiratory protection devices are a useful numerical tool to aid in the selection of appropriate respiratory protection. Protection factors measure the overall effectiveness of a respirator.

The protection factor of a given respirator for a specific user multiplied by the TLV for a given substance is the maximum allowable concentration of that substance for which the respirator may be used. For example, if the protection factor for a full-face mask respirator is 100 and substance X has a PEL (or TLV) of 10 ppm, the full-face mask respirator will provide protection up to 1000 ppm (see Table E.2).

Escape

Engineering-Science will provide and ensure that all employees will carry an escape respirator on initial site entries (as required in 29 CFR Part 1910.120) or where exposure to extremely toxic substances may occur (an extremely toxic substance is defined as a gas or vapor having an LC_{50} equal to or less than 10 ppm).

TABLE E.2

SELECTED RESPIRATOR PROTECTION FACTORS

Type of Respirator	Protection Factor (Qualitative Test)
Air-purifying	
quarter-mask	10
half-mask	10
Air-line	
quarter-mask	10
half-mask	10
Hose mask	
full facepiece	10
SCBA, demand	
quarter-mask	10
half-mask	10
Air-purifying	
full facepiece	100
Air-line, demand	
full facepiece	100
SCBA, demand	
full facepiece	100
Air-line, pressure-demand, with escape provision	
full facepiece (no test required)	10,000+
SCBA, pressure-demand or positive pressure	
full facepiece (no test required)	10,000+

For additional information consult ANSI Z88.2 - 1980.

HEALTH AND SAFETY PLAN

ATTACHMENT F
GUIDELINES FOR SELECTION OF PROTECTIVE CLOTHING

ATTACHMENT F

GUIDELINES FOR SELECTION OF PROTECTIVE CLOTHING

PURPOSE

To establish guidelines to be used by Engineering-Science personnel in the selection of protective clothing for hazardous waste site investigations.

GUIDELINES

Protective clothing is needed to ensure the health and safety of field personnel involved with hazardous substances. Specific protective garments are selected on the basis of a variety of criteria. Clothing is selected by evaluating the performance characteristics of the clothing against the requirements and limitations of the site- and task-specific conditions. The selection of chemical protective clothing is a complex task and should be performed by personnel with training and experience.

Considerations for Choice of Protective Clothing

Performance Requirement

Clothing must be able to withstand a variety of physical abuses. The advantages and disadvantages of reusable versus disposable clothing must be considered.

Construction Requirements

The construction requirements of any garment depend on the intended use of the garment. The material that the garment is made of has been selected because of its effectiveness as a barrier against specific hazards--there is no such thing as "universal" protection.

1. The physical construction of the garment must prevent penetration (e.g., location of seams and zippers, size of clothing).
2. The material that the garment is constructed of must resist penetration. In some instances, it may be necessary to layer protective clothing to achieve the desired protection.

Permeation Rate

Permeation rate is affected by a combination of the base material, the nature of the chemicals to which the material is exposed, and the duration and nature of exposure. Most materials allow some degree of permeation.

Ease and Cost of Decontamination

Considerations that should be made upon purchasing garments are the ability and degree to which the garment can be decontaminated and the cost of decontamination. Disposable clothing may be advantageous in some situations; however, such clothing is rather expensive in the long run. In most instances, field personnel will use a combination of disposable and reusable clothing.

Protective Materials

The following materials are generally available for a number of garments:

1. Cellulose or paper
2. Natural and synthetic fibers
   a. Tyvek®
   b. Nomex®
3. Elastomers
   a. Polyethylene
   b. Saran®-Dow-product
   c. Polyvinyl chloride
   d. Neoprene
   e. Butyl rubber
   f. Chlorapel®
   g. Viton®

Materials such as Tyvek® or paper offer little or no protection against hazardous contaminants. Such materials can, however, protect against particulate contaminants. Tyvek® should be used as an outer covering over the primary protective gear such as splash or fully encapsulating suits. Although Tyvek® provides little chemical resistance, it does limit the amount of direct contamination on the primary protective gear. Tyvek® garments are disposable.

Elastomers (polymeric materials that, after being stretched, return to about their original length) provide the best protection against chemical degradation, permeation, and penetration from toxic and corrosive liquids or gases. Elastomers are used in boots, gloves, overalls, and fully encapsulating suits. They are sometimes combined with a flame-resistant fabric called Nomex® to enhance durability and protection.

The abilities of elastomers to resist degradation and permeation range from poor to excellent. The selection of a particular material should be based on its resistance to chemical degradation, as well as on its ability to resist permeation.

Table F.1 indicates the effectiveness of certain materials to resistance from degradation.

Types of Protective Clothing

Each type of protective clothing has a specific purpose; many, but not all, are designed to protect against chemical exposure. Table F.2 describes the types of protective clothing available, details the protection they offer, and lists factors to consider in their selection and use.

SELECTION OF WORK ENSEMBLE

Protection Level

The individual components of clothing and equipment must be assembled into a full protective ensemble that both protects the worker from the site-specific hazards and minimizes the hazards and drawbacks of the personal protective equipment ensemble itself.

TABLE F.1

CHEMICAL PROTECTION OF CLOTHING MATERIALS BY GENERIC CLASS

Generic Class	Butyl Rubber	Polyvinyl Chloride	Neoprene	Natural Rubber
Alcohols	E	E	E	E
Aldehydes	E-G	G-F	E-G	E-F
Amines	E-F	G-F	E-G	G-F
Esters	G-F	P	G	F-P
Fuels	F-P	G-P	E-G	F-P
Halogenated hydrocarbons	G-P	G-P	G-F	F-P
Hydrocarbons	F-P	F	G-F	F-P
Inorganic acids	G-F	E	E-G	F-P
Inorganic bases and salts	E	E	E	E
Ketones	E	P	G-F	E-F
Natural fats and oils	G-F	G	E-G	G-F
Organic acids	E	E	E	E

Key: E, excellent; F, fair; G, good; P, poor.

Source: "Survey of Personnel Protective Clothing and Respiratory Apparata..." September 1974, Department of Transportation, Office of Research and Development.

TABLE F.2

PROTECTIVE CLOTHING AND ACCESSORIES

Type of Clothing or Accessory	Description	Type of Protection
Fully-encapsulating suit	One-piece garment. Boots and gloves may be integral, attached and replaceable, or separate.	Protects entire body against splashes, dust, gases, and vapors.
Non-encapsulating suit	Jacket, hood, pants, or bib overalls, and one-piece coveralls.	Protects body against splashes, dust, and other materials but not against gases and vapors. Does not protect parts of head or neck.
Aprons, leggings, and sleeve protectors	Fully sleeved and gloved apron. Separate coverings for arms and legs. Commonly worn over non-encapsulating suit.	Provides additional splash protection of chest, forearms, and legs.
Firefighters' protective clothing	Gloves, helmet, running or bunker coat, running or bunker pants (NFPA No. 1971, 1972, 1973), and boots.	Protects against heat, hot water, and some particles. Does not protect against gases and vapors, or chemical permeation or degradation. NFPA Standard No. 1971 specifies that a garment consist of an outer shell, an inner liner, and a vapor barrier with a minimum water penetration of 25 lb/in^2 (1.8 kg/cm^2) to prevent the passage of hot water.
Safety helmet	Hard plastic or rubber hat.	Protects the head from blows. Helmets shall meet OSHA Standard 29 CFR Part 1910.135.

TABLE F.2 (Continued)

Type of Clothing or Accessory	Description	Type of Protection
Face shield	Full-face coverage, eight-inch minimum.	Protects face and eyes against chemical splashes.
Safety glasses	Plastic or glass lenses with side shields.	Protects eyes against large particles and projectiles. Safety glasses shall meet OSHA Standard 29 CFR Part 1910.133.
Goggles	Plastic lenses, flexible fitting.	Depending on their construction, goggles can protect against vaporized chemicals, splashes, large particles, and projectiles (if constructed with impact-resistant lenses). Goggles shall meet OSHA Standard 29 CFR Part 1910.133.
Gloves and sleeves	May be integral, attached, or separate from other protective clothing.	Protects hands and arms from chemical contact.
	Overgloves.	Provides supplemental protection to the wearer and protects more expensive undergarments from abrasions, tears, and contamination.
Safety boots	Boots constructed of chemical-resistant materials (e.g., neoprene, nitrile, butyl rubber, etc.).	Protects feet from contact with chemicals.

TABLE F.2 (Continued)

Type of Clothing or Accessory	Description	Type of Protection
Safety boots (continued)	Boots constructed with some steel materials (e.g., toes, shanks, insoles).	Protects feet from compression, crushing, or puncture by falling, moving, or sharp objects. All boots must meet specifications required by OSHA (29 CFR Part 1910.136).
	Boots constructed from nonconductive, spark-resistant materials or coatings.	Protects the wearer against electrical hazards and prevents ignition of combustible gases or vapors.
Disposable shoe or boot covers	Made of a variety of materials. Slip over the shoe or boot.	Protects safety boots from contamination. Protects feet from contamination.

SOURCE: NIOSH, OSHA, USCG, EPA. 1985. Occupational Safety and Health Guidance Manual For Hazardous Waste Site Activities.

Level A

Level A protection should be used when percutaneous hazards exist or where there is no known data to rule out percutaneous hazards. Because wearing a fully encapsulated suit is physiologically and psychologically stressful, the decision to use this protection must be carefully considered. The following conditions suggest a need for Level A protection.

1. The hazardous substance has been identified and requires the highest level of protection for skin, eyes, and the respiratory system based on either the measured (or potential for) high concentration of atmospheric vapors, gases, or particulates; or based on the site operations and work functions involve a high potential for splash, immersion, or exposure to unexpected vapors, gases, or particulates of materials that are harmful to skin or capable of being absorbed through the intact skin.
2. Substances with a high degree of hazard to the skin are known or suspected to be present, and skin contact is possible.
3. Operations must be conducted in confined, poorly ventilated areas and the absence of conditions requiring Level A have not yet been determined.

The following items constitute Level A protection:

1. Pressure-demand, full-face piece, self-contained breathing apparatus (SCBA), or pressure-demand supplied air respirator with escape SCBA, approved by the National Institute for Occupational Safety and Health (NIOSH).
2. Totally-encapsulating chemical-protective suit.
3. Coveralls.
4. Long underwear.*
5. Gloves, outer, chemical resistant.
6. Gloves, inner, chemical resistant.

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*Optional, as applicable.

7. Boots, chemical-resistant, steel toe and shank.
8. Hard hat (under suit).*
9. Disposable protective suit, gloves, and boots (depending on suit construction, may be worn over totally-encapsulating suit).
10. Two-way radios (worn inside encapsulating suit).

Before a fully encapsulated suit can be worn into a hazardous situation the suit must be properly inspected. The following is a checklist for visually inspecting all types of fully encapsulated suits.

1. Spread suit out on flat surface.
2. Examine the following:
    a. Fabric and seams for abrasions, cuts, or holes.
    b. Zippers and other connecting devices for proper sealing.
    c. Visor for dirt and cracks.
    d. Exhaust valves (if applicable) for inhibiting debris and proper functioning.
3. If air source is available, seal the suit and inflate it. Check for any leaks on surface and seams using a mild soap solution.
4. Record each suit's inspection, use, and repair status.

Level B

Level B protection should be worn when the highest level of respiratory protection is necessary, but a lesser level of skin protection is needed. The following conditions constitute a need for Level B protection.

1. Atmospheres with concentrations of known substance greater than protective factors associated with full-face, air-purifying respirators.
2. The atmosphere contains less than 19.5 percent oxygen.

3. Site operations make it highly unlikely that the small, exposed areas of the head or neck will be contacted by splashes of extremely hazardous substances.
4. Type(s) and concentration(s) of vapors in air do not present a cutaneous or percutaneous hazard to the small, unprotected areas of the body.

The following items constitute Level B protection:

1. Pressure-demand, full-face piece, self-contained breathing apparatus (SCBA), or pressure-demand supplied air respirator with escape SCBA (NIOSH approved).
2. Hooded chemical-resistant clothing (overalls and long-sleeved jacket, coveralls, one or two-piece chemical splash suit; disposable chemical-resistant overalls).
3. Coveralls.*
4. Gloves, outer, chemical resistant.
5. Gloves, inner, chemical resistant.
6. Boots, outer, chemical-resistant, steel toe and shank.
7. Boot covers, outer, chemical-resistant (disposal)*.
8. Hard hat.
9. Two-way radios.*
10. Face shield.*

<u>Level C</u>

Level C protection should be worn when the type(s) of airborne substance(s) is measured, and the criteria for using air-purifying respirators are met. The following conditions suggest a need for Level C protection:

1. The atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect or be absorbed through any exposed skin.

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*Optional, as applicable.

2. The types of air contaminants have been identified, concentrations measured, and a canister or cartridge respirator is available that can remove the contaminants.
3. All criteria for the use of air-purifying respirators are met.

The following items constitute Level C protection:

1. Full-face or half-mask, air-purifying canister or cartridge equipped respirators (NIOSH approved).
2. Hooded chemical-resistant clothing (overalls; two-piece, chemical-splash suit; disposal, chemical-resistant overalls).
3. Coveralls.*
4. Gloves, outer, chemical-resistant.
5. Gloves, inner, chemical-resistant.
6. Boots (outer), chemical-resistant, steel toe and shank.*
7. Boot covers, outer, chemical-resistant (disposal).*
8. Hard hat.*
9. Escape mask.*
10. Two-way radios.*
11. Face shield.*

Level D

Level D protection should not be worn on any site where respiratory or skin hazard exist. Level D protection should be used when:

1. The atmosphere contains no known hazard.
2. Work functions preclude splashes, immersion, or the potential for unexpected inhalation of or contact with hazardous levels of any chemicals.

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*Optional, as applicable.

The following items constitute Level D protection:

1. Coveralls.
2. Gloves.*
3. Boots/shoes, chemical-resistant, steel toe and shank.
4. Boots, outer, chemical-resistant (disposal).*
5. Safety glasses or chemical splash goggles.*
6. Hard hat.*
7. Escape mask.*
8. Face shield.*

The type of clothing used and the overall level of protection should be reevaluated periodically as information about the site increases and as workers perform different operations. The Project Health and Safety Officer will determine when to upgrade or downgrade the level of protection for site personnel.

Reason to upgrade:

1. Known or suspected presence of dermal hazards.
2. Occurrence or likely occurrence of gas or vapor emission.
3. Change in work task that will increase contact or potential contact with hazardous materials.
4. Request of the individual performing the task.

Reasons to downgrade:

1. New information indicating that the situation is less hazardous than was originally thought.
2. Change in site conditions that decreases the hazard.
3. Change in work task that will reduce contact with hazardous materials.

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*Optional, as applicable.

HEALTH AND SAFETY PLAN

ATTACHMENT G
GUIDELINES FOR THE PROPER USE OF PERSONAL PROTECTIVE EQUIPMENT

ATTACHMENT G

GUIDELINES FOR THE PROPER USE OF PERSONAL PROTECTIVE EQUIPMENT

PURPOSE

These guidelines are provided to establish a personal protective equipment program for hazardous waste operations.

GUIDELINE

Personal protective equipment (PPE) can only provide a high degree of protection if it is used properly. The following areas must be addressed for an effective PPE program:

- training
- work duration
- fit testing
- donning of equipment
- in-use monitoring
- doffing of equipment
- inspection
- storage

Training

Training in PPE use is required as part of the initial training for all ES employees that are to work on hazardous waste sites. This training allows the user to become familiar with the equipment in a non-hazardous environment. As a minimum, the PPE training portion should delineate the user's responsibilities and explain the following:

1. OSHA requirements as delineated in 29 CFR Part 1910 Subparts I and Z.

2. The proper use and maintenance of the selected PPE, including capabilities and limitations.
3. Instruction in inspecting, donning, checking, fitting, and using PPE.
4. Individualized respirator fit testing to ensure proper fit.
5. The user's responsibility (if any) for decontamination cleaning, maintenance, and repair of PPE.
6. Emergency procedures and self-rescue in the event of PPE failure.

Work Mission Duration

Before entering a hazardous waste site in personal protective equipment, the anticipated work mission duration must be established in the project health and safety plan. Several factors limit the work mission length. These are:

1. Air supply.
2. The permeation and penetration rates of chemical contaminants.
3. Ambient temperature.

Respirator Fit Testing

The integrity of the face piece-to-face seal of a respirator determines its effectiveness. A secure fit is important with positive-pressure equipment, and is necessary to the safe functioning of negative-pressure equipment. Most face pieces are designed to fit only a certain percentage of the population; thus, every face piece must be tested on the potential wearer. The procedure for fit testing an air-puryifying respirator is presented below.

Prior to each use of the respirator, the user will conduct a negative pressure and positive pressure sealing test.

Negative Pressure Sealing Test

1. With the cartridge in place, cover the porous area of the cartridge with your hand.

2. Inhale attempting to achieve a negative pressure in the face piece.

3. Inability to achieve or maintain negative seal may be indicative of poor repirator fit or malfunction.

4. Recheck integrity of the respirator and reposition respirator for better seal.

5. Repeat step 1 and 2.

6. Do not use respirator if unable to achieve a negative pressure.

7. This is not considered a qualitative fit test, but rather a quick check of respirator integrity and seal.

Positive Pressure Sealing Test

1. Remove the protective covering of the exhalation valve and seal the exhalation port with your hand.

2. Exhale slightly.

3. Inability to maintain a slight positive pressure without indications of leakage may be indicative of poor respirator fit or malfunction.

A respirator-fit test using an irritant or odorous agent is required before donning a new negative pressure respirator.

Irritant Agent Test

1. Conduct an amyl acetate pre-test before using stannic chloride.

2. Break the ends off a stannic chloride tube, taking care not to get any of the material on your skin.

3. Attach the squeeze bulb to one end of the tube. Squeeze the bulb to ensure that a satisfactory stream of chloride can be generated for the fit test.

4. Have the subject don their respirator with the appropriate cartridge. In a closed space (a large trash bag is satisfactory) with the stannic chloride tube approximately two feet from the respirator, begin exposing the subject to the irritant agent.

5. Watch the subject closely for signs of irritation. If no penetration of the irritant agent is detected, move the stannic chloride closer to within 6 inches of the respirator, and direct smoke to potential leak areas.

6. If no penetration of smoke is detected at this stage, have the subject rotate the head from side to side, up and down, and undertake deep breathing.

7. If the respirator wearer does not detect the penetration of smoke into the respirator, the subject is deemed to have achieved a satisfactory fit.

Donning of Equipment

Periodic practice for donning chemical resistant clothing and respirators should be established. Assistance should be provided because donning and doffing operations are difficult to perform alone. Table G.1 lists sample procedures for donning a chemically resistant suit/SCBA ensemble.

After the equipment has been donned, the fit should be evaluated. Clothing that are too small will restrict movement, thus increasing the possibility of tearing the suit and increasing worker fatigue. Clothing that are too large increases the possibility of snagging the suit and the worker's dexterity and coordination may be compromised. In each instance, the worker should be recalled and refitted.

In-Use Monitoring

The wearer of protective clothing must understand all aspects of the clothing's operation and limitation. This is particularly important for fully-encapsulating ensembles where misuse could result in suffocation.

Worker should report any perceived problems or difficulties with equipment to their Project Health and Safety Officer. These malfunctions include, but are not limited to:

- Degradation of protective clothing.
- Perception of odor while wearing a respirator.
- Skin irritation.

TABLE G.1

SAMPLE DONNING PROCEDURES

---

1. Inspect respiratory equipment and clothing before donning.
2. Standing or sitting, put on chemically-resistant suit. Secure the suit by closing all fasteners on openings.
3. Put on chemically-resistant safety boots. Tape the leg cuff over the tops of the boots.
4. Put on inner gloves (surgical gloves). Additional overgloves may be worn. Tape the sleeves of the suit over the gloves.
5. Put on air tanks and harness assembly of the SCBA. Don the face piece and adjust it to be secure, but comfortable. Perform negative and positive respirator face-piece seal test procedures. Open the main valve.
6. Put on hard hat.
7. Have assistant check all closures.
8. Have assistant observe the wearer for a period of time to ensure that the wearer is comfortable, psychologically stable, and that the equipment is functioning properly.

- o Resistance in breathing during respirator use.
- o Fatigue because of respirator use.
- o Vision or communication difficulties.
- o Personal responses such as rapid pulse, chest pain, and nausea.

If a supplied-air respirator is being used, all hazards that might endanger the integrity of the air line should be removed from the working area before use. During use, air lines should be kept as short as possible and other workers and vehicles should be excluded from the area.

Doffing of Equipment

Procedures for removing chemically-resistant suit/SCBA ensembles must be developed and followed precisely to prevent the spread of contaminants from the work area to the wearer's body, and to decontamination personnel. Doffing should be performed in concert with the decontamination of the suited worker. Throughout the doffing precedure, both the worker and decontamination personnel should avoid direct contact with the outside surface of the suit.

Inspection

An effective PPE program will consist of three different inspections:

1. Inspection of equipment as it is issued to workers.
2. Inspection after use in training.
3. Periodic inspection of stored equipment.

Each inspection will cover different areas in varying degrees of detail. Explicit inspection procedures are usually available from the manufacturer. The inspection checklists provided in Table G.2 will also be an aid. It is the responsibility of the field worker to inspect the integrity of his or her equipment before use on a site.

Records must be maintained of all inspection procedures. Identification numbers should be assigned to all reusable pieces of equipment (ID numbers) and records should be kept by that number. As a minimum, each inspection should record the ID number, date, inspector, findings, and any future actions to be taken. Periodic review of these records may indicate an item or type of item with excessive maintenance costs or a high level of down time.

Storage

Clothing and respirators must be properly stored to prevent damage or malfunction due to exposure to dust, moisture, sunlight, temperature extremes, and impact. Procedures should be developed for pre-issuance warehousing and post-issuance (in-use) storage. Improper storage can cause equipment failures.

TABLE G.2

SAMPLE PPE INSPECTION CHECKLIST

Clothing

To be done before use:

- Determine that the clothing material is correct for the specific task at hand.
- Visually inspect for:
  - imperfect seams
  - non-uniform coatings
  - tears
  - malfunctioning closures
- Hold up to light and check for pinholes.
- Flex product:
  - observe for cracks
  - observe for other signs of shelf deterioration
- If the product has been used previously, inspect inside and out for signs of chemical attack:
  - discoloration
  - swelling
  - stiffness

To be done during the work task:

- Evidence of chemical attack (e.g., discoloration, softening, etc.). Chemical permeation can occur without visable signs.
- Tears
- Punctures
- Seam discontinuities

Table G.2 (Continued)

Gloves

To be done before use:

- Pressurize the gloves to check for holes. Either blow into glove, then roll gauntlet towards fingers or inflate glove and hold under water. In any event, no air should escape.

Air-Purifying Respirator

The respirator shall be inspected after each cleaning and before each use. The following items, at a minimum, must be addressed in the course of each inspection:

- Cartridges are fresh and of the appropriate type for the contaminant(s) encountered (check before use).
- Cartridge receptacle gaskets are present (two each).
- Inhalation valve seats and flapper valves are in place (two each).
- Exhalation flapper valve is in place.
- The speaking diaphragm and gasket are in place.
- The lens ring is secure with two nuts.
- The respirator is capable of maintaining a negative and positive pressure seal when fully assembled.

Self-Contained Breathing Appuratus (SCBA)

The following list of items must be addressed by the user immediately before donning of SCBAs. Any malfunction found should be cause to set the unit aside until it can be repaired by a certified repair person.

- Check all connections for tightness.
- Check material conditions for:

  - signs of pliability.
  - signs of deterioration.
  - signs of distortion.

TABLE G.2 (Continued)

- Check for proper setting and operation of regulators and valves (according to manufacturer's instruction).
- Check operation of low pressure alarm.
- Check face shield and lense for:
  - cracks.
  - crazing.
  - fogginess.

SCBAs shall be inspected once a month by a Office Health and Safety Representative to ensure that they are working properly. Monthly inspection involve the following:

- The routine checkout procedure used by personnel before every use of an SCBA must be repeated.
- A complete physical examination must be made of all external working parts on a monthly basis.
- Gaskets, seals, and rubber parts are examined for pliability and signs of deterioration.
- A physical examination of the diaphragm, diaphragm spring, and lever assembly must be made.

SCBAs must be checked twice a year on a portable regulator tester to ensure that the regulator is mechanically sound. Checks on the regulator tester must include the following:

- Static Pressure check.
- Airflow performance test.
- A test for excess aspiration of the regulator.

Air tanks must also be hydrostatically tested to ensure soundness. Aluminum cylinders wound in fiberglass must be tested every three years, steel cylinder need only be tested every five years. All test dates must be recorded in the inspection log book for SCBAs.

Clothing

- Contaminated clothing should be stored in an area separate from street clothing.
- Contaminated clothing should be stored in a well-ventilated area.
- Different types and materials of clothing and gloves should be stored spearately to prevent issuing the wrong material by mistake.

Respirators

- SCBAs and air-purifying respirators should be dismantled, washed, and disinfected after each use.

HEALTH AND SAFETY PLAN

ATTACHMENT H
PRINCIPLES OF DECONTAMINATION

ATTACHMENT H

PRINCIPLES OF DECONTAMINATION

PURPOSE

To establish fundamental decontamination principles to be used as a guide on developing site and activity specific decontamination procedures.

GUIDELINE

Personnel responding to hazardous substance incidents may become contaminated during the course of their work at a site. Protective clothing and respirators help to prevent the wearer from becoming contaminated or inhaling contaminants. Good work practices help reduce the contamination of protective clothing, instruments, and equipment. Even with these safeguards, contamination may occur. Harmful materials can be transferred into clean areas, exposing unprotected personnel. In removing contaminated clothing, personnel may come into direct contact with and/or inhale contaminants. To prevent such occurrences, contamination reduction and decontamination procedures must be developed and implemented. Such procedures are to be in place before anyone enters a hazardous area and must continue (modified if necessary) throughout the period of operation.

Decontamination consists of physically removing contaminants and/or converting them chemically into innocuous substances. The extent of decontamination depends on a number of factors, the most important being the type of contaminants involved. The more harmful the contaminant, the more extensive and thorough the decontamination required. Combining decontamination, the correct donning of protective equipment, and the zoning of site work areas minimizes the possibility of cross-contamination from protective clothing to wearer, or from equipment to personnel. Only general guidance can be given on methods and techniques for decontamination. The exact procedure is determined by evaluating a number of factors specific to the site.

Initial Planning

The initial decontamination plan is based on the assumption that all personnel and equipment leaving the Exclusion Zone (area of potential contamination) are grossly contaminated. The plan includes a system for washing and rinsing, at least once, all of the protective equipment worn. The washing and rinsing are done in combination with a sequential doffing of clothing, starting at the first station with the most heavily contaminated article and progressing to the last station with the least contaminated article.

Contamination Avoidance

Contamination avoidance is the best method for preventing the spread of contamination from a hazardous waste site. While planning site operations, methods are to be developed to prevent the contamination of personnel and equipment. Each person involved in site operations must regularly practice the basic methods of site contamination avoidance listed below.

- Know the limitations of all protective equipment being used.
- Do not enter a contaminated area unless it is necessary to carry out a specific objective.
- When in a contaminated area, avoid touching anything unnecessarily.
- Walk around pools of liquids, discolored areas, or any area that shows evidence of possible contamination.
- Walk upwind of contamination, if possible.
- Do not sit or lean against anything in a contaminated area. If you have to kneel (e.g., to take samples), use a plastic ground sheet.

- Before sampling any hazardous waste, read the label and manifest (if available) for all containers to determine the identity of the substance to be sampled and the potential contamination hazard.
- While checking for waste contents, the field personnel should also check for potential incompatibility of wastes. These conditions might be caused by heat, fire, or gas; an explosion; the contact of water and alkali metals; violent polymerization; or solubilization of toxic substances. Check waste containers for evidence of these conditions such as bulged drums, blistered paint, exploded drums, bubbles, dead vegetation, or melted plastic.
- If at all possible, do not set sampling equipment directly on contaminated areas. Place equipment on a protective cover such as a ground cloth.
- Use the proper tools necessary to safely conduct the study.

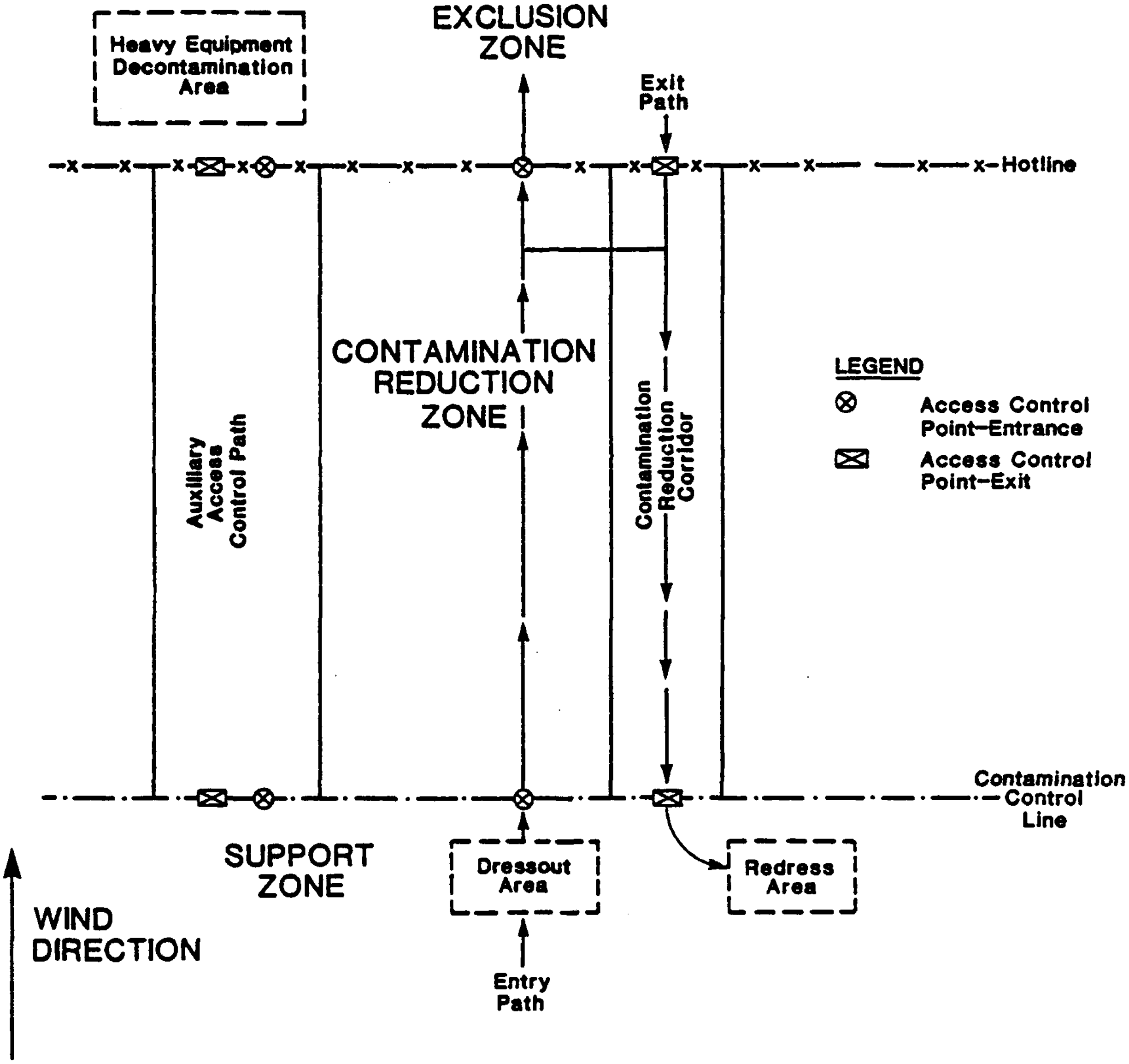
Where possible, plan very specific methods to reduce the risk of contamination. Using remote sampling techniques, opening containers by non-manual means, bagging monitoring instruments, using drum grapplers, watering down dusty areas, and avoiding areas of obvious contamination reduces the possibility of contamination and precludes elaborate decontamination procedures.

Site Organization

An area within the CRZ (Figure H.1) is designated the Contamination Reduction Corridor (CRC). The CRC controls access into and out of the Exclusion Zone and confines personnel decontamination activities to a limited area. The size of the corridor depends on the number of stations in the decontamination procedure, the overall dimension of work controls zones, and the amount of space available at the site. A corridor of 75 feet by 15 feet should be adequate for full decontamination. Whenever possible, it should be a straight path. The CRC boundaries should be conspicuously marked, with entry and exist restricted. The boundary between the Exclusion Zone and the CRZ is referred to as the hotline. Personnel exiting the Exclusion Zone must go through the CRC. Anyone in the CRC should be wearing the level of

FIGURE H.1

CONTAMINATION REDUCTION ZONE LAYOUT



protection designated for the decontamination crew. Within the CRC, distinct areas are set aside for decontamination of personnel, portable field equipment, and clothing. These areas must be marked and restricted to those personnel wearing the appropriate protection. All activities within the corridor are confined to decontamination. The level of decontamination must be spelled out in the project health and safety plan.

Protective clothing, respirators, monitoring equipment, sampling supplies, and other equipment are all maintained in a support area outside of the CRC. Personnel don their protective equipment (dressout) away from the CRC and enter the Exclusion Zone through a separate access control point at the hotline.

Decontamination Guidance

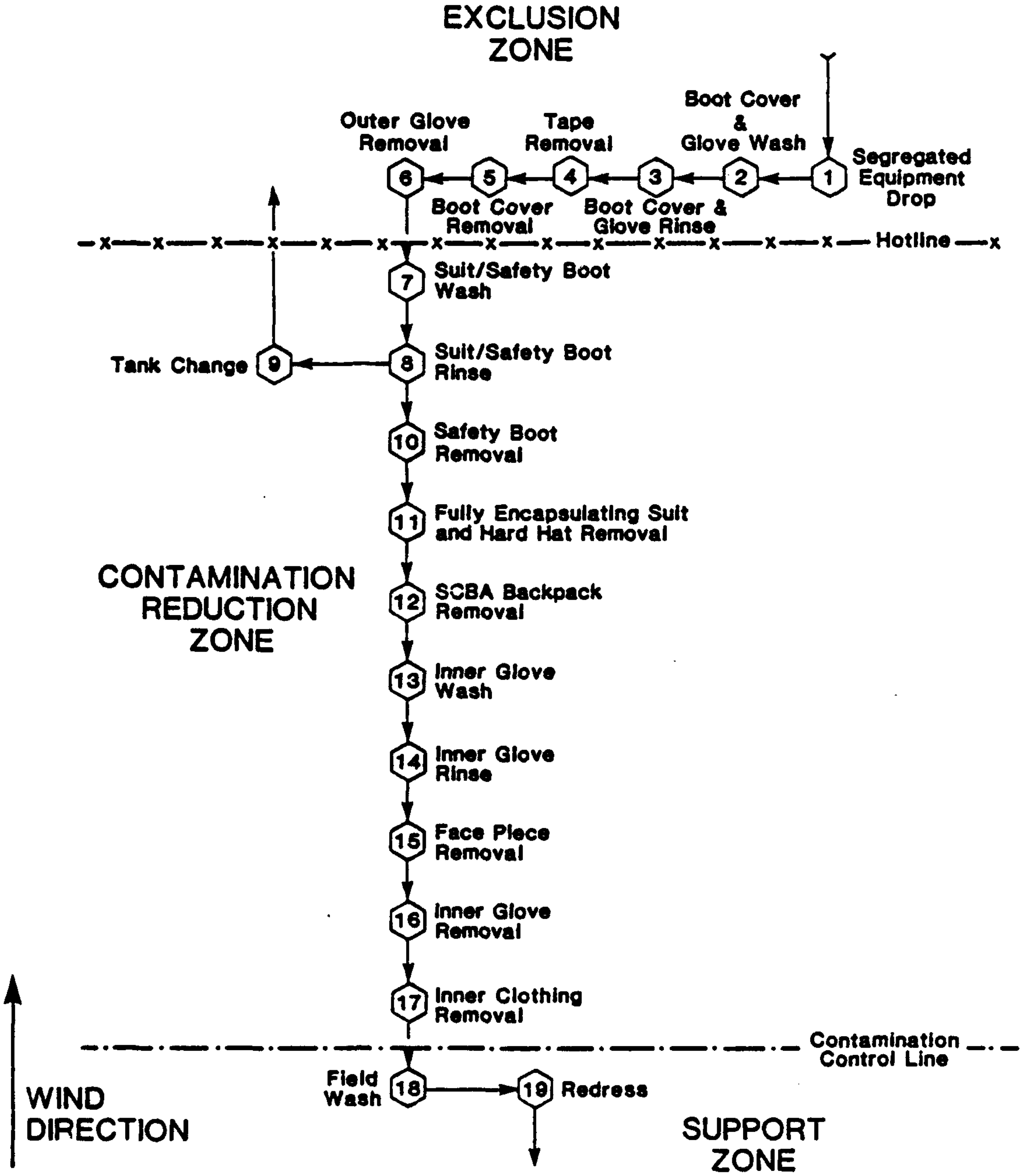
The protection selected for an investigation and the specific pieces of clothing worn in the exclusion zone dictate the items required and layout of the decontamination line. Different degrees of protection present a different situation with respect to the type of decontamination procedure required. Figures H.2, H.3, H.4, H.5, and H.6 outline the decontamination line organization for standard levels of protection.

The reason for leaving the Exclusion Zone determines the need for and extent of decontamination. Also, the time required for personnel decontamination must be determined and incorporated in the scheduling of site activities. A worker leaving the Exclusion Zone to pick up or drop off tools or instruments and immediately returning may not require full decontamination. A worker leaving to get a new air cylinder or change a respirator or canisters, however, would require some degree of decontamination. Personnel wearing self-contained breathing apparatuses must leave their work areas with sufficient air to walk to the CRC and go through decontamination. Individuals departing the CRC at breaktime, lunchtime, or the end of the day must be thoroughly decontaminated.

The type of decontamination equipment, materials, and supplies are generally selected on the basis of availabiity. The ease of equipment decontamination and disposibility are also considered. Most equipment and supplies are easily procured. Soft-bristle scrub brushes or

FIGURE H.2

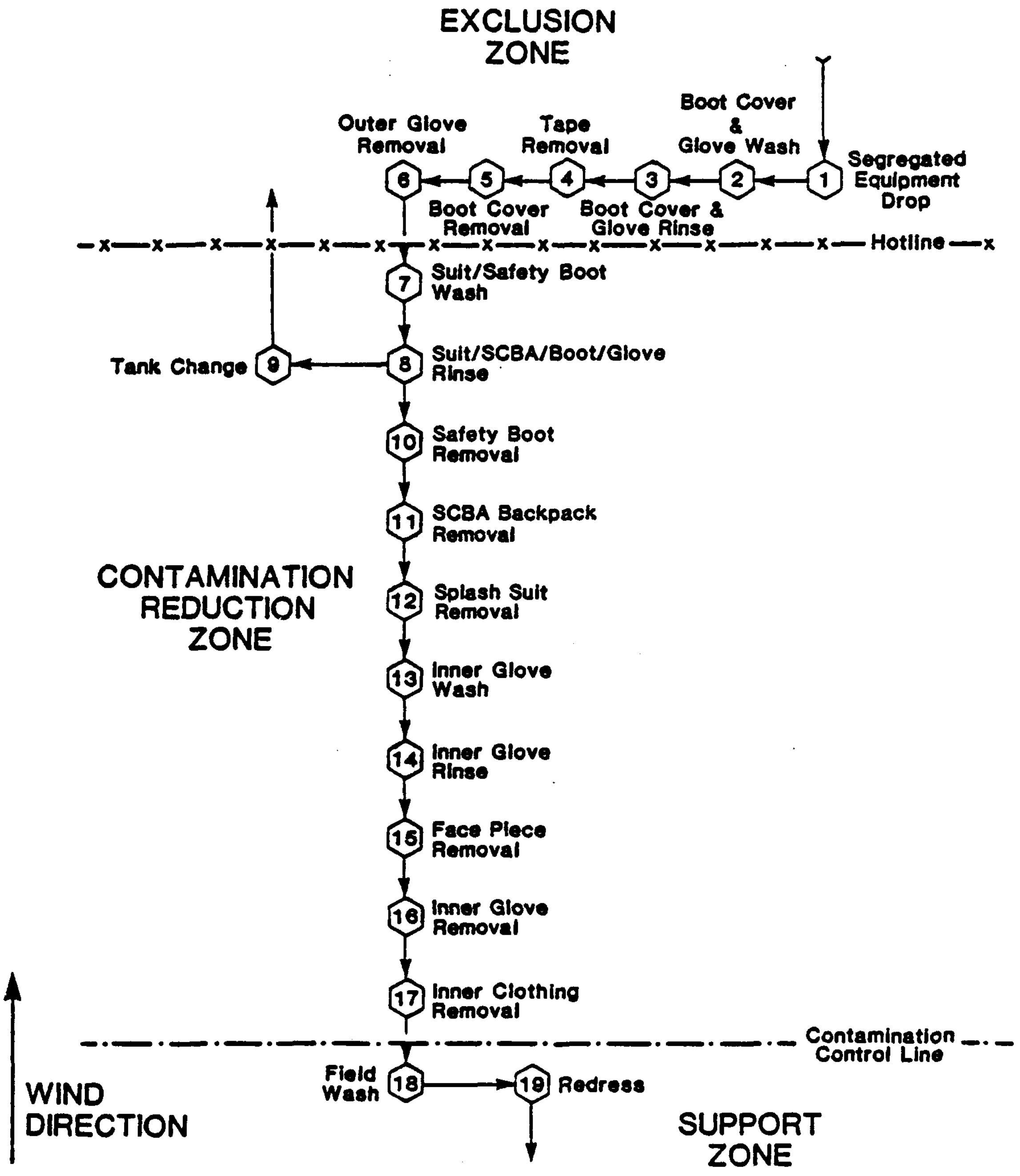
COMPLETE DECONTAMINATION LAYOUT FOR LEVEL A PROTECTION



SOURCE: USEPA 1983. Material Hazards Incidents Training Manual.

FIGURE H.3

COMPLETE DECONTAMINATION LAYOUT FOR LEVEL B PROTECTION



SOURCE: USEPA 1983. Material Hazards Incidents Training Manual.

FIGURE H.4

MINIMUM DECONTAMINATION LAYOUT FOR LEVELS A AND B PROTECTION

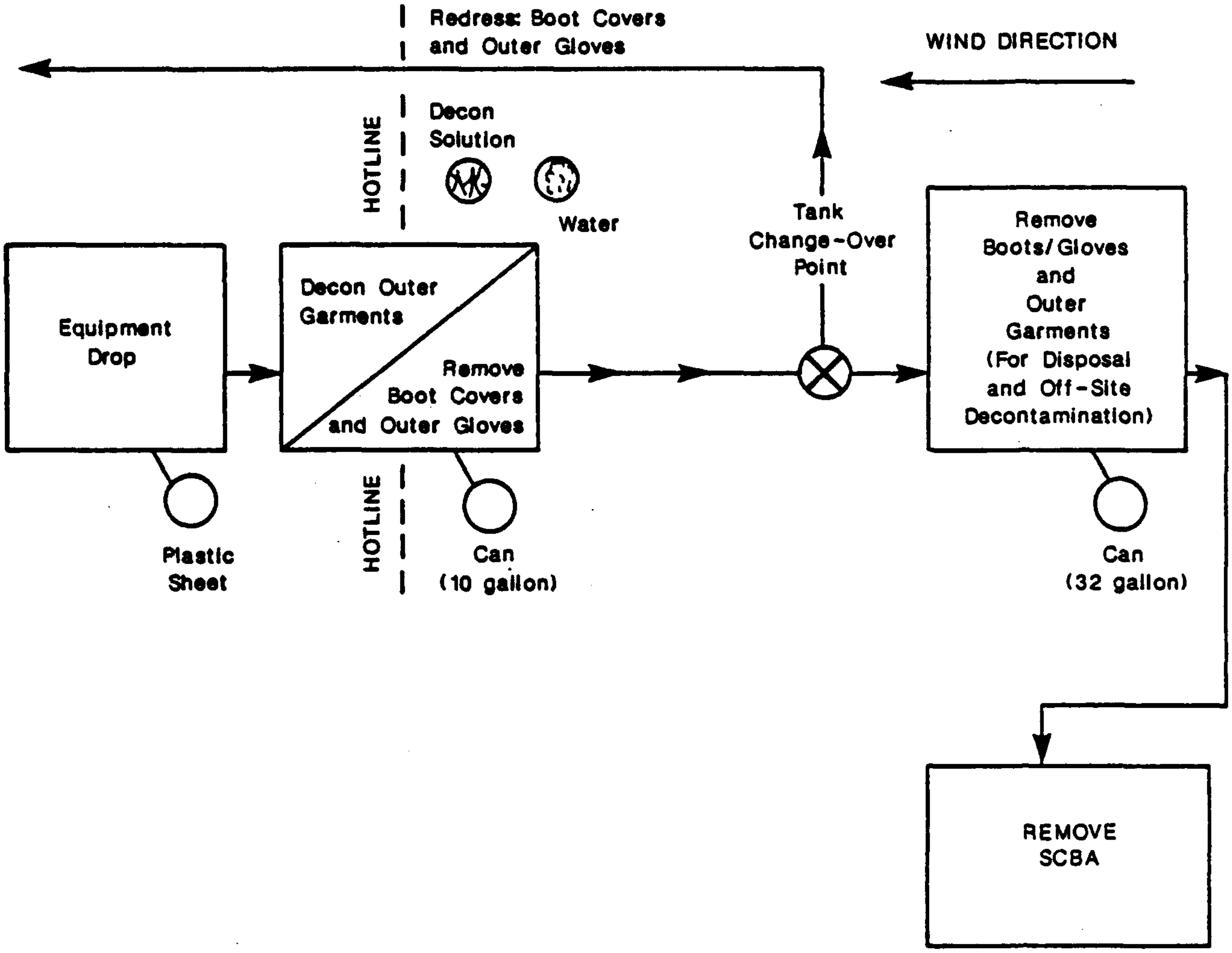
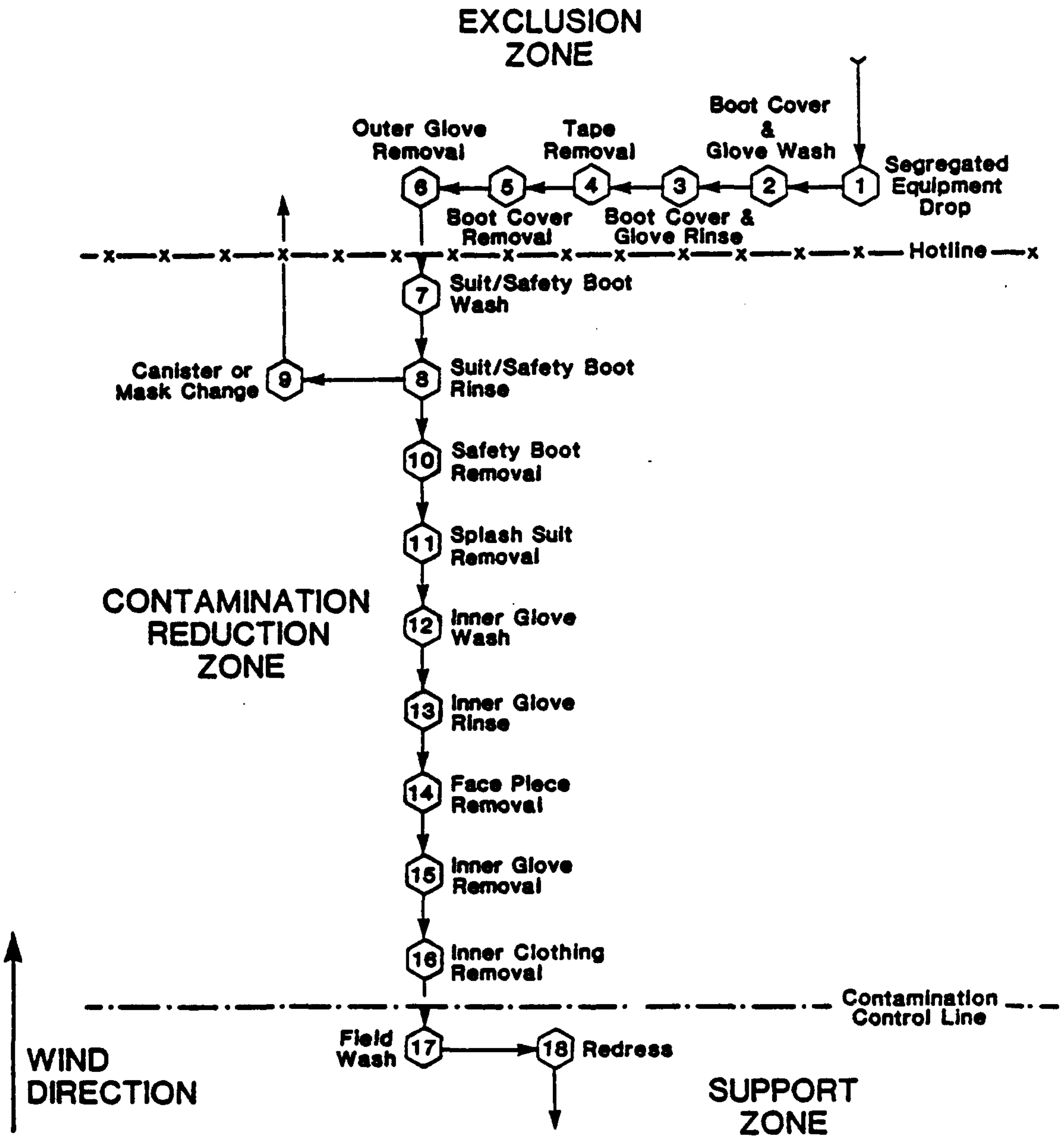


FIGURE H.5

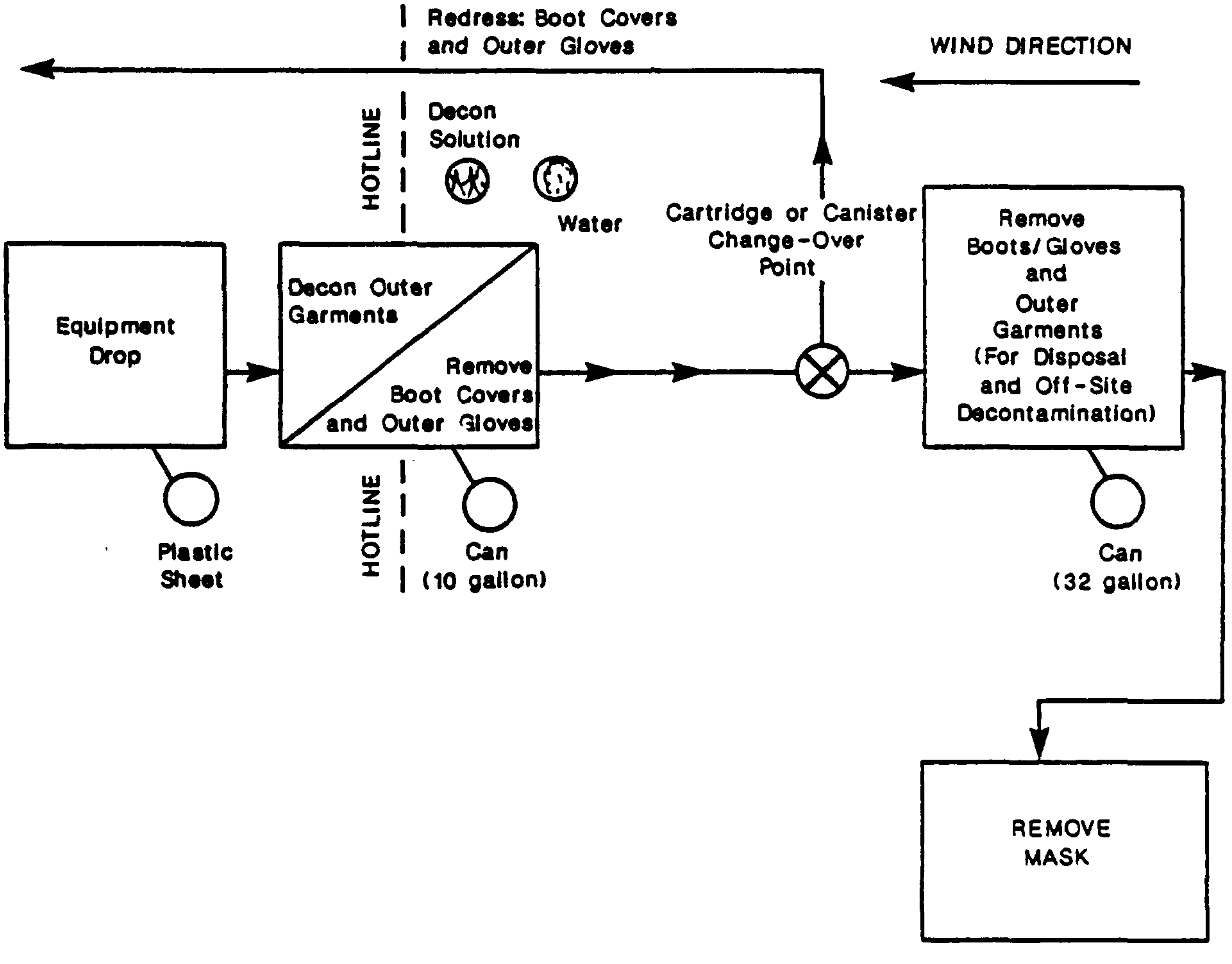
COMPLETE DECONTAMINATION LAYOUT FOR LEVEL C PROTECTION



SOURCE: USEPA 1983. Material Hazards Incidents Training Manual.

FIGURE H.6

MINIMUM DECONTAMINATION LAYOUT FOR LEVEL C PROTECTION



long-handle brushes are used to remove contaminants. Buckets of water or garden sprayers are used for rinsing. Large galvanized wash tubs, stock tanks, or children's wading pools can be used as containers for wash and rinse solutions. Large plastic garbage cans or containers lined with plastic bags are useful for the storage of contaminated clothing and equipment, and metal or plastic cans or drums are useful for the storage of contaminated liquids. Other gear includes paper or cloth towels for drying protective clothing and equipment.

Heavy equipment such as bulldozers, trucks, backhoes, and drilling equipment are difficult to decontaminate. The method generally used is to wash them with water under high pressure and scrub accessible parts with detergent/water solution, also under pressure if possible. Particular attention should be given to tires, scoops, and other components that directly contact contaminated areas. Provisions should be made to collect rinsate for treatment or disposal.

Protective equipment is usually decontaminated by scrubbing with detergent water using a soft-bristle brush followed by rinsing with copious amounts of water. While this process may not be fully effective in removing some contaminants (in some instances the contaminants may react with water), it is a relatively safe option compared to the use of a decontaminating solution. The contaminant must be identified before a decon chemical is used, and reactions of such a chemical with unidentified substances or mixtures could be especially troublesome. Some suggested decontaminating solutions are outlined in Table H.1.

Sampling devices and tools may required special cleaning depending on the specific contaminants found at the site. General decontamination procedures should typically be followed.

Extent of Decontamination Required

The project health and safety plan must be adapted to specific conditions. These conditions may require more or less personnel decontamination than was incorporated into the initial plan, depending on the following factors:

TABLE H.1

SUGGESTED DECONTAMINATING SOLUTIONS

	Decon Solution	Mixing Solutions	Uses/Remarks
A.	An aqueous solution containing a low-sudsing detergent.	Follow the mixing instructions written on the particular product label.	Generally has the widest range of use. Best choice on sites where contaminants exists.
B.	An aqueous solution containing 5% sodium carbonate (Na_2CO_3) washing soda.	To ten gallons of water, add four pounds of sodium carbonate.	Decon solution of choice for base labile compounds such as the organophosphate pesticides. Effective in neutralizing inorganic acids. Because sodium carbonate is a water softening agent, this characteristic is an aid in physical removal of contaminants.
C.	An aqueous solution containing 5% sodium bicarbonate ($NaHCO_3$) baking soda.	To ten gallon of water, add four pounds of sodium bicarbonate.	Sodium bicarbonate can be used to neutralize either base or acid contaminants. Good decon for base labile compounds.
D.	An aqueous solution containing 2% tri-sodium phosphate (Na_3PO_4) TSP/	To ten gallons of water, add two pounds of tri-sodium phosphate.	See uses/remarks for Decon Solution B above.
E.	An aqueous solution containing 10% calcium hypochlorite ($CaCl_2O_2$) HTH.	To ten gallons of water, add eight pounds of calcium hypochlorite.	Cyanide salts.
F.	Ethylenediaminetetraacetic acid (EDTA, versene, sesquesterene).	Commercial product, follow product label.	EDTA is a chelating agent and is decon of choice for heavy metal contaminants.

TABLE H.1 (Continued)

	Decon Solution	Mixing Solutions	Uses/Remarks
G.	An aqueous solution containing 3% to 5% citric, tartaric, oxalic acids, or their respective sodium salts.	To ten gallons of water, add four pounds citric, tartaric, or oxalic acid.	These compounds are chelating agents and are a decon of choice for heavy metal contaminants.

- Type of contaminant - The extent of personnel decontamination depends on the effects the contaminants have on the body. Whenever it is known or suspected that personnel can come in contact with highly toxic or skin-destructive substances, full decontamination procedures should be followed. If less hazardous materials are involved, the procedure can be downgraded.

- Amount of contamination - The amount of contamination on the protective clothing is usually determined visually. If the clothing is badly contaminated, a thorough decontamination is generally required. Gross materials remaining on the protective clothing for any extended period of time may degrade or permeate it. This likelihood increases with higher air concentrations and greater amounts of liquid contamination. Gross contamination also increases the probability of personnel contact.

- Level of protection - The level of protection and specific pieces of clothing worn determine, on a preliminary basis, the layout of the decontamination line. Each level of protection incorporates different problems in decontamination such as the harness straps and backpack assembly of the self-contained breathing apparatus. A butyl rubber apron worn over the harness makes decontamination easier. Clothing variations and different levels of protection may require adding or deleting stations in the original decontamination procedure.

- Work function - The work each person does determines the potential for contact with hazardous materials. In turn, this dictates the layout of the decontamination line. For example, observers, photographers, operators of air samplers, or others in the Exclusion Zone performing tasks that will not bring them in contact with contaminants may not need to have their garments washed and rinsed. Others in the Exclusion Zone with a potential for direct contact with the hazardous material will require a more thorough decontamination. Different decontamination lines could be set up for different job functions, or certain stations in a line could be omitted for personnel performing certain tasks.
- Location of contamination - Contamination on the upper areas of the protective clothing poses a greater risk to the worker because volatile compounds may generate a hazardous breathing concentration both for the worker and for the decontamination personnel. There is also an increased probability of contact with skin when removing clothing from the upper body.

Testing the Effectiveness of Decontamination

Decontamination methods vary in their effectiveness for removing chemicals. The decontamination method chosen for a site should be assessed at the beginning of the program and periodically throughout the program by the Project Health and Safety Officer. If contaminants are not being removed or are permeating protective clothing, the decontamination program should be changed. The following methods may be useful in assessing the effectiveness of decontamination:

- Natural light. Discolorations, stains, corrosive effects, visible dirt, or alterations in clothing fabric may indicate that contaminants have not been removed. Not all contaminants leave visible traces; many contaminants can permeate clothing and are not easily observed.
- Ultraviolet light. Certain contaminants, such as polycyclic aromatic hydrocarbons, which are common in many refined oils and solvent wastes, fluoresce and can be visually detected when

exposed to ultraviolet light. Ultraviolet light can be used to observe contamination of skin, clothing, and equipment. However, the use of ultraviolet light can increase the risk of skin cancer and eye damage; therefore, a qualified health professional should assess the benefits and risks associated with ultraviolet light before its use at a waste site.

- Photoionization detector. A photoionization detector can be used to determine the effectiveness of the decontamination procedure in removing many volatile organic compounds. However, this method would be ineffective in determining the extent of residual pesticides or metal on personal protective equipment because these substances are not volatile.
- Wipe testing. This method provides after-the-fact information on the effectivenss of decontamination. In this procedure, a dry or wet cloth, glass fiber filter paper, or swab is wiped over the surface of a contaminated object and then analyzed in a laboratory. Both the inner and outer surfaces of protective clothing should be tested. Skin may also be tested using wipe samples.

Decontamination During Medical Emergencies

The project health and safety plan should establish methods for decontaminating personnel with medical problems and injuries. It is possible that decontamination may aggrevate or cause more serious health effects. If prompt life-saving first aid and medical treatment is required, decontamination procedures should be omitted. Whenever possible, response personnel should accompany contaminated victims to the medical facility to advise on matters involving decontamination.

Physical Injury

Physical injuries can range from a sprained ankle to a compound fracture, from a minor cut to massive bleeding. Depending on the seriousness of the injury, treatment may be given at the site by trained response personnel. For more serious injuries, additional assistance may be required at the site or the victim may have to be transported to a medical facility.

When protective clothing is grossly contaminated, contaminants may be transferred to treatment personnel or the wearer and cause injuries. Unless severe medical problems have occurred simultaneously with splashes, the protective clothing should be washed off as rapidly as possible and carefully removed.

Closure of the CRC

When the Contamination Reduction Corridor (CRC) is no longer needed, it must be closed down by the operators. All disposable clothing and plastic sheeting used during the operation must be double-bagged and either contained on site or removed to an approved off-site disposal facility. Decon and rinse solutions should be discarded on site if approved by regulatory agencies or it must be removed to an approved disposal facility. Reusable rubber clothing should be dried and prepared for future use (if gross contamination had occurred, additional decontamination of these items may be required). Cloth items must be bagged and removed from the site for final cleaning. Commercial laundries or cleaning establishments that decontaminate protective clothing or equipment shall be informed of the potentially harmful effects of exposures to hazardous substances. All wash tubs, pails, containers, etc., must be thoroughly washed, rinsed, and dried before removal from the site.

APPENDIX B

COMMUNITY RELATIONS PLAN

APPENDIX B
COMMUNITY RELATIONS PLAN

The purpose of the Community Relations Plan is to outline procedures which will be followed to keep the Base Public Affairs Office apprised of the status of the Installation Restoration Program. The Plan includes addresses and phone numbers, of project participants, local media, key political figures and interested regulatory agency representatives.

Study Participants

Rickenbacker Public Affairs Office	1-614-492-3400
Public Affairs Officer:	Tom Foley
Engineering-Science:	1-216-486-9005
Project Manager	Chris Raddell
Deputy Project Manager	Bill Hughes
Martin Marietta Energy Systems	1-615-576-0531
Project Manager	Paula Pritz

REGULATORY AGENCIES

The regulatory agencies concerned with IRP activities at Rickenbacker are the Ohio Environmental Protection Agency (OEPA) and the U.S. EPA - Region V. Both agencies will be provided with opportunities to review the Draft Work Plans and Reports. The draft documents will be transmitted to the Agencies by the NGB. Review meetings with the Agencies will be held at the base prior to preparation of the final documents. The Ohio EPA will assume lead jurisdiction over the investigation.

MEDIA CONTACT

The media should be informed of the overall objectives of the program, the general scope of the IRP, and the schedule of implementation of the project prior to the start of the Site Inspection field work. Copies of the current Work Plan and most recent Final Report should be made available to the public and the media at the Public Affairs Office. Reports of the progress of the investigation will be supplied to the Public Affairs Office upon request. Inquiries from the media to ES personnel will be directed to the Public Affairs Office. ES will assist in providing information to respond to any inquiries. At no time will data which has not been reviewed and verified be released to the press.

Newspaper:

The Columbus Dispatch
34 South 3rd Street, Columbus, OH
614-461-5271

Television:

WBNS Channel 10, CBS
770 Twin Rivers Drive, Columbus, OH
614-460-3950

WCMH Channel 4, NBS
3165 Olentangy Road, Columbus, OH
614-263-5555

WTVN Channel 6, ABS
1261 Dublin Road, Columbus, OH
614-481-6397

Radio:

WCOL-AM-1230
22 South Young Street, Columbus, OH
614-221-2588

WBNS-AM-1460
175 South 3rd Street, Columbus, OH
614-460-3850

WTVN-AM-610
42 East Gay Street, Columbus, OH
614-224-1271

PUBLIC AND POLITICAL INTEREST

The Village of Lockbourne has expressed an interest in the results of the landfill investigations being conducted by the U.S. Army Corps of Engineers concurrent with this project, and would likely be equally interested in the RI/FS/RD. Copies of Work Plans and Reports will be made available to interested parties for review at the Base Public Affairs Office.

Public meetings are not anticipated. However, if the local community requests a meeting during the comment period on the Draft Work Plans or Reports, the meetings should be held to assure that the IRP addresses local concerns. ES will assist in preparation of presentation materials for public meetings and will attend public meetings at the request of the base, the NGB, or Energy Systems.

Legislators:

State Senator Eugene Watts
Ohio Senate - State House
Columbus, OH 43215
614-466-5981

State Representative John Gilmore
Ohio House - State House
Columbus, OH 43215
614-466-8130

U.S. Representative John R. Kasick
200 North High Street, Room 400
Columbus, OH 43215
614-469-7318

U.S. Senator Howard Metzenbaum
200 North High Street, Room 405
Columbus, OH 43215
614-469-6774

U.S. Senator John Glenn
200 North High Street, Room 600
Columbus, OH 43215
614-469-6697

Mayor-Elect., Lockbourne, Ohio
Hilda Lazier
38 Mechanic Street
Lockbourne, Ohio 43137

IMMEDIATE THREAT TO PUBLIC HEALTH OR THE ENVIRONMENT

If during the course of the project, data indicate that conditions exist that constitute an immediate threat to public health or the environment, the base in coordination with the NGB, Energy Systems and ES will notify the impacted parties, and concerned regulatory agencies. After these notifications, a press release will be prepared to inform the general public concerning the problem and steps which will be taken to mitigate the hazard.

Discharge to Sewer:

City of Columbus, OH
Sewerage and Drainage Division
Ms. Mary Jakeway
614-222-7175

Discharge to Surface Streams:

OEPA
Larry Korecko
614-481-2055

APPENDIX C

RESPONSE TO OHIO EPA COMMENTS

APPENDIX C

RESPONSE TO COMMENTS OF OHIO EPA ON "DRAFT FINAL" SI/RI/FS/RD WORK PLAN FOR RICKENBACKER AIR NATIONAL GUARD BASE, COLUMBUS, OHIO

The comments submitted by Ms. Deborah J. Berger of Ohio EPA, on 20 April 1988, have been sequentially numbered and are addressed in the following discussion in ascending order. A copy of the numbered comments is attached for reference.

COMMENT NUMBER	RESPONSE
1.	The text has been corrected.
2.	The text has been corrected.
3.	The revised figure includes an extended spill area outline which intersects the fuel line.
4.	There are only four 50,000 gallon tanks at Pumping Station #5, the text has been changed accordingly.
5.	As described in the text, the spill was a tank overfill. The outline on revised Figure 1.7 surrounds the area of interest for this site.
6.	The revised text details the history of the leaking tanks.
7.	The revised text explains that the two new tanks (as shown) are located in the tank pit which contained the three old tanks.
8.	The text has been corrected.
9.	Revised Figure 1.12 includes the ditch.
10.	Taxiway F is labeled in the revised figure.
11.	UV has been changed to Underground Vault and the triangles have been identified as electric transformers in the revised Table 1.2
12.	The text has been corrected.
13.	The legend designations for the dashed lines has been changed to "Diked Area".
14.	Better reproduction quality will be used for the final Work Plan.
15.	Figure number in the text has been corrected.
16.	The slop oil tank has been labeled on the revised figure.

17. The underground storage tank investigation is incorporated into the IRP as Site 28.

18. Comment noted and considered.

19. The text has been corrected.

20. The sentence has been broken into two sentences.

21. Geophysical surveys may be used more extensively in the Remedial Investigation when determination of pathways and extent of contamination is of greater interest.

22. As stated in the first full sentence of this page, "Detailed descriptions of investigation and sampling techniques are included in Sections 5 and 6..."

23. The upper aquifer will be determined in the field by the drill-site geologist as the shallowest saturated sediments with physical properties conducive to transmitting water.

24. Evaluation of the lower aquifer will be done as part of the RI if contamination is detected in the shallow aquifer.

25. See Section 6 - SOIL SAMPLING.

26. The text has been corrected.

27. Descriptions of compositing rationale and methods are included in Sections 5 and 6.

28. Volatilization is assumed for surface samples. The Plan has been changed to include volatile analysis of hand-boring samples.

29. The revised figure clearly labels the contents of the underground storage tanks.

30. Sampling protocol is detailed in Sections 5 and 6.

31. The drainage ditch is included in the revised figure.

32. Ten soil-gas survey points will be taken.

33. The text has been corrected.

34. The text has been changed to "A twenty point soil-gas..."

35. A total of ten hand borings will be collected from around the end of the building and near the site of the burned building.

36. Table 3.1 has been changed to indicate four ditch bottom sediment samples.

37. Table 3.1 has been changed to indicate five sludge samples.

38. Comment has been noted and considered.

39. The revised text explains that the two additional samples will be located based on field observation of possible point sources.

40. The legend has been corrected.

41. The numbering has been corrected.

42. No soil-gas survey will be conducted at this site.

43. The recommended location was chosen because it is centrally located in the Base well field, and is on Base property (unlike a location on the other side of "C" Avenue). If results of soil and water analyses do not meet OEPA requirements for background, a new background well location will be designated.

44. To sample three distinct depth intervals (0 1-1/3 ft, 1-1/3 - 2-2/3 ft and 2-2/3 - 4 ft).

45. The text has been corrected.

46. A 4.25" ID hollow-stem auger creates a 6-1/2 to 7-inch boring, allowing 4 to 4-1/2 inches for filter pack and sealant installation.

47. The text has been corrected.

48. The 17 initial monitoring well borings will be continuously sampled. Subsequent wells will be sampled at five foot intervals or at stratigraphic changes.

49. Mud-rotary techniques will not be used. If drilling conditions warrant rotary methods, air rotary will be utilized.

50. A mix of 94 pounds cement, 4 pounds bentonite plus water will be used (4.2 percent bentonite).

51. Five foot sampling intervals will be used while making 15' borings.

52. PVC casing and screen is an appropriate well construction material for short-term monitoring of water contaminated with organic compounds and is probably appropriate if total volatile concentrations are less than 1 ppm. The SI is designed to determine whether or not contamination exists and not as a long-term monitoring program, consequently PVC well construction is appropriate.

53. A steel (not stainless steel) outer casing will be used to isolate the upper aquifer to prevent contamination of the second aquifer from the shallow aquifer before installation of the well sealant. The upper aquifer is defined in the response for Comment #23. If no underlying clay layer is identified, then a distinct second aquifer will not exist and the well will be installed as a deeper penetration of the shallow aquifer with no outer casing.

54. The concrete pad will extend below the frost line (approximately 36-inches).

55. All wells will be fitted with a water-tight cap with a 1/8-inch vent hole.

56. Airlifting will not be used as a development technique.

57. A ±10 percent variation will be acceptable.

58. Comment will be considered.

59. The revised text includes a more detailed discussion of soil-gas survey design.

60. These terms are of common usage in hydrogeologic literature.

61. The comment is noted.

62. Falling head tests must be adjusted to account for wetting of the previously unsaturated filter pack (if any exists) above the water table.

63. Yes, pump test data will be used to calculate hydraulic conductivity.

64. See response to Comment #44.

65. Laboratory permeability tests are not very reliable and are not within the scope of an SI.

66. See response to Comment #48.

67. The comment has been noted and considered.

68. The comment has been noted and considered.

69. A minimum of one Total Well Water Volume (TWWV) will be purged and conductivity, pH and temperature monitored for stability (±10 percent). See text for further discussion on this subject.

70. A bladder pump with Teflon® and stainless steel wetted parts may be used for purging, developing and sampling. A PVC positive displacement hand pump may be used for well developing.

71. See response to Comment #57.

72. The text has been corrected.

73. Temperature, pH and conductivity will be measured before and after sample collection.

74. New bailer line will be used for each well sampling event. Dedicated bailers are not appropriate when long-term monitoring is not being proposed.

75. The comments have been noted and considered.

RESPONSE TO COMMENTS ON HEALTH AND SAFETY PLAN

Comments #1, #2 and #8 through #21 have been addressed by changing grammatical or spelling errors in the text. Other, more technical comments are addressed individually below.

COMMENT NUMBER	RESPONSE
3.	Evacuation plan for field team members will be established in the field for each work site.
4.	The Base emergency response plan will take effect.
5.	The location of the nearest telephone will be determined before work is begun at a site. Each field crew will be equipped with a radio set on the Base emergency frequency.
6.	If atmospheric chemical concentrations increase, the level of respiratory protection utilized will be re-evaluated based on limits outlined in Chapter 5 and guidelines in Attachment E.
7.	If screening methods indicate hazardous levels of containments (Chapter 5), the level of personnel protection will be re-evaluated based on Attachments E, F and G.

File 2-10-27

26 APR REC'D

OhioEPA

State of Ohio Environmental Protection Agency

Central District Office
P.O. Box 1049, 1800 WaterMark Dr.
Columbus, Ohio 43266-0149

Toward A Cleaner Environment
15 Year Anniversary
1972 - 1987

Richard F. Celeste
Governor

April 20, 1988

RE: RICKENBACKER ANGB

Lt. Col. Michael C. Washeleski
Chief, Bioenvironmental Engineering
ANGSC/SGB (Building 3500)
Andrews Air Force Base
Maryland 20331-6008

Dear Lt. Col. Washeleski:

Enclosed are Ohio EPA's written comments on the "Draft Final" SI/RI Work Plan for Rickenbacker Air National Guard Base (ANGB), Columbus, Ohio.

Although I am unable to, Mr. Lundy Adelsberger and Ms. Pam Doerner plan to attend the Work Plan review meeting at Rickenbacker scheduled for May 4, 1988, at 9:00. They will be prepared to discuss Ohio EPA's written comments at this meeting.

If you have any question, please contact me at (614) 644-2055.

Sincerely,

Deborah Berger

Deborah J. Berger
Division of Solid & Hazardous Waste Management
Central District Office

DJB/sc

Enclosure

cc: Alan Friedstrom, Rickenbacker ANGB

0006m/3

COMMENTS ON THE SI/RI/FS/RD WORK PLAN DRAFT FOR RICKENBACKER ANGB

COLUMBUS, OHIO

No.

1. Page 1-5, Section Soils, Paragraph 1, Sentence 3: The "%" sign should be written out as "percent".

2. Page 1-5, Section Groundwater, Paragraph 1, Sentence 2: There should be an apostrophe after the s in the word "drillers". It is possessive.

3. Page 1-14, Figure 1.6, Site 3 Pumping Station No. 4: This spill is allegedly from a ruptured pipeline, however there is no fuel pipeline in the vicinity of the fuel spill area shown on Figure 1.6. From which fuel pipeline did this spill originate?

4. Page 1-16, Figure 1.7, Site 4 Pumping Station No. 5: According to the description for Site 4 (Page 1-15) there are eight 50,000 gallon underground tanks at this pumping station, however Figure 1.7 shows only four 50,000 gallon underground tanks. Where are the other four 50,000 gallon underground tanks located?

5. This figure also does not show where the spill occurred in relation to the pumping station.

6. Page 1-18, Figure 1.9, Site 6 Base Filling Station: From which tank did approximately 100 gallons of unleaded fuel leak in 1985? Where did the line connection rupture? Which of the three storage tanks was determined to be leaking by ANGB personnel?

7. According to the description for Site 6 (Page 1-15) there were three tanks at this site prior to 1987, however Figure 1.9 shows only two tanks. Where is the third tank located? Does this figure show the locations of the new tanks rather than those of the removed tanks? If so, a figure showing the locations of the removed tanks will be needed.

8. Page 1-20, Section Site 12: Old Drum Storage Area, Paragraph 2, Sentence 4: There is a typo in this sentence, "onto" should read "into".

9. Page 1-22, Figure 1.12, Site 12 Old Drum Storage Area: Where is the drainage ditch that is adjacent to the paved drum storage area?

10. Page 1-23, Figure 1.13, Site 14 and 16 KC-135 Crash Site and Northeast Fuel Dump Pit: According to the description for Site 14 (Page 1-20) the crash took placed on Taxiway F, however this taxiway is not shown on Figure 1.13. Taxiway F should be labeled as such on this figure.

11. Page 1-26, Figure 1.15, Sites 19 and 22 North Coal Pile and Lube Oil Drum Storage: What do the initials UV stand for? What do the triangles stand for? Figure 1.15 needs a legend to identify the symbols that are not addressed by table 1.2 (Page 1-10).

12. Page 1-29, Section Site 23: Fire Training Area, Paragraph 2, Sentence 2: The word "area" should be plural.

13. Page 1-30, Figure 1.18, Site 23 Fire Training Area: Do the dashed lines of the fire rings represent the locations of the earth dikes described on Page 1-29? If so, they should be labeled as such. If not, the locations of these dikes should be shown on this figure.

14. Page 1-32, Figure 1.20, Sites 25 and 27 Drainage Ditch Network and Ditch Near Landfill Gate: Figure 1-20 is of poor quality. In some cases it is difficult to distinguish the open drainage ditches from roads and streams. Very little detail can be obtained from this figure.

15. Page 1-33, Section Site 26: Electrical Transformer Storage: The site is shown on Figure 1.10 and not Figure 1.9.

16. Page 1-38, Figure 1.24, Site 28d Abandoned UST's Behind Base Filling Station: According to the description for Site 28d (Page 1-37) there are three tanks, however only two are shown on Figure 1.24. Where is the third tank located? Which tanks are the abandoned gasoline tanks and which is the abandoned slop oil tank?

17. Page 2-1, Section TASK 1 - PREPARE PROJECT WORK PLAN, Paragraph 1, Sentence 2: This document does not appear to have a plan for implementation of an Abandoned Underground Storage Tank Investigation.

18. Page 2-2, Section Develop Detailed Alternatives, Bullets 1 and 4: In both cases, it would make better sense to place the word "incorporated" before the noun rather than after ("incorporated technologies" and "incorporated management methods").

19. Page 2-3, Section Evaluate Detailed Alternatives, Bullet 4: To be consistent with the other listed criteria, "Assessment" should not be capitalized.

20. Page 2-5, Section Technical Support During Remediation, Paragraph 1, Sentence 3: This is a run-on sentence, its meaning would be much clearer if it was broken into two separate sentences.

21. Page 3-2, First Full Paragraph, Sentence 1: Surface geophysical surveys (resistivity, electromagnetic conductivity, seismic reflection, etc.) should also be considered. Geophysical surveys can yield valuable information on the depth to the confining unit, the types of unconsolidated material present, the presence of fracture zones or structural discontinuities, and the continuity of formations between bore holes. This type of information is necessary to identify the potential pathways of contamination and their affects on the environment.

22. Page 3-2, First Full Paragraph, Sentence 4: At what depths will these samples be collected?

23. Page 3-2, Second Full Paragraph, Sentence 2: How will the "upper aquifer" be defined?

24. Why will no wells be installed in the lower aquifer at this time? Wells should be installed in the lower aquifer at this stage to further characterize the geology, determine the direction of groundwater flow in the lower aquifer, and detect any contaminants in the lower aquifer.

25. Page 3-2, Second Full Paragraph, Sentence 4: How will the sample for chemical analysis be chosen?

26. Page 3-4, Section Site 1 - Hazardous Waste Storage Area, Paragraph 1, Sentence 3: The words "Pesticides" and "Herbicides" do not need to be capitalized.

27. Page 3-5, Table 3.1, SUMMARY OF SITE INSPECTION PROGRAM: What does "composite by 2's" mean? Why will it only be done to samples from Sites 1, 12, 17 and 24?

28. Page 3-12, Section Site 1 - Hazardous Waste Storage Area, Paragraph 1 (Continued from Page 3-4), Sentence 7: Why has it been assumed that volatilization has probably occurred at these sampling depths?

29. Page 3-12, First Full Paragraph, Sentence 1: Which of these tanks contained hazardous waste?

30. Page 3-12, First Full Paragraph, Sentence 5: From what depths will these "selected soil samples" be collected?

31. Page 3-13, Figure 3.3, Site 2 Bulk Storage Tank Farm: The drainage ditch on the south side of the cell (Page 3-12) is not shown on Figure 3.3.

32. Page 3-15, Section Site 6 - Underground Storage Tanks at the Base Filling Station, Paragraph 1, Sentence 2: The number of soil-gas survey points to be conducted here does not agree with the number given in Table 3.1 for this site.

33. Page 3-20, Section Site 12 - Old Drum Storage Area, Paragraph 2, Sentence 2: The word "Halogenated" does not need to be capitalized.

34. Page 3-24, Section Sites 15 and 16 - Fuel Dump Pits, Paragraph 1, Sentence 2: The number of soil-gas survey points to be conducted does not agree with the number given in Table 3.1 for these two sites.

35. Page 3-25, Figure 3.12, Site 17 Old Entomology Laboratory: According to the description of Site 17 (Page 3-24) eight hand borings will be collected around the exterior of the end of the building where the laboratory was located, however only seven hand borings are shown on Figure 3.12. Where will the eighth boring be located?

36. Pages 3-26 and 3-27, Figures 3.13 and 3.14, Sites 19 and 22 North Coal Pile and Lube Oil Drum Storage and Site 20 South Coal Pile: Table 3.1 indicates that three ditch bottom samples will be collected from Sites 19 and 20, however Figures 3.13 and 3.14 show that a combined total of four samples will be collected.

37. Page 3-31, Figure 3.17, Site 24 Sewage Treatment Plant Sludge Beds: The number of sludge samples given in Table 3.1 does not agree with the number given in Figure 3.17. According to Figure 3.17 there are ten sludge beds. If each sample is composited with a sample from the adjacent beds, there will be five samples rather than the four given in Table 3.1.

38. Page 3-32, Section Site 25 - Storm Drainage Ditch System, Paragraph 1, Sentence 1: The word "and" is unnecessary and should be removed. A comma should be placed between "extensive" and "although".

39. Page 3-33, Figure 3.18, Sites 25 and 27 Drainage Ditch Network and Ditch Near Landfill Gate: According to the description for Site 25 (Page 3-32) thirty ditch bottom sediment samples will be collected, however only 28 ditch bottom sediment sample locations are shown on Figure 3.18. Where will the other two samples be located?

40. There is a typo in the legend, the word "seperator" should read "separator".

41. Pages 3-34 and 3-38, Sections Site 28c - Abandoned UST's at Base Filling Station and Site 28d - Abandoned Diesel Fuel Tanks Near Site 1: The numbers for these two sites are reversed. Site 28c is the location of the abandoned diesel fuel tanks and Site 28d is the location of the abandoned UST's at the Base filling station.

42. Page 3-38, Section Site 28d - Abandoned Diesel Fuel tanks Near Site 1: There is no mention of a soil-gas survey for this site. However Table 3.1 indicates that a five point soil-gas survey will be conducted at this site.

43. Page 3-38, Section Additional Hydrogeologic Control, Paragraph 2, Sentence 1: Soil and groundwater samples collected from this location to establish "background conditions" will not be acceptable to the Ohio EPA due to the railroad line. In order to establish background conditions for the Base's soil and groundwater from the shallow and lower aquifer, this well cluster should be installed hydrologically upgradient from the site and as far as possible from any potential sources of contamination.

44. Page 5-1, Section HAND-BORING AND SURFACE SOIL SAMPLING, Paragraph 2, Sentence 1: Why will the soil samples be divided into three equal segments?

45. Page 5-1, Paragraph 5: The sentence heading "DRILLING PROGRAM" should be in bold type.

46. Page 5-2, Section Drilling Procedures, Paragraph 1, Sentence 1: According to the RCRA Ground-Water Monitoring Technical Enforcement Guidance Document, U.S. EPA, 1986, the differential between the inner diameter of the auger and the outer diameter of the well casing should ideally be at least three to five inches to permit effective placement of filter pack and annulant sealant. If the well casing has an inner diameter of two inches, a hollow-stem auger with an inside diameter of six inches or six and one-quarter inches would be better than one with an inside diameter of four and one-quarter inches.

47. Page 5-2, Section Drilling Procedures, Paragraph 1, Sentence 2: The word "installed" does not belong in this sentence.

48. Because little is known about the geology or the presence of contaminants in the soils of this site, continuous sampling or a smaller sampling interval (for example, 2.5 feet) would provide more information than a 5 feet sampling interval.

49. Page 5-2, Section Drilling Procedures, Paragraph 1, Sentence 3: Why will mud-rotary drilling techniques replace hollow-stem auger drilling techniques at a depth of 60 feet? In unconsolidated material, hollow-stem auger drilling can be used to a depth of about 150 feet. Furthermore, the use of mud rotary drilling techniques to install monitor wells is not recommended. Mud rotary can adversely affect the assessment of aquifer characteristics, the chemistry of groundwater samples, and the operation of the well itself.

50. Page 5-2, Section Drilling Procedures, Paragraph 2, Sentence 1: According to the RCRA Ground-Water Monitoring Technical Enforcement Guidance Document, the addition of bentonite to the cement mixture should generally be in the amount of 2 to 5 percent by weight of cement content.

51. Page 5-2, Section Drilling Procedures, Paragraph 3, Sentence 2: See comment for Page 5-2, Section Drilling Procedures, Paragraph 1, Sentence 2.

52. Page 5-2, Section Monitoring Well Construction, Completion, and Development, Paragraph 1, Sentence 1: PVC may be used if only trace metals or nonvolatile organics are to be monitored for. Stainless steel (i.e. 304, 316, or 2205 stainless steel) should be used when volatile organics are to be monitored for. Because of the potential existence of aromatic volatile organics in the soil and groundwater at the site, stainless steel casing and screen should be used rather than PVC.

53. Page 5-4, Paragraph 1, Sentence 2: Why is a separate stainless steel casing being used to isolate the upper aquifer? How will the upper aquifer be defined? Where will the casing be installed if there is no underlying clay layer?

54. Page 5-4, Paragraph 2, Sentence 2: Is six inches below the frost line? The concrete pad should extend below the frost line to protect the well from damage due to frost heaving.

55. Page 5-4, Paragraph 2, Sentence 5: In the wells installed below grade, what precautions will be taken to prevent well contamination should the area be flooded or under standing water?

56. Page 5-4, Paragraph 3, Sentence 1: Airlifting should not be used to develop monitoring wells. Air development techniques may expose field crews to hazardous constituents when contaminated groundwater is present. The technique may also cause chemical reactions with contaminants present in the groundwater, especially volatile organic compounds. The injected air must also be filtered to prevent contamination of the well with oil and other lubricants present in the compressor and airlines.

57. What variations in pH, temperature, and conductivity will be acceptable for demonstrating stabilization?

58. Page 5-4, Section <u>Pumping-Well Drilling and Installation</u>, Paragraph 2, Sentence 1: Any "other well drilling techniques" should comply with the <u>RCRA Ground-Water Monitoring Technical Enforcement Guidance Document</u>, U.S. EPA, 1986.

59. Page 5-7, Section <u>SOIL-GAS SURVEYING</u>, Paragraph 1, Sentence 3: Initially, all of the soil-gas samples should be collected from the same depth. The samples can then be directly compared to one another.

60. Page 5-7, Section <u>AQUIFER MONITORING AND TESTING</u>, Paragraph 2, Sentence 1: What is a Falling-Head test? What is a Rising-Head test?

61. It should be remembered that any information obtained from a single well (slug) test is limited in scope to the geologic area directly adjacent to the screen. It can not be used to determine an aquifer's characteristics over a large area. On the other hand, multiple well (pumping) tests can be used to characterize a greater proportion of the subsurface and provide more details about an aquifer's characteristics over a large area.

62. Page 5-7, Section <u>AQUIFER MONITORING AND TESTING</u>, Paragraph 3, Sentence 2: Why is the data from a Falling-Head test less reliable than that from a Rising-Head test?

63. Page 5-7, Section <u>AQUIFER MONITORING AND TESTING</u>, Paragraph 4: Will the data collected during the pumping tests also be used to calculate hydraulic conductivity?

64. Page 6-1, Section <u>SOIL SAMPLING</u>, Paragraph 1, Sentence 2: See comment for Page 5-1, Section <u>HAND-BORING AND SURFACE SOIL SAMPLING</u>, Paragraph 2, Sentence 1.

65. Page 6-1, Section <u>SOIL SAMPLING</u>, Paragraph 2: The collection of Shelby tube samples should also be considered. The undisturbed samples obtained using Shelby tubes can be used to conduct lab tests for permeability. Permeability tests are important in determining how fast contaminants may move through the unconsolidated layers at the site.

66. Page 6-1, Section <u>SOIL SAMPLING</u>, Paragraph 2, Sentence 1: See comment for Page 5-2, Section <u>Drilling Procedures</u>, Paragraph 1, Sentence 2.

67. Page 6-1, Section <u>SOIL SAMPLING</u>, Paragraph 2, Sentence 4: This is a run-on sentence, its meaning would be much clearer if it was divided into at least two separate sentences.

68. Page 6-3, Paragraph 1, Sentence 3: In order to avoid confusion (here and throughout the text), a hyphen should be placed between "organic" and "free" and read as "organic-free".

69. Page 6-3, Section <u>GROUNDWATER SAMPLING</u>, Paragraph 1, Sentence 1: How many well volumes will be removed from the high yield wells? It is recommended that at least three well volumes be removed prior to sampling.

70. Identify the type of pump (and its construction material) that may be used.

71. What variations in pH, temperature, and conductivity will be considered acceptable for demonstrating stabilization?

72. Page 6-3, Section <u>GROUNDWATER SAMPLING</u>, Paragraph 1, Sentence 3: The word "Bailer" does not need to be capitalized.

73. Page 6-3, Section <u>GROUNDWATER SAMPLING</u>, Paragraph 1, Sentence 5: It is not necessary to measure the pH, temperature, and conductivity after the collection of the volatile samples. PH, temperature, and conductivity should be measured before and after sample collection as a check on the stability of the water sampled over time.

74. Page 6-4, First Full Paragraph, Sentence 1: Does decontamination include the bailer cable? Dedicated bailers are recommended for each well.

75. Page 7-8, Section <u>Data Reduction and Validation</u>, Paragraph 4, Sentence 3: The word "Analysis" probably does not need to be capitalized. The word "and" should be placed after the last comma in the sentence and before the phrase "reextraction/redigestion of the affected samples and QC samples".

COMMENTS ON THE HEALTH AND SAFETY PLAN FOR RICKENBACKER ANGB

No.

1 Page 4-1, Paragraph 2, Sentence 2: All unfamiliar activities should be rehearsed before work at the site begins.

2 Page 4-2, First Bullet (Continued from Page 4-1), Sentence 4: The "%" sign should be written out as "percent".

3 Page 6-2, Section Evacuation Procedure: To further facilitate emergency evacuations, clearly audible warning signals should be used, well-marked emergency exists located throughout the site, and internal and external communication plans developed.

4 What procedures have been established to evacuate residents who live near the site?

5 Page 6-3, Section EMERGENCY CONTACTS, Paragraph 1, Sentence 3: The locations of the nearest phones should also be posted.

6 Page 6-6, Section Groundwater Sampling, Paragraph 1, Sentence 2: What procedures will be implemented should the atmospheric chemical conditions change from the initial air characterization during groundwater sampling.

7 Page 8-1, Paragraph 1: What procedures will be implemented should hazardous substances be detected in the air during work at the site?

8 Page 8-2, Table 8.2, Section "1. Battery Check", Sentence 2: There are two typos in this sentence, there should be space between "be" and "in" and the word "green" is misspelled.

9 Page 8-2, Table 8.2, Section "3. 0-20 or 0-200 range", Sentence 5: Which step is "step c"? Which step is "step a"?

10 Page 8-3, Table 8.3, Paragraph 1: The phrase "for response for known gas sample" should read "for a response from a known gas sample".

11 Page 10-1, Paragraph 4, Sentence 1: The meaning of this sentence is unclear.

12 Page 11-2, Section 5. FIRE PROTECTION EQUIPMENT/SYSTEMS, Subsection c: The word "streams" should be singular.

13 Page 11-2, Section 5. FIRE PROTECTION EQUIPMENT/SYSTEMS, Subsection e: The phrase "fire hydrant water main control valve" should read either "the fire hydrant water main control valve" or "fire hydrant water main control valves". A comma should also follow the word valve (or valves) of this phrase.

14 Page 11-3, Section 10, Subsection 5, Sentence 4: The word "area" should be plural.

15 Page C-3, Section Organic Vapor/Gases, Paragraph 2, Sentence 1: The word "detection" should read "detector".

16 Page C-6: The margins for the headings "Radiation Survey Instrument" and "Limitations" are reversed. "Radiation Survey Instrument" should not be indented, whereas "Limitations" should be indented.

17 Page D-1, Section GUIDELINE, Paragraph 1, Sentence 3: There is a typo in this sentence, "cotaminated" should read "contaminated".

18 Page D-5, Section Support Zone, Paragraph 1, Sentence 1: The phrase "is considered noncontaminated or clean area" should read "is considered a noncontaminated or clean area".

19 Page D-5, Section Support Zone, Bullet 2, Sentence 2: The word "along" should read "alone".

20 Page D-8, Second Full Paragraph, Sentence 2: The word "objectives" should probably read "objects".

21 Page H-15, First Full Bullet, Sentence 1: The word "compound" should be plural.

0006m/11-12

APPENDIX D

RESPONSE TO USEPA REGION 5 COMMENTS

APPENDIX D
RESPONSE TO U.S. EPA REGION 5 COMMENTS ON "DRAFT FINAL" SI/RI/FS/RD WORK PLAN FOR RICKENBACKER AIR NATIONAL GUARD BASE, COLUMBUS, OHIO

The following is a response to comments submitted by the U.S. EPA Region 5 on 17 May 1988, on the Draft Final Site Inspection/Remedial Investigation/Feasibility Study/Remedial Design Work Plan for Rickenbacker Air National Guard Base. A copy of the comments with paragraph numbers annotated is included for reference.

In general, implementation of the scope of work changes suggested by the EPA reviewer would go beyond the objectives of a Site Inspection, i.e., to establish whether or not contamination exists.

Paragraph 2

Water sampling at each ditch bottom sampling point is necessary to establish whether or not surface water contamination exists in a given ditch segment.

Paragraph 3

Additional sampling emphasis on known spill locations is addressed by the two ditch sampling locations for Site 27 (Table 3.1, Page 3-9) and the two excess ditch sampling points which will be determined in the field based on observed signs of contamination. The 1982 "milky white liquid" contamination was a one time event. Unauthorized dumping was suspected as the source of the contamination.

Analysis of water samples for total suspended solids would not give a reliable indication of total sediment load without correlation with ditch discharge information. A detailed evaluation of ditch hydrology (including sediment load) may be included in the RI if contamination is detected in the ditch sediments.

Paragraph 4

Sampling of each confluence within the drainage system is adequate to identify ditch segments which contain contamination. However, ditch bottom sample points will be located in depositional areas of the confluences as suggested. Further definition of extent of contamination along ditch segments or in receiving streams is more appropriately postponed until the Remedial Investigation when extent of contamination is to be determined.

Paragraph 5

The boring for the initial well installation at Site 23 is proposed for the topograhically low side of the pavement. Subsequent wells and borings will be placed based on soil-gas survey results or, lacking definitive results, in topographic lows.

We feel that the general sampling program for Site 25 will identify potential contamination from Site 24 in the drainage ditches. Locations of ditch-bank seeps and permanently flooded portions of the ditch will be noted as possible ground water/surface water interfaces.

The scope of Site 28 (a, b, c and d) investigations has been changed to include magnetometer survey location of tanks and preparation of plans and specifications for removal of the tanks including appropriate sampling of surrounding sediments.

Paragraph 6

Surface water samples will be collected from mid-depth at each sampling point with water depth less than 3 feet unless a floating hydrocarbon sheen or sinking immiscible layer is detected. The field notes will reflect sampling depth and rationale for selection of depth.

Paragraph 7

Soil-gas probe locations will be determined in the field based on a number of factors including, surface soil/pavement conditions and proximity to utility lines with the objective of defining contaminant plumes. At least one soil-gas profile (samples from 5 foot intervals to water or 15', whichever is shallower) will be collected at each site to evaluate vertical changes in soil-gas concentrations. Additional monitoring wells at the sites mentioned will be recommended in the RI if the soil-gas survey indicates elevated levels of contamination.

Paragraph 8

The soil-gas survey of Site 2 will include the entire area illustrated in Figure 3.3 (Page 3-13). The areas of the soil-gas surveys at each site will be expanded as necessary to determine a soil-gas plume-edge. Monitoring wells at underground storage tank sites will be located downgradient of the tanks or at points of highest soil-gas concentrations.

Paragraph 9

PVC casing and screen is an appropriate well construction material for short-term monitoring of water contaminated with organic compounds or fuel and is probably appropriate if total volatile concentrations are less than 1 ppm. The SI is designed to determine whether or not contamination exists and not as a long-term monitoring program, consequently PVC well construction is appropriate.

Paragraph 10

A wetland inventory is more appropriately included in the Remedial Investigation. The primary purpose of the SI is to determine whether or not contamination exists at the sites.

Paragraph 11

Determination of extent of contamination off-Base is more appropriately included in the RI.

Paragraph 12

Information concerning efficacy and disposal of activated carbon used at Site 27 is not readily available at this time. Further investigation of the clean-up operation will be included in the SI report.

Paragraph 13

There is some doubt about whether present operations include soaking the coal with fuel oil. Further investigations of coal handling practices will be conducted.

Laboratory QA/QC Review Response

The comments not addressed specifically in the following discussion imply a need for greater QA/QC documentation than as required for this project. Because of the lack of proven contamination at the sites and the preliminary nature of a Site Inspection, laboratory QA/QC practices will be employed which will abide by standards set forth in the particular analytical methods specified. If during the course of the SI, significant contamination is identified, a step up in QA/QC will be considered and the Work Plan modified accordingly.

Specific responses to the comments are as follows:

I. There is no title page for the QA/QC sections because they are part of the Work Plan document rather than a stand-alone plan.

II. All of the comments in this section are addressed in Sections 1, 2, 3, 4 and 5 of the Work Plan.

V. A,B,D,H. Sample collection details which address these comments are included in Sections 5 and 6.

C. Total metals will be determined for samples from this project.

E. Sample jars listed in Table 6-2 are for water samples. One liter glass containers with Teflon®-lined caps will be used for herbicide and pesticide samples.

G. Steps have been taken to clarify the sample numbering system.

I. As stated in the "Detection Limits" subsection of Section 6, the detection limits for the GC and GC/MS analyses as detailed in the method description (SW 846) will be used.

VII. A. Table 7.1 lists appropriate sample containers for water samples, <u>not</u> soil samples.

VIII. A paragraph describing internal Engineering-Science and Martin Marietta Energy Systems Audits has been added to Section 7.

5-20-88

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
230 SOUTH DEARBORN ST.
CHICAGO, ILLINOIS 60604

REPLY TO THE ATTENTION OF:

17 MAY 1988

Lieutenant Colonel Michael Washeleski
Chief, Bioenvironmental Engineering
Office of the Air Surgeon
Department of the Air Force
Air National Guard Support Center
Andrews Air Force Base
Washington, D.C. 20331-6008

RECEIVED
MAY 2 1988
CLEVELAND ES

Dear Colonel Washeleski:

ra. #

1 The Region V Office of the U.S. Environmental Protection Agency (USEPA) has reviewed the Draft Final Site Inspection/Remedial Investigation Work Plan for the Air National Guard (ANG) Installation Restoration Program (IRP) effort scheduled for Rickenbacker Air National Guard Base (ANGB) in Columbus, Ohio. The Rickenbacker ANGB covers approximately 2,100 acres. Our major concerns are related to surface water and drinking water quality as the plan is designed to assure the present and future integrity of the Base water supply.

2 The Work Plan placed appropriate emphasis on the drainage ditch system since surface water runoff from the entire base is thought to be channeled through this system. Our experience suggests that greater emphasis in the sampling program should be placed on sediments and less on surface water samples. Historical contamination is more likely to be detected in the sediments than the overlying water and it is appropriate for the site inspection to sample the sediments most likely to demonstrate elevated contaminant levels.

3 Additional surface water samples are appropriate at locations where ongoing releases to the surface water, other than from contamination in the underlying sediments, are suspected. For example, surface water samples would be appropriate at Site 27, near the landfill, if the discharge is an ongoing leachate seep as opposed to a spill. The source of the "milky white liquid" or other contaminants found in the ditch in 1982 should be determined. Total suspended solids should be measured in all water samples to gauge the sediment load carried in the water for this final determination. Surface water sampling may be scaled back to include one sampling point above, and one below the oil-water separator in each drainage ditch.

4 Additional sediment sampling stations should be established. Specifically, depositional areas should be identified within the drainage system and added to the site sampling list. It would also be useful to add a sediment sampling station in the receiving streams (Walnut Creek and Big Walnut Creek)

Para.#

4 below each drainage ditch outfall, again in depositional areas affected by the outfall. Incorporation of these modifications would necessitate changes to the discussion of Site 25, Storm Drainage Ditch System on page 3-32, Figure 3.18, and possibly discussion of Site 27, Drainage Ditch Near Landfill on page 3-34.

5 We recommend that borings to be taken at Site 23 for examination of the extent of volatile contamination be taken at the topographic low range. This is the area where contamination is likely to concentrate. At Site 24, the ditch near the sludge beds should be checked for possible contamination. This investigation should be included in the sediment sampling plan for the ditch (Site 25). The sediment sampling plan for Site 25 should take into account any surface water/ground water interfaces. At Site 28c, the monitoring well should be placed down-gradient of the USTs. We also recommend taking sediment samples of the nearby ditch, if this area is not already included in the ditch sediment sampling plan for Site 25.

6 The discussion of surface water sampling on page 6-4 also requires modification. In particular, the second sentence contradicts the remainder of the paragraph. The second sentence indicates that sample depth will be based on the contaminant of concern, but the remainder of the paragraph discusses how the sample depth will, instead, be a function of the water depth in the ditch. We recommend that the sampling depth be standardized unless specific circumstances warrant otherwise. For example, it may be appropriate for samples to be taken adjacent to a contaminant source. The field log should specifically record the sample location and depth and the justification for the location and depth.

7 We recommend that soil/gas probes be placed as close as possible to underground utility lines or the points where they intersect since these lines can be paths of contaminant migration. Soil/gas surveys should consist of deep 15 foot probes interspersed among probes of shallower depths in order to avoid the false negatives that may result from using only shallow probes to monitor for volatile compounds. If the surveys indicate elevated, in accordance to regulations and/or background, levels of contaminants, additional monitoring wells should be placed at sites 5, 9, 10, 14, 15, 16, 19, 20, 21, 22, 23, and 25.

The Site Inspection Program discussed in Chapter 3 raises the following comments:

8

a. The intent to conduct a soil/gas survey is mentioned on page 3-12 for Site 2, but it is not indicated on the Site Inspection Plan on page 3-13. This needs to be clarified.

b. A soil/gas survey should be conducted around the underground storage tanks (USTs) southwest of the fuel spill at Site 3. If monitoring wells are placed near USTs, they should be installed down-gradient from the tanks, near the concentration of jet fuel lines.

ra.#

8 c. If the soil/gas survey at Site 4 shows no contamination, monitoring wells should be placed down-gradient from the USTs.

9 Monitoring wells are described on page 5-3 to be of polyvinyl chloride (PVC) construction. We suggest that stainless steel screens be used. Since many of the sites involve fuel spills, there may be a layer of hydrocarbons floating on the water table. High concentrations of hydrocarbons can be absorbed by the PVC. Further, the PVC may degrade in the presence of organics.

10 The Work Plan identifies 23 potential pollution sources for investigation and remedial action planning. Descriptions suggest that eight of those sites may involve special aquatic sites. A thorough inventory of wetlands on the Base should be provided in the report. A map identifying wetlands sites and potential pollution sources should be included.

11 We recommend off-base sampling sites must address releases to the base storm drain system and whether off-site areas have been affected.

12 The Work Plan described, on page 1-33, a 1982 release of alkyl benzene and olefin hydrocarbon compounds. The spill was corrected using activated charcoal bags to absorb the organic compounds. The efficacy of this treatment and the final disposal method utilized for the activated charcoal should be described.

13 A description of the coal pile management program and its effects are given on page 1-24. However, the method of adding oil to the coal is unclear. If this was performed at the storage site, the impact to the adjacent drainage ditch and its vegetative cover are more readily understood.

A separate review of your Laboratory Quality Assurance/ Quality Control (QA/QC) Plan was performed and we offer the following comments:

I. Title/Signature Page

There is not title page with the provision of an approval signature by responsible parties.

II. Project Description

A. Site Existing Information

The description of the existing information lacks details. The following areas must be addressed and/or expanded:

1. Site Setting

The site setting should include information on site topography, geology, hydrogeology, etc.

2. Summary of Past Data

A summary of data collected from previous activities should be provided. This summary should contain compounds/parameters and measure amounts along with instrument detection limits.

B. Intended Data Usage

The intended usage of data collected from both Site Inspection (SI) and Remedial Investigation (RI) are not clearly addressed. The description of intended data usage should account for all data to be generated including field screening and measurements. It is important to address the intended data usage as it dictates the quality control (QC) requirements for analytical measurements.

III. Project Organization and Responsibility

There is only a brief discussion on responsibility in Section 7 (Laboratory Analytical Quality Assurance/Quality Control Manual). The description of Project Organization and Responsibility should include the following:

A. Management Responsibilities

B. Quality Assurance Organization and Responsibility

C. Field Operations

D. Laboratories Responsibilities

E. Final Data Assessment

F. Field Laboratory

IV. Quality Assurance Objectives

A brief discussion is provided on accuracy and precision in Section 7 and is inadequate. The QA objective should be addressed in terms of accuracy, precision, representativeness, completeness and comparabilities. The description should include the approaches to be implemented to achieve these objectives and the required detection limits for each parameter to be tested.

V. Sampling procedure

A. The description of sample collection must be expanded. For example, the hand boring technique involves collection of soil samples; however, the depth of boring, number of samples (i.e. every 5 feet), composite or grab samples, etc., are not addressed and need to be included in this Section.

B. It is stated that selected soil and ground water samples will be analyzed for specific parameters; however, the criteria to be used for sample selection is not addressed.

C. For the analysis of metals, it is necessary to specify whether total metals or dissolved metals are needed for the project. For the dissolved metals, the samples are required to be field filtered. This should be addressed in appropriate sections. (Groundwater, Surface Water, etc., for example).

D. If composite samples will be collected, then the detailed sample compositing procedure should be clearly addressed.

E. The size of sample containers specified to be used for pesticide and herbicide samples (Table 6-2) are not appropriate. An 8 oz wide mouth glass jar should be used.

F. It is not clear whether total metal or dissolved metals are required for this project. The water samples for dissolved metals are required to be field filtered prior to the addition of preservatives. Please revise Table 6-2 accordingly and make the necessary changes throughout the QAPP where they are appropriate.

G. Under Sample Custody, the description of the sample numbering system is unclear. Please provide a detailed description along with examples.

H. Quality Control Sample Collection

1. The field duplicate samples should be collected as one per group of 10 or fewer samples.

2. The field blank should be collected one per group of 10 or fewer samples.

I. Table 6.4 and 6.5 should be revised to include the required detection limits (RDL). Please include the RDL for both water and soil matrices.

VI. Sample Custody

Only the Field Custody is discussed in Section 6 (Sampling Procedure). The description should include the chain-of-custody procedures for laboratory analysis, and the final evidence file. Please use the attachment for reference.

VII. Laboratory Quality Assurance/Quality Control Manual

A. Table 7.1 should be revised to state 8 oz glass jars for sample containers.

B. The control limits for accuracy and precision are not addressed. They should be project specific.

C. The Internal Quality Control Check should be expanded to include a method blank.

D. The Calibration Procedures and Frequency are not adequately addressed (p 7-5) and should be elaborated.

E. The Preventative Maintenance of both laboratory improvements and field improvements must be addressed.

F. The corrective action is not addressed. The description should include both field measurement and laboratory analysis.

VIII. Performance and System Audits

The Performance and System Audits are not addressed. Please note that the description should include both the internal audits, which can be initiated and implemented by site manager or QA Officer, and the external audits by U.S. EPA.

Thank you for the opportunity to review the doucment. If you have any questions concerning our comments, please contact Ms. Amy Blumberg of my staff at (FTS) 886-7342 or (312) 886-7342.

Sincerely yours,

William D Franz

William D. Franz, Chief
Environmental Review Branch
Planning and Management Division

INSTALLATION RESTORATION PROGRAM

2

RICKENBACKER AIR NATIONAL GUARD BASE
COLUMBUS, OHIO

ADDITIONAL SITE INSPECTION SAMPLING
ADDENDUM #1 TO SI/RI/FS/RD WORK PLAN

AD-A252 558

FINAL

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OCTOBER 1989

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For the U.S. DEPARTMENT OF ENERGY under contract DE-AC05-84OR21400

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13. Abstract (maximum 200 words)

The purpose of this addendum work plan is to define the additional Site Inspection (SI) work to be conducted at Rickenbacker Air National Guard Base. The additional work was necessary in order to accomplish the objectives of the SI at 23 Installation Restoration Program sites. The objectives of this field effort were to determine the presence or absence of contamination at the identified sites. Additionally to determine the magnitude and extent of soil contamination

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ADDITIONAL SITE INSPECTION SAMPLING

ADDENDUM #1 TO SI/RI/FS/RD WORK PLAN FOR

RICKENBACKER AIR NATIONAL GUARD BASE

COLUMBUS, OHIO

FINAL

OCTOBER, 1989

Prepared by:

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Submitted by:

HAZARDOUS WASTE REMEDIAL ACTIONS PROGRAM

Operated by:

MARTIN MARIETTA ENERGY SYSTEMS, INC.
Oak Ridge, Tennessee

For the

U. S. DEPARTMENT OF ENERGY
Under Contract No. DE-AC05-840R21400

Submitted to:

NATIONAL GUARD BUREAU
ANGSC/DER
Andrews AFB, Maryland

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TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

SECTION 1.0

INTRODUCTION

1.1 Background and Purpose

This Work Plan Addendum was prepared by Engineering-Science (ES) for the Hazardous Waste Remedial Actions Program (HAZWRAP) and the National Guard Bureau (NGB) for implementation of additional Site Inspection (SI) sampling at Rickenbacker Air National Guard Base (RANGB), Ohio. This additional work is made possible through an interagency agreement between the U.S. Department of Energy and the U.S. Air Force which facilitates the use of the Installation Restoration Program (IRP) by the NGB. This document serves as an addendum to the Final RANGB Site Inspection/Remedial Investigation/Feasibility Study/Remedial Design Work Plan dated June 1988.

The purpose of this addendum work plan is to define the additional Site Inspection (SI) work to be conducted at the RANGB sites. The additional work is necessary in order to accomplish the objectives of the SI at each site, which are the following: 1. Determine if the soil is contaminated, 2. Determine the depth of soil contamination, and 3. Determine if the groundwater is contaminated. This addendum work plan will also be used to define some modifications to the initial SI work plan based on guidelines established by HAZWRAP and comments from the U.S. Environmental Protection Agency (U.S. EPA) and Ohio EPA. Data generated by the additional SI sampling will be added to the previous SI database for reporting purposes.

1.2 Work Plan Modifications

This section serves to outline the various sections of the SI work plan (SIWP) that will either remain the same or require modifications. The majority of the SIWP will not change and will be utilized as the guidance document for field investigations.

Section 1 of the SIWP is an introduction of the IRP, the Base, and the various sites under investigation. Section 1 remains unchanged. Section 2 of the SIWP presents the tasks to be performed in the SI/RI/FS/RD for the 23 sites at RANGB. Section 2 remains unchanged. Section 3 of the SIWP presents the types of investigation to be conducted at the 23 sites at the RANGB. Section 3 is not modified, but additional investigation will be added to most sites (See Section 3 of this document). Site 26 is not mentioned in Section 3.0 because no additional work will be conducted at the site. The initial SI work program at Site 26 (surface soil sampling and analysis) did not detect any contamination and therefore the site will be removed from future SI activities. Section 4 of the SIWP describes the Remedial Investigation portion of the SI/RI/FS/RD and is not changed.

Modifications to Sections 5 (Field Investigation Techniques), 6 (Sampling and Analytical Plan) and 7 (Laboratory Analytical Quality Assurance/Quality Control [QA/QC] Plan) are defined in Section 2 of this addendum.

SECTION 2.0

SPECIFIC WORK PLAN MODIFICATIONS

Modifications to the SI work plan are necessary due to comments and guidelines established after the SI work plan was compiled. The comments are from the U.S. EPA and Ohio EPA who reviewed the SI work plan and submitted several suggestions. The guidelines consist of two HAZWRAP documents: Requirements for Quality Control of Analytical Data (August 1988) and Quality Control Requirements for Field Methods (February, 1989).

2.1 Modifications to Field Investigation Techniques

There are only three modifications to the Field Investigation Techniques discussed in Section 5 of the SIWP.

The first change deals with the handling of the soil cuttings from the drilling operations. In the SIWP the stated procedure is to store all soil cuttings in drums on-site pending receipt of chemical analytical results on representative samples. The new procedure will be to store the cuttings in drums only if the field photoionization detector (PID) values for the soil headspace exceed 100 parts per million (ppm). If the PID values are less than 100 ppm, the cuttings will be placed on, and covered with, plastic sheeting. After receipt of the soil analytical results, the cuttings will be spread at the drilling sites if non-hazardous, or disposed of at the proper landfill if hazardous.

The second modification involves increasing the documentation for monitoring well construction. The HAZWRAP monitoring well construction log shown as Figure 2.1 will now be used in all reports.

2.2 Modifications to Sampling and Analytical Plan

There are three modifications to the Sampling and Analytical Plan presented in Section 6 of the SIWP.

In regards to the methodology of sampling soil for volatile organics analysis, the following procedure will be followed. Prior to driving, each split-spoon will be

FIGURE 2.1

REV. DATE: JAN 1989

MONITORING WELL CONSTRUCTION LOG - Double Cased

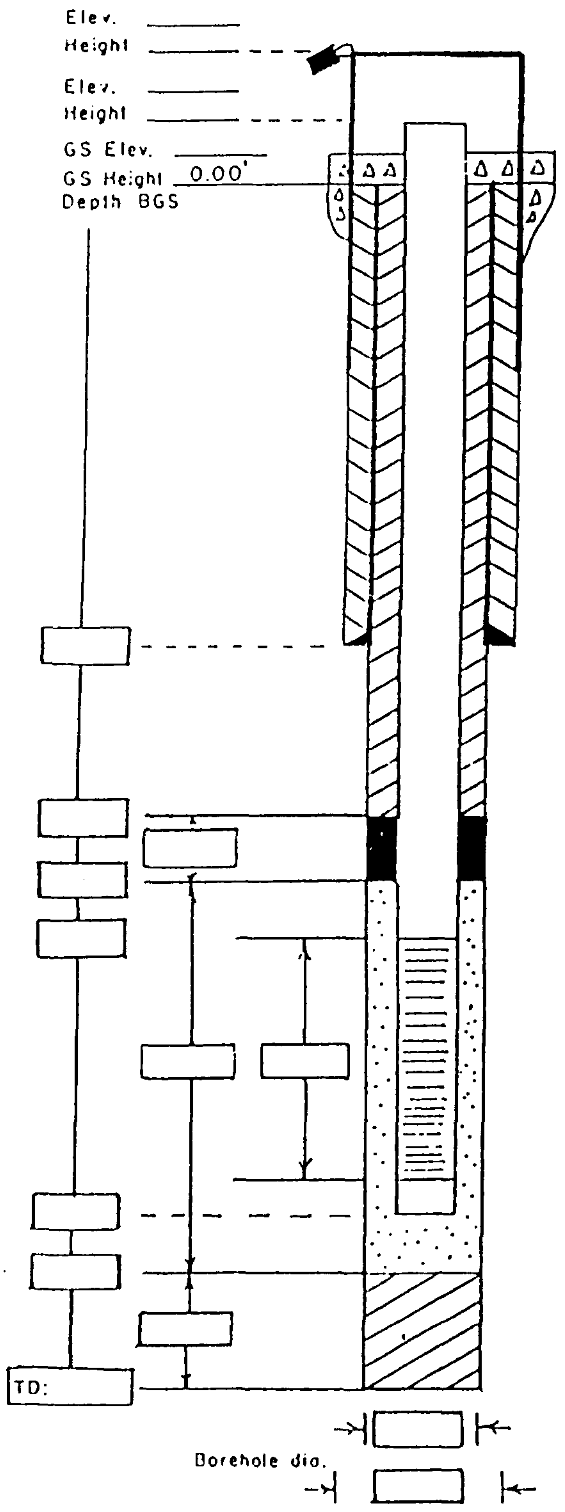
WELL NO.: | Installation: | Site:

Project No: | Client/Project:

HAZWRAP Contractor: | Drlg Contractor:

Comp. Start: (: _ m) | Comp. End: (: _ m)

Built By. | Well Coord: ______



PROTECTIVE CSG

Material/Type ______

Diameter ______

Depth BGS ______ Weep Hole (Y/N)

GUARD POSTS (Y/N)

No. ______ Type ______

SURFACE PAD

Composition & Size ______

SURFACE CSG

Type ______

Diameter ______ Total Length ______

GROUT: Setup/Hydration Time ______

Composition & Proportions ______

Interval BGS ______

Tremied (Y/N)

RISER PIPE

Type ______

Diameter ______

Total Length (TOC to TOS) ______

GROUT

Composition & Proportions ______

Interval BGS ______

Tremied (Y/N)

CENTRALIZERS (Y/N)

Depth(s) ______

SEAL

Type ______

Source ______

Setup/Hydration Time ______ Vol. Fluid Added ______

Tremied (Y/N)

FILTER PACK

Type ______

Amount Used ______

Source ______

Gr. Size Dist. ______

Tremied (Y/N)

SCREEN

Type ______

Diameter ______

Slot Size & Type ______

SUMP (Y/N)

Interval BGS ______ Length ______

Bottom Cap (Y/N)

BACKFILL PLUG

Material ______

Setup/Hydration Time ______

Tremied (Y/N)

assembled with several 6-inch brass liners, the number of liners used being dictated by the length of the split-spoon. After driving, the split-spoon will be disassembled and the second liner from the bottom (stratigraphically) will be sealed with Teflon caps, wrapped in aluminum foil and securely taped. This sample will then be ready for transport to the laboratory. The remaining liners will then be extruded and the material used for lithologic description and other analyses. The emptied liners will be decontaminated and reused in subsequent split-spoons.

The second modification to the SAP involves groundwater samples collected for metals analysis. These samples will be filtered in the field with a 0.45 micron mesh filter. The purpose of the filtering is to remove the suspended particles from the groundwater, so that the subsequent laboratory analysis will measure only the dissolved metal concentrations. Both an unfiltered and filtered groundwater sample will be analyzed from all wells where metals analysis is conducted.

The third change pertains to where the SIWP incorrectly listed the holding time prior to extraction for environmental samples tested for semi-volatile organic compounds (SVOC). The correct holding time for SVOC samples prior to extraction is seven (7) days.

2.3 Modifications to Laboratory QA/QC Plan

The modifications to the Laboratory QA/QC Plan are based exclusively on the U.S. EPA comments on the SIWP. The following subsections address the EPA comments on the SI QA/QC Plan.

COMPLETENESS

The completeness objective for this project is 90 percent. This is the amount of valid data obtained versus the amount of data expected.

REPRESENTATIVENESS

Representativeness expresses the degree to which sample data represents the characteristics of a population. The following QA/QC samples will be analyzed to insure a high level of representativeness.

Trip Blank - Trip blanks consist of deionized organic-free water in 40 ml vials filled by the laboratory for purposes of traveling with a cooler of samples back to the lab. The purpose of the trip blank is to determine if any volatile organics have been absorbed by the samples during shipment. The trip blanks are only tested for volatile organic compounds.

Field and Rinseate Blanks - A field blank is a sample of the deionized organic-free water or tap water that is used during the decontamination of the sampling equipment. It is placed directly from the source bottle into an appropriate sample container. The field blanks document whether the decontamination water is contaminant-free. Rinseate blanks consist of deionized organic-free water poured through the decontaminated bailer or split-spoon sampler into sample bottles. The rinseate blanks document whether the sampling equipment has been successfully decontaminated. Field and rinseate blanks are analyzed for the same parameters as the corresponding samples. Field blanks are collected for each sampling event and/or from each source of decontamination water. One rinseate blank is collected for each day of sampling, however, analysis will only be performed on half of the samples (alternate days).

Method Blanks - Method blanks are aliquots of analyte-free water analyzed with a sample batch to identify contaminants introduced by the preparation or analysis procedure. One method blank is analyzed for every 20 samples.

One field duplicate will be collected for every 10 samples. It will be given a coded identifier and analyzed for the same parameters as the sample.

COMPARABILITY

Where appropriate, the results of analyses obtained will be compared with the results obtained in previous studies.

Consistency in the acquisition, handling, and analysis of samples by EPA-recommended procedures is necessary in order that the results may be compared. To this end, standard solutions and materials used in calibrating field and laboratory analytical instruments must be traceable to National Bureau of Standards (NBS) or EPA standards, and published analytical methods will be followed scrupulously.

ACCURACY

The degree of accuracy, on percentage recovery for inorganics and metals should fall in the range of 80 to 120 percent.

PRECISION

The precision obtained for metals analyses shall be evaluated based upon a control limit of 20 relative percent difference (RPD) for values greater than five times the detection limit. For values less than five times the detection limit, a control limit of two times the detection limit is used for soils and a control limit of one times the detection limit is used for water samples.

REAGENT BLANKS

An analyte concentration in a reagent blank of two times the reporting limit associated with the method will be used as an advisory limit.

DATA VALIDATION

Data validation for the analyses to be performed on soil and groundwater samples collected during this additional SI work will be made in compliance with HAZWRAP Level C or CLP protocols. SW-846 and EPA methodologies will be validated to HAZWRAP Level C. CLP analyses will be validated to CLP protocols.

SECTION 3.0

SITE INSPECTION ADDENDUM WORK SCOPE

This section describes the additional SI work to be conducted at the sites at Rickenbacker ANGB. Table 3.1 provides a summary of the sampling program, and is followed by more detailed accounts of the work scope at each site.

Site 26 is not mentioned in Section 3.0 because no additional work will be conducted at the site. The initial SI work program at Site 26 (surface soil sampling and analysis) did not detect any contamination and therefore the site will be removed from future SI activities.

The analyses performed at each site at RANGB during the additional SI work is based upon the findings of the SI Report dated February 1989 and meetings with representatives of the National Guard Bureau and HAZWRAP. For example, volatile organic analyses at known fuel spill sites will consist of the aromatic volatile organics (Method 8020) instead of the extensive volatile scan (CLP). In general, the analyses for each site cover the same target parameters as the previous work, except where modified by prior laboratory results.

TABLE 3.1

SUMMARY OF ADDITIONAL SITE INSPECTION SAMPLING PROGRAM

RICKENBACKER ANGB, OHIO

Site	Field Activity	# Field Samples	Matrix	Analyses
#2	**JP-4 Tank Farm:**			
	- Two borings to 15' or water table	4	Soil	DEI
	- Four 2" wells to upper aquifer	8	Soil	DEI
	- Twenty soil-gas survey points	--	--	--
	- Groundwater sampling of new and existing wells	7	Water	DEI
	- Slug tests in four wells	--	--	--
#3	**JP-4 Pumping Station 4:**			
	- Four borings to water table or 15'	8	Soil	CEI
	- Groundwater sampling of existing wells	2	Water	CEI
#4	**JP-4 Pumping Station 5:**			
	- Two boring to water table or 15'	4	Soil	CEI
	- Groundwater sampling of existing wells	2	Water	CEI
#5	**Lateral Safety Zone Spill Area:**			
	- One boring to water table or 15'	2	Soil	DE
	- Groundwater sampling of existing wells	2	Water	DE
#6	**Underground Storage Tanks at the Base Filling Station:**			
	- One 2" well to upper aquifer	2	Soil	DEI
	- Groundwater sampling of new and existing wells	2	Water	DEI
	- Slug test one well	--	--	--
#9	**Salvage Yard:**			
	- Groundwater sampling of existing well	1	Water	F

*** EXPLANATION**

B = Organochlorine Pesticides and Chlorinated Phenoxy Herbicides (Method 8080/3510 and 8150)
C = Volatile Organics (CLP)
D = Aromatic Volatile Organics (Method 8020)
E = Petroleum Hydrocarbons (Method 418.1), soil extraction by (SW846, Method 9071).
F = Priority Pollutants Metals (Total and Dissolved on each water sample)
H = Sulfates (Method 9038), Alkalinity (EPA 310.1), and Acidity (EPA 305.1)
I = Lead (Method 7421)
K = Semi-Volatile Organics (Base/Neutral Extractables) (CLP)

NOTE: Data Quality Objective for all analyses will be in accordance with HAZWRAP Level C or with CLP protocol where indicated.

TABLE 3.1 - (continued)

SUMMARY OF ADDITIONAL SITE INSPECTION SAMPLING PROGRAM

RICKENBACKER ANGB, OHIO

Site	Field Activity	# Field Samples	Matrix	Analyses
#10	**JP-4 Fuel Line Rupture:**			
	- One boring to 15' or water table	2	Soil	CEF
	- One 2" well to upper aquifer	2	Soil	CEF
	- Groundwater sampling of new and existing wells	2	Water	CEF
	- Slug test one well	--	--	--
#12	**JP-4 Old Drum Storage Area:**			
	- One 2" well to upper aquifer	2	Soil	CE
	- Groundwater sampling of new and existing wells	2	Water	CE
	- Slug test one well	--	--	--
#14	**KC 135 Crash Site:**			
	- Groundwater sampling of existing wells	2	Water	DE
#15	**Southwest Fuel Dump Pit:**			
	- Two borings to 15'or the water table	4	Soil	DEI
	- Groundwater sampling of existing wells	2	Water	DEI
#16	**Northeast Fuel Dump Pit:**			
	- Two borings to 15'or water table	4	Soil	DEI
	- Groundwater sampling of existing wells	2	Water	DEI
#17	**Old Entymology Lab:**			
	- Groundwater sampling of existing well	1	Water	B
#19	**North Coal Pile:**			
	- Groundwater sampling of existing wells	2	Water	CEFHK

* EXPLANATION

B = Organochlorine Pesticides and Chlorinated Phenoxy Herbicides (Method 8080/3510 and 8150)
C = Volatile Organics (CLP)
D = Aromatic Volatile Organics (Method 8020)
E = Petroleum Hydrocarbons (Method 418.1), soil extraction by (SW846, Method 9071).
F = Priority Pollutants Metals (Total and Dissolved on each water sample)
H = Sulfates (Method 9038), Alkalinity (EPA 310.1), and Acidity (EPA 305.1)
I = Lead (Method 7421)
K = Semi-Volatile Organics (Base/Neutral Extractables) (CLP)

NOTE: Data Quality Objective for all analyses will be in accordance with HAZWRAP Level C or with CLP protocol where indicated.

TABLE 3.1 - (continued)

SUMMARY OF ADDITIONAL SITE INSPECTION SAMPLING PROGRAM

RICKENBACKER ANGB, OHIO

Site	Field Activity	# Field Samples	Matrix	Analyses
#20	**South Coal Pile:**			
	- One 2" well to upper aquifer	2	Soil	CEFHK
	- Groundwater sampling of new and existing wells	3	Water	CEFHK
	- Slug test one well	--	--	--
#21	**Leaking Drum and Oil Change Area at Plant:**			
	- One boring to 15' or water table	2	Soil	DEF
	- One 2" well to upper aquifer	2	Soil	DEF
	- Groundwater sampling of new well	1	Water	DEF
	- Slug test one well	--	--	--
#22	**Heat Plant Lube Oil Drum Storage Area:**			
	- One boring to 15' or water table	2	Soil	CE
	- One 2" well to upper aquifer	2	Soil	CE
	- Groundwater sampling of new well	1	Water	CE
	- Slug test one well	--	--	--
#23	**Fire Training Area:**			
	- One 2" well to upper aquifer	2	Soil	CKF
	- Groundwater sampling of new and existing wells	5	Water	CKF
	- Slug test one well	--	--	--

*** EXPLANATION**

B = Organochlorine Pesticides and Chlorinated Phenoxy Herbicides (Method 8080/3510 and 8150)
C = Volatile Organics (CLP)
D = Aromatic Volatile Organics (Method 8020)
E = Petroleum Hydrocarbons (Method 418.1), soil extraction by (SW846, Method 9071).
F = Priority Pollutants Metals (Total and Dissolved on each water sample)
H = Sulfates (Method 9038), Alkalinity (EPA 310.1),and Acidity (EPA 305.1)
I = Lead (Method 7421)
K = Semi-Volatile Organics (Base/Neutral Extractables) (CLP)
NOTE: Data Quality Objective for all analyses will be in accordance with HAZWRAP Level C or with CLP protocol where indicated.

TABLE 3.1 - (continued)

SUMMARY OF ADDITIONAL SITE INSPECTION SAMPLING PROGRAM

RICKENBACKER ANGB, OHIO

Site	Field Activity	# Field Samples	Matrix	Analyses
#24	**Sewage Treatment Plant Sludge Beds:**			
	- One 2" well to upper aquifer	2	Soil	F
	- Groundwater sampling of new and existing wells	4	Water	F
	- Slug test one well	--	--	--
#25	**Storm Drainage Ditch System:**			
	- Groundwater sampling of existing wells	4	Water	F
#27	**Drainage Ditch Near Landfill:**			
	- Groundwater sampling of existing wells	1	Water	F
	Background Soil Samples:			
	- Four borings to 15' or the water table	8	Soil	F

* EXPLANATION

B = Organochlorine Pesticides and Chlorinated Phenoxy Herbicides (Method 8080/3510 and 8150)
C = Volatile Organics (CLP)
D = Aromatic Volatile Organics (Method 8020)
E = Petroleum Hydrocarbons (Method 418.1), soil extraction by (SW846, Method 9071).
F = Priority Pollutants Metals (Total and Dissolved on each water sample)
H = Sulfates (Method 9038), Alkalinity (EPA 310.1), and Acidity (EPA 305.1)
I = Lead (Method 7421)
K = Semi-Volatile Organics (Base/Neutral Extractables) (CLP)
NOTE: Data Quality Objective for all analyses will be in accordance with HAZWRAP Level C or with CLP protocol where indicated.

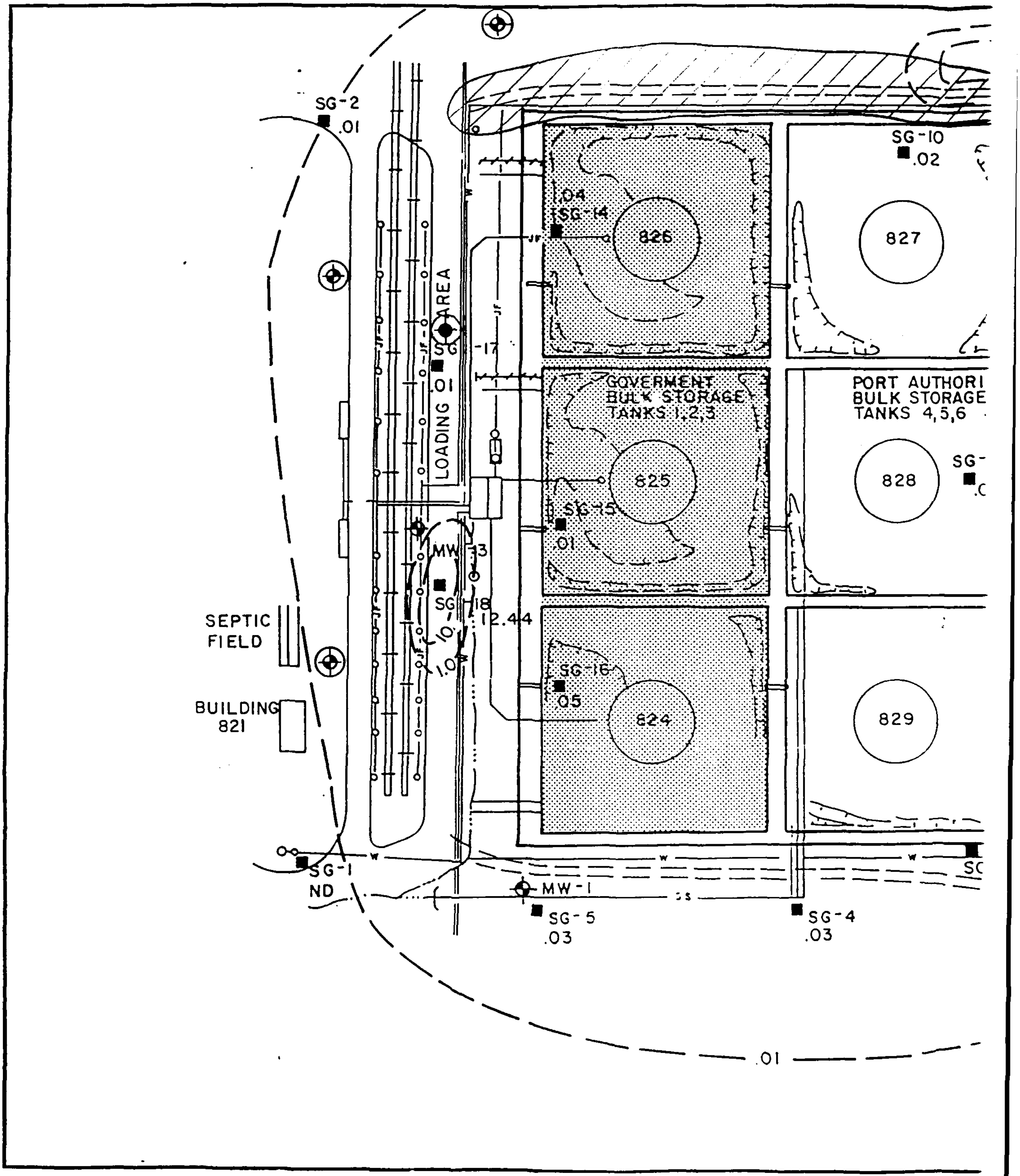
3.1 SITE 2: JP-4 Tank Farm

Previous work on site 2 included a nineteen-point soil gas survey and the installation of three groundwater monitoring wells. The purpose of the additional sampling at Site 2 is primarily to investigate the eastern half of the tank farm for soil and groundwater contamination. This portion of Site 2 (including tanks 4, 5 and 6) was operated by the Rickenbacker Port Authority (RPA) but is still owned by the RANGB. During this investigation, a twenty-point soil gas survey will be conducted, four monitoring wells will be installed, and two soil borings will be drilled. Soil and water samples will be taken at each boring/monitoring wells respectively. Laboratory analysis for aromatic volatile organics (SW-846 Method 8020), lead (Method 7421), and petroleum hydrocarbon (EPA Method 418.1) content will be performed on all environmental samples collected.

A twenty-point soil gas survey will be performed on the northern and eastern boundaries of the bulk storage area (see Figure 3.1). This area was chosen due to the occurrence of a product release identified along the RPA product line northwest of the tank farm in July 1988. Upon further investigation, the source of the product spill was found to be a poorly sealed catch basin in the RPA fuel loading area. The soil-gas survey will aid in determining the extent of hydrocarbons in the backfill material surrounding the pipeline.

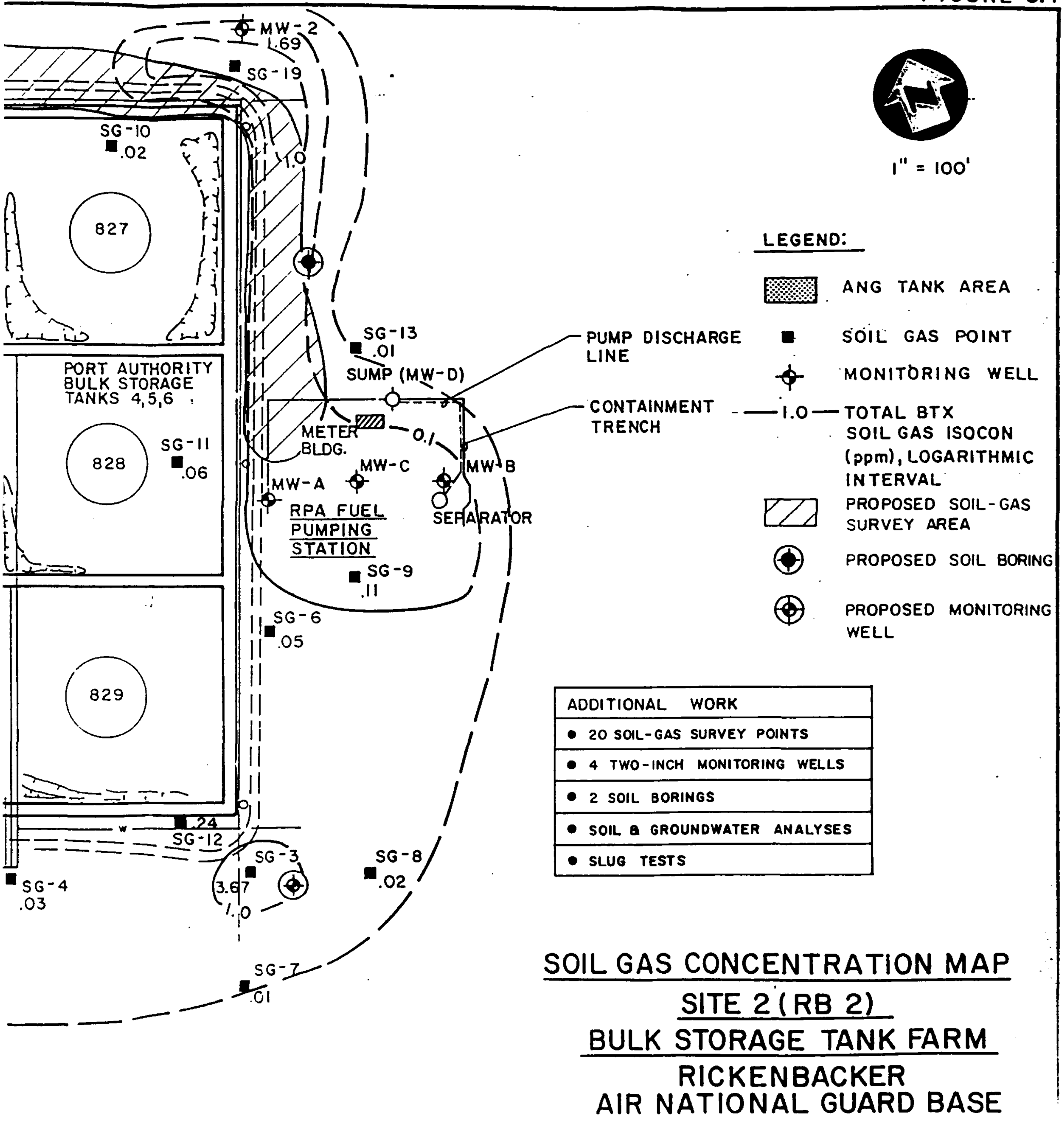
Two soil borings will be placed on the site. These borings will be completed to a depth of fifteen feet or to the initial occurrence of the water table. Soil samples will be taken at five foot intervals. The two soil samples from each boring having the highest headspace photoionization detector (PID) values will be sent to the laboratory for analysis.

A total of four monitoring wells will be installed on the site. These wells will be drilled to a depth of approximately thirty feet and set with the base of the 10 foot well screen approximately 5 to 7 feet below the water table. Using the same criteria as the borings, two soil samples will be taken from each well for further laboratory analysis. Groundwater samples from the four new wells and the three existing monitoring wells will be taken for laboratory analysis.


SG-2
.01
SG-10
.02
.04
SG-14
826
827
LOADING AREA
SG-17
.01
GOVERMENT
BULK STORAGE
TANKS 1,2,3
PORT AUTHORI
BULK STORAGE
TANKS 4,5,6
825
828
SG-15
.01
MW-3
SG-18
12.44
10
1.0
SEPTIC
FIELD
SG-16
.05
BUILDING
821
824
829
SG-1
ND
MW-1
SG-5
.03
SG-4
.03
.01
JF
W
SS

K

FIGURE 3.1



ADDITIONAL WORK
• 20 SOIL-GAS SURVEY POINTS
• 4 TWO-INCH MONITORING WELLS
• 2 SOIL BORINGS
• SOIL & GROUNDWATER ANALYSES
• SLUG TESTS

SOIL GAS CONCENTRATION MAP
SITE 2 (RB 2)
BULK STORAGE TANK FARM
RICKENBACKER
AIR NATIONAL GUARD BASE

B

Each new groundwater monitoring well will have a slug test performed on it to determine hydrogeologic characteristics of the aquifer in the vicinity of the well.

3.2 SITE 3: JP-4 Pump Station No. 4

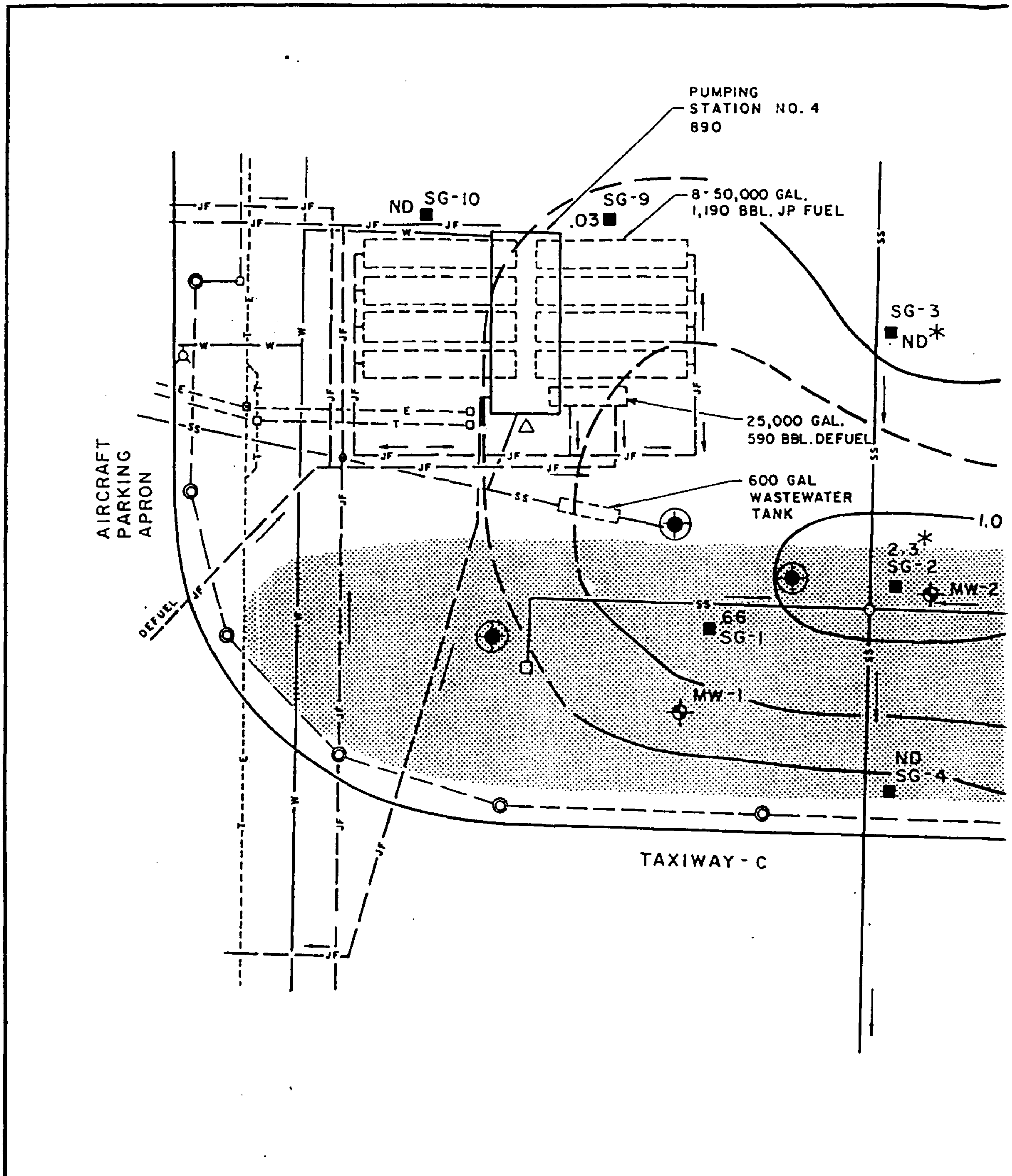
Previous activities for Site 3 included a ten-point soil gas survey and the installation of two groundwater monitoring wells. The purpose of the additional sampling at Site 3 is to determine whether the water pumped and discharged from the underground storage tank (UST) pit onto the surface is contaminating the soil or groundwater. The drainage path leading from the discharge point typically has dead vegetation and a hydrocarbon sheen. During this investigation, four soil borings will be drilled at the site, and groundwater samples will be collected from the existing monitoring wells. Laboratory analysis for volatile organics (CLP) petroleum hydrocarbon (EPA Method 418.1) content and lead (total and dissolved for water samples) will be performed on all soil and water samples collected.

A total of four soil borings will be drilled in the fuel ponding area of Site 3 (see Figure 3.2). All borings will be drilled to a depth of fifteen feet or initial occurrence of the water table. Soil samples will be collected at five foot intervals. The two samples from each boring with the highest headspace PID value will be sent to the laboratory for analysis. Three of the four borings will be placed upgradient and north to northwesterly of the two existing monitoring wells in the fuel ponding area. A fourth boring will be located downgradient of the two existing wells and at the far northeasterly boundary of the fuel ponding area.

Groundwater samples from the existing monitoring wells will be collected and analyzed.

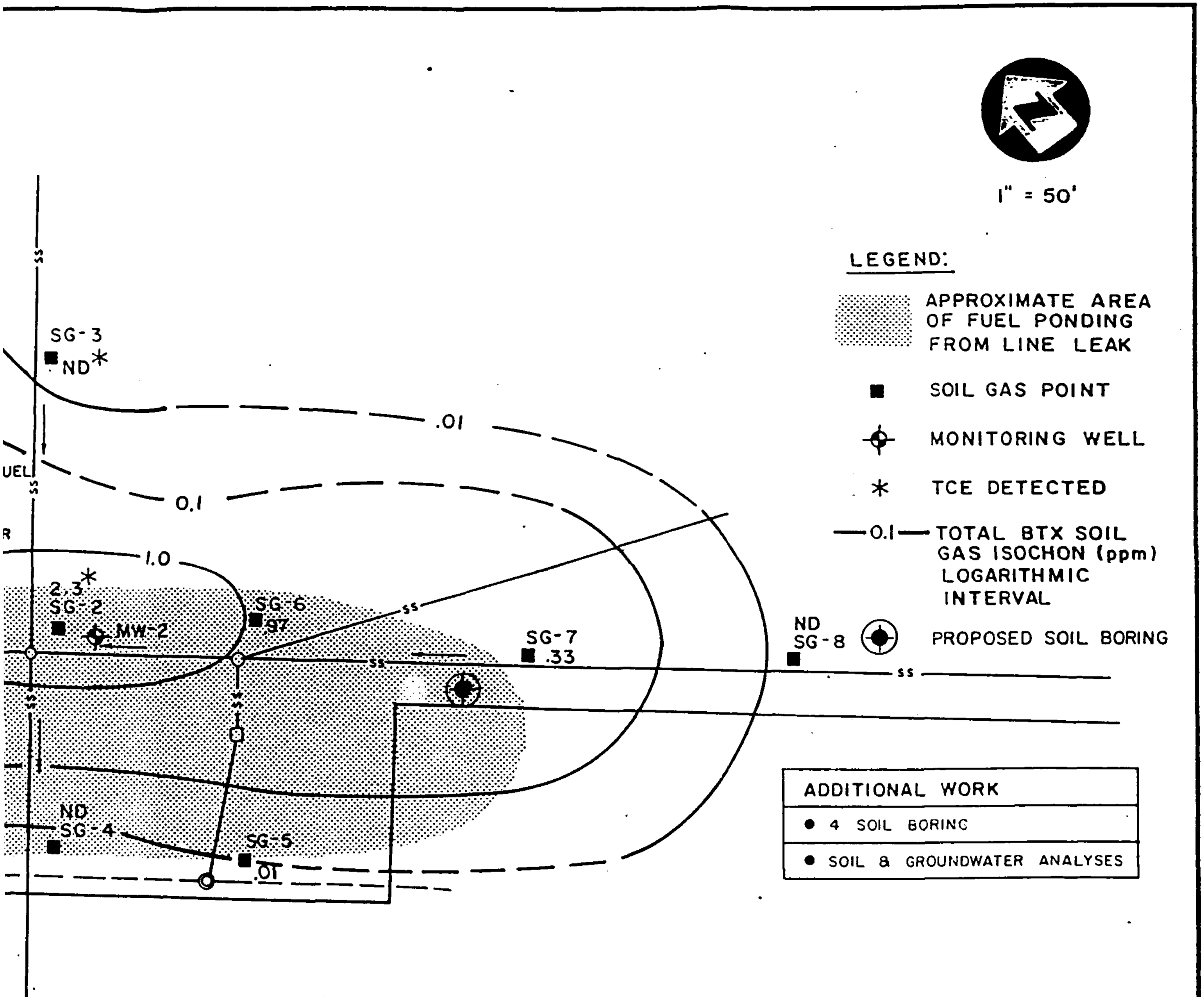
3.3 SITE 4: JP-4 Pump Station No. 5

Previous site activities included a five-point soil gas survey and the installation of two groundwater monitoring wells. The purpose of the additional sampling at Site 4 is to determine whether the water pumped and discharged from the UST pit onto the surface is contaminating the soil or groundwater. The drainage path leading from the discharge point typically has dead vegetation and a hydrocarbon sheen. During this investigation, two soil borings will be drilled with soil samples collected



SOURCE:
BASE DETAILED SECTIONAL MAPS

FIGURE 3.2



SOIL GAS CONCENTRATION MAP
SITE 3 (RB 3)
PUMPING STATION NO. 4
RICKENBACKER AIR NATIONAL GUARD BASE

from each boring. Groundwater samples will be collected from the two existing monitoring wells. Laboratory analysis for volatile organics (CLP), petroleum hydrocarbon (EPA Method 418.1) content and lead (total and dissolved for water samples) will be performed on all environmental samples collected.

Two soil borings will be drilled to a depth of fifteen feet or at initial occurrence of the water table. Location of these borings will be east of the existing MW-1 (Figure 3.3). Soil samples will be collected at five foot intervals. The two samples from each boring with the highest PID value will be sent to the laboratory for analysis.

Groundwater samples will be collected from the two existing monitoring wells on site for laboratory analysis.

3.4 SITE 5: Lateral Safety Zone Spill Area

Previous work on Site 5 included a seventeen-point soil gas survey and the installation of two groundwater monitoring wells. The purpose of the additional sampling at Site 5 is to test whether volatile organic compounds are present in the soil and groundwater beneath the site. During additional SI sampling, one soil boring will be drilled and groundwater samples will be collected from the two existing wells. All environmental samples from Site 5 will be analyzed for aromatic volatile organics (SW-846 Method 8020) and petroleum hydrocarbons (EPA Method 418.1).

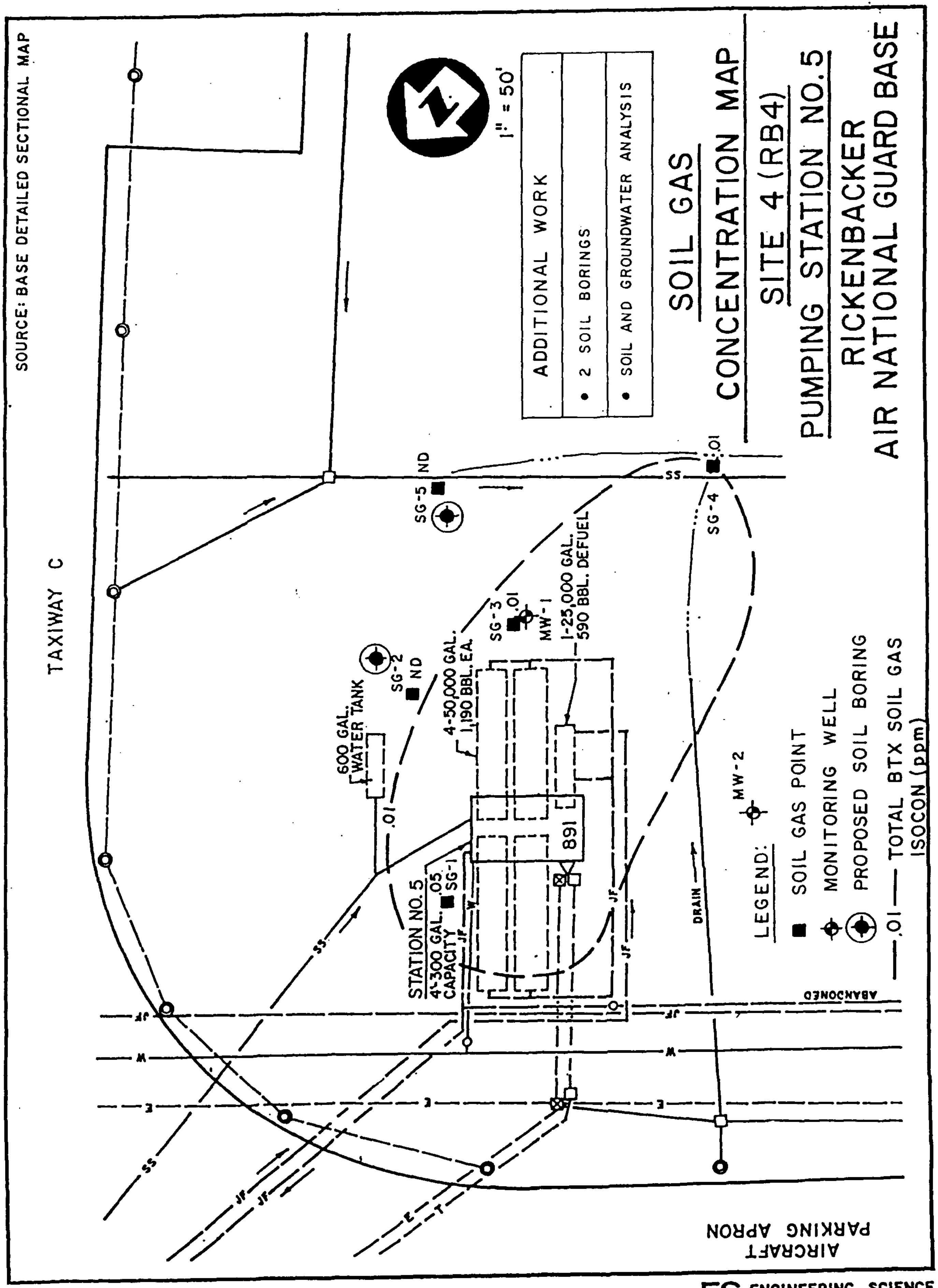
One soil boring will be drilled to a depth of fifteen feet or initial encounter of the water table. Figure 3.4 is a map showing the proposed boring location. Soil samples will be collected at five foot intervals. The two samples with the highest PID values will be sent to the laboratory for analysis.

Groundwater samples will be collected for laboratory analysis from the two existing monitoring wells on site.

3.5 SITE 6: Base Filling Station

Previous site activities included a eight-point soil gas survey and the installation of one monitoring well. The purpose of the additional sampling at Site 6 is to

FIGURE 3.3



SOIL GAS CONCENTRATION MAP

SITE 4 (RB4)

PUMPING STATION NO. 5

RICKENBACKER

AIR NATIONAL GUARD BASE

SOURCE: BASE DETAILED SECTIONAL MAP

ES ENGINEERING-SCIENCE

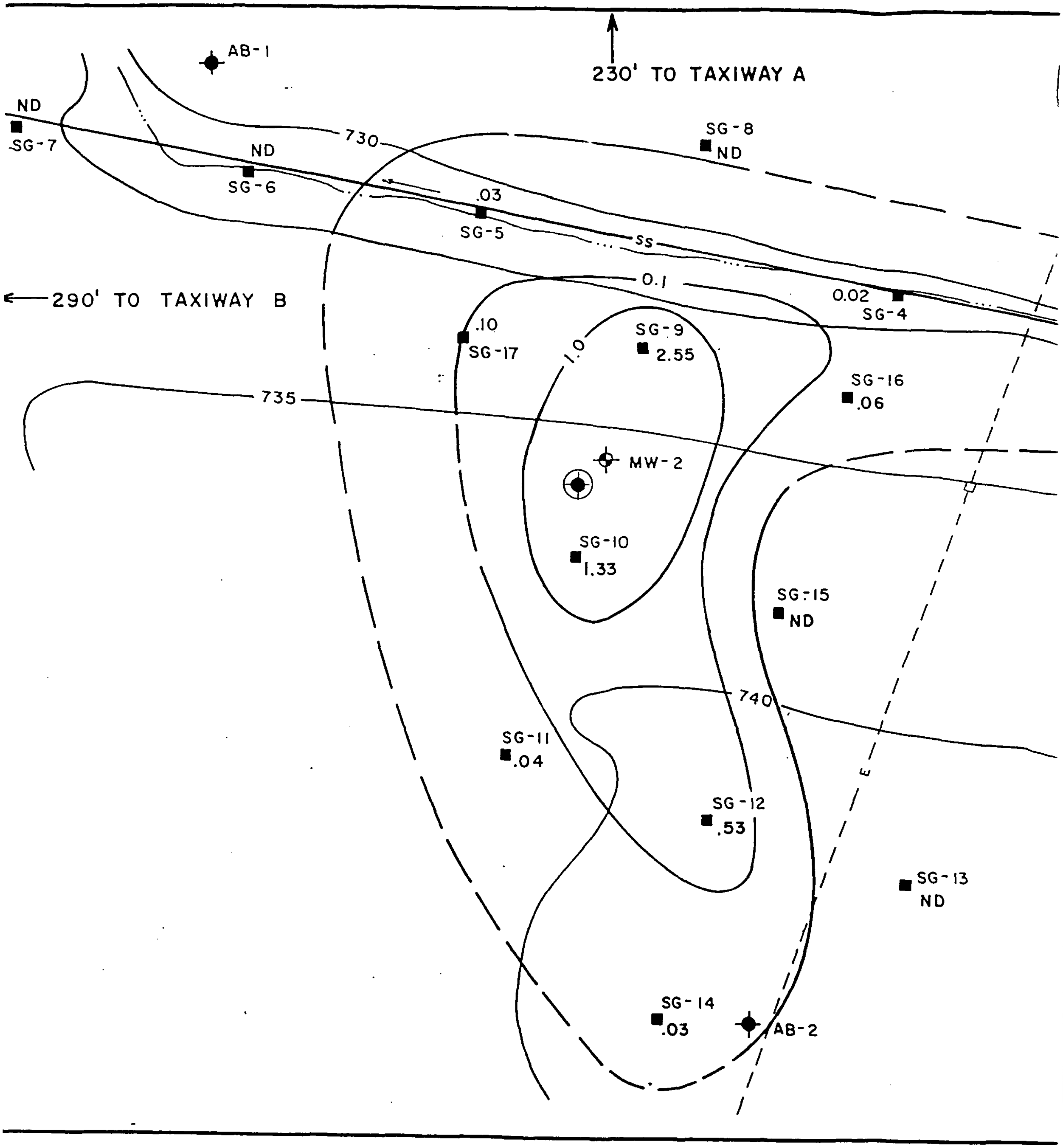
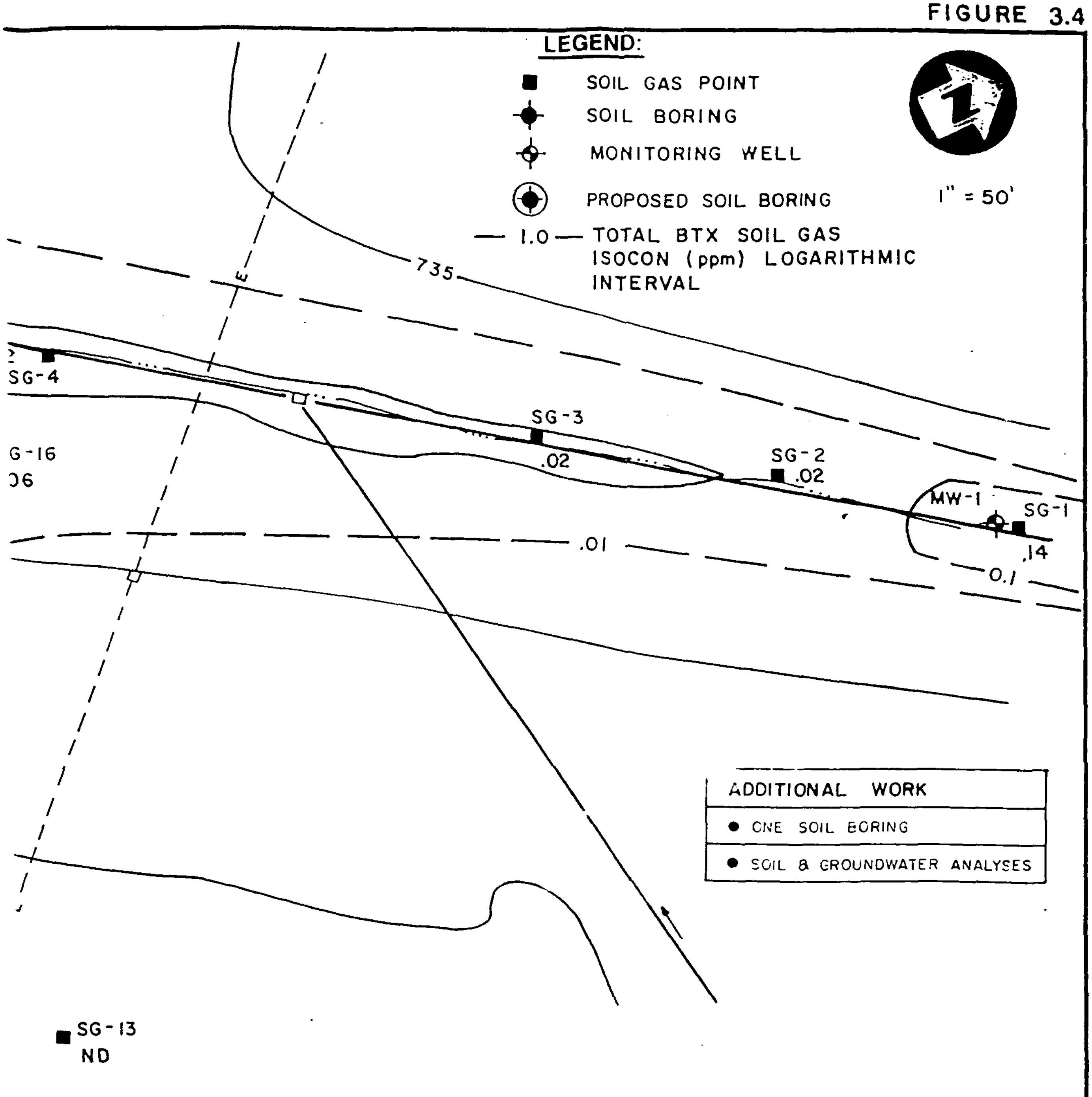

AB-1
230' TO TAXIWAY A
ND
SG-7
SG-8
ND
730
ND
SG-6
.03
SG-5
SS
290' TO TAXIWAY B
0.1
0.02
SG-4
.10
SG-17
SG-9
2.55
1.0
SG-16
.06
735
MW-2
SG-10
1.33
SG:15
ND
740
SG-11
.04
E
SG-12
.53
SG-13
ND
SG-14
.03
AB-2

FIGURE 3.4



ADDITIONAL WORK
● ONE SOIL BORING
● SOIL & GROUNDWATER ANALYSES

SOIL GAS CONCENTRATION MAP
SITE 5 (RB 5)
LATERAL SAFETY ZONE SPILL
RICKENBACKER AIR NATIONAL GUARD BASE

determine whether hydrocarbons are present in the soil and groundwater downgradient from the pump islands. During additional site investigation sampling, one monitoring well will be installed and a slug test performed at the well. Soil and groundwater samples will be collected at the new well, along with water samples from the existing well. Laboratory analysis for all environmental samples collected will include tests for aromatic volatile organics (SW-846, Method 8020), petroleum hydrocarbons (EPA Method 418.1) and lead (total and dissolved for water samples).

The additional monitoring well will be located northeast of the existing well (Figure 3.5). Soil samples will be taken at five foot intervals, each soil sample will be tested for organic headspace content with the PID in the field. The two samples with the highest PID readings will be sent to a laboratory for analysis.

A slug test will then be carried out on the new well to determine hydrogeologic characteristics of the aquifer in the vicinity of the groundwater monitoring well.

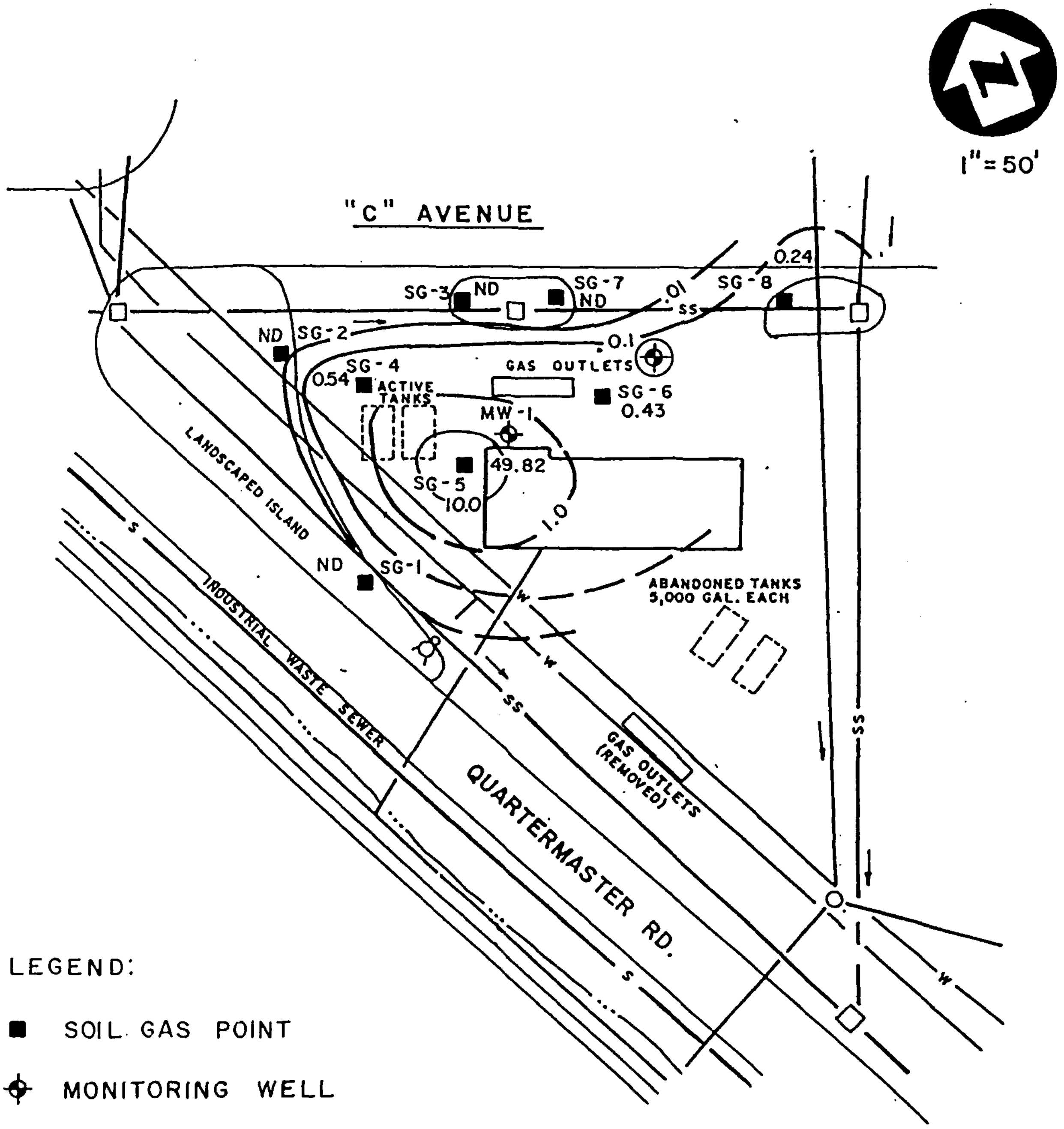
3.6 SITE 9: Salvage Yard

Previous site activities at Site 9 included an eight-point soil gas survey, ten hand borings around the edges of the pavement, and the installation of one groundwater monitoring well. The additional investigation will consist of resampling the groundwater from the existing monitoring well and analyzing for total and dissolved priority pollutant metals. The purpose of the additional work is to conclude whether Site 9 can be exempted from the Remedial Investigation.

3.7 SITE 10: JP-4 Fuel Line Rupture

Previous site activities at Site 10 included a six-point soil-gas survey and the installation of one groundwater monitoring well. In the additional investigation, two soil borings will be drilled, and one of the borings will be completed as a monitoring well. Soil samples will be collected during drilling, along with groundwater samples from the new and existing monitoring wells. Laboratory analysis for all samples collected (both soil and water) will include tests for volatile organics (SW-846 Method 8240) and petroleum hydrocarbons (EPA Method 418.1) and priority pollutant metals (total and dissolved for water samples).

FIGURE 3.5



LEGEND:

■ SOIL GAS POINT

⌖ MONITORING WELL

⊕ PROPOSED MONITORING WELL

—0.1—TOTAL BTX SOIL GAS ISOCON (ppm) LOGARITHMIC INTERVAL

ADDITIONAL WORK
• ONE TWO-INCH MONITORING WELL
• SOIL AND GROUNDWATER ANALYSIS
• SLUG TEST

SOURCE:
BASE DETAILED SECTIONAL MAPS.

SOIL GAS CONCENTRATION MAP
SITE 6 (RB6)
BASE FILLING STATION
RICKENBACKER
AIR NATIONAL GUARD BASE

The purpose of the additional sampling is to determine whether volatile organic compounds are present in the soil and groundwater beneath the site. The soil boring and monitoring well will be located north and west respectively, of the existing well at Site 10 (Figure 3.6). The boring will be drilled to fifteen feet or to the top of the water table. The monitoring well will be completed five to ten feet into the top of the shallow aquifer. Soil samples will be collected at five foot intervals. The two soil samples from each boring having the highest headspace PID value will be sent to the laboratory for analysis.

Groundwater samples will be collected for laboratory analysis from the new monitoring well, and from the existing well on site. A slug test will be performed on the new well.

3.8 SITE 12: Old Drum Storage Area

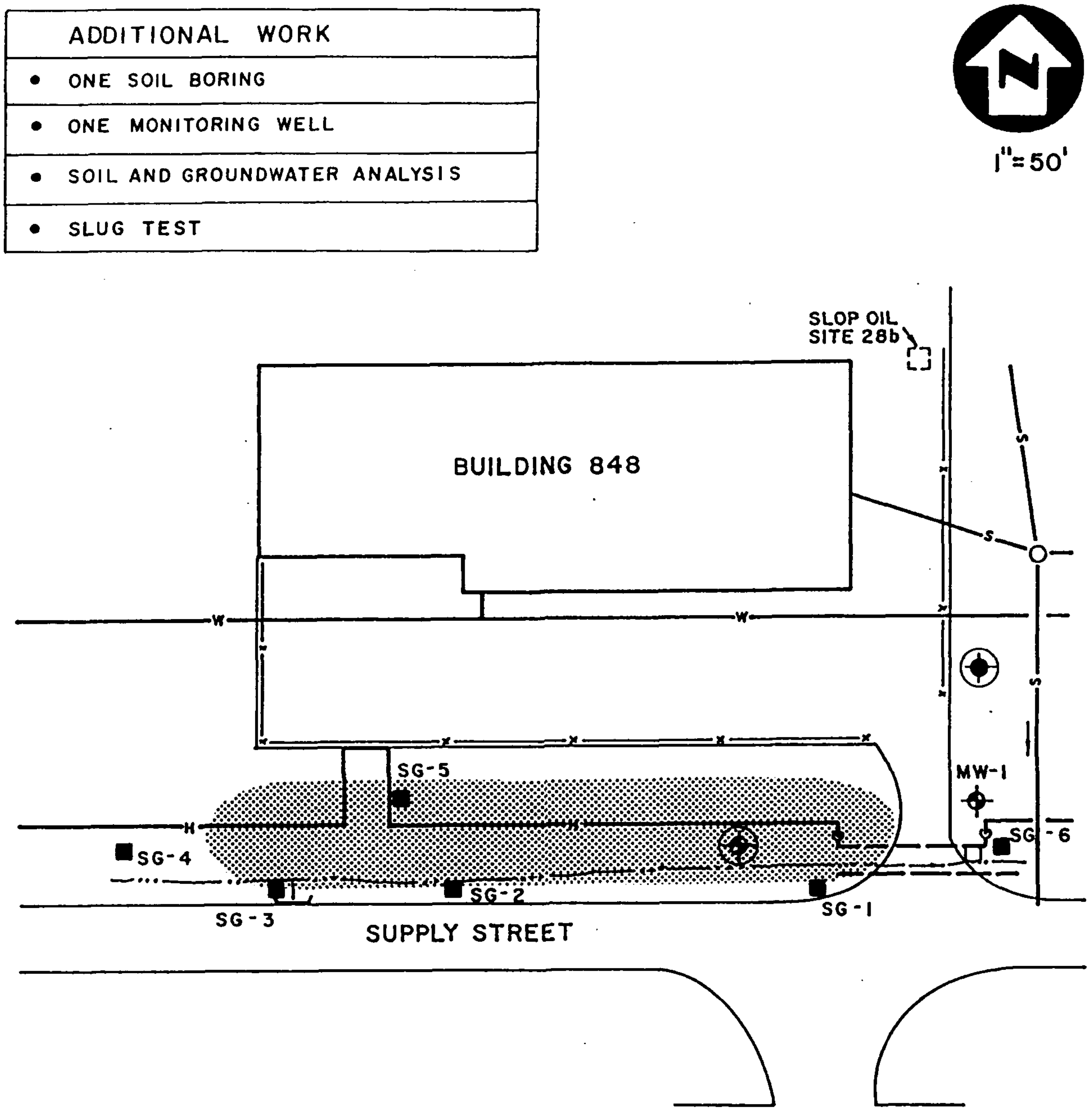
The previous investigation included a seven-point soil gas survey, ten hand borings and the installation of one groundwater monitoring well. During the additional SI work, one monitoring well will be installed. Soil and water samples will be taken from the new monitoring well. These samples will be analyzed for volatile organic compounds (CLP) and petroleum hydrocarbons (EPA Method 418.1).

The purpose of the additional sampling at Site 12 is to test the soil and groundwater for volatile organics (VOCs) in the vicinity of several hand borings (HB-7, HB-8, HB-10) where these compounds were detected. One groundwater monitoring well will be installed in the upper portion of the shallow aquifer. The well will be located west and hydraulically upgradient from the existing monitoring well (Figure 3.7). Soil samples will be collected at five foot intervals during drilling operations. The two samples with the highest PID values will be sent to the laboratory for analysis. Groundwater samples will be taken for laboratory analysis from the existing monitoring well and the new well on site.

A slug test will be performed on the new groundwater monitoring well, to determine hydrogeologic characteristics of the aquifer in the vicinity of the well.

FIGURE 3.6

ADDITIONAL WORK
• ONE SOIL BORING
• ONE MONITORING WELL
• SOIL AND GROUNDWATER ANALYSIS
• SLUG TEST



LEGEND:

▨ APPROXIMATE EXTENT OF SPILL

■ SOIL GAS POINT

⌖ MONITORING WELL

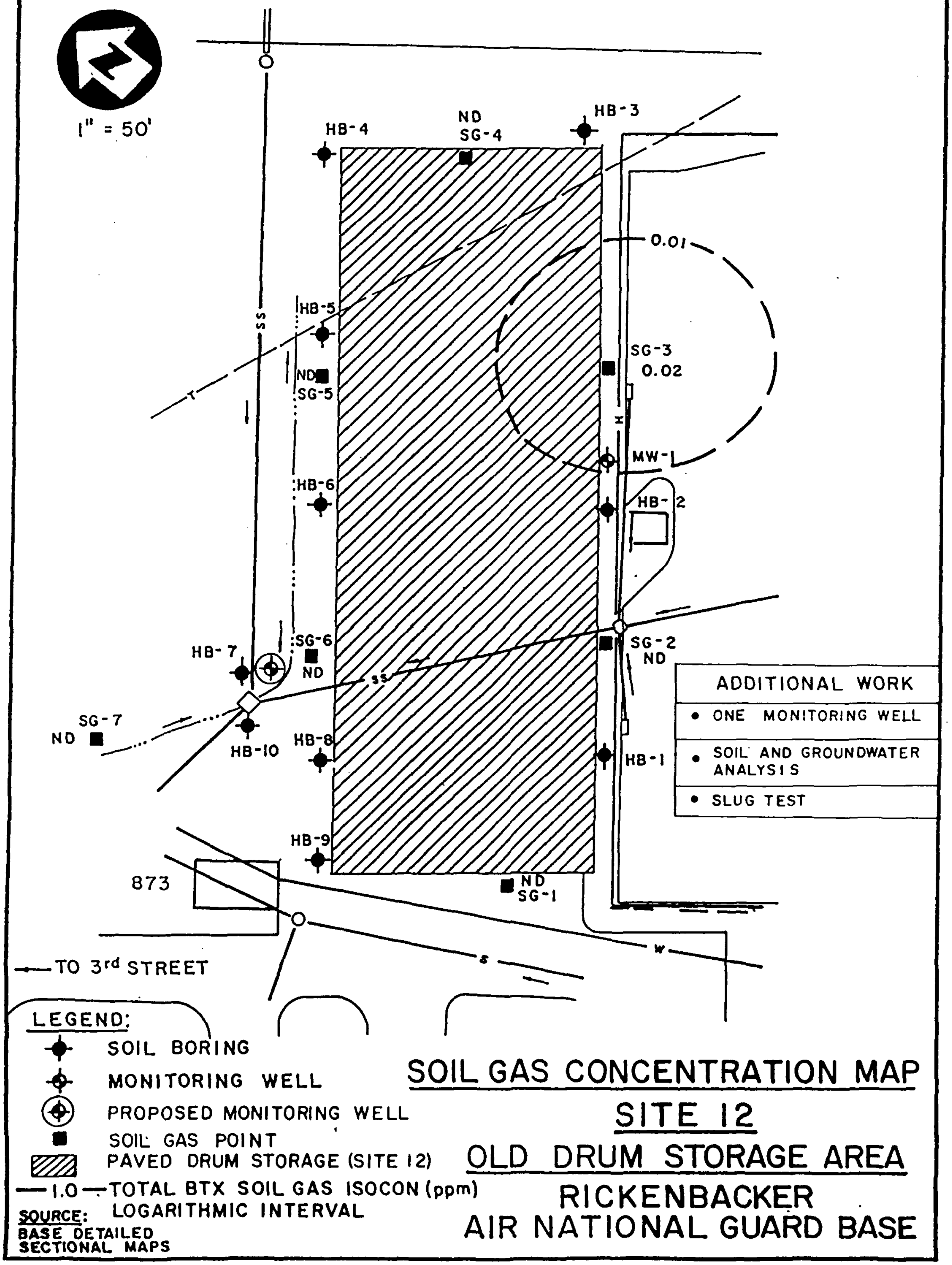
◉ PROPOSED SOIL BORING

⊕ PROPOSED MONITORING WELL

SOURCE:
BASE DETAILED SECTIONAL MAPS.

MONITORING WELL AND
SOIL GAS POINT LOCATIONS
SITE 10 (RB10)
JP4 FUEL LINE RUPTURE
RICKENBACKER
AIR NATIONAL GUARD BASE

FIGURE 3.7



SOIL GAS CONCENTRATION MAP

SITE 12

OLD DRUM STORAGE AREA

RICKENBACKER
AIR NATIONAL GUARD BASE

3.9 SITE 14: KC 135 Crash Site

During the previous investigation, site activities included a ten-point soil-gas survey and the installation of two groundwater monitoring wells. The purpose of the additional sampling at Site 14 is to determine whether volatile organic compounds are present in the groundwater from the two existing wells. Laboratory analysis for aromatic volatile organics (SW-846 Method 8020) and petroleum hydrocarbons (EPA Method 418.1) will be performed on these water samples.

3.10 SITE 15: Southwest Fuel Dump Pit

Previous site activity included a twenty-three point soil-gas survey and the installation of two monitoring wells. Soil samples were collected from two soil borings. During the additional SI sampling, two soil borings will be drilled. Soil samples from each boring and groundwater samples from all monitoring wells will be collected. Laboratory analysis for aromatic volatile organics (SW-846 Method 8020), petroleum hydrocarbons (EPA Method 418.1) and lead (dissolved and total for water samples) will be performed on all samples.

The purpose of the additional sampling is to test whether volatile organics and lead are present in the soil and groundwater beneath the site.

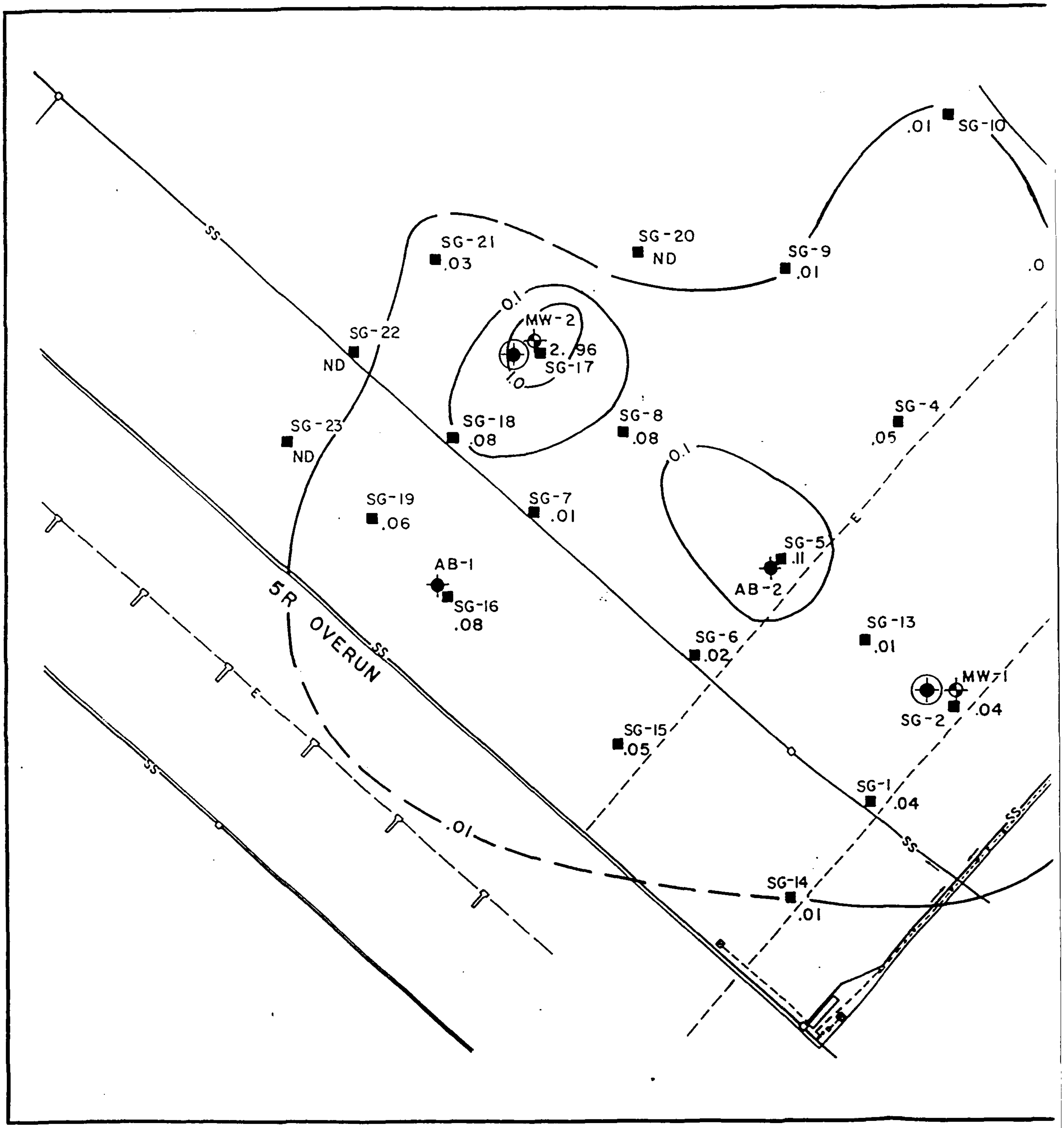
The two soil borings will be drilled to a depth of fifteen feet or initial depth of the water table, whichever occurs first. These borings will be located adjacent to the existing monitoring wells (Figure 3.8). Soil samples will be collected at five foot intervals during drilling operations. The two soil samples from each boring having the highest PID headspace VOC value will be sent to the laboratory for analysis.

3.11 SITE 16: Northeast Fuel Dump Pit

Previous site activity included a sixteen-point soil-gas survey and the installation of two monitoring wells. Soil samples were collected from two soil borings. During the additional SI sampling, two soil borings will be drilled. Soil samples from each boring and groundwater samples from all monitoring wells will be collected. Laboratory analyses for aromatic volatile organics (SW-846 Method 8020), petroleum hydrocarbons (EPA Method 418.1) and lead (dissolved and total for water samples) will be performed on all samples.

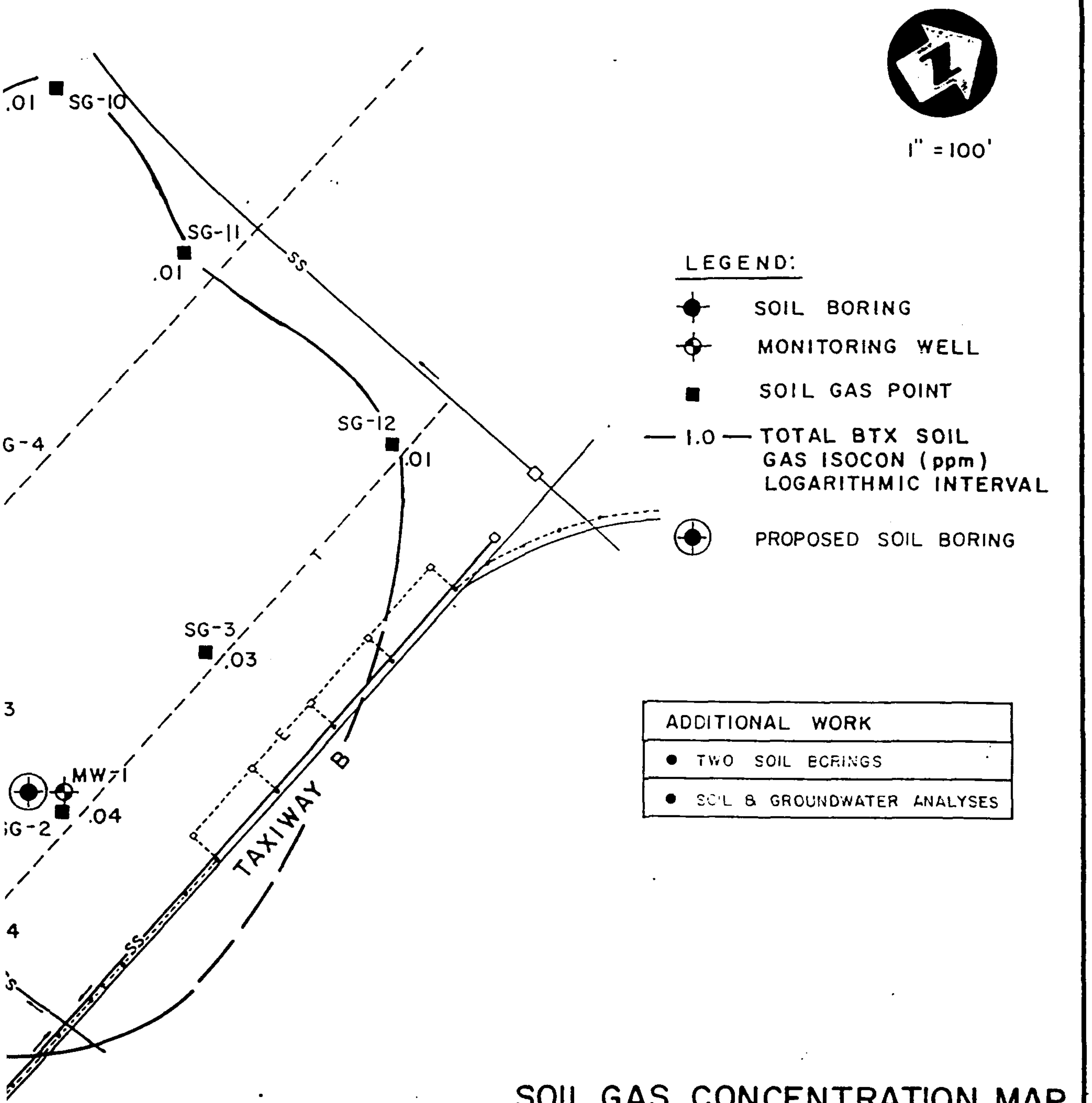
The purpose of the additional sampling is to test whether volatile organics and lead are present in the soil and groundwater beneath the sites.

The two soil borings will be drilled to a depth of fifteen feet or initial depth of the water table, whichever occurs first. These borings will be located adjacent to the existing monitoring wells (Figure 3.9). Soil samples will be collected at five foot intervals during drilling operations. The two soil samples from each boring having the highest PID headspace VOC value will be sent to the laboratory for analysis.



SG-10
.01
.0
SG-20
ND
SG-9
.01
SG-21
.03
SG-22
ND
0.1
MW-2
2.96
SG-17
1.0
SG-18
.08
SG-8
.08
SG-23
ND
SG-4
.05
0.1
SG-19
.06
SG-7
.01
SG-5
.11
AB-2
AB-1
SG-16
.08
5R OVERUN
SS
SG-6
.02
SG-13
.01
MW-1
SG-2
.04
SG-15
.05
SG-1
.04
.01
SG-14
.01
SS
E
E
SS
SS
SS

FIGURE 3.8



SOIL GAS CONCENTRATION MAP
SITE 15 (RB15)
SOUTHWEST FUEL DUMP PIT
RICKENBACKER
AIR NATIONAL GUARD BASE

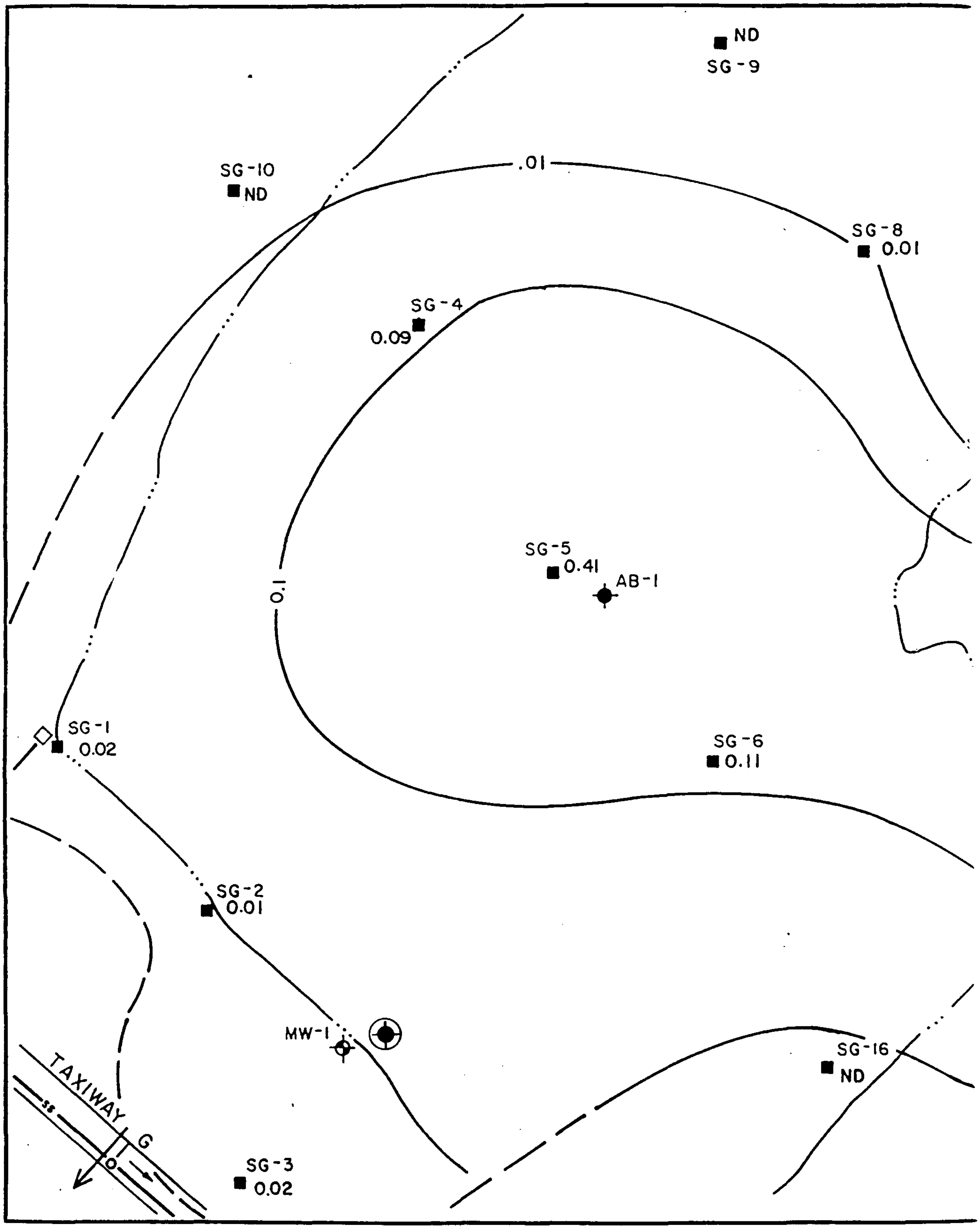
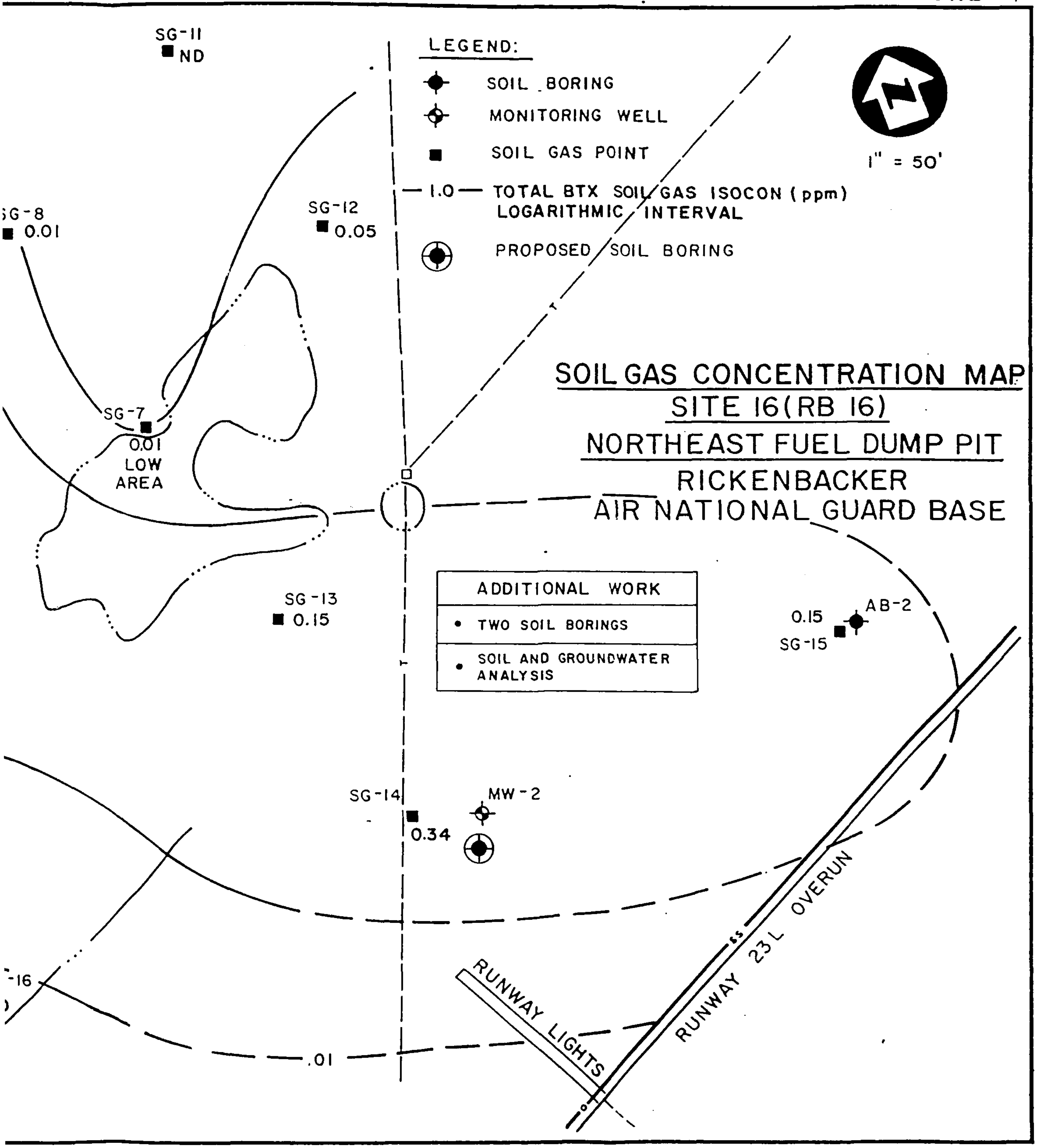

ND
SG-9
SG-10
ND
.01
SG-8
0.01
SG-4
0.09
0.1
SG-5
0.41
AB-1
SG-1
0.02
SG-6
0.11
SG-2
0.01
MW-1
SG-16
ND
TAXIWAY G
SS
SG-3
0.02

FIGURE 3.9



SOIL GAS CONCENTRATION MAP
SITE 16 (RB 16)
NORTHEAST FUEL DUMP PIT
RICKENBACKER AIR NATIONAL GUARD BASE

3.12 SITE 17: Old Entomology Lab

During the initial investigation, site activities included hand borings and the installation of one monitoring well. During the additional SI sampling, the existing groundwater monitoring well will be sampled. Laboratory analysis for pesticides and herbicides (SW-846 Methods 8080 and 8150) will be performed on the water sample. The purpose of the additional sampling is to conclude whether Site 17 can be removed from the Remedial Investigation.

3.13 SITE 19: North Coal Pile

Previous activities for Site 19 included a nineteen-point soil-gas survey, installation of two groundwater monitoring wells, drilling of four soil borings, and collection of ditch water and sediment samples.. The purpose of the additional sampling is to substantiate the presence of hydrocarbons in the groundwater beneath Site 19. During the additional SI sampling, water samples from the existing monitoring wells will be collected. Laboratory analysis will include tests for volatile organics (CLP), petroleum hydrocarbons (EPA Method 418.1), priority pollutants metals (total and dissolved), sulfates (EPA Method 9038), alkalinity (EPA 310.1),acidity (EPA 305.1) and base/neutral semi-volatile organics (CLP).

3.14 SITE 20: South Coal Pile

Previous site activities included a twelve-point soil-gas survey, the installation of two groundwater monitoring wells, drilling of four soil borings, and collection of two ditch water and two sediment samples. The purpose of the additional sampling at Site 20 is to install a downgradient monitoring well in order to test the soil and groundwater for hydrocarbons near a high BTX soil-gas concentration (SG-7). During the additional SI sampling, one monitoring well will be installed, water samples from the new and existing wells will be collected, and a slug test of the new monitoring well will be performed. The new monitoring well will be installed south of the existing MW2, at the location shown on Figure 3.10. Laboratory analysis will include tests for volatile organics (CLP), petroleum hydrocarbons (EPA Method 418.1), priority pollutants metals (total and dissolved for water) sulfates (EPA Method 9038), alkalinity (EPA 310.1), acidity (EPA 305.1), and base/neutral semi-volatile organics (CLP).

3.15 SITE 21: Leaking Drum and Oil Change Area at Water Plant

Previous site activities included six hand borings and soil analysis. During this investigation one soil boring and one groundwater monitoring well will be placed on site.

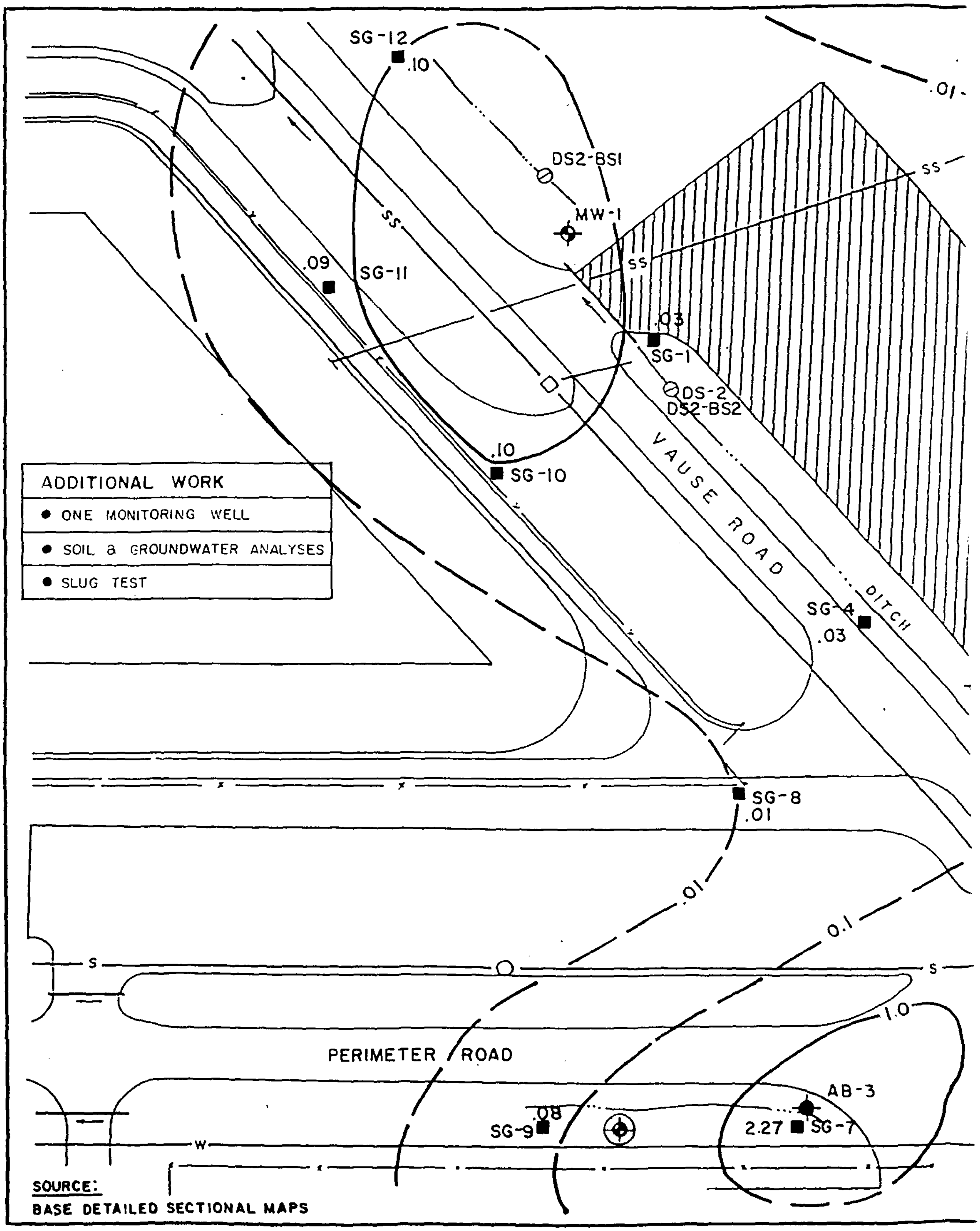
Soil and water samples will be collected and a slug test of the new monitoring well will be performed. Laboratory analysis of all environmental samples. Analysis will include tests for aromatic volatile organics (SW-846 Method 8020), petroleum hydrocarbons (EPA Method 418.1) and priority pollutants metals (total and dissolved on all water samples). The soil boring will be drilled southeast of the water treatment plant (Figure 3.11), to determine vertical hydrocarbon content of the soil. This boring will be drilled to a depth of fifteen feet or to the water table. Soil samples will be collected at five foot intervals, and the two samples having the highest headspace PID values will be sent to the laboratory for analysis.

One groundwater monitoring well will be placed at a depth of thirty feet or occurrence of upper aquifer. This well will determine the relative amount of hydrocarbons in the water and will be located hydraulically downgradient from the leaking drum area. Two soil samples will be collected during drilling based on the criteria discussed in the previous paragraph. The soil samples, along with groundwater samples taken from the monitoring well, will be sent to the laboratory for analysis.

The groundwater monitoring well will have a slug test performed on it to determine hydrogeologic characteristics of the aquifer in the vicinity of the well.

3.16 SITE 22: Heat Plant Lube Oil Drum Storage Area

During previous investigations, soil samples were collected from two hand borings. Additional SI sampling will include: the installation of one soil boring and one monitoring well, the collection and chemical analysis of soil and water samples and a slug test on the new monitoring well. Laboratory analysis will be conducted on all environmental samples collected and will include tests for volatile organics (CLP) and petroleum hydrocarbons (EPA Method 418.1).

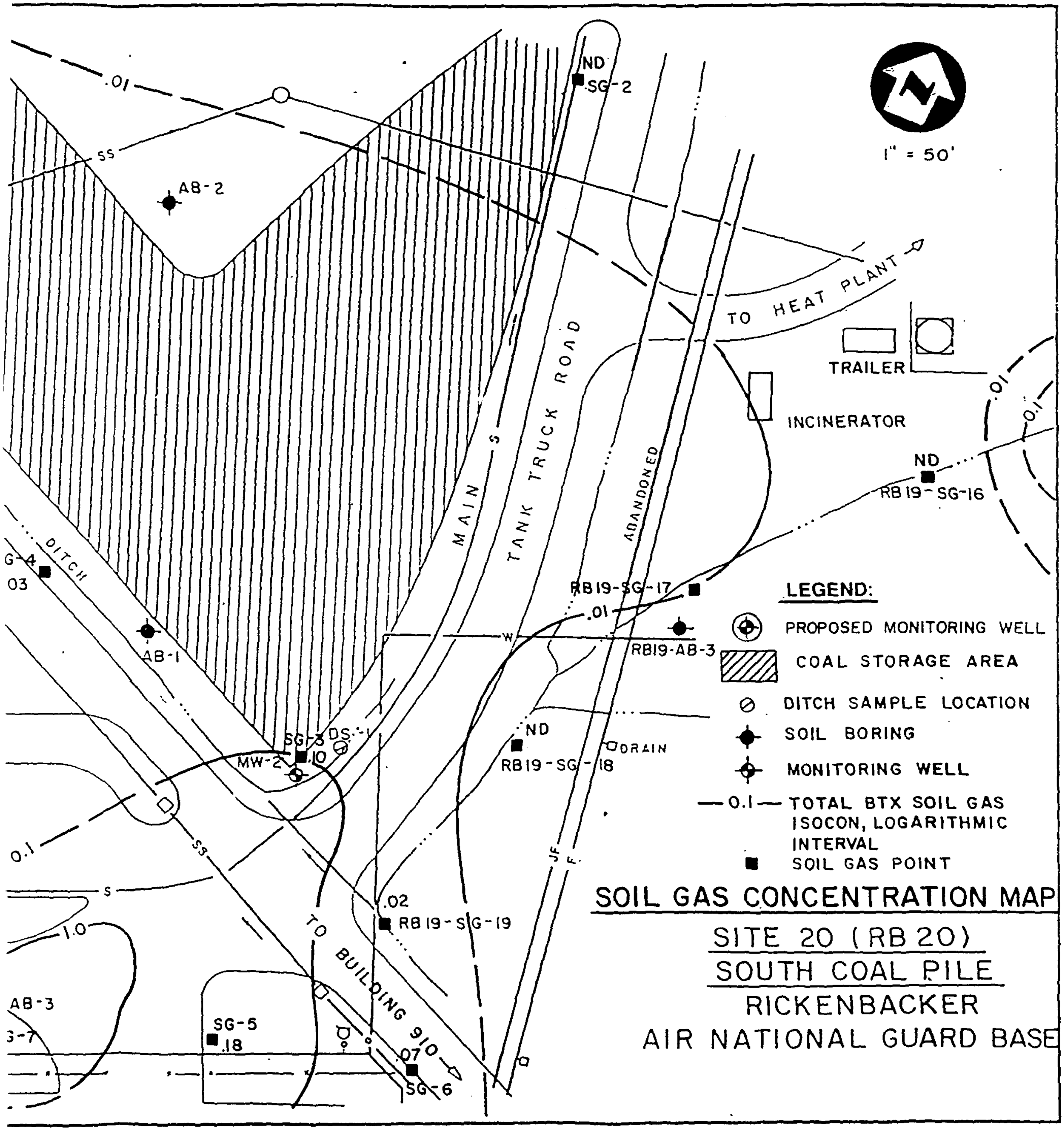


ADDITIONAL WORK

- ● ONE MONITORING WELL
- ● SOIL & GROUNDWATER ANALYSES
- ● SLUG TEST

SOURCE:
BASE DETAILED SECTIONAL MAPS

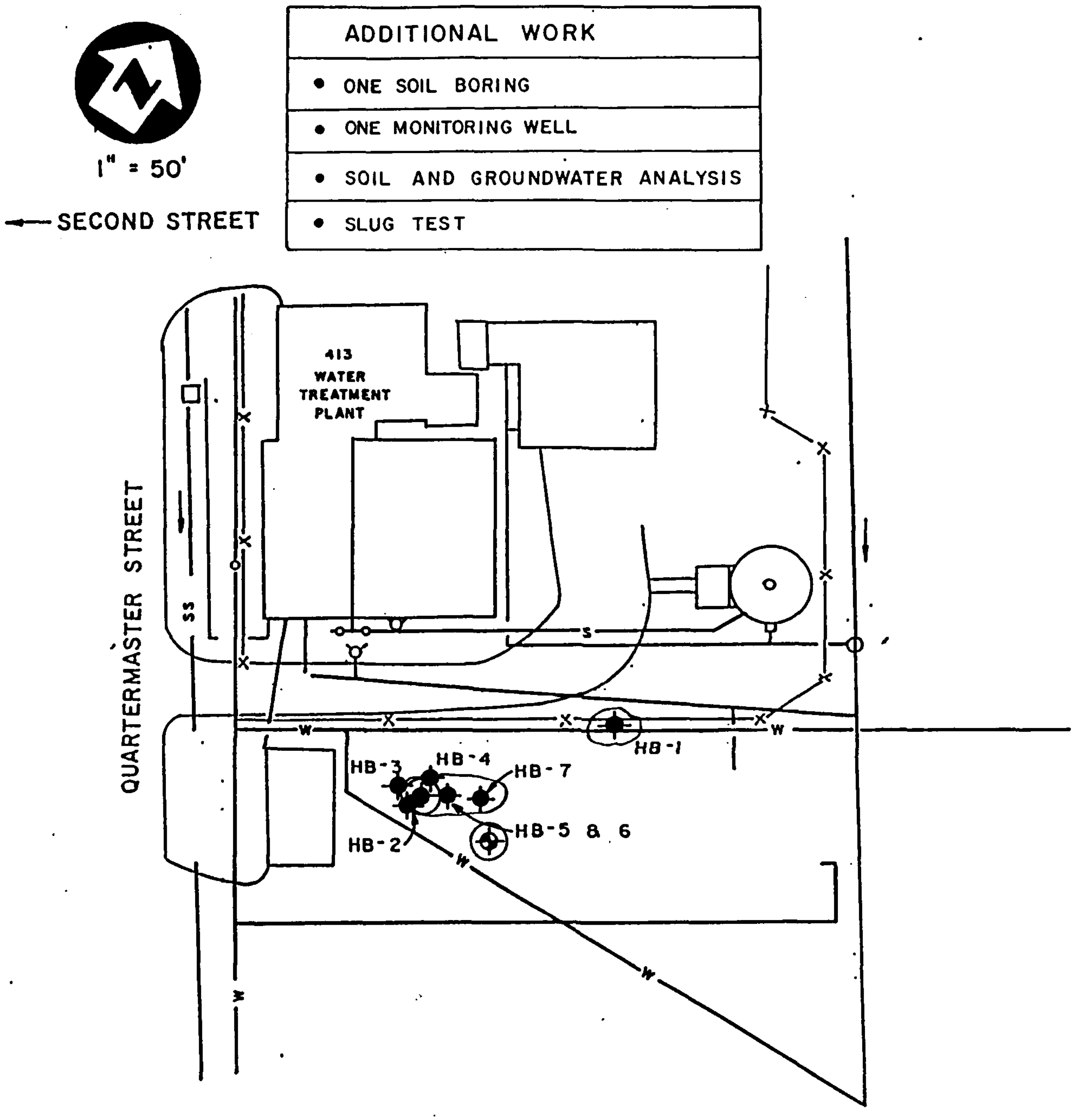
FIGURE 3.10



SOIL GAS CONCENTRATION MAP

SITE 20 (RB 20)
SOUTH COAL PILE
RICKENBACKER
AIR NATIONAL GUARD BASE

One soil boring will be drilled southeast of the heating plant (Figure 3.12) to a depth of fifteen feet or initial occurrence of the water table. The purpose of the boring is to determine the vertical extent of the hydrocarbons. Soil samples will be taken at five foot intervals. The two samples with the highest headspace PID values will be sent to a laboratory for analysis.



LEGEND:

◯ OIL SPILL AREAS

✦ SOIL BORING

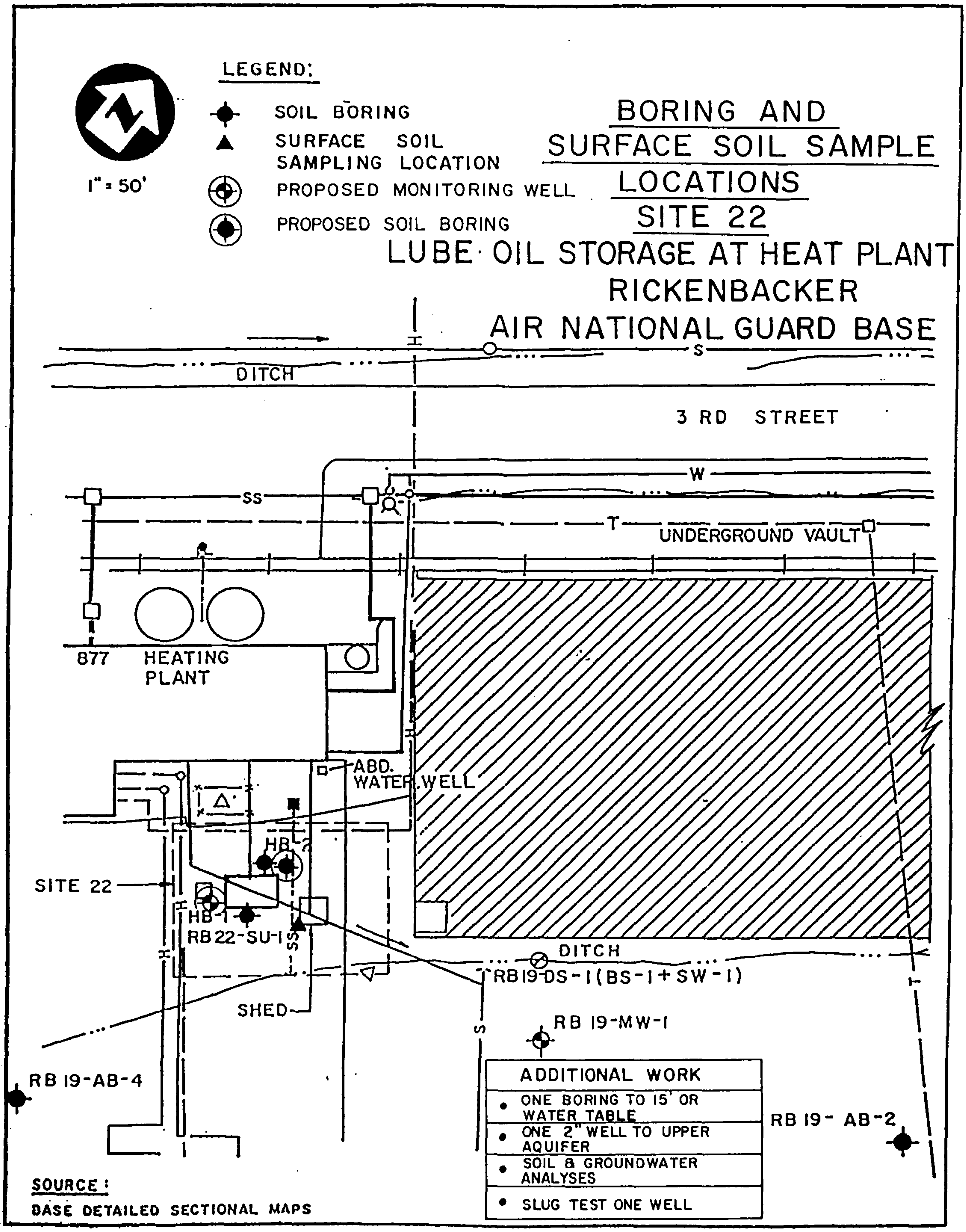
⊕ PROPOSED SOIL BORING

⊕ PROPOSED MONITORING WELL

SOURCE:
BASE DETAILED SECTIONAL MAPS

SOIL BORING LOCATIONS
SITE 21 (RB 21)
LEAKING DRUM AND OIL CHANGE AREA
RICKENBACKER AIR NATIONAL GUARD BASE

FIGURE 3.12



BORING AND SURFACE SOIL SAMPLE LOCATIONS SITE 22 LUBE OIL STORAGE AT HEAT PLANT RICKENBACKER AIR NATIONAL GUARD BASE

LEGEND:

- SOIL BORING
- ▲ SURFACE SOIL SAMPLING LOCATION
- PROPOSED MONITORING WELL
- PROPOSED SOIL BORING

ADDITIONAL WORK
• ONE BORING TO 15' OR WATER TABLE
• ONE 2" WELL TO UPPER AQUIFER
• SOIL & GROUNDWATER ANALYSES
• SLUG TEST ONE WELL

SOURCE:
BASE DETAILED SECTIONAL MAPS

One groundwater monitoring well will be installed southeast and hydraulically downgradient of the heating plant. Soil samples will be collected during drilling in accordance with the sampling procedure described in the preceding paragraph. Groundwater samples will be collected and analyzed to test for the presence or absence of dissolved hydrocarbons.

A slug test will be performed on the new groundwater monitoring well to determine hydrogeologic characteristics of the aquifer in the vicinity of the well.

3.17 SITE 23: Fire Training Area

Previous site activities included a twenty-five point soil-gas survey, drilling of eight soil borings, and the installation of four groundwater monitoring wells. Site activities for this investigation includes: installation of one groundwater monitoring well, the collection and analysis of soil and groundwater samples, and a slug test on the new monitoring well. All environmental samples collected will be analyzed for volatile organics (CLP), base/neutral semi-volatile organics (CLP) and priority pollutant metals (total and dissolved for water samples).

The purpose of the additional sampling at Site 23 is to install a downgradient monitoring well, and to substantiate whether contaminants are present in the groundwater. One groundwater monitoring well will be installed on site to a depth of 30 feet or occurrence of the upper aquifer. It will be located west and hydraulically downgradient of the existing monitoring wells (Figure 3.13). Soil samples will be taken at five foot intervals, and the two samples with the highest headspace PID values will be submitted for analysis. These soil samples along with water samples from the new and existing monitoring wells will be collected for further laboratory analysis. A slug test will be performed on the new groundwater monitoring well to determine hydrogeologic characteristics of the aquifer in the vicinity of the well.

3.18 SITE 24: Sewage Treatment Plant Sludge Beds

During the previous investigation, twenty soil samples were collected from the surface of the sludge beds, four from hand borings in the sludge spreading area, and three groundwater monitoring wells were installed.

During the additional SI sampling, one groundwater monitoring well will be installed, soil and groundwater samples will be collected, and a slug test conducted on the new monitoring well. Laboratory analysis on the environmental samples collected will include tests for priority pollutant metals (total and dissolved for water samples).

The purpose of the additional sampling at Site 24 is to install a downgradient monitoring well, and confirm whether dissolved metals are present in the groundwater beneath the site. The new monitoring well will be located hydraulically downgradient of hand borings 1 through 4 (see Figure 3.14). The well will be completed at the top of the shallow aquifer. Soil samples will be collected at five foot intervals during drilling, and the two most visibly contaminated samples will be sent to the lab for analysis. Groundwater samples will be collected from all wells for analysis.

A slug test will be performed on the new monitoring well to determine hydrogeologic characteristics of the aquifer in vicinity of the well.

3.19 SITE 25: Storm Drainage Ditch System

Previous site activities included bottom sediment and surface water sampling at thirty locations at ditch intersections, and the installation of four groundwater monitoring wells at drainage basin oil/water separators. Site activities during the additional SI sampling will include groundwater sampling of each of the existing wells. Laboratory analysis for these samples will include a test for priority pollutant metals (total and dissolved). The purpose of the additional sampling is to test whether dissolved metals are present in the groundwater beneath the site.

3.20 SITE 27: Drainage Ditch Near Landfill

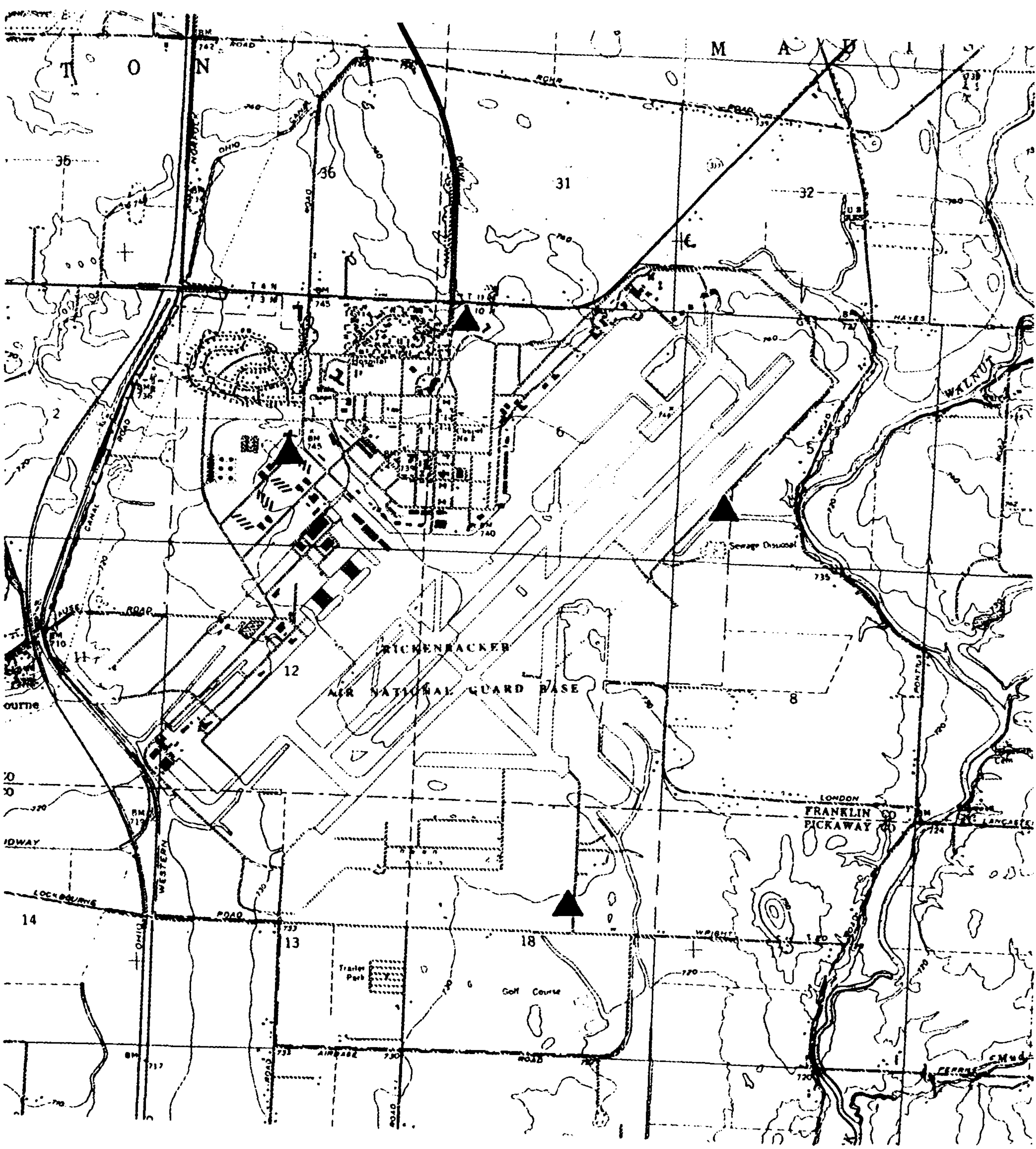
During Phase 1 of the site investigation site activities included bottom sediment and surface water sampling and the installation of one groundwater monitoring well. The purpose of the additional sampling is to test whether dissolved metals are present in the groundwater beneath the site. Site activities for the additional SI sampling will include water sampling of the existing well. Laboratory analysis of the water samples collected will be for priority pollutant metals (total and dissolved).

3.21 Background Soil Samples

Four locations at the RANGB have been chosen to determine a background metal content for the soils. At each location the soil boring will be drilled to a depth of fifteen feet or initial occurrence of the water table. Two soil samples will be collected from each boring at the ground surface (upper 6 inches) and at the water table. The soil samples will be analyzed for priority pollutant metals.

As shown in Figure 3.15, the four locations are spread out across the base. One boring is located west of the Airbase Road and Wright Road intersection, a second boring located north of the sewage disposal area (Site 24), a third boring located near the visiting officers quarters and the fourth boring north of the railroad tracks by the housing area.

FIGURE 3.15



LEGEND:

▲ BACKGROUND SOIL SAMPLE COLLECTION LOCATION

BACKGROUND SOIL SAMPLING LOCATIONS RICKENBACKER AIR NATIONAL GUARD BASE

616281

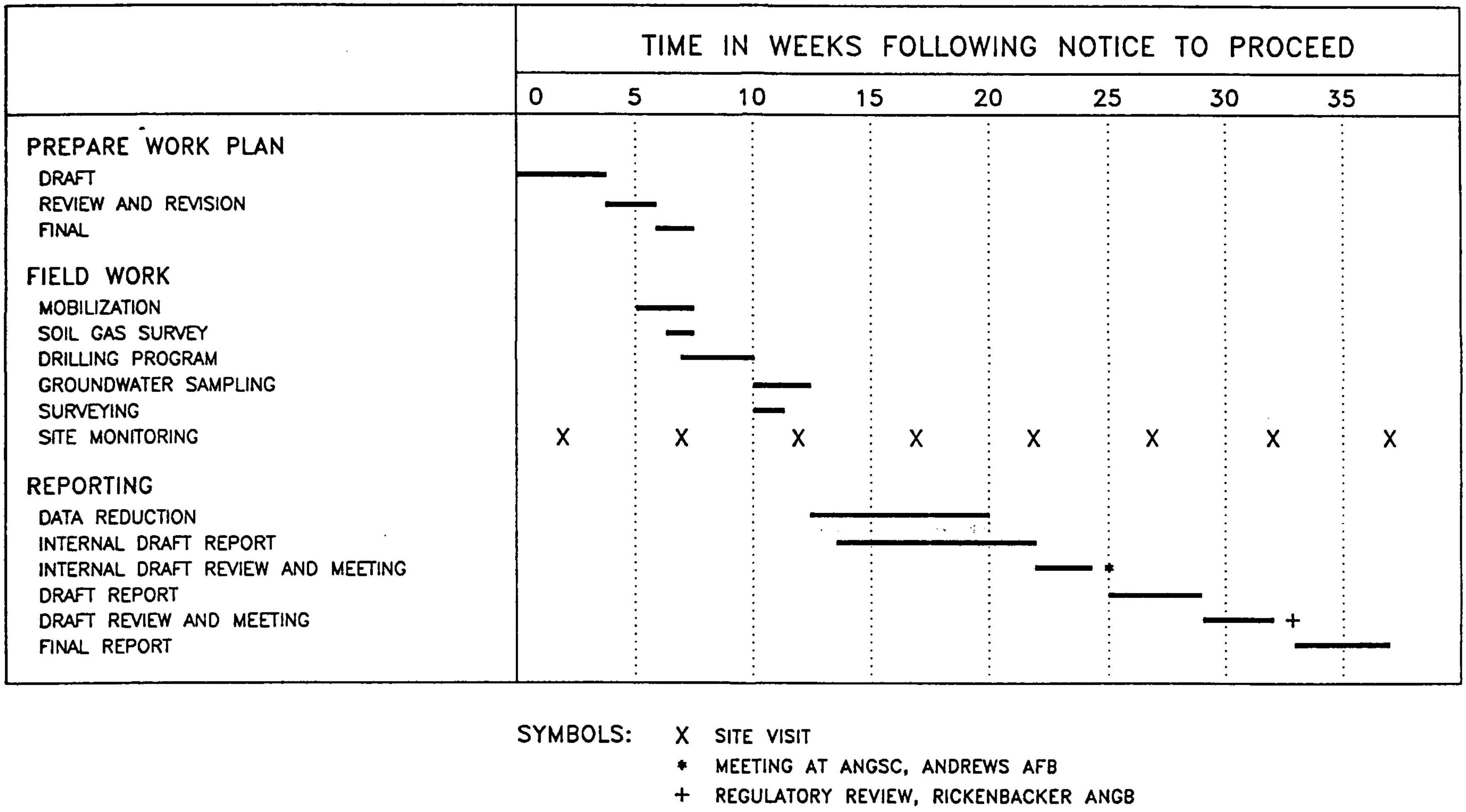
SECTION 4.0

WORK SCHEDULE

Table 4.1 is a projected work schedule for the additional Site Inspection activities that will be conducted at the Rickenbacker ANGB sites. The schedule assumes a two week NGB/HAZWRAP review and revision period between submittal of the Draft and Final Addendum Work Plan. It is assumed that a third draft of this Work Plan will not be required.

FIGURE 4.1

PROJECTED WORK SCHEDULE
ADDITIONAL SITE INSPECTION
RICKENBACKER ANGB, OHIO



City: **LOCKBOURNE**

RICKENBACKER AIR NATIONAL GUARD (USAF)

Site Information:

Site Name: RICKENBACKER AIR NATIONAL GUARD (USAF)
Address: LOCKBOURNE, OH

EPA ID: OH3571924544
EPA Region: 05

Site Alias Name(s):

RICKENBACKER AIR NATIONAL GUARD BASE

Record of Decision (ROD):

ROD Date: 05/19/1995
Operable Unit: 01
ROD ID: EPA/ROD/R05-95/900

Text: Full-text ROD document follows on next page.

EPA/ROD/R05-95/900
1995

EPA Superfund
Record of Decision:

RICKENBACKER AIR NATIONAL GUARD (USAF)
EPA ID: OH3571924544
OU 01
LOCKBOURNE, OH
05/19/1995

DEPARTMENT OF THE AIR FORCE
WASHINGTON DC

OFFICE OF THE ASSISTANT SECRETARY

MEMORANDUM FOR GOVERNMENT OFFICIALS, PUBLIC LIBRARIES, AND INTERESTED PARTIES

SUBJECT: Record of Decision (ROD) for Rickenbacker Air National Guard Base (ANGB), Ohio (OH)

Attached is a copy of the Air Force's Record of Decision (ROD) for disposal of portion of Rickenbacker Air National Guard Base (ANGB) in the State of Ohio.

The ROD was developed based upon review and consideration of the Final Environmental Impact Statement (FEIS) for the Disposal and Reuse of Rickenbacker ANGB, Ohio, February 1995, public comments received, and other relevant factors. I have taken into consideration the potential environmental impacts addressed in the FEIS for this proposal prior to making my decision.

RODNEY A. COLEMAN
Assistant Secretary
(Manpower, Reserve Affairs,
Installations and Environment)

Attachment:
As Stated

RECORD OF DECISION
FOR DISPOSAL OF PORTIONS OF
RICKENBACKER AIR NATIONAL GUARD BASE, OHIO

May 1995

Prepared By:

Air Force Base Conversion Agency
Midwest Division

TABLE OF CONTENTS

Page

VI. EXHIBITS
- 1 Location of Rickenbacker ANGB
- 2 Property to be retained by the Air Force at Rickenbacker ANGB
- 3 Property Status
- 4 Rickenbacker ANGB Parcelization
- 5 Summary of Impacts and Suggested Mitigations for Proposed Action and Alternatives

I. INTRODUCTION

This Record of Decision (ROD) documents the Air Force's decisions regarding the disposal of surplus United States (U.S.) owned real property located at Rickenbacker Air National Guard Base (ANGB), Columbus, OH. The ROD was developed in accordance with the Council on Environmental Quality Regulations (40 Code of Federal Regulations [CFR] subsection 1505.2). The decisions included in this ROD have been made in consideration of the information contained in the Final Environmental Impact Statement (FEIS) for Disposal and Reuse of Portions of Rickenbacker ANGB, which was filed with the U.S. Environmental Protection Agency (EPA) and made available to the public on February 17, 1995. That FEIS is still considered current and adequately analyzes the proposed action and alternatives in the decision process.

Exhibit 1 shows the location of Rickenbacker ANGB and Exhibit 2 shows the areas to be retained by the U.S. Air Force. Exhibit 3 shows the location of Rickenbacker International Airport, including areas of the base currently leased by the Rickenbacker Port Authority (RPA) from the U.S. Air Force. Exhibit 4 shows the areas for which disposal decisions are being made in the ROD.

A. Purpose and Need

The Air Force action is to dispose of surplus real property at Rickenbacker ANGB which realigned on September 30, 1994, pursuant to the Defense Base Closure and Realignment Act (DBCRA) of 1990 (10 U.S.C. § 2687 note) and recommendations of the Defense Base Closure and Realignment Commission (DBCRC). Rickenbacker ANGB was recommended for closure by the 1991 Commission, but as a result of a proposal by the State of Ohio, the 1993 Commission recommended that Rickenbacker ANGB be realigned rather than closed, so Ohio Air National Guard units could continue to operate in a smaller cantonment area within the base. The purpose of the FEIS was to analyze and disclose the potential environmental consequences of the disposal of real property and the reuse of the base outside the area retained for use by the Ohio ANG.

Rickenbacker ANGB comprises 2,016 acres of Federal Government fee-owned land, of which five percent (5%) will be retained by the U.S. Air Force for use by the Ohio Air National Guard as mandated by the DBCRC. The Army will retain four percent (4%) of the property for use by the Army National Guard and Army Reserves. The U.S., acting through the Air Force, will relinquish its legal title to ninety one (91%) percent of the base property determined to be surplus to the needs of the Federal Government when compliance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Section 120(h), is achieved.

This ROD addresses the Rickenbacker Port Authority’s (RPA) plans to develop the area into an international cargo airport. The decisions to be made by the Air Force are: (1) how to dispose of the Federal Government owned property; (2) how to terminate leaseholds and other limited interests in the remaining property; and (3) what actions, if any, the Air Force will take to avoid or mitigate adverse environmental consequences from its disposal actions.

The Federal Aviation Administration (FAA) was a cooperating agency with the Air Force in preparation of the FEIS. The FAA has jurisdiction by law regarding reuse of the airfield as a civil aviation public airport. This jurisdiction arises from its authority to approve the Public Airport Layout Plan (ALP) that is required for federally funded, public-use airports. A decision by the FAA to approve the ALP is announced by a separate ROD issued by the FAA based on the analysis in the FEIS and any additional analysis required and performed by the FAA.

The FEIS provides information required to understand the future environmental consequences of disposal actions as they relate to reuse options at Rickenbacker ANGB. As the Federal disposal agent for the property, the Air Force's disposal options are to: (1) assign it to another Department of Defense (DoD) department or Federal agency; (2) dispose of it through or with the approval of a Federal sponsoring agency for public benefit conveyance or other public use (including aviation, public health, education, public park and recreation, historic monument, corrections, or wildlife conservation); (3) negotiate its sale to an eligible public body; (4) convey it as an economic development conveyance to a Local Redevelopment Authority (LRA); or (5) offer it for public sale.

B. Federal Agency Requirements Under the National Environmental Policy Act (NEPA)

Any Federal Agency that either (1) acquires property for its use in accomplishing its mission, or (2) is assigned property for disposal under its authority for conveyance to eligible public or private nonprofit entities under public benefit sale, grant or donation programs, must comply with the requirements of NEPA, as implemented by that agency’s regulations. Therefore, this ROD makes disposal decisions for only those actions of the Air Force, as the Federal disposal agent, acting under authority delegated from the Administrator, General Services Administration.

C. Public Involvement

The Notice of Intent (NOI) to prepare an EIS for disposal and reuse of Rickenbacker ANGB was published in the Federal Register on October 9, 1991. The Air Force conducted a scoping meeting on November 14, 1991, at the Franklin County Building, Columbus, OH, to receive comments from the public regarding environmental concerns related to the proposed disposal and reuse of property at the installation, and to determine the scope and the direction of the studies/analyses to accomplish the EIS. A second scoping meeting was held at the Hamilton South Elementary School near Lockbourne, OH, on May 3, 1994, to announce the changes to the proposed action at Rickenbacker ANGB which were the result of the 1993 BCRC redirection. A public hearing on the Draft EIS (DEIS) was held on August 10, 1994, within the forty five (45) day public comment period. The FEIS was issued February 17, 1995, and was published in the Federal Register on February 24, 1995.

Simultaneous with the preparation of the FEIS, the RPA initiated local land use planning. Information from the RPA-sponsored Draft Airport Master Plan and subsequent Draft Community Reuse Plan was considered in the EIS and the Air Force's disposal planning.

D. Stewart B. McKinney Homeless Assistance Act

The Air Force has fully complied with the requirements of the Stewart B. McKinney Homeless Assistance Act (McKinney Act), 42 U. S. C., Section 11411, as amended. Pursuant to its responsibility to make suitability determinations under the McKinney Act, the Department of Housing and Urban Development (HUD) determined which property on Rickenbacker ANGB outside of the retained Air Force area would be suitable for use to assist the homeless. A list of suitable and available property was initially published in the Federal Register in August 1993, and periodically, thereafter. In addition, the Air Force accomplished its final McKinney Act screening under the National Defense Authorization Act for Fiscal Year 1994 ("Pryor Amendments") in the February 24, 1995, Federal Register. There were no applications for property on Rickenbacker ANGB under the McKinney Act.

E. Alternatives Considered in the FEIS

1. Description of Alternatives Analyzed in the FEIS

The FEIS analyzed potential environmental impacts for a variety of reasonably foreseeable, future uses of the base property and facilities outside of the area retained by the Air Force for the Ohio National Guard.

a. Proposed Action

The Proposed Action analyzed in the Disposal and Reuse FEIS is based on the draft Airport Master Plan and Community Reuse Plan by the RPA in which Rickenbacker ANGB property would be part of the phased development of Rickenbacker International Airport as an international cargo airport. The airport would include land already owned by RPA, land being acquired as part of the FAR Part 150 Noise Control Program, some privately owned land within the airport's foreign trade zone (FTZ), and land currently comprising Rickenbacker ANGB. The RPA proposal also includes eventual acquisition of private land adjoining the airport to the southeast for the development of a new runway parallel to the existing runways. The plan includes land uses for airfield and aviation support, industrial warehousing and light manufacturing, with smaller areas for continued military use and for vacant land or open space.

b. Aviation with Industrial Park Alternative

This alternative is similar to the Proposed Action, but would not include eventual airport expansion for the new runway. The airport would be limited to land already owned by the RPA or being acquired as part of the FAR Part 150 Noise Control Program, some privately owned land within the FTZ, and land currently comprising Rickenbacker ANGB.

c. Aviation with Mixed Use Alternative

This alternative includes residential, commercial and community/recreation uses in addition to aviation, industrial, and military uses. Like the Aviation with Industrial Park alternative, this alternative would be limited to land already owned by the RPA, properties to be acquired as part of the FAR Part 150 Noise Control Program and land currently comprising Rickenbacker ANGB, and would not include expansion of the airport for the new runway.

d. No Action Alternative

The No Action Alternative would result in the U.S. Air Force retaining one hundred percent (100%) of the land at Rickenbacker ANGB. Land currently leased by the RPA under 70-year and 50-year leases (shown in Exhibit 3) would continue to be leased and used for aviation purposes. The Ohio Air National Guard would remain in the cantonment area shown as Parcel A in Exhibit 4, and the Ohio Army National Guard and U.S. Army Reserve would use an enclave shown as Parcel B in Exhibit 4. The remainder of the base property would be maintained in caretaker status indefinitely.

2. Summary of Environmental Impacts

Table S-2 in the FEIS (Exhibit 5) summarizes the potential environmental impacts and suggests mitigation for the Proposed Action and alternatives. Key environmental issues are addressed in Section III of this ROD.

3. Environmentally Preferred Alternative

The No Action Alternative is the environmentally preferred alternative. The development of the property outside of the area retained by the Federal Government under any other alternative would create a possibility for greater direct environmental impacts, including the risk of environmental harm associated with the storage of hazardous materials used in industrial or commercial operations, increased traffic, increased utility demands, increased regional air pollutant emissions (though still within both Federal and State air quality standards), increased noise from air traffic, and a potential loss of native biota, wetlands, and wildlife habitat. Under the Proposed Action, there could also be impacts to private property holders due to airfield expansion.

F. Results of Excess and Surplus Screening

In August 1991, the Air Force conducted real property screening, which announced the potential availability of excess and surplus property at the base under various statutory programs. “Excess” refers to property not required for Federal uses and available for acquisitions by eligible public bodies or private nonprofit entities. Surplus property is also available for disposal by the Federal Government to the public. In order to assist the local community in their redevelopment efforts, the Air Force screened Rickenbacker ANGB for potential reuses and acquisition interest in February 1994. There was no immediate interest received from either screening notice. The following results were received relative to Rickenbacker ANGB:

1. Requests from DoD departments and Federal agencies:

a. The U.S. Army requested an enclave of 129 acres adjacent to the Ohio Air National Guard cantonment for use by the Ohio Army National Guard.

b. The U.S. Army requested an additional enclave of 35 acres to be used by the U.S. Army Reserve, 83rd Army Reserve Command (ARCOM) for administration, training and storage.

2. Surplus property requests:

a. The RPA requested all surplus property as a public airport conveyance under sponsorship of the FAA.

b. The Ohio Department of Rehabilitation and Correction (DRC) requested 20 facilities for a Correctional Complex through public benefit conveyance under the sponsorship of the U.S. Department of Justice. The DRC has since withdrawn its request for any property at Rickenbacker.

3. Negotiated Sale:

South Central Power Company submitted a request to purchase the electrical system and associated land for expansion at Rickenbacker ANGB.

4. Economic Development Conveyance:

No interest was received from the RPA.

5. Public Sale:

The American Veterans requested acquisition of eleven facilities for use as an American Veteran Post, day care and seniors' center, gymnasium, and continued billeting services at the airfield.

6. Other:

a. Ameritech has requested the Air Force retain easements for the purpose of maintaining and upgrading the telephone system.

b. Columbia Gas Company (CGC has requested the Air Force retain easements over all installed gas lines that are owned by CGC, for the purpose of maintaining and upgrading the gas system.

c. The City of Columbus has requested the Air Force retain easements for the purpose of maintaining and upgrading the area water system.

d. The City of Columbus has requested the Air Force retain easements for the purpose of maintaining and upgrading the area sewer system.

G. Objectives of Disposal of Real Property at Rickenbacker ANGB

The following objectives for the disposal of real property at the installation were considered in the disposal process: (1) to encourage rapid transition from Federal Government control, foster job creation, and support economic development; (2) support the community's redevelopment plans for the base property outside of the retained Air Force area; (3) accommodate acquisition requests with priority or special standing (e.g., homeless housing providers); (4) accommodate Federal sponsoring agency requests for transfer of property for public benefit conveyance; and (5) balance the fair return to the taxpayer in the disposal of property, consistent with the value and nature of such property and successful redevelopment of base property.

II. DECISION

The Air Force has considered the potential environmental impacts of the Proposed Action and the alternatives analyzed in the FEIS for the Disposal and Reuse of Portions of Rickenbacker ANGB in developing the disposal plan and this ROD. The referenced Draft Airport Master Plan and Community Reuse Plan, together with the results of screening of the Air Force property, have also been considered. I have decided to dispose of approximately 2,016 acres of Air Force property at Rickenbacker ANGB in a manner that will meet immediate reuse requirements and enable the RPA to develop portions of the base outside of the retained Air Force area. My decision is supported by the analysis of the proposed action and alternatives considered in the FEIS.

My decision with regard to parcelization of portions of the real property and methods of disposal are as follows:

A. Parcelization of Real Property

The areas identified below may be further subdivided for the purpose of facilitating disposal, consistent with the reuses analyzed in the FEIS and this ROD.

Parcels A-1 through A-12, (approximately 203 acres) (Exhibit 4) consist of a main cantonment area (A-1) and 11 outlying parcels (A-2 through A-12).

Parcel A-1 (approximately 170 acres) consists of the principal facilities for the continued operation of the Air National Guard. This area consists of 3 hangars (Facilities 597, 885 and 888) 5 administrative office buildings (Facilities 880, 887, 910, 911, and 913) and two warehouses (Facilities 872 and 875).

Parcel A-2 (approximately 5.5 acres) consists of a transmitter site (Facility 901).

Parcel A-3 (approximately 3.5 acres) consists of two jet fuel storage tanks and associated facilities including an easement along the fuel pipeline route.

Parcel A-4 (approximately 1 acre) consists of one building (Facility 868) which houses the communications switch and parking.

Parcel A-5 (approximately 2 acres) consists of two buildings (Facilities 869 and 871) and associated parking for use by Civil Engineering and an abandoned boiler plant.

Parcel A-6 (approximately 2.5 acres) consists of two buildings (Facilities 863 and 864) to be used as a Medical Training Facility and Dining Facility.

Parcel A-7 (approximately 1.5 acres) consists of two buildings (Facilities 440 and 441) to be used as State Headquarters and Civil Engineering Shops.

Parcel A-8 (approximately 7 acres) consists of two hangars (Facilities 594 and 595/596) to be used for maintenance and storage.

Parcel A-9 (approximately .25 acre) consists of a gasoline pump and UST adjacent to Building 538.

Parcel A-10 (approximately 4 acres) consists of one building (Facility 500) to be used as Base Operations and adjacent parking.

Parcel A-11 (approximately 4 acres) consists of one building (Facility 502) to be used as the Fire Station and adjacent parking.

Parcel A-12 (approximately 1.75 acre) consists of two buildings (Facilities 898 and 899) which are pump houses for the current POL hydrant system.

As part of the above Federally-retained property, the Air National Guard will retain a drainage ditch system consisting of a combination of approximately twenty two (22) Federally retained licenses and easements. To be included in the retained drainage system is a lot consisting of approximately one-tenth of an acre located in the Town of Lockbourne, OH, for purposes of accessing the ditch system.

It is the intention of the Ohio Air National Guard to relocate some of the operating functions of Parcels A-2 through A-12 into the primary 170-acre cantonment area. If any of these parcels become excess to the needs of the Air National Guard and the Air Force they will be disposed of, as they become available, in accordance with governing statutory provisions regulating real property in effect at the time. It is the intent of the Air Force to dispose of these parcels to the RPA for reuse and future development as they become available and if such disposal is appropriate under the laws in effect at the time the parcels are available.

Parcel B (approximately 129 acres) (Exhibit 4) consists of 2 hangars (Facilities 918 and 931), 8 warehouse and storage buildings (Facilities 929, 935, 936, 937, 938, 939, 940 and 941), 7 administrative and office buildings (Facilities 915, 920, 930, 932, 933, 943, and 944) and an aircraft parking apron.

Parcels C-1 through C-3 (approximately 35 acres) (Exhibit 4) consist of 3 parcels of property. C-2 and C-3 are separated by an easement for highway purposes.

Parcel C-1 (approximately 5 acres) consists of vacant land and a softball field.

Parcel C-2 (approximately 20 acres) consists of 1 warehouse (Facility 874), 3 maintenance buildings (Facilities 846, 848 and 849), a softball field and 2 tennis courts.

Parcel C-3 (approximately 10 acres) consists of a paved parking lot.

Parcels D-1 through D-3 (approximately 1648 acres) (Exhibit 4) consist of the runway, aprons, airside related facilities, parking and the middle marker that is currently long-term leased to the RPA as well as the remaining property adjacent to the main cantonment area.

Parcel D-1 (approximately 1606 acres) consists of runways, aprons, alert facility (Facility 1050), hangar (Facility 505), approximately 41 abandoned buildings, miscellaneous facilities, and vacant land.

Parcel D-2 (approximately 41 acres) consists of two storage buildings (Facilities 905 and 908) and vacant land.

Parcel D-3 (approximately 1 acre) consists of the runway 23L middle marker site.

B. Methods of Disposal

Refer to Exhibit 4 for a summary of disposal decisions by area.

I have decided to dispose of the following property in the manner described below. In the case of transfers outside the Federal Government, a contractual commitment will be obtained from the transferee and, if necessary, leases to the same transferee will be used until the Air Force has met the requirements of the CERCLA, Section 120(h)(3), and the property can be conveyed by deed.

Parcels A-1 through A-12 consisting of a total of 203 acres with related facilities, will be retained by the Air Force for use by the Air National Guard.

Parcel B consisting of 129 acres with related facilities will be assigned to the U.S. Army for use by the Army National Guard. The utilities that service the area, water, sewer, gas and telephone will also be assigned to the U.S. Army.

Parcels. C-1 through C-3 consisting of a total of 35 acres will be assigned to the U.S. Army for use by the U.S. Army Reserves. The utilities that service the area, water, sewer, gas and telephone will also be assigned to the U.S. Army.

Parcels D-1 through D-3, consisting of a total of 1648 acres will be transferred to the RPA through an FAA-sponsored airport conveyance. The RPA proposes to continue using the property for an international airport. The utilities that service the area, water, sewer, gas and telephone which are currently under ownership of the Air Force, will be transferred through the FAA-sponsored airport conveyance for purposes of running the airport. Included in the airport conveyance are items of personal property including the Navigational Aids System at Rickenbacker. This action is taken so that the RPA can obtain FAA certification of the Instrument Landing Systems.

Base Utility Systems:

Only those utility systems and supporting utility easements that are required to continue the Federal mission at Rickenbacker Airport will be retained by the Federal Government.

The remaining base utility systems will be transferred as follows:

The base telephone system and supporting utility easements that belong to Ameritech Corp. outside of the Federally-retained area (Parcels A, B, and C) will be retained by Ameritech Corp. Any easements and telephone lines belonging to the Air Force outside of the Federallyretained area will be transferred to the RPA. Any lines that belong to the Air Force within parcels B and C, will be assigned to the U. S. Army. Telephone lines belonging to the Air Force in parcel A and E will remain under Air Force ownership.

The base gas line system and supporting utility easements that belong to Columbia Gas outside of the Federally-retained area (Parcels A, B, and C) will be retained by Columbia Gas. Any easements and gas lines belonging to the Air Force outside of the Federally retained area will be assigned to the RPA. Any lines that belong to the Air Force within parcels B and C, will be transferred to the U. S. Army. Gas lines belonging to the Air Force in parcel A will remain under Air Force ownership.

Any sewer and water lines belonging to the Air Force outside of the Federally-retained area (parcel A, B, and C) will be transferred to the RPA. Any lines that belong to the Air Force within parcels B and C will be assigned to the U. S. Army. Sewer and water lines belonging to the Air Force in parcel A will remain under Air Force ownership.

All Air Force owned utility systems, except for the electric system, will be transferred to the RPA through the FAA-sponsored Airport Conveyance for development of the airport property.

All utility service will be provided to the cantonment area by the respective utility companies through dedicated easements.

Public sale:

There will be no public sales.

III. ENVIRONMENTAL ISSUES

Many environmental factors were analyzed and presented in the FEIS for the Disposal and Reuse of Portions of Rickenbacker ANGB. These factors included land use and aesthetics, transportation, utilities, hazardous materials management, hazardous waste management, the Installation Restoration Program (IRP), storage tanks, asbestos, pesticides usage, polychlorinated biphenyls, radon, medical/biohazardous waste, ordnance, lead-based paint, soils and geology, water resources, air quality, noise, biological resources, and cultural resources. Potentially significant environmental issues were identified with regards to land use, surface transportation, the IRP, asbestos, radon, lead-based paint, soils and geology, water resources, noise, biological resources, and cultural resources. These resources are discussed below.

A. Land Use

Potential impacts to nearby property owners could result if the RPA acquires additional land for airport expansion as indicated in the Proposed Action in the FEIS and the Draft Airport Master Plan.

B. Surface Transportation

Development of an international cargo airport by the RPA may result in unacceptable level of service on segments of area roadways if improvements are not made in the future.

C. Installation Restoration Program

The Air Force will continue its IRP at Rickenbacker ANGB until all contaminated sites are remediated. When the Air Force transfers property, it will do so in compliance with Section 120(h)(3) of CERCLA. All deeds subject to 120(h)(3) of CERCLA will contain a covenant warranting that all remedial action necessary to protect human health and the environment has been taken (which means the remedial action has been completed, or initiated and demonstrated to be operating properly and successfully).

Further, all transfers will ensure that necessary remedial action can still be performed on the Air Force property. The Air Force and the environmental regulators will have access to the transferred property through either retaining access easements or restricting usage of the property transferred until remedial action has been taken, or both. Until Air Force property can be transferred by deed, the Air Force may execute leases to allow reuse to begin as quickly as possible, provided such actions will not hinder compliance with other applicable laws and regulations. However, it is the Air Force's intent to dispose of all property by lease during the transition period. by deed conveyance or other appropriate final disposal methods at the earliest feasible date.

D. Asbestos

A comprehensive survey for asbestos-containing material (ACM) as required by the Federal Property Management Regulation disclosure requirements prior to base disposal has been completed for Parcels A-1 through A-12, C-1 through C-3 and D. ACM is present in some facilities. A comprehensive survey for ACM will be completed for Parcel B by June 1995.

The Air Force will mitigate impacts through disclosure of known ACM. After transfer, asbestos management will be the sole responsibility of the property recipients. The disturbance of asbestos through renovation of existing structures during civilian reuse may occur after property transfer. A disclosure covenant on ACM will be provided for in the deeds and leases, with notification that lessees or property recipients will be required to handle asbestos in accordance with all applicable regulations.

E. Radon

Radon sampling in water, soil, and air was conducted at Rickenbacker ANGB from May 1988 to August 1988. Results from air sampling indicated that no radon levels were above the U.S. EPA - recommended guidelines of 4 picocuries per liter (pCi/1). Results from water sampling were all in compliance with the recommended standard of 10,000 pCi/1. Results from soil sampling indicated that three of ten locations had radon levels above the recommended standard of 500 pCi/l. Currently, no radon exposure guidelines or action levels have been established by federal or state regulatory agencies for buildings other than schools or residences. A disclosure covenant on radon will be provided for in the deeds, with notification that lessees or property recipients should handle radon in accordance with U.S. EPA recommendations.

F. Lead-Based Paint

No survey to assess the presence of lead-based paint has been conducted at Rickenbacker ANGB. Lead-based paint may be in facilities at Rickenbacker ANGB constructed before or during 1978. A disclosure covenant on lead-based paint will be provided for in the deeds, with notification that lessees or property recipients will be required to handle lead-based paint in accordance with all applicable regulations.

G. Soils and Geology

Potential erosion effects could result from ground disturbance of 300 acres within the disposal area and 850 additional acres for the proposed airport development and airfield expansion.

H. Water Resources

Impacts to surface water drainage and water quality could result from ground disturbance of 300 acres within the disposal area and 850 additional acres for proposed airport development and airfield expansion if adequate storm water controls are not used.

I. Noise

Increased air traffic could expose 2,277 residents to day-night average sound levels above 65 decibels by the year 2014.

J. Biological Resources

Up to 35 small jurisdictional wetlands could be affected by proposed development on disposal property. Any property development affecting wetlands would be subject to Section 404 of the Clean Water Act. The Air Force deeds will reference the existence of the wetlands and their regulatory control and will contain restrictive provisions assuring no actions can be taken which would adversely affect these wetlands.

K. Cultural Resources

Regulations for implementing Section 106 of the National Historic Preservation Act indicate that the conveyance of historic properties without adequate measure to ensure preservation is considered to be an adverse impact, thereby ensuring full regulatory consideration in Federal project planning and execution. The State Historic Preservation Office (SHPO) confirmed that there are no eligible historic or archaeological properties on the base that could be impacted by conveyance. The SHPO also agreed that it is unlikely that significant paleontological resources would be found.

Therefore, no impacts to cultural resources are expected. Should previously unknown archaeological resources be discovered during activities associated with reuse, work would cease immediately and the agency or reuse proponent would be required to make a reasonable effort to evaluate the resources. The agency or reuse proponent would be required to notify the SHPO of the discovery. No sites considered sacred or spiritually significant to Native Americans exist on Rickenbacker ANGB.

L. Air Quality

Franklin County, where Rickenbacker ANGB is located, is in an area formally designated as a Marginal Area for ozone nonattainment. However, based on more recent monitoring data, which indicate the ozone standard is no longer exceeded, and projections of decreased volatile organic compound emissions in future years, a formal application for redesignation of the area to attainment has been submitted to the U.S. Environmental Protection Agency (EPA).

Section 176 of the Clean Air Act prohibits Federal agencies from engaging in, licensing or permitting, approving, funding, or otherwise, supporting any activity which does not conform to a State Implementation Plan or promulgated Federal Implementation Plan. An activity does not conform to an implementation plan if the activity: (1) causes or contributes to a new violation of the national standards for criteria air pollutants; (2) increases the frequency or severity of any existing violations of the national standards; or (3) delays timely attainment of the national standards or any required interim emission reductions or milestones.

On November 30, 1993, EPA published a general conformity rule, effective January 31, 1994. The rule, codified at 40 CFR Part 93, Subpart B, specifically exempts land transfers and certain long-term leases incident to transfers of Federal real property, such as base closure property, from conformity analyses and determination requirements in accordance with §93.153(c)(xix). Other Federal agencies sponsoring, or otherwise, supporting certain types of reuse activities on transferred or leased base property, may be required to perform a conformity analysis and/or make a conformity determination for reuse-caused emissions of nonattainment criteria air pollutants.

IV. CONCLUSIONS

The FEIS presented an analysis of the potential environmental consequences of the disposal and reuse of the base and is adequate for the real property disposal decisions documented in this ROD. Land use proposals offered by the public and concepts developed by the Air Force have been analyzed in the FEIS as reasonable reuse alternatives. The Air Force has evaluated the possible consequences of transfer or sale, area-by-area and alternative-byalternative. The FEIS provides ample environmental impact information to make reasoned choices of whether and how to dispose of individual areas.

The potential environmental impacts that have been identified in the FEIS would result directly from the reuse by others and not from disposal of the property. Most measures identified in the FEIS to mitigate those potential impacts would be the responsibility of the future property owners. Land use management and community planning are under local control and authority, based upon state laws and local priorities. Redevelopment proponents and local agencies will be responsible for implementing any specific mitigation measures associated with reuse or development of the property, as may be required by local regulation. State and local government agencies may impose requirements through zoning, subdivision and site development regulations, and other land use controls.

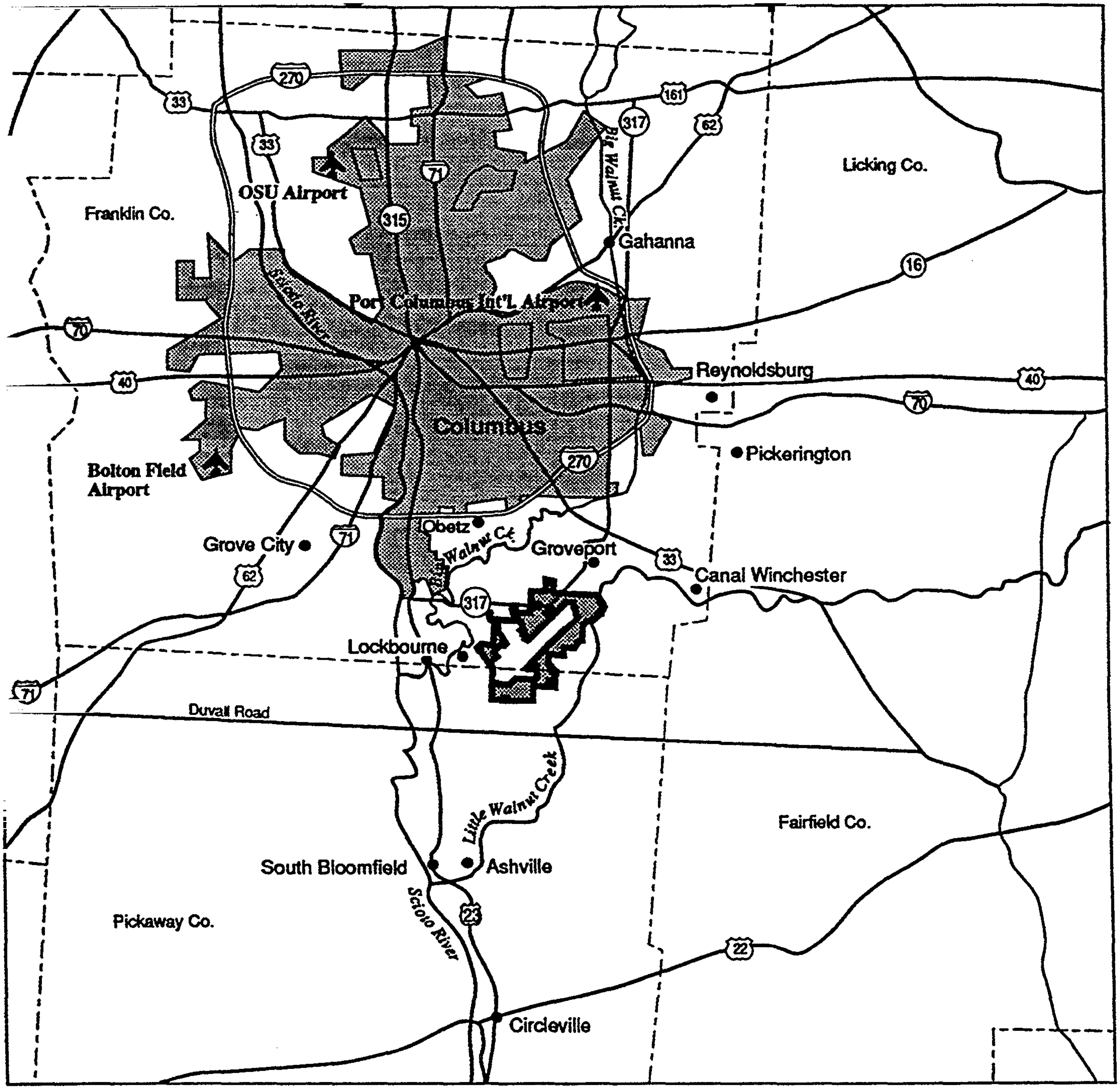
This disposal is in compliance with the provision of DBCRA of 1990 (Public Law 100-510), and recommendations of the Defense Base Closure and Realignment Commission. Based upon consideration of the FEIS for Disposal and Reuse of Portions of Rickenbacker ANGB and other relevant considerations, the Air Force has decided to proceed with the disposal of excess and surplus property at Rickenbacker ANGB in accordance with the decisions indicated in this ROD. All practicable means to avoid or minimize environmental harm from the alternative selected have been adopted as noted in this ROD.

V. DECISION

In accordance with the conclusions reached in this ROD, I approve the disposition of Parcels A1-A12, B, Cl-C3, and D1-D3 at Rickenbacker ANGB.

19 May 95
Date

RODNEY A. COLEMAN
Assistant Secretary
(Manpower, Reserve Affairs,
Installations and Environment)



EXPLANATION

▬	Rickenbacker Air National Guard Base Boundary
▩	Rickenbacker Port Authority Boundary
▨	City of Columbus
✈	Major Airport

N

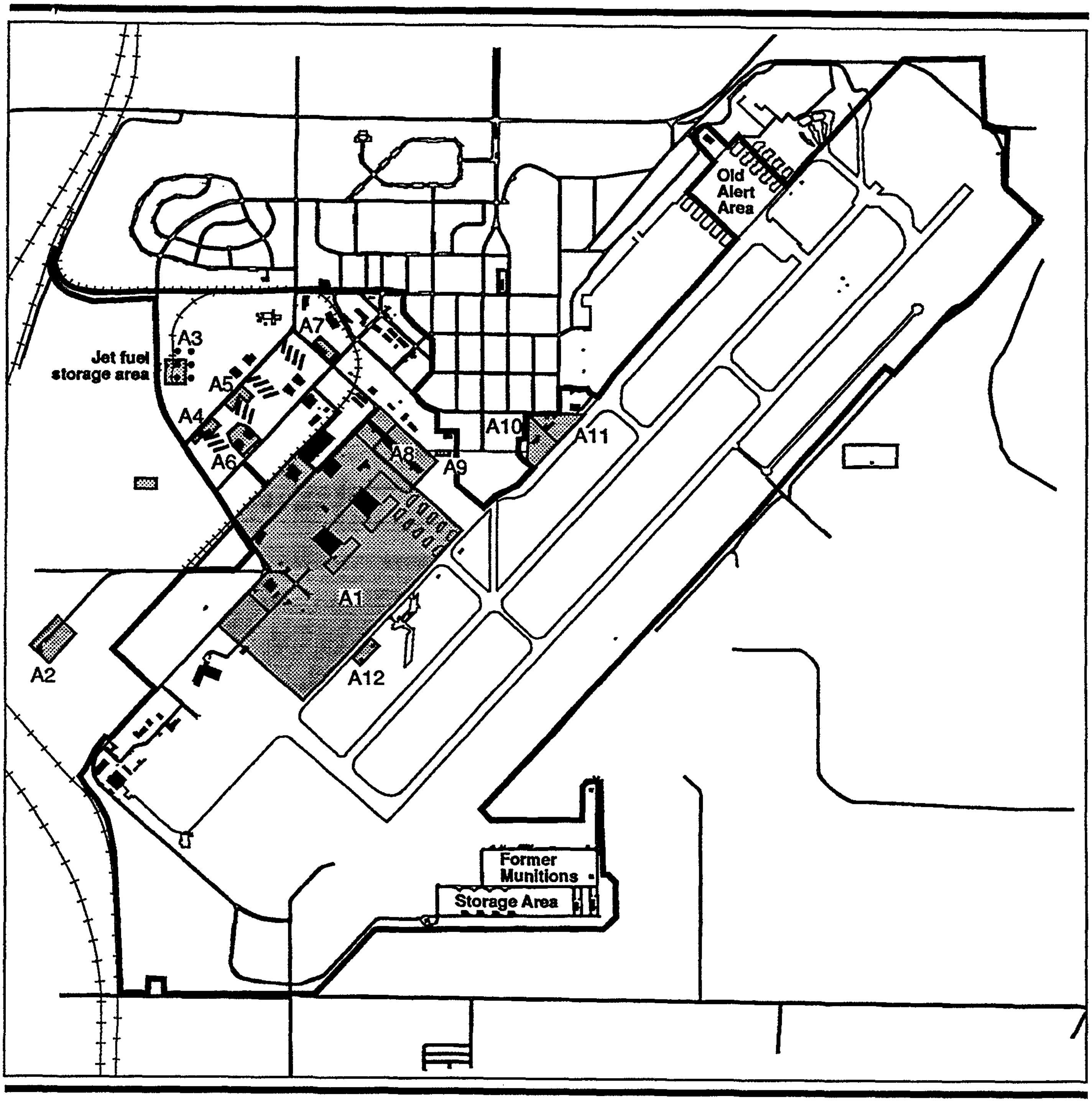
Scale

0 5 10 15 20

Statute Miles

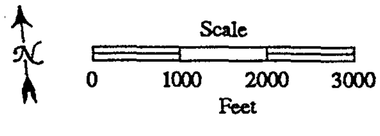
Rickenbacker ANGB Regional Location

Exhibit 1



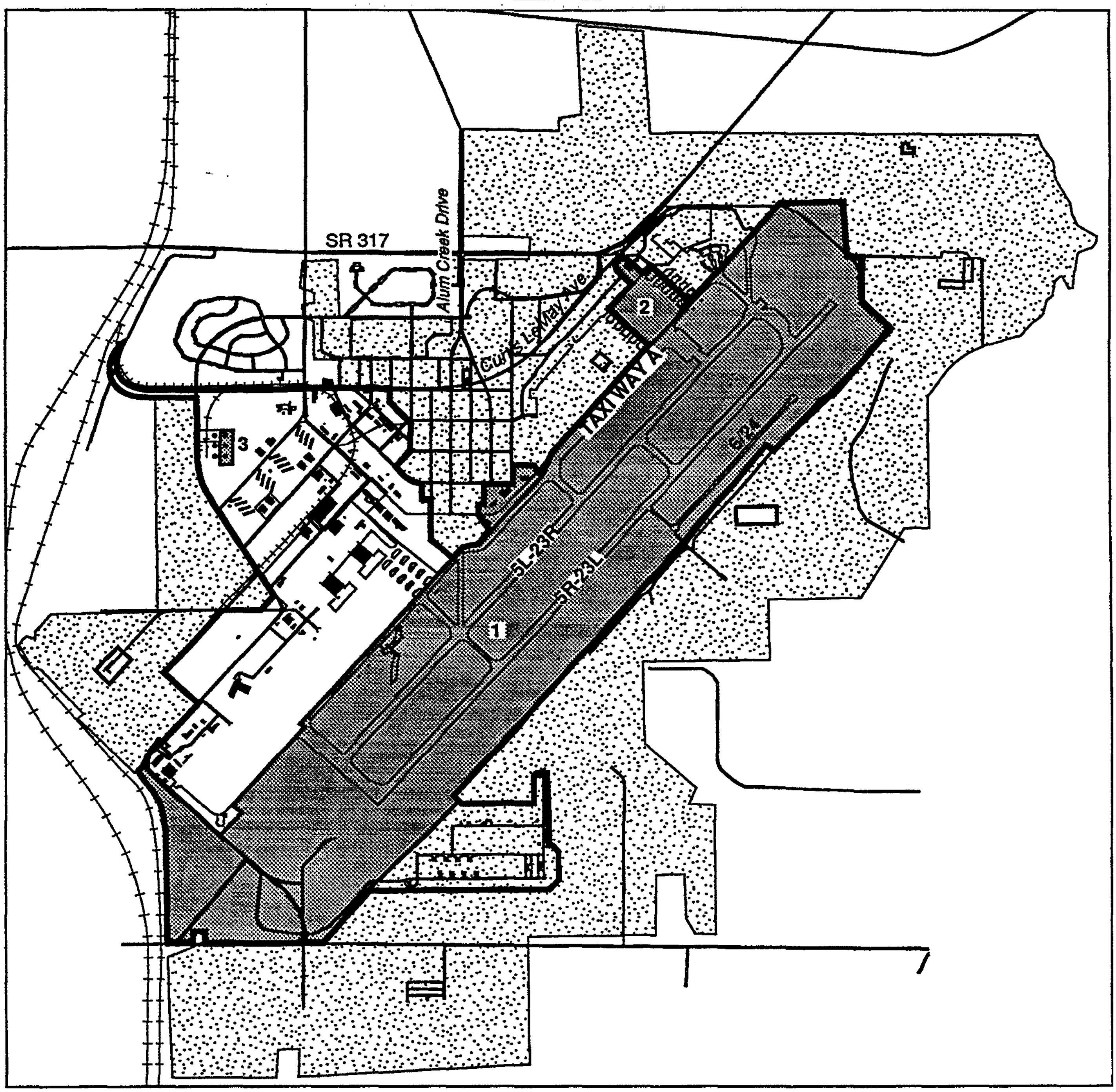
EXPLANATIONS

A ▨ Areas to be retained by Air Force



Property to be Retained by U.S. Air Force at Rickenbacker ANGB

Exhibit 2



EXPLANATION

▬ Rickenbacker Air National Guard Base Boundary (owned by U.S. Air Force)

▨ RPA lease areas
- 1 Airfield
- 2 Old Alert area
- 3 Jet fuel storage

░ Rickenbacker International Airport

N

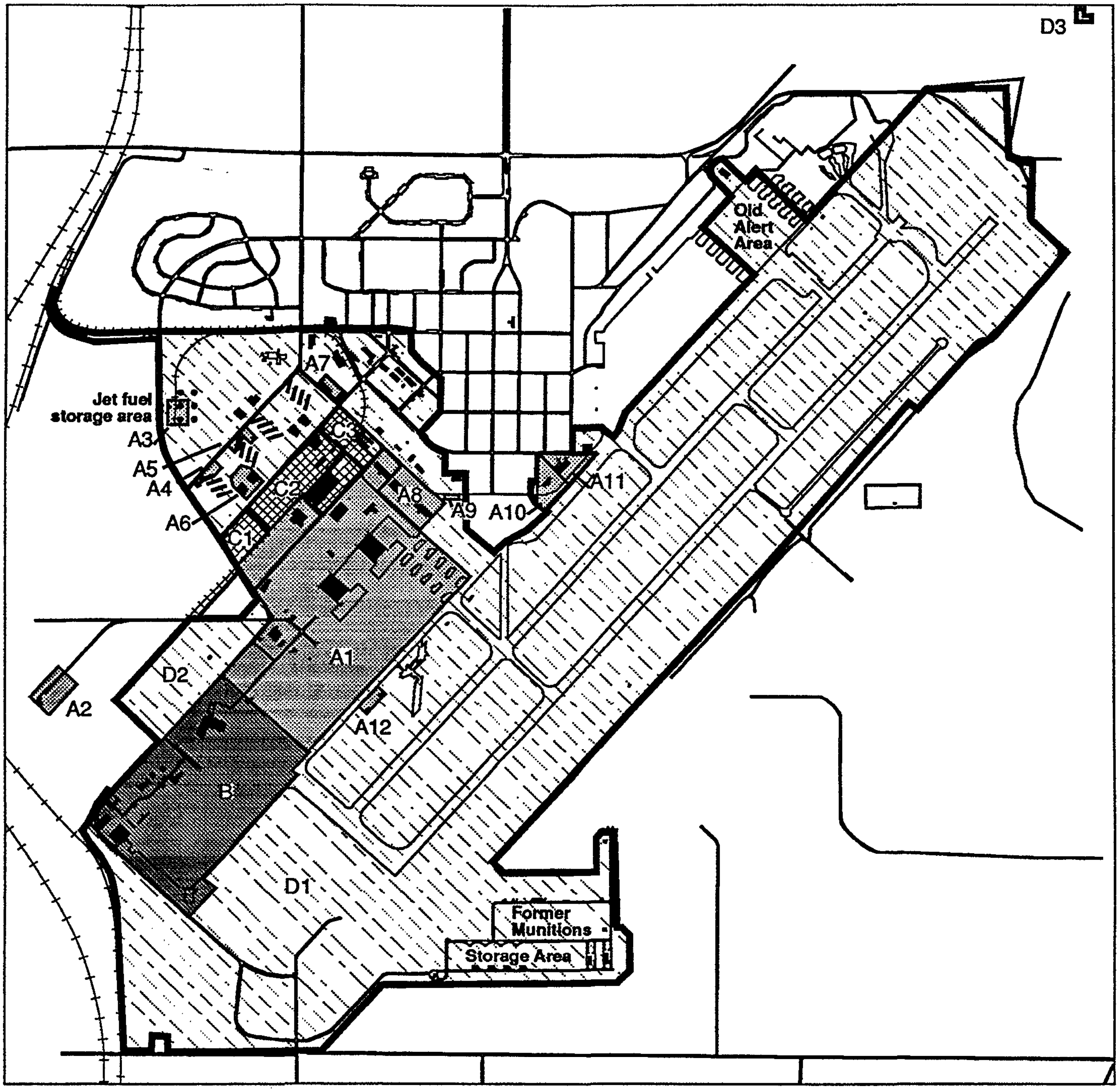
Scale

0 1000 2000 3000

Feet

Property Status

Exhibit 3



EXPLANATIONS

A ▒	Retained by Air Force, to be used by Air National Guard
B ▓	Transferred to U.S. Army, to be used by Army National Guard
C ▨	Transferred to U.S. Army to be used by the Army Reserve
D ▧	Public Benefit Conveyance to the Rickenbacker Port Authority

Rickenbacker ANGB Parcelization

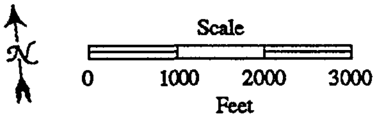


Exhibit 4

Table S-2. Summary of Impact and Suggested Mitigations for the Proposal Action and Alternatives
Page 1 of 10

Resource Category	Realignment Baseline	Propose Action	Aviation with Industrial Park	Aviation with Mixed Use	No-Action Alternative
Local Community Land Use and Aesthetics	Conditions: Combined military activities within retained cantonment areas and joint use of airfield. Other portions of the base placed under caretaker status.	, Impacts: Civilian redevelopment within the study area and total RPA planning area for Industrial and aviation support activities. Projected high growth In civilian air operations; expansion of airfield for new runway. May require revisions to Columbus Comprehensive Plan. Impacts to existing residential uses adjacent to the base. Impacts to property holders due to airfield expansion.	, Impacts: Same as Proposed Action except no expansion for new runway.	, Impacts: Combined joint-use airfield activities and mixed use redevelopment within study area may have beneficial impacts on adjacent residential areas and provide recreation resources for surrounding area. Residential and community areas may be in proximity to Industrial areas.	, Impacts: Empty facilities in study area may affect marketability and growth of RPA air industrial park activities.
		, Potential Mitigations: Modification of Columbus Comprehensive Plan to include Intensive development in vicinity of Rickenbacker international Airport; zoning amendments regarding development near airport; early acquisition of undeveloped land for airport expansion. Continued agricultural use in airfield protection and buffer zones. Use of butters and landscaping to screen Incompatible uses.	, Potential Mitigations: Same as Proposed Action except no acquisition of land for expansion required. Use of buffers and landscaping to screen incompatible uses.	, Potential Mitigations: Same as Aviation with industrial use although zoning amendments should also provide for Integrated planning district development. Use of buffers and landscaping to screen incompatible uses.	, Potential Mitigations: Amendments to local zoning ordinances to restrict development near airport. Use of buffers and landscaping to screen incompatible uses.

Note: Impacts are based on the changes from realignment basement conditions, which are projected to occur as a result of implementing that alternative.
RPA = Rickenbacker Port Authority

Table S-2. Summary of Impact and Suggested Mitigations for the Proposal Action and Alternatives
Page 2 of 10

Resource Category	Realignment Baseline	Propose Action	Aviation with Industrial Park	Aviation with Mixed Use	No-Action Alternative
Surface Transportation	Conditions: 2,020 daily vehicular trips.	, Impacts: Reuse would generate 13,487 daily vehicular trips, an increase of 11,467 daily trips by the year 2014. Roadway segments would not provide acceptable level of service (LOS) due to growth within the study area and total RPA planning area. , Potential Mitigations: Improvements to State Highway 317 and Groveport Road would be required 10-20 years after base realignment due to growth in planning area.	, Impacts: Reuse would generate 13,570 daily vehicular trips, an increase of 11,550 daily trips, by the year 2014. Similar to Proposed Action.	, Impacts: Reuse would generate 9,828 daily vehicular trips, an increase of 7,808 daily trips, by the year 2014. Roadway segments would continue to provide acceptable LOS.	, Impacts: Reuse would generate 2,035 daily vehicular trips, an increase of 15 daily trips, by the year 2014. Roadway segments would continue to provide acceptable LOS.
Air Transportation	77,146 annual aircraft operations at the airfield from both military and commercial users.	, Impacts: Increase of 156,595 annual aircraft operations. No airspace conflicts or air transportation impacts.	, Impacts: Same as Proposed Action.	, Impacts: Increase of 15,235 annual aircraft operations. No airspace conflicts or air transportation Impacts.	, Impacts: Same as Aviation with Mixed Use Alternative.
Utilities Use	Conditions: Water: 0.17 MGD Wastewater: 0.30 MGD Solid Waste: 2.7 Tons/Day Electric: 19.07 MWH/Day Gas: 0.06 MMCF/Day ,	, Impacts: Minor Increases in R0l utility demand; natural gas increase of 55 percent. Current systems with planned improvements would be able to accommodate these increased demands.	, Impacts: Same as Proposed Action.	, Impacts: Natural gas use increase 27 percent. Otherwise same as Proposed Action.	, Impacts: No changes in base-related utility use.

Note: Impacts are based on the changes from realignment basement conditions, which are projected to occur as a result of implementing that alternative.
Los = level of service
RPA = Rickenbacker Port Authority

Table S-2. Summary of Impact and Suggested Mitigations for the Proposal Action and Alternatives
Page 3 of 10

Resource Category	Realignment Baseline	Proposed Action	Aviation with Industrial Park	Aviation with Mixed Use	No-Action Alternative
Utilities Use (Cont.)		, Potential Mitigations: Pretreatment of Industrial wastewater may be required.			
Hazardous Materials and Hazardous Waste Management					
Hazardous Materials Management	Conditions: Materials used for retained military activities and caretaker activities will be managed in compliance with applicable regulations.	, Impacts: Increase in quantities of materials used. Compliance with applicable regulations would preclude unacceptable impacts.	, Impacts: Same as Proposed Action.	, Impacts: Same as Proposed Action.	, Impacts: No change in types and quantities used.
		, Potential Mitigations: Establish cooperative planning body.	, Potential Mitigations: Same as Proposed Action.	, Potential Mitigations: Same as Proposed Action.	
	Conditions: Wastes generated by retained military activities are managed in accordance with applicable regulations.	, Impacts: Increase in quantities of wastes generated. Compliance with applicable regulations would preclude unacceptable impacts.	, Impacts: Same as Proposed Action	, Impacts: Same as Proposed Action	, Impacts: No change In quantities generated.
		, Potential Mitigations: Collection of hazardous household products; educational programs on recycling, waste minimization waste disposal.	, Potential Mitigations: Same as Proposed Action.	, Potential Mitigations: Same as Proposed Action.	

Notes: Impact are based on the changes from realignment baseline conditions, which are projected to occur as a result of implementing that alternative.

MGD = million gallons per day
MWH = megawatt hours
MMCF = million cubic feet per day
ROI = region of influence

Table S-2. Summary of Impact and Suggested Mitigations for the Proposal Action and Alternatives
Page 4 of 10

Resource Category	Realignment Baseline	Proposed Action	Aviation with Industrial Park	Aviation with Mixed Use	No-Action Alternative
Installation Restoration Program	Conditions: IRP activities will continue in accordance with applicable regulations regardless of base realignment and reuse.	, Impacts: Possible redevelopment delays and land use restrictions due to remedation. , Potential Mitigations: Coordination between OL and planning agencies to address potential problems. Remedation activities coordinated between OL and management teams for reuses involving 14 IRA sites.	, Impacts: Same as Proposed Action. , Potential Mitigations: Same as Proposed Action.	, Impacts: Same as Proposed Action. , Potential Mitigations: Same as Proposed Action.	, Impacts: IRP remediation activities completed or continued as needed.
Storage Tanks	Conditions: Storage tanks used by retained military activities will be managed in accordance with applicable regulations. Inactive underground storage tanks will be removed in accordance with applicable standards.	, Impacts: Storage tanks used by new owner/operator would be subject to all regulations to avoid unacceptable impacts. , Potential Mitigations: Appropriate precautions to avoid damage to remain USTs and piping systems during construction.	, Impacts: Same as Proposed Action. , Potential Mitigations: Same as Proposed Action.	, Impacts: Same as Proposed Action. , Potential Mitigations: Same as Proposed Action.	, Impacts: Storage tanks would be removed or maintained in place according to required standards.

Notes: Impacts are based on the changes from realignment baseline conditions, which are projected to occur as a result of implementing that alternative.
IRP = Installation Restoration Program
OL = Operating Location

Table S-2. Summary of Impact and Suggested Mitigations for the Proposal Action and Alternatives
Page 5 of 10

Resource Category	Realignment Baseline	Proposed Action	Aviation with Industrial Park	Aviation with Mixed Use	No-Action Alternative
Asbestos	Conditions: Asbestos posing a health risk will be remediated. Remaining asbestos will be managed in accordance with Air Force policy.	, Impacts: Removal and disposal of asbestos in facilities to be demolished. Remaining asbestos would be managed in accordance with applicable regulations to minimize potential risk to human health or the environment.	, Impacts: Same as Proposed Action,.	, Impacts: Same as Proposed Action.	, Impacts: Continued management of asbestos in accordance with Air Force policy.
Pesticide Usage	Conditions: Pesticides used by military activities are managed in compliance with applicable standards.	, Impacts: Increased use associated with civilian development. Management in accordance with FIFRA and state guide lines would preclude unacceptable impacts.	, Impacts: Same as Proposed Action.	, Impacts: Same as Proposed Action.	, Impacts: No change in usage or management practices.
Polychlorinated Biphenyls (PCBs)	Conditions: All federally regulated PCBs removed and property disposed of prior to realignment.	, Impacts: No Impacts.	, Impacts: Same as Proposed Action.	, Impacts: Same as Proposed Action.	, Impacts: Same as Proposed Action.
Radon	Conditions: No facilities that were tested had registered radon levels above 4 pCi/1.	, Impacts: No impacts.	, Impacts: No impacts.	, Impacts No impacts.	, Impacts: No impacts.
Medical/Blohazardous Waste	Conditions: Existing wastes removed prior to realignment. Minimal waste generated after realignment through military use of clinic,	, Impacts: No impacts.	, Impacts: No impacts:	, Impacts: Proper management under applicable regulations would avoid unacceptable impacts,	, Impacts: No impacts.

Notes: Impacts are based on the changes from realignment baseline conditions, which are projected to occur as a result of implementing that alternative.

PCBs = polychlorinated biphyenls
USTs = Underground storage tanks
FIFRA = Federal Insecticide, Fungicide, and Rodenticided Act

Table S-2. Summary of Impact and Suggested Mitigations for the Proposal Action and Alternatives
Page 6 of 10

Resource Category	Realignment Baseline	Proposed Action	Aviation with Industrial Park	Aviation with Wed Use	No-Action Alternative
Ordnance	Conditions: No known unexploded ordnance disposal sites on base.	, Impacts: No impact.	, Impacts: No impact.	, Impacts: No impact.	, Impacts: No impact.
Lead	Conditions: Facilities built before 1978 may contain lead-based paint.	, Impacts: Removal and disposal of bad-based paint in accordance with applicable federal, state and local regulations during renovation or demolition of buildings built before 1978.	, Impacts: Same as Proposed Action.	, Impacts: Same as Proposed Action.	, Impacts: Continued management of lead-based paint in buildings built before 1978 in accordance with Air Force Policy.
Natural Environment Soils and Geology	Conditions No ground disturbance.	, Impacts: Minor erosion effects from 337 acres of ground disturbance on base over the 20-year study period. Potential erosion impacts from 850 acres of ground disturbance in the RPA planning area, which would include development of a new airfield at the end of the 20-year study period. , Potential Mitigations: Use standard techniques such as protective cover and diversion dikes to minimize erosion during and after construction.	, Impacts: Mirror erosion effects from 295 acres of ground disturbance on base and 682 acres in RPA planning area over the 20-year study period, , Potential Mitigations: Same as Proposed Action.	, Impacts: Minor erosion effects from 114 acres of ground disturbance on base and 322 acres in RPA planning area over the 20-year study period. , Potential Mitigations: Same as Proposed Action.	, Impacts: Minor erosion effects from 89 acres of ground disturbance on base and 325 acres in RPA planning area over the 20-year study period. ! Potential Mitigations: Same as Proposed Action.

Notes: Impacts are based on the changes from realignment baseline conditions, which are projected to occur as a result of implementing that alternative.
pCi/1 = picocurfes per liter
RPA = Rickenbacker Port Authority

Table S-2. Summary of Impact and Suggested Mitigations for the Proposal Action and Alternatives
Page 7 of 10

Resource Category	Realignment Baseline	Proposed Action	Aviation with Industrial Park	Aviation with Mixed Use	No-Action Alternative
Water Resources	Conditions Adequate water supply for limited on-base demand Potable water from City of Columbus system	, Impacts: Slight Increase in ROl water consumption rates would not adversely effect water supply. Disturbance and development of 337 acres over the 20-year study period could affect surface water drainage patterns and water quality. , Potential Mitigations: Use storm water run-off controls, minimize areas of disturbance and length of exposure, and stagger timing of construction/ demolition activities. Compliance with NPDES and local permit requirements for storm water and wastewater discharge. Landscape disturbed areas not dedicated to facility or support structure.	, Impacts: Slight Increase i ROl water consumption rates would not adversely affect water supply. Disturbance and development of 295 acres on base and 662 acres in RPA planning area over the 20-year study period could affect surface water drainage patterns and water quality. , Potential Mitigations: Same as Proposed Action.	, Impacts: Slight Increase i ROl water consumption rates would not adversely affect water supply. Disturbance and development of 114 sores on base and 322 acres In RPA planning area over the 20-year study period could affect surface water drainage patterns and water quality. , Potential Mitigations: Same as Proposed Action.	, Impacts: No change in water demand, therefore, no draw down on ROl water supply. Disturbance of 69 acres on base and 325 sores in RPA planning area over the 20 year study period could affect surface water drainage patterns and water quality. , Potential Mitigations: Same as Proposed Action.
Air Quality	Conditions:	, Impacts: Reuse related emissions in 2004:	, Impacts: Reuse related emissions in 2004:	, Impacts: Reuse related emissions in 2004:	, Impacts: Emissions in 2004:

Notes: Impacts are based on the changes from realignment baseline conditions, which are projected to occur as a result of implementing that alternative.
ROI = region of influence
NPDES = National Pollutant Discharge Elimination System
RPA = Rickenbacker Port Authority

Table S-2. Summary of Impact and Suggested Mitigations for the Proposal Action and Alternatives
Page 8 of 10

Resource Category	Realignment Baseline	Proposed Action	Aviation with Industrial Park	Aviation with Mixed Use	No-Action Alternative
Air Quality (Cont,)	NO_X. 1.84 tons/day VOC: 3.09 tons/day PM_{10}: 0.72 tons/day SO_2: 0.34 tons/day CO: 7.01 tons/day Limited air pollutant emissions generated from retained military activities and caretaker activities. Air Force will implement air emission controls in State implementation Plan (SIP) as appropriate.	NO_X: 3.81 tons/day VOC: 3.83 tons/day PM_{10}0.66 tons/day SO_2: 0.41 tons/day CO: 11.82 tons/day Air pollutant emissions during construction and operations would not materially affect the region's progress toward attainment of the ozone standard. Concentrations would not materially increase the frequency or severity of violations of the ozone standard. No adverse impacts for other criteria pollutants , Potential Mitigations: Control of fugitive dust and combustion emissions from construction activities.	NO_x: 4.71 tons/day VOC: 4.74 tons/day PM_{10}:1.09 tons/day SO_2: 0.58 tons/day CO: 15.37 tons/day Air pollutant emissions during construction and operations would not materially affect the region's progress toward attainment of the ozone standard. Concentrations would not materially increase the frequency of severity of violations of the ozone standard. No adverse impacts for other criteria pollutants. , Potential Mitigations: Same as Proposed Action.	No_x: 2.45 tons/day VOC: 3.42 tons/day PM_{10}: 0.64 tons/day SO_2: 0.33 tons/day CO: 9.00 tons/day Air pollutant emissions during constriction and operations would not materially affect the region's progress toward attainment of the ozone standard. Concentrations would not materially increase the frequency or severity of violations of the ozone standard. No adverse impacts for other criteria pollutants , Potential Mitigations: Same as Proposed Action.	NO_x: 1.99 tons/day VOC: 2.96 tons/day PM_{10}: 0.43 tonslday SO_2: 0.24 tons/day CO: 7.21 tons/day Air pollutant emissions during construction and operations would not materially affect the region's progress toward attainment of the ozone standard. Concentrations would not materially increase the frequency or severity of violations of the ozone standard. No adverse impacts for other criteria pollutants , Potential Mitigations: Same as Proposed Action.
Noise	Conditions: 4,126 acres and 1,427 residents exposed to DNL 65 dB or greater due to aircraft operations.	, Impacts: 6,220 acres and 2,277 residents exposed to DNL 65 dB or greater due to aircraft operations in 2014.	, Impacts: 5,589 acres and 2,103 residents exposed to DNL 65 dB or greater due to aircraft operations in 2014.	, Impacts: Slightly increased operations would result in minimal noise impacts during 20-year study	, Impacts: Same as Aviation with Mixed Use Alternative.

Notes: Impacts are based on the changes from realignment baseline conditions, which are projected to occur as a result of implementing that alternatives.

No_x = nitrogen oxides
VOC = Volatile organic compounds
PM_{10} = particulate matter equal to or less 10 microns in diameter
SO_2 = sulfur dioxide
CO = carbon monoxide
SIP = State Implementation Plan

Table S-2. Summary of Impact and Suggested Mitigations for the Proposal Action and Alternatives
Page 9 of 10

Resource Category	Realignment Baseline	Proposed Action	Aviation with Industrial Park	Aviation with Mixed Use	No-Action Alternative
Noise (Cont.)		, Potential Mitigations: Re-accomplish FAR Part 150 to identify potential mitigation.	, Potential Mitigations: Re-accomplish FAR Part 150 to identify potential mitigations.		
Biological Resources	Conditions: No ground disturbance. No state or federal threatened or endangered species are known to occur on base. Thirty-five small jurisdictional wetlands (mostly 0.1 acres) for an estimated 22 acres on base.	, Impacts: Potential impact on state threatened upland sandpiper in vicinity of RPA planning area. Potential impacts to 91 small wetlands on existing RPA property, including 35 jurisdictional wetlands on base. Potential for additional wetlands in the airport expansion area. , Potential Mitigations: Wetlands mitigation could include avoidance through facility design, replacement, enhancement of wetland habitat, or control of construction-related erosion into near wetlands.	, Impacts: Potential impact on state threatened upland sandpiper in vicinity of RPA planning area. Potential impacts to 91 small wetlands on existing RPA property, including 35 jurisdictional wetlands on base. , Potential Mitigations: Same as Proposed Action.	, Impacts: Same as Aviation with Industrial Park Alternative, but impacts may be more limited on base. , Potential Mitigations: Same as Proposed Action.	, Impacts: No change in base-related activities. Limited potential for impacts to 35 small jurisdictional wetlands on base. Potential increase In habitat due to long-term decrease in human activity.
Cultural Resources	Conditions: No archaeological, native American, architectural or paleontological resources on base.	, Impacts: No archaeological, Native American, architectural, or paleontological resources on base. Potential for cultural resources on off-base areas to be developed the RPA.	, Impacts: Same as Proposed Action.	, Impacts: Same as Proposed Action.	, Impacts: No archaeological, Native American, architectural, or paleontological resources on base.

Note: Impacts are based on the changes from realignment baseline conditions, which are projected to occur as a result of Implementing that alternative.

DNL = day-night average sound level
dB = decibel
FAR = Federal Aviation Regulation
RPA = Richenbacker Port Authority
SHPO = State Historic Preservation Officer

Table S-2. Summary of Impact and Suggested Mitigations for the Proposal Action and Alternatives
Page 10 of 10

Resource Category	Realignment Baseline	Proposed Action	Aviation with Industrial Park	Aviation with Mixed Use	No-Action Alternative
Cultural Resources (cont.)		, Potential Mitigations: No mitigation necessary within base boundary. On off-base areas project proponents would be required to coordinate with Ohio SHPO and comply with the National Historic Preservation Act if federal funding is obtained or a federal permit is required for the project.	, Potential Mitigations: Same as Proposed Action.	, Potential Mitigations: Same as Proposed Action.	

Notes: Impacts are based on the changes from realignment baseline conditions, which are projected to occur as a result of implementing that alternative.

US Army Corps of Engineers
Louisville District

Site Investigation of 21 Areas of Concern Former Lockbourne Air Force Base Columbus, Ohio

Final Report
Volume I

Prepared for
U.S. Army Corps of Engineers
Louisville District
Contract No. DACW27-98-D-0022 • Delivery Order 0011

Prepared by

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June 29, 2006

PN 776047

Mr. Jay Trumble
US Army Corps of Engineers, Louisville District
600 Dr. Martin Luther King, Jr. Place
Room 921
Attn: CELRL-ED-EE(TRUMBLE)
Louisville, Kentucky 40402-2230

Re: Final Site Investigation Report
Former Lockbourne Air Force Base
Contract No. DACA27-98-D-0022, D.O. 11

Dear Mr. Trumble:

Please find enclosed two (2) copies of the Final Site Investigation Report for the Former Lockbourne Air Force Base. Also included are copies of the responses to the comments received on the draft document. If you have any questions or comments, please contact me at (513) 782-4745 or e-mail to Karl.VanKeuren@shawgrp.com. Thank you.

Sincerely,

SHAW ENVIRONMENTAL, INC.

Karl Van Keuren

Karl Van Keuren, P.G.
Project Manager

cc: Diana Bynum
John Lengel
CT-C (Shirley Garvey)
Laurie Eggert
Paul Kennedy
Bonnie Buthker

Attachments

N:\P\776047\Final SI Report\TRANSLTRjune 28 2006.doc

A Shaw Group Company

Responses to Ohio EPA Comments Dated September 17, 2003
Former Lockbourne Air Force Base
Columbus, Ohio

General Comments:

1. Elimination of chemicals - Many times in the responses to comments, detected chemicals are being eliminated even when they exceed a screening level. Please follow the criteria as listed in the work plan for this project, Section 5.1 Data Quality Assessment and Data Validation, pages 5-1 and 5-2.

Response: Based on Comments #1, 2, and 3, the following screening criteria will be used in the revised report:

- **The metals results will be screened against background.**
- **If a metals result exceeds background, it will be screened against the Region 9 Commercial/Industrial PRGs if it is a carcinogen and 1/10 the Commercial/Industrial PRG if it is a non-carcinogen.**
- **Organic compounds will be screened against the Region 9 Commercial/Industrial PRGs if it is a carcinogen and 1/10 the Commercial/Industrial PRG if it is a non-carcinogen.**
- **For groundwater and surface water samples the samples will be screened against the tap water PRGs (1/10 the PRG for non-carcinogens) and will be compared to the MCLs (but not as a part of the screening criteria).**

2. Comment 1 from Ohio EPA's October 23, 2002 letter - See the first part of the comment. Screening criteria from one project does not automatically apply to other projects. Criteria should be agreed to on a site by site basis. In addition, the evaluation of residential Preliminary Remediation Goals (PRGs) against site data will assist decision making and the determination of institutional controls.

Response: Please see response to Comment 1. Anticipated future land use is Commercial/Industrial and remediation decisions should be made on that basis. Since PRGs and exposure criteria are continually updated, if a residential land use evaluation is required, it will be done when needed.

3. Comment 3 from Ohio EPA's October 23, 2002 letter - The work plan for this project does not state that the Environmental Baseline Survey qualitative risk assessment would be followed for this project. For carcinogenic compounds, the whole PRG value is used as the screening value. For non-carcinogenic compounds, the PRG value is adjusted by 1/10th and the adjusted value is used to screen contaminants that are considered non-carcinogens. This approach provides an order of magnitude margin of error built into the screening process, which allows multiple chemical exposure to be evaluated without exceeding the risk goal of 1E-5 and an HI = 1 from exposure to a single chemical. Please note that during the screening stage, non-carcinogens are not to be evaluated or segregated based on mechanism

or mode of action, or target organ. All non-carcinogenic compounds are considered to be additive in the screening stage of an area of concern (AOC) evaluation. This approach is consistent with the work plan and consistent with Ohio EPA's approach.

Response: Please see response to Comment 1.

4. Comment 4 from Ohio EPA's October 23, 2002 letter - Fate and migration are key aspects of any environmental investigation and risk assessment. Contaminants are present in soil, and therefore, the potential for these to migrate to ground water exists. The soil screening levels (SSLs) included in the PRG tables provide a mechanism to evaluate migration to ground water and should be used to evaluate this pathway.

Response: Soil analytical results will be screened against the SSL (DAF=20) criteria (when available) to evaluate the migration to groundwater pathway. In determining whether further evaluation is warranted based on results of the SSL screen, results from site-specific groundwater analytical results will be considered in assessing the risk due to this pathway.

Specific Comments:

5. Comment 9 from Ohio EPA's October 23, 2002 letter - Ohio EPA agrees with the response as given, however, the first part of Comment 9 was not addressed and needs to be provided..

Response: AOC 109 will be added to the list of sites for no further action and will be added the no further action report. The revised no further action report will be submitted with revised SI report.

6. Comment 10 from Ohio EPA's October 23, 2002 letter - AOC "19" is a typographical error. The comment should have listed AOC 109. It was decided that no further action was needed for AOC 109.

Response: AOC will be removed from page 1-3 and added to the list of sites for no further action.

7. Comment 11 from Ohio EPA's October 23, 2002 letter - The underground storage tanks (USTs) may have been part of the scope that included the 21 AOCs that this report covers, however, the USTs should have their own set of reports. This site investigation (SI) report should cover only the 21 AOCs as given in the work plan.

Response: The UST text will be removed from the SI Report. A letter report will be submitted that covers AOCs 88 and 89 plus comment responses for the AOC 91 Closure Report will be submitted and the report will be revised.

8. Comment 13 from Ohio EPA's October 23, 2002 letter - When might responses to comments and the report for AOC 91 be expected?

Response: The UST comment responses are attached. The revised UST report will be sent

with the revised SI Report.

9. Comment 23 from Ohio EPA's October 23, 2002 letter - In addition to sampling areas near soil boring 17SB02SO01, soil boring 19SB02SO01 should also be sampled at depth.

Response: Section 4 will be revised to recommend additional soil sampling at AOCs 17 and 19 to delineate the vertical extend of PAHs in the unsaturated zone.

10. Comment 26 from Ohio EPA's October 23, 2002 letter - In checking with the Division of Hazardous Waste Management, I was informed that the plume is still moving. This concern remains.

Response: The bullet referencing IRP Site 1 will be removed.

11. Comment 30 from Ohio EPA's October 23, 2002 letter - The discussion of arsenic should not be removed from the report. Arsenic in soil is above background. Also, the soil analyses for AOC 19 are missing from this report. Metals should not be ignored. See Comment 9 above regarding subsurface sampling at AOC 19.

Response: The discussion of arsenic will not be removed – the comment response was referring only to removing the discussion of arsenic relative to the PRG for AOC 17, since arsenic at AOC 17 is not above background. The soil results for AOC 19 will be included in Appendix K. Any additional samples will probably be analyzed for VOCs and metals also.

12. Comment 31 from Ohio EPA's October 23, 2002 letter - Metals found in soil above screening levels should not be eliminated at this point. Arsenic is above background and its PRG and the discussion should not be removed from this report.

Response: The response was only referring to removing the discussion of arsenic relative to the PRG when arsenic is below background.

13. Comment 32 from Ohio EPA's October 23, 2002 letter - Carbazole was detected and should not be removed from the text.

Response: Carbazole was detected and will not be removed from the text.

14. Comment 34 from Ohio EPA's October 23, 2002 letter - The response should be added to the report.

Response: Text will be added that describes additional investigation activities described in the response.

15. Comments 35, 36, 37 and 39 from Ohio EPA's October 23, 2002 letter - According to the work plan, a second soil boring would be used to attempt the collection of ground water. Was this done? A discussion should be added regarding this effort, along with the revisions already proposed.

Response: As stated in Section 2.2 of the Work Plan, "...If the presumed down gradient boring does not yield sufficient volume for sampling, then another boring may be selected. A maximum of two hours will be allowed for groundwater sample collection." The objective was to allow up to 2 hours per AOC for groundwater recharge. Since a saturated zone was encountered at the presumed down gradient borings, it appeared likely that a sample could be collected and the selected boring at each AOC was allowed to recharge for 2 hours. However, at some AOCs, the boring did not yield sufficient water for sample collection. In some instances, the geoprobe drive shoes smear the borehole wall such that a hydraulic connection between the surrounding formation and the screen-point samplers can not be established. In many cases, the hydrostatic pressure will break the smear zone resulting in a hydraulic connection that is sufficient to collect a groundwater sample. However, the smear zone can periodically prevent sample collection. In addition, since there is no sand filter pack, the 0.004 slot screen in the screen-point samplers are susceptible to clogging from fines. This discussion will be added to the text.

16. Comment 40 from Ohio EPA's October 23, 2002 letter - Metals should not be eliminated from the investigation. Barium was detected in soil above background, and therefore, a ground water sample should have been collected from this location. The work plan did not distinguish between screening numbers regarding this proposal. Also, some discussion should be included outlining the concern with volatile organic compounds (VOCs).

Response: The recommended sampling will include metals in groundwater. Also, the following text will be added to Section 3.12. "Although detected VOC concentrations in the groundwater sample were below respective screening criteria, the limited nature of investigations completed to date can not rule out the potential that higher VOC concentrations exist."

17. Comments 41 and 42 from Ohio EPA's October 23, 2002 letter - The responses should be added to the report.

Response: The information presented in responses to comments 41 and 42 will be included in the final report.

18. Comment 43 from Ohio EPA's October 23, 2002 letter - Additional sampling should be conducted at AOC 97. Sediment samples should be collected at depth and the bottom of the lagoon determined. Also, the barrier to installing the piezometer should be determined. Where were the attempts made? Does the lagoon have a liner? More information is needed before a determination can be made regarding AOC 97.

Response: The following discussion will be added to Section 3.14. "Fifteen attempts to install a piezometer down gradient (south) of the lagoon each resulted in refusal at approximately 4 to 5 feet bgs. This area is heavily wooded and tree roots might be responsible for refusal." Additional sampling will be recommended to determine the thickness of the lagoon sediment, to determine if a liner is present, and to further characterize the sediment.

19. Comment 44 from Ohio EPA's October 23, 2002 letter - Please note that cumulative risk must be evaluated in the revised report for all exposed receptors, unless discussion and justification is provided to show that receptors not evaluated are inherently protected by the receptors that are evaluated.

Response: The revised report will include text that justifies the receptors evaluated in the cumulative risk evaluation.

20. Comment 46 from Ohio EPA's October 23, 2002 letter - An explanation is needed detailing why ground water was not available for sample analysis. For example, soil boring 98SB01 is a total of twelve feet deep. The bottom half of the boring is sand, with the water table at eight feet. Why is it that water was not available? The other two soil borings at this location are also twelve feet deep, with the water table at eight feet and the bottom five feet in sand. All three locations would appear to be good candidates for obtaining ground water samples.

Response: See response to Comment #15.

21. Comment 49 from Ohio EPA's October 23, 2002 letter - The lead concentration in surface water at AOC 99 exceeds the MCL and this needs to be stated as part of the discussion. Because the surface water is contained within a package aeration plant, it could probably remain there until the plant is dismantled. In addition, heptachlor should not be eliminated because it exceeds the PRG for that chemical. MCLs and PRGs should be used in conjunction with each other such that the lower value is used for screening and selecting chemicals of potential concern (COPC).

Response: The text will state that the lead concentration is above the drinking water action level. Heptachlor will not be eliminated. The PRGs (or 1/10th the PRG) will be used for screening as described in the response to Comment #1. The contaminants will also be compared to the MCLs, but now as part of the initial screen.

22. Comment 51 from Ohio EPA's October 23, 2002 letter - The information requested in this comment needs to be addressed. The response indicates that construction had not started on the passenger terminal nor had the monitoring wells been abandoned at the time the SI report was written. According to my field log book, the monitoring wells had been abandoned some time before March 12, 2002. I was onsite that date and was informed that the wells had been abandoned. In addition, construction of the passenger terminal had already begun. The SI report was dated June 2002. Also, it was Ohio EPA's understanding that the abandoned monitoring wells would be replaced. This should be discussed.

Response: The report was several months in preparation and was originally submitted to USACE as a draft in March 2002. However, a figure will be included in the revised report that depicts the location of the terminal relative to the groundwater contamination and text will be added to state that the wells were abandoned by the RPA during terminal construction. Additional investigation is already proposed for AOC 19. It will be noted that any future investigations will need to take into consideration the redevelopment of the site.

23. Comment 53 from Ohio EPA's October 23, 2002 letter - The extent of source contamination has not been determined. The highest ground water contamination at AOC 19 is located at an area where there is a lack of soil analyses. More investigation and characterization is needed before a "presumptive remedy" of natural attenuation can be considered. In addition, natural attenuation is not working at Site 41 under the Air Force Real Property Agency (AFRPA). Levels of certain VOCs are well above MCLs and continue to increase over time.

Response: The revised report will not include remediation recommendations.

24. Comment 54 from Ohio EPA's October 23, 2002 letter - The second part of Comment 54 needs to be addressed.

Response: The reference to the surface soil being removed will be deleted from the text regarding soil at AOCs 17, 18, 19, and 103. Additional investigation will be recommended.

25. Comment 56 from Ohio EPA's October 23, 2002 letter - The rationale for selecting the MCL as the remediation goal (in lieu of the PRG) when the MCL is higher than the PRG must be provided. In addition, cumulative exposure must be evaluated to ensure that the cumulative target risk goal is not exceeded and associated residual risks are acceptable. Also, it is too soon to be discussing a remedial design. More information needs to be provided before a decision can be made.

Response: Recommendation of remedial actions will be removed from the text.

26. Comment 57 from Ohio EPA's October 23, 2002 letter - The portion of the comment regarding source areas needs to be addressed. Also, prior to conducting sampling for remedial design, the remedial investigation/feasibility study (RI/FS) needs to be conducted, followed by the proposed plan and the decision document. It appears that this report is projecting too far into the future. The RI/FS may be tailored towards fast-tracking the process, but it should be conducted.

Response: Recommendation of remedial actions will be removed from the text. Additional investigation will be recommended.

27. Comment 62 from Ohio EPA's October 23, 2002 letter - Guidance states that the maximum detected concentration should be used as the default when the calculated value is greater than the maximum detected concentration. The report should be revised accordingly.

Response: The representative concentrations presented on Table 2-8 will be revised to be the maximum detected concentration in instances where the UTL is greater than the maximum detected concentration.

28. Comments 64, 65, 70 and 71 from Ohio EPA's October 23, 2002 letter - See Comment 3 of this letter and revise footnotes b and c as specified in the October 23, 2002 letter.

Response: The tables referenced in these comments will have the footnotes revised to be consistent with the screening process presented in response to Comment #1.

29. Comment 67 from Ohio EPA's October 23, 2002 letter - Comment 67 needs to be addressed. Vinyl chloride exceeded its MCL.

Response: Tables will be reviewed to verify that all analyte concentrations that exceed screening criteria are flagged.

30. Comment 69 from Ohio EPA's October 23, 2002 letter - The second part of Comment 69 needs to be addressed.

Response: Table 3-18 will be reviewed to verify that all detected chemicals listed on Table 3-13 are listed on Table 3-18.

31. Comment 72 from Ohio EPA's October 23, 2002 letter - PRGs should be used for screening when the MCL is higher.

Response: The PRGs will be used as the screening criteria, but the results will also be compared to the PRGs.

32. Comment 73 from Ohio EPA's October 23, 2002 letter - Prior to using a surrogate for screening purposes, the Ohio EPA risk assessor should be consulted to ensure appropriate use and selection of a surrogate. In addition, chemicals that do not have a toxicity value or appropriate surrogates are not to be dropped from the COPC list. They must be retained and discussed qualitatively in the risk assessment.

Response: The revised report will discuss qualitatively chemicals that do not have a toxicity value or an appropriate surrogate.

33. Comment 77 from Ohio EPA's October 23, 2002 letter - My copy of the report does not have the referenced compounds flagged.

Response: It will be verified that the appropriate compounds are flagged. However, the compounds above MCLs appear to be flagged with "{ }" brackets.

Response to USACE Comments Received by OEPA March 15, 2004
Former Lockbourne Air Force Base
Columbus, Ohio

1. Comment 1 - Inorganic results from soil analysis should be screened against Region 9 Preliminary Remediation Goals (PRGs) even though the results do not exceed the background value. Also, maximum contaminant levels (MCLs) and PRGs should be used to screen ground water samples so that the lower value is used as the point value for screening and selecting chemicals of potential concern (COPCs).

Response: The metals results were screened against background and against the Region 9 Commercial/Industrial PRGs.

2. Comment 8 - The UST comment responses were not attached to the letter and still need to be provided.

Response: The UST comment responses will be provided.

3. Comment 15 - The work plan states that closed screen samplers were to be used when collecting ground water samples with geoprobes and should have helped keep clogging from being much of a concern. Was the work plan followed? Also, a second borehole was to be attempted in locations where no ground water was obtainable. This information has been requested three times and an answer is expected. Ground water was noted in most of the boreholes but was not obtainable (This statement should remain in the report.) The text states that no ground water was present in many of the boreholes yet the logs indicate that ground water was encountered.

Response: The work plan was followed. Groundwater samples were not collected from borings if sufficient volume (for all analyses) was not available after two hours' recharge. One reason for the lack of volume may have been that the hydraulic connection between the surrounding formation and the screen-point sampler could not be established. The second possible reason for the lack of volume is that the 0.004 slot screens in the screen-point samplers are susceptible to clogging from fines, thereby not allowing water to pass. A second boring was an option ("may be selected") but was not mandatory.

4. Comment 20 - See the previous comment. At this AOC, the boreholes are twelve feet deep at three locations. At one location, sand was six feet thick, and at the other two locations, it was five feet thick. All thicknesses were at the bottom of the boreholes. In all instances, ground water was found at eight feet below ground surface. By using a closed screen sampler, there should not have been much of a problem with clogging or smearing.

Response: See response to issue No. 3.

5. Comment 23 - Will the requested sampling be conducted?

Response: The decision for additional sampling is not Shaw's decision.

6. Comment 25 - The first part of the comment was not responded to.

Response: The discussion on remediation goals was removed from the document, in response to an earlier comment (see responses to comments date 9/17/2003, item No. 25).

7. Comment 31 - Is the response to this comment correct? Should the comparison be to the MCL and not the PRG as stated here?

Response: The response was incorrect. It should have read, "The PRGs will be used as the screening criteria, but the results will also be compared to the MCLs."

8. Comment 33 - Not all of the chemicals exceeding their MCLs have been flagged at two soil boring locations. In addition, total 1,2-DCE should be broken down into trans and cis forms where they exceed their respective MCLs. Using total 1,2-DCE does not give a true picture. It has no MCL. This comment applies to Figures 3-8, 4-1 and 4-2.

Response: The laboratory reported the total 1,2-DCE concentration, not the *trans* and *cis* forms.

Responses to Ohio EPA Comments on the Draft Site Investigation Report for the Former Lockbourne Air Force Base

Ohio EPA received the Draft Report, Site Investigation for Areas of Concern at the Former Lockbourne Air Force Base, Columbus, Ohio, on July 25, 2002, and has the following comments.

General Comments:

1. Chemicals with a reporting limit exceeding a screening level should be included in the appropriate tables as a chemical of potential concern (COPC). In addition, if any screening levels are exceeded, these chemicals should not be eliminated at this time.

   Response: The method detection limits are much lower than the reporting limits and are below the commercial/industrial PRGs for soil. For water, a few of the tap water PRGs are very low and are below the MDLs. Non-detected analytes were not considered COPCs in the Environmental Baseline Survey that was done on the Air Force property at the facility.

2. The report title should include a reference to the fact that 21 AOCs were investigated. There is more than one project being conducted at the Former Lockbourne AFB.

   Response: The report will be titled "Site Investigation of 21 Areas of Concern..."

3. For non-carcinogenic compounds, the Preliminary Remediation Goal (PRG) is used at 1/10th of its given value to screen contaminants. This approach provides an order of magnitude margin of error built in to the screening process, which allows multiple chemical exposure to be evaluated without exceeding the risk goal of 1E-5 and HI = 1 from exposure to a single chemical. Please note that during the screening stage, non-carcinogens are not to be evaluated or segregated based on mechanism or mode of action, or target organ. All non-carcinogenic compounds are considered to be additive in the screening stage of an area of concern (AOC) evaluation. This approach is used to screen site related data initially during a site investigation. Revise all tables and areas of this report to reflect this comment.

   Response: The qualitative risk assessment in this SI was done in accordance with the work plan and was consistent with the Environmental Baseline Survey that was done on the Air Force property at the facility.

4. Soil results should be evaluated against the Region 9 PRGs soil screening levels to evaluate the potential for the migration of contaminants from soil to groundwater, prior to recommending no further action.

   Response: The qualitative risk assessment in this SI was done in accordance with the work plan and was consistent with the Environmental Baseline Survey that was done on the Air Force property at the facility.

5. An explanation is needed showing how it was determined that exposure to multiple PAHs detected at levels above the PRG was determined to be within the acceptable risk range? Was cumulative exposure to multiple contaminants in multiple media via multiple pathways evaluated to ensure that the target risk goal of 1E-5 for cumulative risk was not exceeded? If so, explain how this was conducted.

   Response: The qualitative risk assessment in this SI was done in accordance with the work plan and was consistent with the Environmental Baseline Survey that was done on the Air Force property at the facility. However, in the revised report cumulative risk will be evaluated in cases were multiple chemicals exceed the PRGs.

6. Any AOCs moving forward to a baseline risk assessment will require the evaluation of the construction worker scenario.

   Response: Exposure scenarios will be detailed in the work plan for additional work at the site.

Specific comments:

7. Section 1.0 Introduction, page 1-1, first paragraph - The text states that 30 sites were eliminated as AOCs. It might be more correctly stated to say that 23 sites were eliminated because they need no further action and that seven other sites were or will be handled under other programs.

   Response: The text will be revised as suggested.

8. Section 1.1 Background, page 1-1, first paragraph, first sentence - The Former Lockbourne Air Force Base (FLAFB) is located in central Ohio and not south central Ohio as stated here.

   Response: The text will be revised.

9. Section 1.1 Background, page 1-2, list of AOCs that have been eliminated - AOC 109, Building 1071, needs to be added to this list and added to the report titled "Justification for No Action under DERP/FUDS for 22 Areas of Concern at the FLAFB" dated February 1999. In addition, comments were provided by Ohio EPA on March 11, 1999 to this report, and, to date, have not been addressed. Ohio EPA realizes that funding constraints are holding up the finalization of this report, however, we had three comments and Camp Dresser & McKee had four comments. It seems that it would not take much effort to complete this project.

   Response: The comments requested that documentation be provided for agreements between RPA and USACE regarding two sites and for notification of the Navy about possible AOCs on their property. USACE is currently working on providing this documentation.

10. Section 1.1 Background, page 1-3, second list - AOC 19 should be removed.

    Response: AOC 19 appears to belong on the list.

11. Section 1.2 UST Removals, page 1-4 - Why are underground storage tanks (USTs) discussed in this report? Only the 21 AOCs investigated in this site investigation (SI) should be discussed. AOCs 90, 91, 92 and 98 have their own reports and, in fact, could be referred to in Section 1.1 Background. That leaves AOCs 88 and 89 needing reports. I am open to suggestions as to how this should be documented. Would a letter report suffice?

    Response: The USTs were initially investigated as part of the scope and this section presents information about the geophysical surveys not presented in the closure reports. All the information regarding AOCs 88 and 89 is presented in this section. No additional reports are planned.

12. Section 1.2.2 AOC 89 - UST at Fire Station, page 1-5, line 21 - Dick Haines was the former fire marshal and not the former fire chief as stated here.

    Response: The text will be revised.

13. Section 1.2.3 AOC 90 - USTs at Bldg. 320 and 323, page 1-6; Section 1.2.4 AOC 91 - UST at Readiness Crew Bunker, pages 1-6 and 1-7; Section 1.2.5 AOC 92 - UST at Alert Hanger, page 1-7; and Section 1.2.6 AOC 98 - UST at Transmitter Facility, pages 1-7 and 1-8 - On December 5, 2000, Ohio EPA submitted a comment letter regarding these UST removals. The comments were never addressed nor were any final documents received. In addition, Ohio EPA was asked to sign-off on AOC 91 because it was not a BUSTR site and verification of completeness was needed from the State. It appears that Ohio EPA was left out of the loop. No copies of no further action letters were received by this office from BUSTR and no report for AOC 91 has been submitted for approval.

    Response: The comments will be responded to and the AOC 91 report will be submitted to Ohio EPA for review. The no further action letters from BUSTR were included in Appendix B of the SI report.

14. Section 1.5.2 Regional Setting, page 1-9 - Lines 7 and 8 need to be joined.

    Response: The revision will be made.

15. Section 1.5.3 Site-Specific Geology, page 1-9, line 17 and Section 1.6.1 Regional Hydrogeology, page 1-10, line 21 - The thickness of the gray till is described as at least 10 feet thick in the former section and as at least five feet thick in the latter section. Please correct the text.

    Response: The text will be revised to indicate the till is at least 10 feet thick.

16. Section 1.8.1 Adjacent Land Use, page 1-13, line 2 - It might be more appropriate to refer to the area as the Rickenbacker International Airport.

    Response: The text will be revised.

17. Section 2.2.4.2.3 Groundwater Purging and Sampling Procedures, page 2-6, first paragraph - From the text, it appears that all the monitoring wells in this study were purged dry. Is this true?

    Response: Most, but not all, of the wells were purged dry. The sentence will be revised to read: "The samples were collected after the wells had been purged dry, or a minimum of three well volumes had been removed and the pH, temperature, and conductivity readings had stabilized, or six well volumes had been removed."

18. Section 2.2.7 Impounded Water and Sediment Sampling, page 2-8, first paragraph - Clarification is needed. Section 2.7 is referenced here but it covers record keeping. Was the reference to Section 2.7 in the Field Sampling Plan (FSP)? In addition, the second paragraph refers to Section 2.4 in the FSP for decontamination procedures. Section 2.4 in the report also covers decontamination.

    Response: The reference to Section 2.7 will be removed since the analytical parameters are discussed in Section 3.0 of the report. The reference to the FSP will be removed.

19. Section 2.2.7 Impounded Water and Sediment Sampling, page 2-8, fourth paragraph - This paragraph contradicts itself and needs to be rewritten.

    Response: The paragraph will be rewritten to clarify that the VOC samples were placed directly into the sample containers.

20. Section 2.8 Laboratory Analysis, page 2-15 - The Data Validation Summary Reports in Appendix C indicate that Quanterra was used for the first phase of sample analysis. This section should note that Quanterra was bought out by Severn-Trent Laboratories, Inc. (STL).

    Response: The section will note that the lab is now owned by Severn-Trent.

21. Section 2.9 Data Evaluation, page 2-15, first paragraph - This paragraph should state that the quality control results are found in Tables 2-2 through 2-6. Table 2-1 gives the survey results. In addition, in the third paragraph, there should a discussion of the 2-butanone and toluene found in the trip blanks.

Response: The requested revisions will be made.

22. Section 2.11 Method of Risk Screening, page 2-17, lines 6-9 - A discussion of the hazard index (HI) equaling 1 for non-carcinogens should be added to this paragraph.

Response: The requested revisions will be made.

23. Section 3.2.1 Phase I Site Investigation Field Work, page 3-3, second paragraph - The polyaromatic hydrocarbon (PAHs) soil results for AOC 17 could be compared against numbers showing that the results are related to airport operations after deeper soil samples are collected to determine depth of contamination. For this report, the text should state that the contamination is likely to be non-AOC related but detailed proof needs to be presented in the next phase. This discussion also applies to AOC 19.

Response: Deeper samples (between 6 and 10 feet) were collected from the other two borings at AOC 17 and did not contain PAHs. Therefore, PAHs appear to only be present in the shallow soil. Section 4 will be revised to recommend additional soil samples in the area of 17SB02SO01 to establish that the SVOCs are only in the shallow soil and therefore probably anthropogenic.

24. Section 3.2.1 Phase I Site Investigation Field Work, page 3-4, lines 4 through 19 - Some of the statements made in these three paragraphs do not agree with the information in the related tables. For AOC 18, it states that no semi-volatile organic compounds (SVOCs) were detected and two volatile organic compounds (VOCs) were above screening levels in the ground water. Table 3-12 indicates that two SVOCs were detected and three VOCs were above screening levels. The maximum contaminant level (MCL) was exceeded for lead as well as arsenic. For AOC 19, PAHs should not be eliminated if they are above the PRGs. In addition, vinyl chloride is not the only VOC to exceed a limit. MCLs should also be taken into consideration. For AOC 103, MCLs also need to be taken into account. PRGs are not the only screening tool.

Response: The information in the text will be corrected to match the table. In cases where multiple chemicals exceed the PRGs, a cumulative risk calculation will be done. The MCL screening will be discussed for AOCs 19 and 103.

25. Section 3.2.1 Phase I Site Investigation Field Work, page 3-4, first bullet - Soil Boring 103SB03 should be 103SB01. Also, the sand seams are described as being 1.5-2 feet thick. According to the soil boring logs, the thicknesses are 2-3 feet and could be thicker at one location. The bottom of the boring was in sand.

    Response: The text will be revised.

26. Section 3.2.1 Phase I Site Investigation Field Work, page 3-4, third bullet - The plume at Site 1 is approximately 300 feet downgradient of the source, however, this plume is still moving downgradient and has currently reached the farthest monitoring wells from the source.

    Response: The results from the downgradient wells at Site 1 fluctuate between low detections and non-detects. Therefore, the plume appears to be stable.

27. Section 3.2.1 Phase I Site Investigation Field Work, page 3-5 - In the first bullet, the compound concentrations should be added to the discussion. In the second bullet, some SVOCs were detected in ground water.

    Response: The text will be revised to reflect these results.

28. Section 3.2.2 Phase II Site Investigation Field Work, page 3-5, first paragraph - Clarifications and corrections are needed in this paragraph. Monitoring Well 18MW02 was installed near Soil Boring 18SB03 and not 18SB02 as stated in this paragraph. Monitoring Well 18MW04 was installed close to Soil Boring 18SB02. In addition, Monitoring Well 103MW01 is not close to Soil Boring 103SB01. Also, Monitoring Well 103MW03 is not between AOCs but is a downgradient monitoring well.

    Response: The text will be revised to clarify the well locations.

29. Section 3.2.3 Additional AOC 19 Investigation, page 3-8, lines 15 and 16 - The cited sentence refers the reader to Figure 3-8 to locate Soil Boring 19SB02R. The boring needs to be added to the figure. In addition, Figure 3-12 is referred to on page 3-9, line 18. This should be Figure 3-8.

    Response: The figure and text will be revised as requested.

30. Section 3.2.4 Risk-Based Evaluation, page 3-9 - The background concentration for arsenic should be used for screening at these AOCs and not the PRG. In addition, the PAHs should be evaluated for this AOC.

Response: The PRG discussion for arsenic will be removed. It will be noted that PAHs were not detected in the two subsurface samples collected at the AOC.

31. Section 3.2.4 Risk-Based Evaluation, page 3-10, first paragraph - Metals found in soil above screening levels should not be eliminated at this point.

Response: The discussion of arsenic above the PRG will be removed since it is below background.

32. Section 3.2.4 Risk-Based Evaluation, page 3-10, second paragraph - Arsenic and SVOCs should not be eliminated from consideration at this time. In addition, carbazole was listed in this paragraph as being above its PRG but is not flagged in Table 3-23. It might also be mentioned that none of the detected metals has a MCL.

Response: Cumulative risk will be calculated for this AOC. Carbazole was not detected – it will be removed from the text. It will be noted that none of the metals detected in the groundwater has an MCL.

33. Section 3.2.4 Risk-Based Evaluation, page 3-11, first paragraph - The background concentration in soil for arsenic should be the screening value to use for this project. VOCs should not be eliminated at this time. It should also be stated that the metals detected did not have MCLs.

Response: The discussion of the arsenic PRG will be removed. VOCs were not eliminated. It will be noted that there are not MCLs for the metals detected.

34. Section 3.3 AOC 49 - Building 783, Small Arms Firing Range, page 3-12, fourth paragraph - The rationale for continuing investigation at this AOC needs more details.

Response: Additional investigation was proposed to help verify that higher concentrations of VOCs are not present. An additional well will be proposed in the area between 783MW01 and 783MW02, since neither of those wells is directly downgradient of the AOC.

35. Section 3.4 AOC 55 - Possible Waste Disposal Location, page 3-13, second paragraph - Ground water was encountered at all three soil borings at this AOC. An explanation is needed detailing the reasons for not being able to collect a ground water sample.

Response: The text will be revised to indicate that although the borings penetrated the water table, there was insufficient yield to collect a sample within the time frame specified in the work plan (two hours). The phrase "groundwater was not present in any of the borings" will be removed.

36. Section 3.5 AOC 55A - Possible Waste Disposal Location, page 3-13, third paragraph - Ground water was encountered at two of the three soil borings at this AOC. An explanation is needed detailing the reasons for not being able to collect a ground water sample.

Response: The text will be revised to indicate that although the borings penetrated the water table, there was insufficient yield to collect a sample within the time frame specified in the work plan (two hours). The phrase "groundwater was not present in any of the borings" will be removed.

37. Section 3.6 AOC 56 and AOC 72 - Possible Waste Disposal Location, page 3-14, third paragraph - An explanation is needed detailing the reasons for not being able to collect a ground water sample at either of these AOCs. Soil Boring SB03 had four feet of sand at the bottom of the boring and water was encountered.

Response: The text will be revised to indicate that although the borings penetrated the water table, there was insufficient yield to collect a sample within the time frame specified in the work plan (two hours). The phrase "groundwater was not present in any of the borings" will be removed.

38. Section 3.7 AOC 57 - Possible Waste Disposal Location, page 3-15, line 13 - The AOC listed here should say AOC 57. In addition, in lines 21-25, it should state that the arsenic result for soil is below the background value.

Response: The text will be revised to indicate AOC 57. Since arsenic is below background, the PRG discussion will be removed.

39. Section 3.10 AOC 69 - Possible Waste Disposal Location, page 3-17, second paragraph - An explanation is needed detailing the reasons for not being able to collect a ground water sample at this AOC. Soil Boring SB01 encountered ground water at eight feet.

Response: The text will be revised to indicate that although the borings penetrated the water table, there was insufficient yield to collect a sample within the time frame specified in the work plan (two hours). The phrase "groundwater was not present in any of the borings" will be removed.

40. Section 3.12 AOC 94 - Stained Soil Near Precision Maintenance Lab, page 3-19, second paragraph - Barium has been detected in soil above background. It was agreed that a ground water sample would be collected wherever metals were detected above background in soil. In addition, in the third paragraph, it is stated that additional investigation would be proposed for this area. Details are needed on what the proposed work would be and should also be added to Section 4.3 Proposed Further Action for AOCs 49 and 94.

Response: Barium was below the PRG. Additional investigation was proposed to help verify that higher concentrations of VOCs are not present. The exact details of any additional work will be presented in a work plan, but would probably consist of some limited additional soil and groundwater sampling.

41. Section 3.13 AOC 96 - Well #2, page 3-19 - The monitoring well abandonment form should be added to this report.

Response: The abandonment form could not be located in the Air Force or RPA files.

42. Section 3.14 AOC 97 - Sewage Treatment Facility and Lagoon, page 3-19, first paragraph - This section should include a discussion of the disposal of sludge from this operation. Was it spread on a nearby field?

Response: Dick Haines, AFCEE field Engineer, checked with Dave Edwards (who used to be in charge of the base sewage operations) about the lagoon. Dave said they never had to remove sludge from the lagoon because most of it was removed by the package plant treatment systems at the trailer court and the dog kennel. The sludge that accumulated in the package plants was generally removed by a vacuum truck and taken to the City of Columbus sewage plant. On several occasionally the sludge was removed and disposed of in an on-base sanitary sewer and was subsequently treated at the on-base treatment plant.

43. Section 3.14 AOC 97 - Sewage Treatment Facility and Lagoon, page 3-20, third paragraph - More details are needed on the lagoon. What is the depth of the sediment in this lagoon? Were samples collected beneath the lagoon? Is there a possibility that ground water has been impacted?

Response: The depth of sediment in the lagoon is not known. Only surface samples were collected. Fifteen attempts were made to install a piezometer. Refusal occurred in every hole at approximately 4 to 5 feet. No groundwater sample was collected.

44. Section 3.14 AOC 97 - Sewage Treatment Facility and Lagoon, page 3-20, lines 30-33 - PCBs should be screened against their respective PRG value. In addition, explain how cumulative risk was evaluated to determine that exposure to multiple contaminants via multiple pathways/routes did not exceed the target risk range.

Response: PCBs were screened against the PRGs but the TSCA cleanup criteria were also considered. The qualitative risk assessment was done in accordance with the work plan and was consistent with the Environmental Baseline Survey that was done on the Air Force property at the facility. Cumulative risk will be evaluated in the revised report, but only for commercial/industrial worker cumulative exposure to soil or tapwater.

45. Section 3.14 AOC 97 Sewage Treatment Facility and Lagoon, page 3-21, lines 1 and 2 - Chemicals that do not have PRGs available are not to be excluded as potential chemicals of concern using the rationale that there is no value to compare to.

Response: Table 3-55 indicates that benzo(g,h,i)perylene and endrin aldehyde are not excluded. However, the text will be revised to indicate that the concentrations of both chemicals are well below the PRGs for the respective surrogate compounds pyrene and endrin.

46. Section 3.15 AOC 98 Base Communications Center and Transmitter Facility, page 3-21, third paragraph - An explanation is needed detailing the reason(s) for not being able to collect a ground water sample in any of the three soil borings installed in this AOC. All three borings encountered ground water at eight feet below the surface. There was a minimum of five feet of sand in two of the borings and a minimum of six feet in the third boring.

Response: The text will be revised to indicate that although the borings penetrated the water table, there was insufficient yield to collect a sample within the time frame specified in the work plan (two hours). The phrase "groundwater was not present in any of the borings" will be removed.

47. Section 3.15 AOC 98 Base Communications Center and Transmitter Facility, page 3-21, line 33 - Figure 3-23 should be referenced. In addition, line 35 should probably state that the Aroclor detected in Transmitter #1 is 1260 and the result should be listed in Table 3-58.

Response: The figure reference will be added. The text and table will be corrected to indicate Aroclor 1260 was detected in Transformer #1.

48. Section 3.15 AOC 98 Base Communications Center and Transmitter Facility, page 3-22, second paragraph - Aroclor 1260 needs to be added to Table 3-60.

Response: Table 3-60 should be titled "Soil" not "Transformer Oil" and will be corrected.

49. Section 3.16 AOC 99 Package Aeration Plant, page 3-23, lines 14 and 15 - The sentence referring to lead should indicate what action level is being referred to. The previous sentence mentions three possibilities. In addition, an explanation should be included providing the rationale for recommending no further action when heptachlor exceeds screening criteria.

Response: The text will be revised to indicate that the lead concentration is below the surface water background value. The reference to the action level will be removed. The text will be revised to indicate that heptachlor is eliminated because it is less than the MCL.

50. Section 4.0 Recommendations, page 4-1 - This section may need to be revised upon resolution of the comments on this report. Further investigation may be needed at the lagoon located at AOC 97 and there is some uncertainty associated with the lack of ability to collect ground water samples at AOCs 55, 55A, 56, 68 and 98. In addition, the discussion on PAHs in lines 10-13 may need to be revised to reflect earlier comments. It may be too early in the investigation to determine what has caused the PAH contamination of soil at AOCs 17 and 19. Possible sources and non-point sources should be discussed using them to determine whether the contamination is source related. The extent needs to be determined at AOCs 17 and AOC 19.

Response: The recommendations section will be revised to reflect the resolution of comments on other sections of the report.

51. Section 4.1 Proposed Further Actions for AOCs 17, 18, 19 and 103, pages 4-2 through 4-8 - Before proposing the remedial actions for these AOCs, some additional information and investigation is needed. Firstly, a discussion is needed covering the construction of the passenger terminal at AOC 19 and how this impacts the environmental investigation in this area. In addition, three monitoring well were abandoned during the construction of the terminal. That was not discussed, nor was a figure (uncluttered) included depicting the location of the terminal and the location of ground water contamination. Secondly, data gaps at AOCs 18, 19 and 103 should be identified and discussed.

Response: At the time the report was prepared, the passenger terminal had not been constructed and the monitoring wells had not been abandoned. The construction of the terminal and abandonment of the wells were performed by RPA. If this information is provide by RPA, it will be included in the revised report.

52. Section 4.1 Proposed Further Actions for AOCs 17, 18, 19 and 103, page 4-2, third paragraph - On

line 26, add OEPA as one of the signatories.

Response: The text will be revised as requested.

53. Section 4.1 Proposed Further Actions for AOCs 17, 18, 19 and 103, page 4-3 - The proposal of using a "presumptive remedy" as determined by the Superfund Acceleration Cleanup Model (SACM) is premature and may not be appropriate. The geology is similar, however, no comparison of chemical concentrations has been made between these AOCs and the referenced sites. In addition, the extent of source contamination has not been determined. The highest ground water contamination at AOC 19 is located at an area where there is a lack of soil analyses. In summary, proof is needed to use a "presumptive remedy". The remedial investigation/feasibility study conducted on Air Force Base Conversion Agency property may not be used for the above four AOCs without showing that natural attenuation will work.

Response: Additional information will be added that compares the chemical concentrations. The document titled "Two-Year Review of Remedial Actions Performed at IRP Sites 2, 21, 42, and 43" was submitted to Ohio EPA by AFCEE in December 2002. This document indicates that hot spot removal and natural attention is effective at the facility.

54. Section 4.1.1.1 Summary of Soil Contamination at AOCs 17, 18, 19 and 103, page 4-4, lines 14 and 15 - Are you certain that surficial soil will be removed? In addition, the extent of soil contamination has not been determined. Before conducting a source removal, the extent of soil contamination is needed.

Response: The text will be revised to reflect the actual redevelopment that has occurred.

55. Section 4.1.2 Recommendations of Further Action for AOC 19, page 4-5 - Comparisons are made between AOC 19 and Sites 21 and 42, however, chemical concentrations also need to be compared to show that the levels of contamination are similar.

Response: A discussion of the chemical concentrations will be added.

56. Section 4.1.2 Recommendations of Further Action for AOC 19, page 4-7, line 19 - MCLs and PRGs may be used as action levels, depending on which number is lower. In addition, the last paragraph discusses a hot spot removal. Where is this hot spot located given that it appears that this has yet to be defined?

Response: USACE proposes using the MCLs as the remediation goal in cases where the MCL is higher than the PRG. The hot spot removal refers to removal of aquifer material, not vadose zone contamination. The exact area to be removed will be determined as part of the remediation design.

57. Section 4.1.3 Recommendation of Further Action for AOC 18 and AOC 103, page 4-8, lines 5 through 15 - Soil samples should be collected for analysis from the proposed sampling area to determine vertical and horizontal extent. This is needed to determine any source areas. A risk evaluation or risk assessment would be needed and the data would need to be validated. Only monitoring well samples for VOC analysis is acceptable for a risk assessment.

Response: The groundwater at AOCs 18 and 103 exceeds the MCLs, which are the proposed remediation goals. Therefore, the proposed use of the additional data is remediation design, and the need for data validation and risk assessment is not clear.

58. Section 4.2 Proposed Further Action for AOC 75, page 4-9, line 1 - Sampling of ground water should also be conducted beneath the old runway.

Response: The text will be revised to indicate that the soil and groundwater beneath the runway should be sampled.

59. Section 4.3 Proposed Further Action for AOCs 49 and 94, page 4-9 - General details should be given outlining the additional work.

Response: General details have not been established yet. This will likely involved discussions between USACE and Ohio EPA and could be affected by the availability of funding.

60. All tables should be checked and revised to address specific comments regarding footnotes.

Response: The table footnotes will be checked and revised as necessary.

61. Table 2-7 Analytical Results of Trip Blanks - Clarification is needed. The report text states that two trip blanks had 2-butanone and toluene in them. This table shows only one chemical in two different samples.

Response: The report text cited could not be located.

62. Tables 2-8 Soil Background Concentrations, 2-9 Groundwater Background Concentrations, 2-10 Sediment Background Concentrations and 2-11 Surface Water Background Concentrations - If the 95% upper tolerance limit (UTL) exceeds the maximum detected concentration for a chemical, then the representative background concentration of the chemical defaults to the maximum concentration detected. For instance, the representative concentration of aluminum should be

1.9E+4 instead of 2.2E+04 mg/kg. Revise these tables so that the representative concentration of each individual chemical is the lower value of the maximum detected concentration vs. the 95% UTL. Chemicals with a sample size of less than five should be included in this summary table and evaluation. Typically, a limited number of samples are collected during site investigations, so the low sample size is not unusual and the results of chemicals having five or less samples must be included in this summary table and background evaluation.

Response: The background values are based on the 95% UTL not the maximum detection when lower, which is consistent with previous work at the facility. Results were not eliminated based on the frequency of detections or number of samples.

63. Table 3-1 Summary of Risk Based Screening and Recommendations - Explain how cumulative risk was evaluated to ensure that the PRG risk of 10E-5 is not exceeded. For example, this is stated in AOC 97.

Response: The text states that the cumulative risk would be in the target risk range, which USEPA defines as between 10^{-6} and 10^{-4}. Only two compounds exceeded 10^{-6} and both were less than 10^{-5}, so cumulative risk could not exceed 10^{-4}. Cumulative risk will be calculated for AOCs that have multiple chemicals above the PRGs.

64. Table 3-5 Risk Based Evaluation of Soil for AOC 9 Building T-263 Photo Lab - See Comment 2. In addition, Footnote b should be revised.

Response: It is assumed this comment is actually referring to Comment 3. The chemicals were screened against the PRGs which is consistent with the site investigation work done by AFCEE at the facility.

65. Table 3-6 Risk Based Groundwater for AOC 9 Building T-263 Photo Lab - See Comment 2 and revise Footnote c.

Response: It is assumed this comment is actually referring to Comment 3. The chemicals were screened against the PRGs which is consistent with the site investigation work done by AFCEE at the facility.

66. Tables 3-7 Soil AOC 17 Building T-530 Base Engineer's Shop, 3-8 Soil-AOC 18 Building T-532 Base Engineers Maintenance and Inspection, 3-9 Soil AOC 19 Building T-535 Engine Cleaning Building and 3-10 Soil AOC 103 Building T-531 Battery Shop - Add the depth of each soil sample to each of these tables. In addition, the footnote regarding the result exceeding the MCL should be removed because these values do not apply to soils.

Response: The requested changes will be made.

67. Table 3-14 Groundwater - AOC 103 Building T-531, Battery Shop - Sample results exceeding a MCL should be flagged.

    Response: Results exceeding MCLs were flagged.

68. Table 3-16 Groundwater Levels and Elevations, AOCs 18, 19 and 103 - The water level and groundwater elevation values for Monitoring Wells 18-MW02 and 103-MW02 have been switched and need to be corrected. See Figure 3-6 in this report.

    Response: The table is correct. The figure will be corrected.

69. Table 3-18 Analytical Results Summary AOC 19 Former Building 535 - State whether these results reflect ground water or soil data and add the date of the sampling event. In addition, all of the chemicals detected and listed on Table 3-13 are not listed on Table 3-18. They should be.

    Response: The table will be revised to indicate it is DSITMS groundwater data from May 2001.

70. Table 3-19 Risk Based Evaluation of Soil for AOC 17 Building T-530 Base Engineer's Shop; Table 3-20 Risk Based Evaluation of Groundwater for AOC 17 Building T-530; Table 3-21, Table 3-23, Table 3-24, Table 3-25, Table 3-26, Table 3-31, Table 3-32, Table 3-34, Table 3-36, Table 3-38 and Table 3-40 - See Comment 2 and revise Footnote b accordingly.

    Response: It is assumed this comment is actually referring to Comment 3. The chemicals were screened against the PRGs which is consistent with the site investigation work done by AFCEE at the facility.

71. Table 3-28 Soil AOC 49 Building 789 Small Arms Firing Range; Table 3-33 Soil AOC 55; Table 3-35 Soil AOC 55A; Table 3-37 Soil AOCs 56 and 72; and Table 3-39 Soil AOC 57 - See the second part of Comment 64.

    Response: It is assumed this comment is actually referring to Comment 3. The chemicals were screened against the PRGs which is consistent with the site investigation work done by AFCEE at the facility.

72. Table 3-63 Risk Based Evaluation of Surface Water for AOC 99 Building 777 Package Aeration Plant and Table 4-3 Chemicals of Interest in Groundwater for AOCs 18 and 103 - Clarify what

footnote "f=action level" corresponds to. What action level are you referring to?

Response: Lead and Copper do not have MCLs, which are health based, but do have action levels in the National Primary Drinking Water Regulations. This will be added to the footnote on all appropriate tables.

73. Table 4-1 Chemicals of Interest in Soil for AOCs 17, 18, 19 and 103 - Revise Footnote b to include chemicals that are detected but do not have screening criteria as COPCs. Revise all tables where this comment is applicable.

Response: In the revised report, chemicals that do not have a PRG or MCL will be screened against a surrogate if available. Chemicals that do not have toxicity values or appropriate surrogates will not be retained as COPCs, since it is not possible to evaluate the risk associated with them.

74. Table 4-4 Comparison Between AOC 15 and Sites 21 and 42 - AOC 15 should be AOC 19.

Response: The table will be revised.

75. Figure 3-9 AOC 49 - The label for Monitoring Well 783MW01 should be moved. The outline for the old leach field obscures part of the well label.

Response: The label will be moved.

76. Figure 4-1 AOC 19 TCE, Vinyl Chloride and DCE in Groundwater - This figure needs to be simplified to make it readable. It should show the new passenger terminal, new roads and the monitoring wells that were abandoned.

Response: The figure will be revised.

77. Figure 4-2 AOCs 18 and 103 TCE, Vinyl Chloride and DCE in Groundwater - Concentrations that exceed MCLs should also be flagged.

Response: The results that exceed MCLs are already flagged as noted in the legend.

78. Appendix C - The reason codes used in the Data Validation Summary Report should be explained.

Response: A table of reason codes will be added to Appendix C.

79. Appendix E - Field Borehole Log for lagoon piezometer - A discussion of the failure to install a piezometer should be included in the text of the report, including the reasons for the failure.

Response: The reason a piezometer was not installed (refusal) will be explained in the text.

80. Appendix Q - The TCLP sampling results should be included in this appendix.

Response: The TCLP results are archived off-site and cannot be easily retrieved.

FINAL REPORT

SITE INVESTIGATION
OF
21 AREAS OF CONCERN
FORMER LOCKBOURNE AIR FORCE BASE
COLUMBUS, OHIO

Project No. 776047
Contract No. DACA27-98-D-0022, Delivery Order 11

PREPARED FOR

U.S. Army Corps of Engineers
Louisville District

PREPARED BY

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June 2006

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CONTRACTOR STATEMENT OF INDEPENDENT TECHNICAL REVIEW

Shaw Environmental, Inc., has completed the Site Investigation, Former Lockbourne Air Force Base. Notice is hereby given that an independent technical review (ITR) has been conducted that is appropriate to the level of risk and completely inherent in the project. During the independent technical review, compliance with established policy principles and procedures, utilizing justified and valid assumptions, was verified. This included review of assumptions, methods and procedures used in the analyses; alternatives evaluated; the appropriateness of data used and level of data obtained; and reasonableness of the results, including whether the product meets the customer's needs consistent with law and existing Corps policy. In addition, the ITR verified that the document is consistent with the Site Investigation Report described in the Work Plan; the format (e.g., headers, spacing) is consistent and in accordance with professional standards; and data presented in text, tables, and appendices are consistent with each other.

Karl Van Keuren — 6/29/2006

Karl Van Keuren
Project Manager

Date

Ida Bennett — 6-29-2006

Ida Bennett
Independent Technical Reviewer

Date

Table of Contents

Table of Contents (continued)

Table of Contents (continued)

List of Tables

List of Tables (continued)

List of Tables (continued)

List of Tables (continued)

List of Tables (continued)

List of Figures

List of Figures (continued)

List of Acronyms

AFBCA	Air Force Base Conversion Agency
AFCEE	Air Force Center for Environmental Excellence
AOCs	Areas of Concern
ARARs	Applicable, Relevant and Appropriate Requirements
AST	aboveground storage tank
ASTM	American Society for Testing and Materials
BRAC	Base Realignment and Closure Program
BTEX	benzene, toluene, ethylbenzene, and xylene
BUSTR	Bureau of Underground Storage Tanks
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cm	centimeter
cm/sec	Centimeters per second
COC	chain-of-custody
DCA	dichloroethane
DCE	dichloroethene
DERP/FUDS	Defense Environmental Restoration Program/Formerly Used Defense Site
DoD	Department of Defense
DOT	Department of Transportation
DSITMS	Direct Sample Ion Trap Mass Spectrometer
DVSR	data validation summary report
EBS	Environmental Baseline Survey
FID	flame ionization detector
FLAFB	Former Lockbourne Air Force Base
FSP	Field Sampling Plan
gpm	gallons per minute
GPS	Global Positioning System
ID	inside diameter
IDW	investigative derived waste
IRP	Installation Restoration Program
IT	IT Corporation
MCL	Maximum Contaminant Level
µg/L	microgram per liter
µg/kg	microgram per kilogram
mg/kg	milligrams per kilogram
ml	milliliter
MSL	mean sea level
NDAI	No DoD Action Indicated
NTU	nephelometric turbidity unit
O.D.	outside diameter
OEPA	Ohio Environmental Protection Agency
OHANG	Ohio Air National Guard
PAH	polyaromatic hydrocarbons
PCB	polychlorinated biphenyls
PETG	polyethylene terephthalate, glycol modified

List of Acronyms (continued)

PID	photoionization detector
PRAC	Preplaced Remedial Action Contract
PRG	Preliminary Remediation Goal
PVC	polyvinyl chloride
QAPP	Quality Assurance Project Plan
QC	quality control
RADD	Remedial Action Decision Document
RANGB	Rickenbacker Air National Guard Base
RI/FS	Remedial Investigation/Feasibility Study
RPA	Rickenbacker Port Authority
SI	Site Investigation
SVOC	semivolatile organic compounds
TAL	Target Analyte List
TCL	Target Compound List
TCE	trichloroethene
TSCA	Toxic Substance Control Act
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UST	underground storage tank
UWBZ	upper water-bearing zone
UXO	unexploded ordnance
VC	vinyl chloride
VOA	volatile organic analysis
VOC	volatile organic compound

List of Appendices

1.0 Introduction

This Site Investigation (SI) Report involves the investigation of a Defense Environmental Restoration Program/Formerly Used Defense Site (DERP/FUDS) site known as the Former Lockbourne Air Force Base (FLAFB). Originally 51 sites were identified as potential Areas of Concern (AOCs) at this facility. Twenty-three of the sites were eliminated as AOCs because they need no further action and seven other sites were or will be handled under other programs as described in Section 1.1 of this report. The remaining 21 sites were investigated to determine if the sites could be closed out with a "No DoD (Department of Defense) Action Indicated" (NDAI) determination, if interim removal actions are required, or if additional investigation is required. This SI Report presents the results of the investigations conducted by Shaw Environmental, Inc. (Shaw) at the 21 sites. This project was conducted under contract to the United States Army Corps of Engineers (USACE), Louisville District.

This section of the report describes a brief history of the facility; an inventory of the sites that were investigated; a description of the installation that includes the site geology, hydrology, ecological settings, and community settings; and a description of the components of this report.

1.1 Background

FLAFB is located in central Ohio, 12 miles southeast of downtown Columbus and one-half mile east of the village of Lockbourne (Figure 1-1). The base is located in Franklin and Pickaway Counties. FLAFB was originally named the Northeastern Training Center of the Army Air Corps and later renamed the Lockbourne Air Force Base. Construction on the base began in 1942. The base consisted of 1,574 acres by the end of 1942 and had two runways; a north-south and an east-west, and an X-shaped taxiway system connecting the two. The current runway configuration was constructed in 1951 while the base was occupied by the Strategic Air Command. The base at that time encompassed over 4,000 acres. The base was renamed Rickenbacker Air Force Base in 1974. In 1980, the base was closed, transferred to the Ohio Air National Guard (OHANG), and renamed the Rickenbacker Air National Guard Base (RANGB). In 1982, the base began the process of disposing of properties, including the transfer of 1,642 acres to the Rickenbacker Port Authority (RPA) in 1984 and 1985. The RPA name was later changed to the Columbus Regional Airport Authority (CRAA). The property owned by the CRAA is named the Rickenbacker International Airport.

The CRAA identified 51 areas that could potentially be AOCs. Approximate locations of the 51 areas are shown on Figure 1-2. After reviewing historical documentation and performing site visits, 22 of the 51 potential AOCs did not need to be included in the scope of this SI. These sites were eliminated because the sites had been extensively redeveloped, were not on property deeded to the CRAA, had never existed, or had been mitigated. The AOCs that have been eliminated are as follows:

- AOC 1 - Aircraft gasoline pipeline
- AOC 6 - Armament storage
- AOC 7 - Oil storage
- AOC 8 - Aircraft refueling
- AOC 14 - Pumphouse battery
- AOC 27 - Warehouse and ordnance office
- AOC 28 - Ordnance ammunition
- AOC 29 - Magazine for pyro storage
- AOC 30 - Igloo for black powder
- AOC 31 - Magazine for segregated storage
- AOC 35 - Fuel storage crew house
- AOC 37 - EXP gasoline tank
- AOC 41 - Skeet range
- AOC 52 - Aircraft weapons calibration
- AOC 85 - Underground storage tank (UST) at hospital
- AOC 86 - Transformer area at hospital
- AOC 87 - UST
- AOC 93 - UST at Rickenbacker FTZ 138
- AOC 95 - Stained soil near maintenance hangar
- AOC 105 - Magazine for SA, AM
- AOC 106 - Non-conventional weapons assembly and storage
- AOC 107 - Diesel fill pipe

These AOCs have been addressed in the *Draft Justification for No Action under DERP/FUDS for 22 Areas of Concern, Former Lockbourne Air Force Base, Ohio* (IT, 1999a).

The following six AOCs involve underground storage tanks that were removed under the USACE Preplaced Remedial Action Contract (PRAC):

- AOC 88 - UST north of Bldg. 250
- AOC 89 - UST at Fire Station
- AOC 90 - UST at Bldg. 320 and 323

- AOC 91 - UST at Readiness Crew Bunker
- AOC 92 - UST at Alert Hangar
- AOC 98 - UST at Transmitter Facility

Documentation of the removals is presented in a letter report under a separate cover.

The following two AOCs require additional work prior to conducting Site Investigation activities for contamination:

- AOC 61 - Target butt
- AOC 74 - Area extending from target butt to calibration pad.

Specifically, the target butt needs to be inspected for structural integrity since it is badly damaged by unexploded ordnance (UXO) demolition conducted there in the past. The target butt and the area between the target butt and the calibration pad may also require a UXO clearance prior to conducting site investigation activities.

The following AOC was not investigated as part of this project because the facility has been used since the property was transferred to CRAA:

- AOC 109 - Non-destructive inspection shop

The remaining 21 AOCs are the subject of this report. These AOCs are:

- AOC 9 - Photo lab
- AOC 17 - Base engineer's shop
- AOC 18 - Base engineer's maintenance and inspection
- AOC 19 - Engine cleaning building
- AOC 49 - Small arms firing range
- AOC 55 - Possible waste disposal location
- AOC 55A - Possible waste disposal location
- AOC 56 and 72 - Possible waste disposal locations
- AOC 57 - Possible waste disposal location
- AOC 65 - Horse barn and stable
- AOC 68 - Possible waste disposal location
- AOC 69 - Possible waste disposal location
- AOC 75 - Indoor firing range
- AOC 94 - Stained soil near Precision Maintenance Lab
- AOC 96 - Well #2

- AOC 97 - Sewage treatment facility and lagoon
- AOC 98 - Base communication center and transmitter facility
- AOC 99 – Lift station
- AOC 103 – Battery maintenance facility
- AOC 108 – Dry cleaning operations.

1.2 Project Objectives

The purpose of this DERP/FUDS identified project was to investigate AOCs identified by the CRAA on their property and to determine if they could be closed out with a NDAI determination, if interim removal actions were required, or if additional investigation is required. Specific objectives were to:

- Collect biased and systematic samples of environmental media (soil and groundwater) to determine the presence or absence of contamination to the environment at the selected sites.

- Screen chemical data from select sites against action levels to determine the need for future action.

- Provide recommendations of NDAI status for those sites with no significant contamination, and provide suggested future activities for any sites requiring additional investigation or remediation.

1.3 Installation Description

This section presents the site topography, surface water characteristics, regional and local geology, the groundwater flow across the base, ecological setting, and community setting. Much of this section was taken from previous studies at the FLAFB.

1.4 Geology

1.4.1 Topography

The topography of the area is flat to gently rolling, with very little relief. Elevations range from 710 feet above mean sea level (MSL) to greater than 750 feet MSL [Parsons Engineering-Science, 1996]. The United States Geological Survey (USGS) topographic map is shown as Figure 1-3 (USGS, 1992).

1.4.2 Regional Setting

The geology in the central portion of Ohio where the site is located consists of glacial deposits overlying shale bedrock. The bedrock beneath the site has been identified as Ohio Shale and

Olentangy Shale undivided (ODNR, 1995). The bedrock surface consists of a series of former drainage valleys that have been buried by glacial sediments. The top of the bedrock beneath the site has been mapped at an elevation between 500 and 550 feet MSL. The glacial deposits in the area fall into one of two categories, till or outwash. The till deposits consist primarily of clay and silt with varying amounts of sand and gravel. The outwash deposits consist primarily of sand and gravel with varying amounts of silt and clay; the surficial till is mapped as ground moraine across almost the entire area and overlies the outwash deposits. Till layers are also interbedded with the outwash deposits. The outwash deposits account for the majority of material present in the buried valleys (IT, 1998a).

1.4.3 Site-Specific Geology

The surficial geology at the site consists of two distinct glacial till deposits overlying glacial outwash deposits. The uppermost till unit consists of silty clay and a clayey silt with varying amounts of sand and gravel. This unit grades in color from brown to gray with depth. Isolated lenses of sand and gravel occur within the unit. The unit ranges in thickness from less than 3 feet to greater than 30 feet thick. The second till unit consists of gray silt and clay with varying amounts of fine sand and gravel. The gray till is typically at least 10 feet thick and is reported in water well boring logs as being over 120 feet thick in places. Both the uppermost till and the gray till are laterally continuous at the site (IT, 1998a).

1.5 Hydrogeology

1.5.1 Regional Hydrogeology

The hydrogeology in the area has been previously characterized as consisting of three distinct water-bearing zones; the upper water-bearing zone (UWBZ), the intermediate aquifer, and the deep aquifer. The UWBZ consists of the saturated portion of the uppermost till unit and laterally discontinuous sand and gravel lenses (IT, 1998a).

The sand and gravel valley train deposits are completely saturated in the area of the base. The valley train deposits have been described as actually containing two distinct aquifers, referred to as the intermediate aquifer and the deep aquifer. The majority of water wells in the area utilize the sand and gravel deposits between 10 and 90 feet below the surface, and some utilize the sand and gravel deposits below 135 feet. The City of Columbus operates a well field located approximately 2 miles to the west of the site. The wells in the City of Columbus well field are installed in the valley train deposits. However, there does not appear to be a separate intermediate and deep aquifer in that area. The saturated zones in the valley train deposits are up to 86 feet thick (IT, 1998a).

The regional buried valley aquifer has reported individual well yields of greater than 1,000 gallons per minute (gpm). The aquifer is present for at least 2.5 miles in every direction from the site. The area beneath, and immediately surrounding, the base is mapped as capable of producing up to 500 gpm from large diameter wells (Schmidt, 1993).

Figure 1-4 is a base-wide potentiometric surface map prepared with groundwater level measurements collected on July 1, 1996. This figure was generated using a computer contouring program (Surfer®) and was edited to take into account the positions of surface water bodies. The software uses an algorithm that interpolates clustered data points. Therefore, while the figure presents a good representation of the potentiometric surface at a base-wide scale, it does not necessarily indicate the flow direction at individual AOCs. The map is also drawn at a 10-foot contour interval, which tends to smooth out local variations in the potentiometric surface. A groundwater divide that exists in the central portion of the site corresponds with the topographic high and surface water divide noted at the site. Generally, groundwater flow is toward the nearest point in the drainage ditch.

1.5.2 Site-Specific Hydrogeology

The results of previous investigations conducted at the base indicate that a laterally continuous gray till confining layer at least 10 feet thick separates the UWBZ from the intermediate aquifer. The principal zone of yield in the UWBZ appears to be the sand and gravel lenses that occur within the upper brown and gray till and at the contact between the upper till and the underlying gray till. The top of the water table at the site is typically less than 10 feet bgs. The lower gray till appears to form a laterally continuous aquitard (low permeability boundary) between the UWBZ and the lower aquifers. The lower gray till is believed to be an effective aquitard because of its continuous lateral extent, thickness, low hydraulic conductivity, and density (IT, 1998a). The saturated zone of the brown till is generally on the order of 10 feet thick (IT, 1995). Based on slug tests performed for previous investigations at the base, the calculated hydraulic conductivity values for silts and clays are on the order of 10^{-7} centimeters per second (cm/sec) and the hydraulic conductivity values for the discrete sand or sand/gravel layers are on the order of 10^{-6} to 10^{-3} cm/sec (IT, 1998b).

1.6 Ecological Setting

Ecological reconnaissance surveys were conducted from September 13 to 15, 1993. The survey was performed for RANGB property that lies adjacent to the FLAFB and the ecological conditions between the two facilities are comparable. The surveys were conducted to collect qualitative information on the types, nature, and locations of biological resources at the Base (Parsons Engineering-Science, 1996). Dominant plant species were identified, plant communities were defined based on dominant species observed, and fauna was observed. The survey identified protected species or habitats in the study area. The ecological characterization is described in terms of terrestrial communities, aquatic and wetland communities, and ditches.

<u>Terrestrial Communities</u>

> "Based on dominant vegetation, the general ecological communities in the assessment area on RANGB are open fields, agricultural land, urban land, and remnant forest.
>
> The open fields that occur throughout the Base are primarily associated with areas that are mowed infrequently. Such areas include open land around abandoned buildings, the closed landfill, and abandoned agricultural fields. Wildlife in this community is characterized by species that prefer the low cover provided by the brushy habitat.
>
> Agricultural land, including corn and soybean, is present throughout the area. Wildlife on the agricultural land is limited, consisting mainly of individual species found in open fields.
>
> Urban land is found in the residential housing area, parks, and industrial and flightline areas, all of which are routinely mowed. Most vegetation is herbaceous. Wildlife in this community includes birds and, around shade trees and fence lines, woodchuck and fox squirrel.
>
> Remnant forests are found near intermittent drainage ditches, swales, and isolated tributaries converging into localized drainages that ultimately discharge into Little Walnut Creek and Big Walnut Creeks. These drainages and two creeks have associated riparian stands of vegetation that include hardwood trees, shrubs, and herbaceous ground cover. The width of these stands varies from approximately 30 feet each side of the drainage to larger remnant forest tracts. The plants vary from mowed grasses to a dense canopy of hardwoods with limited herbaceous ground cover. Fauna of the forest community includes American robin, blue jay, mourning dove, northern mockingbird, house sparrow, European starling, eastern cottontail, eastern fox squirrel, woodchuck, raccoon, opossum, and white-tailed deer (Parsons Engineering-Science, 1996)."

Aquatic and Wetland Communities

> "Aquatic communities on RANGB consist of intermittent watercourses associated with the major drainage ditches. All surface water runoff from the base eventually discharges into the storm drain network. Water courses in the assessment area include approximately 8,600 linear feet of drainage ditches. These ditches vary in width from about 20 feet to minor intermittent swales less than 2 feet deep. Standing water usually is not present in most of the ditches, even when the soil is saturated. Drift marks on the sides of the major ditches are evidence of water levels in excess of 4 feet during extreme storm events (Parsons Engineering-Science, 1996)."

The follow-up jurisdictional wetland survey documented in the USAF Final EIS (USAF, 1995) identified over 50 distinct wetlands on and around FLAFB (AFCEE, 1995).

Aquatic life observed to be present at FLAFB include fish, crawfish, frogs, and turtles.

Ditches

> "Ditches throughout the Base are maintained as a major storm-water drainage relief system. Many of these ditches have steep banks (2 to 1 slope). Hydrophytic vegetation is limited to isolated areas where the ditch bed is wider or the bank less steeply sloped. Throughout the base, roadside drainage swales and secondary drainage ditches support a variety of wetland vegetation. The swales are typically 2 to 6 feet wide and provide surface drainage from adjacent developed areas (Parsons Engineering-Science, 1996)."

1.7 Community Setting

The FLAFB lies primarily in Franklin County with a small portion in Pickaway County. The nearest population centers are Lockbourne, one-half mile west of the base; Duvall, 1½ miles to the south; Groveport, 3 miles to the northeast; and Canal Winchester, 5 miles to the northeast. The closest metropolitan area is Columbus, located approximately 12 miles to the north.

1.7.1 Adjacent Land Use

The Rickenbacker International Airport area has experienced significant industrial/commercial growth and more than 110 companies have operations in the area. Thirteen industrial parks are located to the north of the Rickenbacker International Airport. Directly adjacent to the property on the north side of an existing rail spur is privately owned multifamily housing. The largest concentration of residential development is in Groveport, a town of approximately 3,000 people, situated approximately 2 miles northeast of the runways.

The incorporated village of Lockbourne is adjacent to Rickenbacker International Airport property immediately west of the base. Small industrial operations are located to the west of the Rickenbacker International Airport along Canal Road. Located beyond Canal Road is a corridor for the Chesapeake & Ohio and Norfolk & Western Railroads. Additionally, railway easements are located to the southwest, on the far side of the South Perimeter Road. These corridors are used largely for transporting goods through the region. The majority of the surrounding area is agricultural (RPA, 2001).

1.7.2 On-Base Land Use

Rickenbacker International Airport is a high-speed international logistics hub. It comprises a 5,000-acre logistics hub, an adjacent industrial park, and an on-site Foreign-Trade Zone.

The airport specializes in air cargo and features parallel 12,000-foot-long runways capable of handling all types of aircraft around the clock. The airport has 120 acres of ramp space, 25 hydrant fueling stations, and 500,000 square feet of cargo terminal space.

Sixty companies currently have operation at Rickenbacker. These include six international airfreight companies, two E-commerce operators, 11 logistics operations, and distribution centers for 32 businesses. In addition to these businesses, units of the Ohio Air National Guard, Ohio Army National Guard, Army Reserve, and Navy Reserve are stationed at the facility. The Columbus District Office of United States Customs is located within the Foreign-Trade Zone (RPA, 2001).

1.8 Report Organization

This report organizes the SI information as follows:

- Section 2.0 – Project Activities describes the field laboratory and data evaluation activities conducted during the SI.
- Section 3.0 – Site Investigation describes each of the 21 sites in terms of a brief history, samples collected, analytical results, and results of the risk-based evaluation.
- Section 4.0 – Recommendations provides recommendations for sites requiring further action.
- Section 5.0 – References provides a list documents cited throughout this report.
- Appendices provide ancillary information such as a photo log, soil boring and sample collection logs, laboratory data, chains-of-custody (COCs), vapor intrusion model results, and data validation summary reports (DVSRs).

2.0 Project Activities

Shaw conducted initial SI field activities at the FLAFB November 9-17, 1999. Subsequent follow-up investigations were performed in 2000 and 2001.

Procedures used to conduct the field investigation are detailed in Sections 2.1 through 2.6. Section 2.7 presents descriptions of the field documentation maintained. Section 2.8 identifies the analytical laboratory. Sections 2.9 through 2.11 detail data evaluation procedures, data quality assessment and validation procedures, and the methods used for risk screening.

2.1 Field Activities

SI data collection activities included drilling and sampling of soil borings, direct-push drilling techniques; installation and sampling of temporary piezometers; surface soil sampling; impounded water and sediment sampling; and, monitoring well installation and sampling. All SI data collection procedures were consistent with guidelines published in the United States Environmental Protection Agency (USEPA) "Test Methods for Evaluating Solid Wastes" (SW-846, Third Edition) and "Engineering and Design, Chemical Quality Management for Hazardous, Toxic, and Radioactive Waste Remedial Activities, ER 1110-1-263," (USEPA, April 1996).

2.2 Sampling Activities

2.2.1 Selection of Sample Locations

Because no sampling was previously conducted at these AOCs, the proposed sampling locations were based on the physical characteristics, building location, building layout, and presumed operational history. The sampling locations chosen were those locations presumed to have the highest probability of being contaminated. In cases where the building was no longer present and the building layout was not known, the sample locations were generally placed evenly around the perimeter of the former building location, with one location on the presumed down-gradient side, based on the basewide potentiometric surface shown on Figure 1-4. Specific sampling locations are described for each AOC in Section 3.0..

At most AOCs, three Geoprobe® borings were drilled. The soil borings were drilled to the top of the water table (approximate depth of less than 12 feet) and were continuously sampled using direct-push drilling techniques. One soil sample from each boring was analyzed. The soil sample was collected from the two-foot interval in each boring with the highest photoionization detector (PID) readings and/or visual contamination. If none of the soil samples had elevated PID readings or visual contamination, the soil sample from the two-foot interval directly above the water table was analyzed. Additionally, at least one sample was collected from the 0- to 2-foot interval. If the 0- to 2-foot interval did not have the highest PID reading on any of the borings, an additional sample was collected from this interval. At most AOCs, a temporary piezometer was installed in the downgradient boring based on basewide groundwater flow (Figure 1-4) and an attempt was made to collect a groundwater sample. The sampling rationale and locations for AOCs with sampling other than Geoprobe® soil and groundwater sampling are described by AOC in Section 3.0.

2.2.2 *Drilling Procedures*

Borings used to characterize site geological features and to provide soil samples for chemical analyses were drilled using direct push technologies. Groundwater monitoring wells were installed using rotasonic drilling techniques. A stratigraphic log was completed for each boring. The following sections present the details of each drilling method and associated sampling procedures.

2.2.2.1 *Direct-Push Drilling Procedures*

Direct-push borings were advanced using a van/truck-mounted hydraulic sampler using 2-inch inside diameter (ID) by 4-foot lead samplers and drive-shoes and 1-inch probe rods through the application of downhole pressure. Each soil boring was continuously sampled by advancing the lead sampler and drive shoe at 4-foot increments until target depth or refusal. Soil sampling was conducted by using a polyethylene terephthalate (PETG) clear liner.

2.2.2.2 *Rotasonic Drilling Procedures*

The Rotasonic drilling technique used simultaneous high-frequency vibrational and low speed rotational motion to advance the cutting edge of a hollow circular drill stem. This dual action created a uniform borehole while providing relatively continuous cores of both unconsolidated and consolidated material. During the drilling process, minimal amounts of drill cuttings, mixed with drilling fluid (potable water) were generated. The Rotasonic rig pushed a 4-inch ID core barrel for sampling inside of a 6-inch drive casing. The core barrel was advanced ahead of the drive casing, in 10-foot increments to collect samples from undisturbed soils. After advancement of the core barrel, the drive casing was advanced to just ahead of the leading edge of the core barrel using potable water as a drilling fluid. The core barrel was then removed from the borehole and the stratigraphy logged.

2.2.2.3 Cone Penetrometer Drilling Procedures

Some borings were installed using USACE-Savannah District's cone penetrometer truck. The temporary well points for groundwater sampling were installed using 1.87-inch outside diameter (O.D.) rods. The temporary well points were made of polyvinyl chloride (PVC) and include ¾-inch screens and risers. The well points were connected to disposable drive points that were inserted into the end of the drive rods. When the drive rods were at the desired sample depth, the rods were retracted to expose the screen. The PVC screen and riser were left behind and sampled after the drilling rig was moved. This was done during this investigation because of the slow groundwater yield at most of the sample locations.

2.2.3 Soil Sampling

During soil sampling, clean new disposable nitrile gloves were donned by the sampling teams at each sampling location prior to commencement of sampling.

2.2.3.1 Surface Soil Sampling Procedures

Surface soil samples were collected using pre-cleaned stainless steel spoons or trowels and pre-cleaned stainless steel bowls. Samples for volatile constituents were placed directly into the sample containers. Samples for non-volatile constituents were collected after compositing the soil obtained from the top 6 inches of soil in a stainless steel bowl. Any vegetation, debris or organic matter at the surface was removed prior to sampling.

The collected soil was placed into laboratory pre-cleaned glass sample jars with Teflon® lined lids, labeled, sealed, and immediately placed on ice. Decontamination of sampling equipment, including stainless steel bowls and spoons, were performed in accordance with Section 2.4. Sample handling, packaging, and shipping were performed following the procedures outlined in Section 2.5.

2.2.3.2 Subsurface Soil Sampling Procedures

Upon removal of the core barrel from the borehole, (described in Section 2.2.2.1 and 2.2.2.2) a volatile organic compound (VOC) sample was collected immediately after the liner had been removed and opened. A headspace sample was then taken from the interval to perform field screening and the stratigraphy logged. The soil description included the depths of changes in strata, locations of seepage zones, and depth to groundwater. The remaining soil in the interval was placed in a stainless steel bowl and covered with aluminum foil, pending the headspace readings for all the intervals. The sample interval with the highest headspace reading was composited in a stainless steel bowl and placed in a sample container. The VOC samples collected from the remaining intervals became investigative derived waste (IDW). Semivolatile organic compounds (SVOCs), pesticides, PCBs, and Target Analyte List (TAL) metal samples were then collected.

2.2.4 Groundwater Sampling

2.2.4.1 Direct-Push Groundwater Sampling Procedures

To collect a groundwater sample, 1-inch diameter temporary piezometers were placed in the Geoprobe® boreholes. Groundwater was then recovered using disposable polyethylene tubing and a peristaltic pump. The tubing was inserted into the piezometer screen and then attached to the pump. Low flow pumping rates were maintained to minimize agitation of suspended solids in the screen point. As specified in the work plan, the screen points were not purged prior to sampling, due to low yield.

Groundwater samples were collected directly from the disposable Teflon® lined polyethylene tubing. The samples were not filtered prior to collection. The VOC samples were collected first, followed by the SVOC samples. When collecting VOC samples, the pumping rate was lowered to minimize turbulence and aeration of the sample. Volatile organic analysis (VOA) vials were then filled until a positive meniscus was achieved above the rim of the sample bottle. The vials were immediately capped and then gently tapped to verify that no air bubbles were present in the sample. If bubbles were detected, the vial was opened and more sample was added. Collected samples were capped, labeled, and immediately placed on ice. Pre-preserved sample containers were provided by the analytical laboratory. The pH of the preserved VOC samples was not checked in the field. A groundwater sample collection log was completed during sampling.

2.2.4.2 Monitoring Well Construction and Design

Monitoring wells were installed in accordance with the USACE manual EM 1110-1-4000, "Engineering and Design - Monitoring Well Design, Installation, and Documentation at Hazardous Toxic, and Radioactive Waste Sites" (USACE, 1998) and the Ohio Environmental Protection Agency (Ohio EPA) "Technical Guidance Manual for Hydrogeologic Investigations and Ground Water Monitoring" (Ohio EPA, 1995). Monitoring well installation was started within 48 hours of borehole completion. Installation of each monitoring well was performed by using cleaned and decontaminated equipment and supplies per procedures outlined in Section 2.4. Potable water used during the drilling and construction of the monitoring wells (for drilling, bentonite pellet hydration, decontamination) was obtained from an onsite source. A monitoring well installation sheet and well material summary sheet was completed for each well.

The monitoring wells were constructed using flush-threaded two-inch diameter Schedule 40 PVC casing and screen. The well screen was 10-foot long 0.010 inch continuous slotted PVC. The bottom of the screen was capped. The annular space was filled with clean #8 silica sand to above the top of the screen. Following the verification of the top of the sand pack a bentonite pellet seal was placed. The casings were cut about 3 inches below the land surface and furnished with a water-tight casing cap. Flush-mounted protective covers were installed over each well.

2.2.4.2.1 Monitoring Well Development

Development of newly installed wells began no sooner than 48 hours and no later than 7 days after installation. Development was accomplished using a submersible pump, surge block, and bailers. During development discharge (pumping) rates were measured using a graduated container (i.e., plastic bucket) prior to containerization.

A minimum of five well volumes were removed from the monitoring well during development. The well volume was defined as the volume of submerged casing, screen, and filter pack, minus the estimated volume of the sand in the filter pack.

Development of the well was continued until the turbidity was ≤5 nephelometric turbidity unit (NTU), and when the stabilization of pH, temperature and specific conductance had occurred. Stabilization was defined as when pH was within ±0.1 unit, temperature was within 1°C, and specific conductance was within ±10% over at least 3 successive well volumes. In some instances, collection of non-turbid samples was difficult or unattainable. If a well did not provide a sediment-free sample, and/or stabilization of pH, temperature, and specific conductance did not occur, development was stopped when:

- A maximum of 10 well volumes had been removed, in addition to any volume of water or fluid that may have entered the well and formation during construction and/or

- Temperature, conductivity, and pH had stabilized to the above criteria over at least three successive well volumes, and the turbidity remained within a 10 NTU range for at least 30 minutes.

In other instances, a well might have been purged dry during development. In such cases, the water level was allowed to recharge to at least fifty percent of the static water level, and the well was purged dry a total of three times. After each recharge, the above parameters were measured to confirm stabilization. If stabilization did not occur, the well was sampled after the third purge.

No detergents, soaps, acids, bleaches, or other additives were used to develop a well. All development equipment was decontaminated according to the specifications documented in Section 2.4. A monitoring well development/purge log was completed for each well.

2.2.4.2.2 Groundwater Level Measurements

The groundwater level at each newly installed well was measured approximately 24 hours after installation, prior to development and prior to sampling of the well. One additional set of groundwater levels was conducted at the conclusion of the field investigation. Groundwater levels were measured from each well within a single 24-hour period. A water level indicator was used to measure water level to the nearest 0.01 foot. The portion of the water level indicator cable that entered the well casing was decontaminated by wiping the cable with paper towels soaked with laboratory-grade detergent followed by paper towels soaked with deionized water. The cable was wiped as it is retrieved from the well. Care was taken to prevent decontamination solutions from entering the well and to prevent the cable from touching the ground. Clean paper towels were used each time the water level indicator was decontaminated. A groundwater elevation log was completed for each round of groundwater measurements.

If a well casing cap was airtight prior to the removal of the cap, the well was allowed to equilibrate to atmospheric pressure for several minutes. In this case, a series of water level readings, separated by a minimum of 5 minutes, were conducted to assure equilibration to ±0.01 feet.

2.2.4.2.3 Groundwater Purging and Sampling Procedures

Due to the low yield of the wells, a peristaltic pump was used to collect the groundwater samples. The samples were collected after the wells had been purged dry, or a minimum of three well volumes had been removed and the pH, temperature, and conductivity readings had stabilized, or six well volumes had been removed. The samples were collected as described in Section 2.2.4.1.

A groundwater development/purge log and a groundwater sample collection log were completed during sampling.

2.2.4.3 Cone Penetrometer Groundwater Sampling Procedures

VOC samples were collected at each location using a stainless steel bailer. The bottom-filling bailer was 5/8-inch diameter and 2-feet long. The location of each well point was determined with a Global Positioning System linked to an onsite base station. This setup provided horizontal control that is accurate to within 1 foot.

2.2.5 Abandoning Borings

Small diameter boreholes remaining after the completion of direct-push and cone penetrometer sampling were backfilled with granular bentonite. Direct-push and cone penetrometer well points were removed prior to placement of the bentonite backfill. All abandoned boreholes were checked 24 to 48 hours after bentonite pellet emplacement to determine whether curing had caused significant settling. If so, a sufficient amount of bentonite was added to attain its initial level. In areas where borings were advanced through pavement, the surface was repaired with concrete.

2.2.6 PCB Sampling Procedures

Soil samples for PCB sample analysis were collected at AOC 65 and AOC 98 in accordance with USEPA guidance "Field Manual for Grid Sampling of PCB Spill Sites to Verify Cleanup" (USEPA, 1986). Sample points were measured and staked using clean sample flags. Soil samples were collected from a 10 centimeter (cm) by 10 cm area. Soil samples were collected by scraping soil to a depth of approximately 0 to 6 inches. The soil was placed in the sample container. Any vegetation, debris or organic matter at the surface was removed prior to sampling.

Samples of transformer fluid were collected from transformers by opening the access port and using a disposable glass drum thief to collect 40 milliliters (mL) of the fluid. A new drum thief was used for each transformer. The fluid was placed in a properly labeled scintillation vial. The access port was then closed.

A composite sample of the concrete pad was obtained using a decontaminated metal chisel. The work plan called for preferential sampling of stained areas, but no staining was noted. The chips were less than 1 cm deep.

2.2.7 Impounded Water and Sediment Sampling

Impounded water and sediment samples at AOCs 97 and 99 were collected. Sampling equipment was decontaminated in accordance with Section 2.4. If both surface water and sediment samples were to be collected at a specific location, surface water samples were obtained first. Sample containers were prepreserved.

Impounded water was collected using a clean bailer that was dipped into the water so that bottom sediments were not disturbed and then was used to fill the sample containers for analysis. Care was taken to avoid disturbing the sediment, since suspended sediment in the water sample could have affected the analytical results.

Sediment samples for all parameters except VOCs were collected using a stainless steel spoon to transfer sediments into a stainless steel bowl. The VOC samples were transferred directly from the stainless steel spoon to sample containers. Organic material and cobbles were discarded and the remaining sediments homogenized. The spoon was used to transfer samples to the appropriate sample container.

Following sample collection, sample containers were immediately placed in a sample cooler with ice. Sample handling, packaging, and shipping were performed following the procedures outlined in Section 2.5

2.3 Field Measurements

The following section describes the methodology, equipment and procedures that were used to collect field measurements during the SI.

2.3.1 Field Screening of Soils

Soil samples were screened using a PID for volatile organic compounds to determine the depth from which the laboratory analytical samples were collected. During drilling activities, head space readings were recorded from collected soils. The collected soil from each sample interval was placed in a clean Ziplock® baggie (no more than half full), and sealed. Each headspace sample was allowed to sit for at least ten minutes. The baggie was then opened just enough to insert the PID probe tip and a reading of the results were recorded. All the samples from a given boring were tested at the same time.

2.3.2 Field Parameters for Water Samples

Temperature, pH, specific conductance, and turbidity were measured during monitoring well development, purging, and following collection of groundwater samples. The results are noted on the Groundwater Collection Logs presented in Appendix G. All monitoring equipment was calibrated at the beginning and end of each day in accordance with manufacturer's specifications.

2.4 Equipment Decontamination

The following section described the procedures used to decontaminate sampling equipment. Prior to commencement of field activities, a decontamination area was established. All sampling equipment that was directly or indirectly in contact with samples was decontaminated before use. Sampling equipment (i.e., stainless steel bowls, and trowels or spoons, core barrels, split spoons, etc.) was decontaminated in the following sequential steps:

- Washed and scrubbed equipment with a solution of potable water and laboratory-grade nonphosphate detergent.
- Rinsed several times with potable water.
- Rinsed with 10% hydrochloric acid solution.
- Rinsed with American Society for Testing and Materials (ASTM) Type II water.
- Rinsed with pesticide-grade isopropanol.
- Rinsed with ASTM Type II water.
- Allowed equipment to air dry.
- Wrapped in aluminum foil, shiny side out.

Drilling equipment was steam cleaned prior to drilling each boring, installation of each monitoring well, and before leaving the site. Monitoring well casing material that arrived on-site sealed in factory supplied packaging was not decontaminated prior to using in the well. Any casing material or well screen that was not sealed when it arrived at the wellhead was steam cleaned and allowed to air dry prior to use in the monitoring well.

Potable water used during the field investigation was obtained from an onsite source. One potable water sample was collected for offsite chemical analysis.

All decontamination solutions were stored and dispensed in proper containers. All fluids generated during decontamination activities were placed in 55-gallon steel closed top drums. All drums were properly labeled as to content and were staged in a central location for temporary storage pending removal and disposal.

2.5 Sample Handling

This section describes the sample identification and numbering system, sample preservation requirements, packaging and shipment procedures, and sample holding times. Pre-cleaned sample containers were provided by the analytical laboratory through a second-source distribution. The sample containers were certified to meet or exceed analyte specifications established by USEPA in "Specifications and Guidance for Contaminant-Free Sample Containers," (USEPA, 1992).

2.5.1 Sample Identification and Numbering System

The following information was written in the logbook and on the sample label when samples are collected for laboratory analysis:

- Project identification (name and number)
- Sample identification number
- Sample location
- Preservatives added
- Date and time of collection
- Requested analytical methods
- Sampler's name

Each sample was assigned a unique identification number that describes where the sample was collected. The number was a maximum 9 digit alphanumeric code as follows:

xxxyyzzaabb

where:

xxx	represents the AOC number
yy	represents the location type (e.g., SB - Soil Boring, SS – Surface Soil, MW - Monitoring Well, SW - Surface Water, SD - Sediment)
zz	represents the location number (e.g., 01, 02, 03, etc.)
aa	represents the medium (e.g., GW=groundwater, SO=soil, SW=surface water, SD=sediment)
bb	represents the sample interval (01, 02, etc.)

A list of sample numbers was maintained by the field coordinator.

The field coordinator maintained a list that describes how each quality control (QC) sample corresponds with specific environmental samples. QC samples were designated with a "50's" series number where the second digit indicates the sample interval (bb).

2.5.2 Sample Preservation Requirements, Packaging and Shipping Procedures, and Sample Holding Times

Samples for this project were handled in accordance with the "Final Work Plan, Site Investigation for Areas of Concern, Former Lockbourne Air Force Base, Columbus, Ohio (IT,1999c). All samples were shipped to the analytical laboratory in properly packed and iced coolers in accordance with United States Department of Transportation (DOT) regulations via overnight courier. Samples were shipped daily or on alternate days in order to meet parameter holding times.

2.5.3 Sample Custody

Transportation and custody procedures met DOT and USEPA requirements (40 CFR Parts 170-179). COC procedures documented sample possession from the time of collection to disposal in accordance with Shaw internal procedures and federal guidelines. A sample was considered in custody if:

- It was in the sampler's or the transferee's actual possession.
- It was in the sampler's or the transferee's view, after being in his/her physical possession.
- It was in the sampler's or the transferee's physical possession and then he/she secured it to prevent tampering.
- It was placed in a designated secure area restricted to authorized personnel.

Field custody procedures include the following activities:

- Before sampling began, field personnel reviewed COC procedures.
- The quantity and types of samples were reviewed.
- Sampling locations were finalized and annotated on a site map.
- The field coordinator determined whether proper custody procedures and report forms were used during the field work and documented findings in the field log book.

- The field coordinator had overall responsibility for the care and custody of the samples collected until they are transferred or properly dispatched to the laboratory. Each individual who collected a sample was responsible for its custody until it was transferred to someone else via the COC Record.

- Shipment information was recorded in the field logbook at the end of the shift, day or collection period.

Transfer of custody and shipping procedures included the following activities:

- A COC was maintained in the field by each sampling team for each day of sampling. One copy of this record accompanied each sample and one carbon copy was retained at the site.

- Two COC seals per shipping container were used to secure the lid and provide evidence that samples had not been tampered with. Seals were placed such that they span both the lid and the body of the cooler. The seals were covered with clear tape to prevent damage to the seals.

- If the laboratory sample custodian judged the sample custody to be invalid (e.g., samples arrive damaged), a Nonconformance Report form would have been initiated by the laboratory. The Shaw Project Manager would have conferred with the USACE Project Manager to determine the fate of the sample(s) in question. The sample(s) would either have been processed "as is" with custody failure noted along with the analytical data, or rejected, with sampling rescheduled if necessary. The project manager and quality assurance manager would have signed the Nonconformance Report, noting the reason for disposition [nonconformance reports are discussed more fully in the Quality Assurance Project Plan (QAPP)], "Final Quality Assurance Project Plan, Site Investigation for Areas of Concern, Former Lockbourne Air Force Base, Columbus, Ohio (IT, 1999b).

- Each time responsibility for custody of the sample changed, the new custodian signed the record and noted the time and date.

- The custody of individual sample containers was documented by recording each container's identification on a COC.

- The analyses to be performed for each sample were recorded on the COC. The original copy accompanied the samples. A copy was retained at the site.

- The signed original COCs were returned with the analytical reports.

2.5.4 Field Quality Control Samples

To evaluate the reliability of field sampling procedures, field QC samples were collected or prepared for each media sampled and each sample shipment. QC samples were used for data evaluation and data validation (described in the QAPP). The field QC samples and their frequency of collection are outlined in the Work Plan. Field QC samples included matrix spikes, matrix spike duplicates, duplicates, and trip blanks.

2.6 Surveying

The boring and monitoring well locations were surveyed by Judge Engineering, Inc. The horizontal datum was the North American Datum of 1927. The vertical datum is Mean Sea Level. The survey results are shown in Table 2-1.

2.7 Record Keeping

The following section describes the field documentation procedures that were followed as a means of recording observations and findings during field activities. Field documentation was in the form of in field logbooks, various sample and calibration forms, site photographs, and drawings/sketches. All documentation was completed in indelible ink and corrections were clearly stricken out and initialed.

2.7.1 Field Logbook

Logbooks with sequentially numbered pages were kept at the site during all field activities and were assigned to each sample team. These logs were updated continually and constitute the master field investigation documents. Information recorded in the logs included, but was not limited to, the following:

- Project identification
- Field activity subject
- General work activity, work dates, and general time of occurrence
- Unusual events
- Subcontractor progress or problems
- Weather conditions (ambient air temperature, sky conditions, precipitation, and personal observations of wind conditions)
- Shaw personnel, subcontractors, and visitors on site
- Sample number and time of day for each sample collected for analysis

- Accomplishment of required calibration checks
- Accomplishment of well point purging, with time and/or volume
- Well water levels and field measurements
- Variances from project plans and procedures
- Head space screening results

2.7.2 Field Equipment Logbook

A field equipment logbook was kept on site to document the proper use, maintenance, and calibration of field testing equipment. Accompanying the field equipment logbook was a three-ring binder containing operator manuals, specifications, and calibration requirements and procedures for all field testing equipment. Information recorded in the field equipment logbook includes:

- Equipment calibration status
- Equipment inspection and repair records
- Name and signature of person making entry
- Date of entry
- Name of equipment and its identifying number
- Measurement results.

2.7.3 Sample Collection Log

A sample collection log form was completed for each sample collected during the investigation. Information on the form included:

- Date and time of sample collection
- Sample location
- Sample type (i.e., surface soil, sediment, groundwater, etc.)
- Sample volumes and container types.

2.8 Laboratory Analysis

The analytical laboratory for this project was Quanterra; which is now owned by Severn-Trent Laboratories, Inc., North Canton, Ohio. Samples were shipped to:

Severn-Trent Laboratories, Inc.
4101 Shuffel Drive, NW
North Canton, Ohio 44720
Telephone: 330-497-9396

2.9 Data Evaluation

The analytical results for the quality control samples along with the original samples were compiled into tables and separated by media. QC results are tabulated in Tables 2-2 through 2-7:

- Duplicates (Tables 2-2 to 2-6)
- Trip Blanks (Table 2-7)

All detected concentrations for each site and media were compared with background, Preliminary Remediation Goals (PRGs), and Maximum Contaminant Levels (MCLs) where applicable. As with the duplicate tables and all subsequent data tables (presented in Section 3), concentrations exceeding the PRG are surrounded by "( )". It should be noted that, in the data tables, the non-carcinogenic PRGs are not adjusted by a factor of 1/10. Concentrations exceeding the background values are surrounded by "[ ]" and those that exceed the MCL are surrounded by "{ }". In addition, soil concentrations were compared to Soil Screening Levels (SSLs). These comparisons are presented in tables in Appendix Q.

In a review of the trip blank results, methylene chloride was found to be present at levels that would affect the evaluation of environmental samples. The methylene chloride concentration in five samples was less than the trip blank levels; therefore, these sample results were U-qualified (i.e., determined to be non-detects). Other compounds (i.e., acetone, 2-butanone, chloroform, toluene) found in the trip blanks had no affect on the environmental samples because the sample results were either non-detects or greater than 5 times the levels in the trip blanks.

2.10 Data Quality Assessment and Data Validation

The data validation results are discussed in the Data Validation Summary Report (Appendix A). To ensure data completeness and quality, all samples were subjected to a validation that included a review of the following items:

- Sampling dates and holding times
- Transcription errors
- Initial and continuing calibration verification
- Determination of bias (i.e., percent recovery)
- Precision (e.g., replicate analysis)
- Detection limits
- Field and laboratory blanks.

All laboratory data underwent a USEPA Level III validation. The validation was performed in accordance with USEPA documents "National Functional Guidelines for Organic Data Review" (USEPA, 1991), "Functional Guidelines for Evaluating Inorganic Analytes" (USEPA, 1988) and the project QAPP. These documents specify performance requirements for the field contractor and laboratory. The items reviewed included, at a minimum, those listed above and the following:

- Preservation
- Instrument performance
- Initial and continuing calibration
- Interference check standards
- Field duplicates
- Identification and quantification of analytes.

As the result of the validation, the analytical results were qualified as acceptable without qualification (=), rejected (R), estimated (J or UJ), or below detection (U). Results were rejected (R) when the established criteria were significantly exceeded or the results were deemed unusable; results were qualified as estimated (J or UJ) when a criterion was exceeded but the results were still deemed usable. If dilutions or re-analyses were performed, the validation determined which results were more suitable for use. The unused results were flagged with a Z-qualifier.

2.11 Method of Risk Screening

The risk-based evaluation conducted on the 21 AOCs consists of a comparison of the maximum detected constituent concentration to background concentrations for soil, groundwater, surface water, and sediment inorganics established in the "Final Phase II Remedial Investigation Report for Rickenbacker Air National Guard Base" (IT, 1998a). In addition to the background comparison, detected constituent concentrations (maximum values) were compared with the October 2004 USEPA Region 9 PRGs for industrial use established at a target cancer risk of $1x10^{-6}$ or an adjusted noncancer hazard index of 0.1. A factor of 1/10 is applied to non-carcinogens to add a ten-fold measure of safety to ensure that multiple chemicals that could result in a hazard index (HI) greater than 1 are not eliminated from the assessment. Soil and sediment concentrations were compared to the soil PRGs for industrial exposure scenarios, while groundwater and surface water were compared with the tap water PRGs. In the case of soil lead, a screening level of 800 milligrams per kilogram (mg/kg) of lead in soil (USEPA, 2004). The maximum detected concentrations of lead in groundwater were conservatively compared with USEPA's drinking water action level of 0.015 mg/L (USEPA, 2004). The PRG for chromium VI was chosen as a screening concentration for all chromium in soil as a conservative measure.

Site data were compared with the PRGs for industrial soil because of current and future anticipated land use. Currently the area is industrial in nature, with most of the area having been converted into the Rickenbacker International Airport. The industrial soil PRGs are conservatively derived for exposures via incidental ingestion, inhalation, and dermal absorption of chemicals in soil by commercial/industrial workers. These workers are assumed to be exposed for 250 days/ year over 25 years at the site. The exposure parameters apply to outdoor workers and would be expected to be protective of other potential receptors with less exposure frequency and duration, such as indoor workers, site visitors, or construction workers. There are no specific industrial PRGs for water. Instead, the PRGs for water are derived for ingestion and inhalation of chemicals assuming the domestic use of tap water for 350 days/year over 30 years. Therefore, the tap water PRGs are protective of industrial workers that would have relatively less exposure to water in the workplace. The area is not currently being used for residential purposes, nor is residential use part of the long-term land-use plans for the CRAA.

Typically, an AOC is considered to pose acceptable or insignificant risk if concentrations of individual analytes are:

- Below natural background concentrations presented in Tables 2-8 through 2-11;
- Above background concentrations, but below the applicable PRGs or applicable, relevant and appropriate requirements (ARARs).

AOCs determined to pose acceptable or insignificant risk are recommended for NDAI status. AOCs are considered to pose potential risk, and warrant further action, if concentrations of individual analytes are:

- Above natural background concentrations and there are no applicable PRGs or ARARs
- Above natural background concentrations and above the applicable PRGs or ARARs.

AOCs determined to pose potential risk are recommended for further action. A contaminant concentration that exceeds a PRG level does not, in itself, mean that there is an unacceptable health threat. However, exceeding a PRG suggests that further evaluation of potential risks may be appropriate.

Risk Screening Tables presented throughout Section 3.0 summarize the risk-based evaluation for each of the AOCs and the media sampled in each. In each table, numbers are presented that represent the range of detected values (minimum and maximum), background data used to evaluate a given media, the media-specific screening criteria, and the results of the comparison of media concentration to background and screening criteria. Chemicals exceeding the screening criteria are denoted as a chemical of interest. For AOCs where more than one chemical is denoted as a chemical of interest, a risk-based cumulative evaluation was provided. This evaluation addresses the concern of cumulative exposure to multiple contaminants in multiple media exceeding the target risk goal of 1E-5 for cumulative risk. For this risk-based cumulative evaluation, risk and hazard are calculated based on a ratio of the site concentration to the PRG value corresponding to a risk of 1×10^{-6} or a hazard of 1. Using benzo(a)pyrene (with a soil concentration of 27 mg/kg) as an example, this risk is calculated as follows:

$$\text{(Site concentration * target risk or hazard)/PRG = risk or hazard}$$
$$(2.7 \times 10^{+1} * 1 \times 10^{-6})/2.1 \times 10^{-1} = 1.3 \times 10^{-4}$$

The risk and hazard for each single chemical are then summed to determine the cumulative cancer risk or hazard to commercial/industrial workers for the site.

This information was used to determine if a site could be closed out with a NDAI determination if additional investigation is required. As previously discussed, the PRG is conservatively derived for multiple pathways and is protective of anticipated receptors at the site.

3.0 Site Investigation

This section describes the field, laboratory, and data evaluation activities conducted during the SI. A majority of the field activities were performed from November 9 through November 17, 1999. Supplemental activities were also performed in 2000 and 2001. This section is organized by AOC. Each AOC section includes a brief history of why the AOC was included in the investigation, a description of the sampling activities, a summary of the analytical results, a discussion of the risk screenings and recommendations are made for "NDAI" or "further action." Table 3-1 summarizes the information presented in this section. Table 3-2 presents a summary of the groundwater sampling parameters collected during the course of field investigations. Other support documentation is included as the following appendices:

- Appendix B – Photographic Log
- Appendix C – Visual Classification of Soils
- Appendix D – Soil Sample Collection Logs
- Appendix E – Groundwater Elevation Logs
- Appendix F – Groundwater Well/Monitoring Point Purge Logs
- Appendix G – Groundwater Collection Logs
- Appendix H – Well Diagrams
- Appendix I – Laboratory Data
- Appendix J – Chains of Custody

3.1 AOC 9 - Photo Lab

The photo lab (Building T-263) was included as an AOC because of the general nature of activities that would have occurred within the building. Fluids used for developing and processing film typically contained VOCs, metals (particularly silver), and cyanide. The photo lab was noted on a basic layout drawing for Lockbourne AFB, dated February 1945, revised January 9, 1948. The building layout is shown on Figure 3-1.

The photo lab was demolished and no drawings could be located that indicated the placement of doorways, bays, and other areas where releases most likely would have occurred. Because this information was not available, three boring locations were determined using the estimated groundwater flow direction. The soil borings were advanced and soil samples were collected on November 9, 1999. Boring location 9SB03 was placed at the most downgradient point on the site and the two remaining boring locations, 9SB01 and 9SB02, were distributed evenly around the former building location. The boring locations for AOC 9 are shown on Figure 3-1. Soil samples from each boring (Sample IDs: 009SB01SO07, 009SB02SO05, 009SB03SO01, and 009SB03SO05) were analyzed for Target Compound List (TCL) VOCs, TCL SVOCs, Target Analyte List (TAL) metals, and cyanide. A groundwater sample (Sample ID: 009SB03GW01) was collected from boring 9SB03 on November 10, 1999 and analyzed for TCL VOCs, TCL SVOCs, and cyanide. The laboratory data and COCs are presented in Appendices I and J and a summary of the detected analytes is presented in Tables 3-3 and 3-4.

As shown in Table 3-5, 17 metals were detected in soil. Lead, selenium, and thallium were detected above background but below their respective PRG. Calcium, magnesium, and potassium were detected above background but are considered essential nutrients, and therefore, not chemicals of interest. Seven organic compounds were detected in soil. All maximum concentrations were detected below the PRG. As shown in Table 3-6, one organic compound (acetone) was detected in groundwater. The maximum concentration was detected below the PRG. As shown in Table Q-1 (Appendix Q), methylene chloride was detected above the SSL. However, methylene chloride was not detected in groundwater. NDAI status is recommended for AOC 9.

3.2 AOCs 17, 18, 19, and 103 - Base Engineer's Shop, Base Engineer's Maintenance and Inspection, Engine Cleaning Building, and Battery Shop

The following four facilities were included as AOCs because of the general nature of the activities presumed to have occurred in the building:

AOC 17 - Base engineer's shop (Building T-530)
AOC 18 - Base engineer's maintenance and inspection (Building T-532)
AOC 19 - Engine cleaning building (Building T-535)
AOC 103 - Battery shop (Building T-531)

Solvents, cleaners and other toxic or hazardous materials may have been used during the performance of activities in these buildings. All four facilities were noted on a basic layout drawing for the Lockbourne AFB, dated February 1945, revised January 9, 1948. The locations of the buildings are noted on Figure 3-2. The facilities located at AOCs 17, 19, and 103 have been demolished. Building 532, a World War II Era hangar located at AOC 18, is currently occupied by Lane Aviation.

These AOCs have been evaluated as one unit because of similar soil and groundwater contaminants found during the initial sampling efforts performed as part of the SI, their close proximity to each other, and similarities in the presumed activities performed at each facility. Sampling efforts at these AOCs were performed in several phases.

3.2.1 Phase I Site Investigation Field Work

Because a majority of the facilities were demolished and no drawings could be located that indicated the placement of doorways, bays, and other areas where releases most likely would have occurred, soil boring locations were determined using the estimated groundwater flow direction. Three soil borings and one groundwater sample were collected at each AOC on November 10 and 11, 1999. One sample was placed at the most downgradient point at each of the four AOCs (Boring Locations: 17SB03, 18SB03, 19SB03, and 103SB03) and the two remaining borings were distributed evenly around the building perimeters (Boring Locations: 17SB01, 17SB02, 18SB01, 18SB02, 19SB01, 19SB02, 103SB01, and 103SB02). Boring locations at the four AOCs are shown on Figure 3-2. Samples from each boring and a duplicate from 103SB03 (Sample IDs: 017SB01O04, 017SB02SO01, 017SB03SO05, 018SB01SO04, 018SB02SO01, 018SB03SO04, 019SB01SO04, 019SB02SO01, 019SB03SO04, 103SB01SO04, 103SB02SO01, 103SB03SO04, and 103SB03SO54) were analyzed for TCL VOCs, TCL SVOCs, and TAL metals. Groundwater samples were collected from the most downgradient boring locations at each AOC (Sample IDs: 17SB03GW01, 18SB03GW01, 19SB03GW01, and 103SB03GW01) and analyzed for TCL VOCs and TCL SVOCs. The laboratory data and COCs are presented in Appendices I and J, the soil analytical results are summarized in Tables 3-7 through 3-10, and the analytical results for the groundwater samples collected from the direct-push borings are summarized in Tables 3-11 through 3-14. The detected VOCs and SVOCs in soil are summarized on Figure 3-3. The VOCs detected in the boring groundwater samples are summarized on Figure 3-4.

Five VOCs were detected in the AOC 17 soil samples. All were below the PRGs. Nineteen SVOCs were detected in the soil samples from AOC 17, primarily polynuclear aromatic hydrocarbons (PAHs) in the surface soil sample from 17SB02. Five PAHs exceed the PRGs. This sample was collected in an area between a parking lot and a road and the PAHs are not considered to be AOC related. Due to prolonged vehicle and aircraft operations at the base, PAHs are fairly ubiquitous and should not necessarily be considered to have been caused by a "release", and should thus be considered an "exclusion" to the definition of a release under CERCLA. A CERCLA exclusion in this instance is defined as "(B) emissions from the engine exhaust of a motor vehicle, rolling stock, aircraft, vessel, or pipeline pumping station engine [Title 42 of the U.S. Code, Chapter 103, Section 9601(22(B)]. Additional SVOCs detected are below their respective PRG. All detected metals are below the PRG, below background, or are considered essential nutrients. One VOC was detected in groundwater at AOC 17 below the PRG. No SVOCs were detected in the groundwater.

Seven VOCs were detected in the soil samples from AOC 18, all below the PRGs except trichloroethene (TCE). No SVOCs were detected in the soil samples from AOC 18. One metal was detected above both background and the PRG (arsenic). Vinyl chloride and cis-1,2-dichloroethene (DCE) were detected above the PRGs and MCLs in the groundwater sample. SVOCs were detected in the groundwater.

Seven VOCs were detected in the soil samples from AOC 19, all below the PRGs. Seventeen SVOCs were detected, primarily PAHs in one surface soil sample. Five PAHs exceeded the PRGs. Only one PAH metal (arsenic) exceeded background and the PRG. Nine VOCs were detected in the ground water sample. Only TCE and VC exceeded the PRG. VC also exceeded the MCL. No SVOCs were detected in the groundwater.

Seven VOCs were detected in the soil samples from AOC 103, all below the PRGs except TCE. Eighteen SVOCs were detected in the soil at AOC 103, primarily PAHs in the surface soil sample. Only one (benzo(a)pyrene) exceeded the PRG. Only one metal (arsenic) exceeded background and the PRG. Three VOCs (methylene chloride, TCE, and cis-1,2-DCE) were detected in the groundwater sample from AOC 103, all above the PRGs and MCLs. No SVOCs were detected in the groundwater.

Based on the analytical results, AOCs 18, 19, and 103 were recommended for further action. The following observations were made from the data collected from the Phase I investigation:

- The soils encountered consisted of silty clays and clayey silts. Sand seams were encountered in borings 17SB01, 17SB02, 18SB03, 19SB02, 103SB01 and 103SB03, at depths of approximately 8 to 15 feet, and at or below the top of the water table. The sand seams are generally 1 to 3 feet thick and do not appear to be laterally continuous across the area.

- The soil samples that had VOCs present were collected near the top of the water table. Therefore, these results were believed to represent groundwater contamination that had impacted the soils near the top of the water table. Other than some slightly elevated PID readings at AOC 19, no indication of surface spills was observed.

- The TCE concentration in the groundwater sample from 103SB03 (19,000 µg/L) and in the soil samples from 103SB01 (1,100 µg/kg) and 18SB01 (280 µg/kg) were approximately 5 to 10 times the cis-1,2-DCE concentrations (103SB03 - 1,800 µg/L, 103SB01 - 240 µg/kg, 18SB01 - 24 µg/kg) . TCE was not detected in the groundwater sample from 18SB03 and only a trace of TCE was detected in the groundwater sample from 19SB03 (0.49 µg/L). The concentration of cis-1,2-DCE (71 µg/L and 13 µg/L) was approximately 14 times the concentration of trans-1,2-DCE (49 µg/L and 0.98 µg/L) in these samples (cis-1,2-DCE concentrations of 71 µg/L and 13 µg/L, respectively versus trans-1,2-DCE concentrations of 4.9 µg/L and 0.98 µg/L). Vinyl chloride was also detected in 18SB03 and 19SB03 at concentrations of 36 µg/L and 5.1 µg/L, respectively, but not in the samples from 103SB03. The high cis-1,2-DCE to trans-1,2-DCE ratio is typical of DCE generated by the degradation of TCE. The VC was also interpreted to be a degradation product. These results tend to indicate that borings 103SB01, 103SB03, and 18SB01 were either located closer to spill areas than borings 18SB03 and 19SB03 or the contamination in the areas of 18SB03 and 19SB03 was older.

- No SVOCs were detected in the 1999 groundwater samples from AOCs 17and 19. The only SVOCs detected in the groundwater samples from AOCs 18 and 103 were low concentrations of phthalates.

3.2.2 Phase II Site Investigation Field Work

To better delineate the nature and extent of groundwater contamination in the area and to establish the groundwater flow direction, 12 monitoring wells were installed at AOCs 18, 19, and 103 from September 20 through 26, 2000. The monitoring well locations are shown on Figure 3-5 and the survey results are in Table 3-15. These well locations were based on the analytical data from the Phase I of the SI, the presumed groundwater flow direction, and the typical migration distances of contaminants at other locations at the base. Wells 18MW01, 18MW02, 19MW01, and 103MW01 were installed at soil boring locations 18SB01, 18SB03, 19SB03, and 103SB02 from Phase I of the SI. Well locations 18MW03, 19MW02, 103MW02, and 103MW03 were installed to investigate the continuity of contamination between the AOCs. Well locations 18MW04, 18MW05, 103MW04, and 103MW05 were installed to delineate the limits of the contamination in the downgradient direction.

The wells were sampled between October 3 and 11, 2000, for TCL VOCs, TCL SVOCs, and TAL metals. The VOC data further defined the nature and extent of VOC contamination in the groundwater. The metals samples were collected from the wells due to background exceedances in the soil samples and since metals could not be tested in the Geoprobe® water samples collected during the Phase I SI activities due to turbidity concerns.

The laboratory data and COCs are presented in Appendices I and J and the groundwater samples collected from the direct-push borings are summarized in Tables 3-12 through 3-14. The detected chemicals in the monitoring well groundwater samples are summarized on Figure 3-5.

Water levels were collected from the wells located at AOC 18, 19, and 103 on January 22, 2001 and July 10, 2001. The water levels are presented in Tables 3-16 and 3-17. Figures 3-6 and 3-7 are potentiometric surface maps constructed from the water level data.

Thirteen VOCs were detected in the AOC 18 groundwater. All concentrations were below the PRGs with the exception of chloroform, dibromochloromethane, TCE, and VC. TCE and VC were also found above the MCLs. Two SVOCs were detected. Bis(2-ethylhexyl)phthalate was found above the PRG and MCL. The other SVOC was below both the PRG and MCL. Fifteen metals were detected, eleven were above background. However, all were below PRGs (if available) with the exception of aluminum, arsenic, manganese, and vanadium (all in 18MW04GW01). Iron concentrations were also above the PRG, but was below background. Three metals were found above MCLs: arsenic, lead (EPA's action level from the Primary Drinking Water Regulations), and nickel.

Ten VOCs were detected in AOC 19 groundwater. Four VOCs were above PRGs: 1,1-DCE, 1,2-dichloroethane (DCA), chloroform, and VC. VC was found above the MCL in 19MW01GW01, as was 1,2-DCA in 19MW02GW01. Manganese was detected above the PRG but was below background. Aluminum was detected above the background but below the PRG. Sodium, which has no PRG, was also detected above background. All other metals were detected below PRGs.

Ten VOCs were detected in AOC 103 groundwater. All detected concentrations were below PRGs with the exception of chloroform, dibromochloromethane, 1,2-DCA, TCE, and VC. TCE and VC also exceeded the MCLs. One SVOC was detected in groundwater below the PRG. Nine metals were detected, two were above background (aluminum and zinc). However, all were below PRGs.

The fairly even distribution and low concentration of the contaminants detected during this portion of the investigation also indicate that the contamination might be due to numerous small releases over a period of years, rather than from large releases. The VOC analytical results from the wells around Building 532 (AOC 18) indicate this site is showing several characteristics typical of contaminant degradation by microbial action. The TCE is at low concentrations - maximum detection of 59 micrograms per liter (μg/L) - and appears very degraded. DCE concentrations are higher than TCE concentrations in several wells and the DCE is primarily cis-1,2-DCE, indicating it is a degradation product, not a spill. Benzene, toluene, ethylene and xylene (BTEX) and acetone are present which act as co-metabolites to microbial degradation of the chlorinated solvents (AFCEE,1996), helping to explain the apparently highly degraded state of the contamination.

Chlorinated solvents have not been detected in the downgradient wells, indicating the contamination is localized around AOCs 18, 19, and 103. Given the minimum age of the release(s) (15+ years), the rate of contaminant migration and degradation might be at a steady state, meaning the contamination might not spread any further than it already has.

3.2.3 Additional AOC 19 Investigation

Because of the groundwater and soil contamination found in the former area of Building 535 at AOC 19 and because the CRAA was planning new construction in the area, additional investigations were performed at AOC 19 from May 8 to 12, 2001 and June 10 and 11, 2001. The purposes of the investigations were to:

- Delineate the extent of VOC contamination in the area of former Building 535.

- Assess the representativeness of the laboratory analytical data generated. Specifically, the field results from this investigation were used to determine the area(s) with the highest concentrations of VOCs and these locations were compared with the locations sampled during the Phase I and II investigations to determine if the most contaminated areas were previously sampled.

- Delineate the extent of the PAHs found in the shallow soil sample collected near Building 535.

In the area around AOC 19/Building 535, 14 additional borings were installed and groundwater samples were collected for onsite VOC analyses (Boring Locations: 19SB101R, 19SB102R, 19SB103R, 19SB105R, 19SB107R, 19SB108R, 19SB109, 19SB110, 19SB111, 19SB112, 19SB113, 19SB114, 19SB115, and 19SB116). The borings were installed using a USACE-Savannah District cone penetrometer truck. The locations of the borings are shown in Figure 3-8. The location of the new passenger terminal is also shown in Figure 3-8. Wells 19MW01 and 19MW02 were abandoned by CRAA during construction. The temporary well points for groundwater sampling were installed using 1.87-inch O.D. rods as described in Section 2.2.2.3. The temporary well points were made of PVC and included ¾-inch screens and risers. The well points were connected to disposable drive points that were inserted into the end of the drive rods. When the drive rods were at the desired sample depth, the rods were retracted to expose the screen. The PVC screen and riser were left behind and sampled after the drilling rig was moved. This was done during this investigation because of the slow groundwater yield at most of the sample locations. Initially, the screens and risers were left in the holes without any real seal above the screens. It was determined that perched water in the gravel beneath the pavement was entering the boreholes and probably affecting sample quality. Therefore, the sample results from these initial borings were not used and new screens and risers were installed in adjacent borings using disposable collars above the screen to seal off the interval being sampled (the top of the water table) from the perched water above. These reinstalled sample points were designated with an "R" after the sample ID. Given the very low hydraulic conductivity in the area, it is unlikely that the water that entered the original borings could have affected the formation to the extent that water quality in the replacement borings was affected.

Three existing groundwater monitoring wells (Well Locations: 18MW03, 19MW01, and 19MW02) were sampled and analyzed as part of this investigation. A soil boring (19SB02R) was also drilled adjacent to boring 19SB02 to delineate the vertical extent of PAH contamination in that area. The soil samples were collected from 2 to 4 feet and 6 to 8 feet for SVOC analysis. This soil boring was also installed using USACE-Savannah District cone petrometer truck. The locations of the soil borings and monitoring wells are shown on Figure 3-3.

The field analysis of the groundwater for VOCs was performed following USEPA Method 8265. The samples were analyzed using a sparge device that interfaced with a Direct Sample Ion Trap Mass Spectrometer (DSITMS) for the analysis of VOCs in groundwater samples. Groundwater samples were placed into 40-mL vials and then transported to the on-site locations of the DSITMS. The vials were attached to a vial-sparging device on the DSITMS. The sparging device uses a helium gas flow to strip the VOCs from the groundwater, and then the DSITMS provides real-time analysis. The instrument was calibrated for PCE, TCE, DCE, VC, chloroform, acetone, MTBE, benzene, and toluene. The analytical results from the DSITMS field analyses are presented in Table 3-18 and on Figure 3-8.

Three groundwater samples were submitted to a fix-based laboratory (Severn Trent Laboratories in North Canton, Ohio) for off-site confirmation analyses. These groundwater samples were collected to confirm the DSITMS data and were splits of the samples run on the DSITMS. The split samples were collected from wells 19MW01 and 19MW02 and soil boring 19SB110. A trip blank was also sent. The fixed-based laboratory results and the on-site analysis were in fairly close agreement. The laboratory data and COCs are presented in Appendices I and J, the soil analytical results are summarized in Table 3-9, and the groundwater sample analytical results from the Geoprobe® and cone penetrometer holes are summarized in Table 3-18.

The analytical results in Table 3-18 show the maximum concentration of DCE and VC were in the sample from boring 19SB114. DCE was detected at 5,200 µg/L and VC was detected at 3,300 µg/L. The maximum concentration of TCE detected was 51 µg/L in the sample from 19SB113. The soil samples collected from 19SB02 were non-detect for all SVOCs, indicating that the SVOCs are only present within the upper two feet of soil in that area (Table 3-9).

The Johnson and Ettinger vapor intrusion model was run as described in Appendix K using the maximum detected VC concentration of 3,300 µg/L. Although 3.300 µg/L is not the highest detect of any compound, all the VOCs present were reviewed, and this sample result yields the highest risk value. The model yielded a risk value of 3.5×10^{-4}, indicating that precautions should be taken to prevent vapor intrusion into the building. The data entry sheet and output for the vapor intrusion model are presented in Appendix L.

To better delineate the nature and extent of the contamination at AOC 19, five additional soil borings (Boring Locations: SB201, SB202, SB203, SB204, and SB205) were installed using Geoprobe® drilling techniques on July 10 and 11, 2001. The boring locations are shown on Figure 3-8. Groundwater samples (Sample IDs: SB202GW01, SB202GW01DUP, and SB204GW01) were collected and analyzed for VOCs and SVOCs. PAHs were not included in the analysis. Groundwater was not present in the remaining borings. The laboratory data and COCs are presented in Appendices I and J. The groundwater analytical results are summarized in Table 3-13 and presented on Figure 3-8.

In both SB202GW01 and SB202GW01DUP, levels of TCE, VC, and cis-1,2-DCE exceeded both the PRGs and MCLs. No contaminants were detected in SB204GW01.

3.2.4 Risk-Based Evaluation

Further action is recommended for AOC 17, but this recommendation is based on the proximity of AOC 17 to AOCs 18, 19, and 103. As shown in Table 3-19, 15 metals were detected in soil. All metals were below their respective background and/or PRG, if available, except calcium and magnesium, which are considered essential nutrients. Arsenic is within an order of magnitude of its PRG and, therefore, within the target risk range. Twenty-four organic compounds were detected in soil. Five PAHs [benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene] were detected above their respective PRG. The levels of PAHs imply a risk above $1\text{x}10^{-4}$. As described in Section 2.11, an evaluation of cumulative exposure to the multiple contaminants detected at AOC 17 was conducted to confirm whether cumulative risk and hazard exceeded the target risk and hazard. As shown in Table 3-20, the cumulative hazard estimate is below 1, while the cumulative risk estimate is above the target risk goal. The surface soil sample location in which the PAHs were detected receives run off from an asphalt parking lot. The high levels of PAHs are, therefore, likely due to anthropogenic deposition of PAHs and not due to any AOC-related activity. As shown in Table 3-21, one organic compound (acetone) was detected in groundwater. The maximum concentration was detected below the PRG. As shown in Table Q-2 (Appendix Q), four PAHs and carbozole exceed the SSLs. These chemicals, however, were not detected in groundwater.

Further action is recommended for AOC 18. As shown in Table 3-22, 17 metals were detected in soil. Cobalt, copper, selenium, and zinc were detected above background, as well as essential nutrients magnesium and potassium. Arsenic was detected above both the background and PRG. All other metals were below their respective PRG, if available. Seven organic compounds were detected in soil. The maximum concentrations were detected below the PRG for all compounds except TCE. Because soil contains multiple chemicals of interest, a risk-based cumulative evaluation was performed. As shown in Table 3-23, the cumulative hazard estimate is less than 1. The cumulative risk estimate is above the target risk goal, primarily due to arsenic. As shown in Table Q-3 (Appendix-Q), methylene chloride, TCE, and arsenic exceeded their respective SSL. Of these, TCE and arsenic were detected in groundwater. As shown in Table 3-24, 15 organic compounds were detected in groundwater. Bis(2-ethylhexyl)phthalate, chloroform, dibromochloromethane, cis-1,2-DCE (total), TCE, and VC were detected above their respective PRG. The level of VC implies a risk above $1\text{x}10^{-4}$. Fifteen metals were detected in groundwater. All were detected above background. Aluminum, arsenic, barium, iron, lead, manganese, nickel, and vanadium exceeded the PRG. All other metals were below the PRG or were essential nutrients. Because there are multiple chemicals of interest in groundwater, a risk-based cumulative evaluation was performed. As shown in Table 3-25, the cumulative non-cancer hazard estimate was above 1, primarily due to cis-1,2-DCE, aluminum, iron, manganese, and vanadium. The cumulative risk estimate is above the target risk goal, primarily due to TCE, VC, and arsenic.

Further action is recommended for AOC 19. As shown in Table 3-26, 15 metals were detected in soil. Calcium and magnesium were detected above background but both are considered essential nutrients and are, therefore, not considered chemicals of interest. Arsenic was detected above both background and the PRG. All other metals were below their respective PRG, if available. Twenty-four organic compounds were detected in soil.

Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene were detected above their respective PRG. As shown in Table 3-27, the cumulative non-cancer hazard estimate is less than 1. The cumulative cancer risk estimate is above the target risk goal, primarily due to benzo(a)pyrene and arsenic. As shown in Table Q-4 (Appendix Q), benzo(a)anthracene, benzo(b)fluoranthene, carbazole, and arsenic exceeded the SSLs. These chemicals were not detected in groundwater.

As shown in Table 3-28, 15 VOCs were detected in groundwater for AOC 19. Acetone, chloroform, DCA, 1,2-DCE (total), cis-1,2-DCE, TCE, trans-1,2-DCE, and VC were detected above their respective PRG. Six metals were detected in groundwater. All were below background or PRGs, or are considered essential nutrients. As shown in Table 3-29, the cumulative non-cancer hazard estimate is above 1, primarily due to cis-1,2-DCE and 1,2-DCE (total). The cumulative cancer risk estimate is above the target risk goal, primarily due to DCA, TCE, and VC.

Further action is recommended for AOC 103. As shown in Table 3-30, 16 metals were detected in soil. Arsenic was detected above both the background and PRG. Calcium, cobalt, copper, magnesium, potassium, and thallium were detected above background. All other metals were below background. Cobalt, copper and thallium were detected below their respective PRG. Calcium, magnesium, and potassium do not have PRGs; they are considered essential nutrients. Twenty-four organic compounds were detected in soil. All maximum concentrations were detected below the PRG except for TCE and benzo(a)pyrene. As shown in Table 3-31, the cumulative non-cancer hazard estimate was less than 1. The cumulative cancer risk estimate is above the target goal, primarily due to TCE and arsenic. As shown in Table Q-5 (Appendix Q), methylene chloride, TCE, and arsenic are above SSLs. Methylene chloride and TCE were detected in groundwater.

As shown in Table 3-32, 11 organic compounds were detected in groundwater. Seven compounds (chloroform, dibromochloromethane, DCA, cis-1,2-DCE, methylene chloride, TCE, and VC) were detected above their respective PRG. Seven metals were detected in groundwater. All were detected below background or PRGs or were essential nutrients. As shown in Table --33, the cumulative non-cancer hazard estimate is above 1, primarily due to cis-1,2-DCE, TCE, and aluminum. The cumulative cancer risk estimate is above the target risk goal, primarily due to methylene chloride, TCE, and VC.

3.3 AOC 49 – Building 783, Small Arms Firing Range

Building 783 is the control building for an active, outdoor, small arms range. It was included as an AOC because of a reported fuel release that was caused when a mower struck the supply line from an above ground heating oil tank. Above ground heating oil tanks are not regulated by BUSTR, but the site was investigated to determine if groundwater in the area was impacted, which is regulated by Ohio EPA. The site layout is shown on Figure 3-9.

On September 7, 2000, soil headspace measurements were taken from 13 soil boring locations (783SB01 through 783SB13) shown on Figure 3-9 to determine the location where three monitoring wells would be installed on the site. Geoprobe® borings were drilled to a depth of 8 feet and samples were collected from the 0 to 2 feet, 2 to 4 feet, 4 to 6 feet, and 6 to 8 feet. The soil samples were analyzed with a PID and a flame ionization detector (FID). The screening results and the background values are presented in Table 3-34. While the background reading was always found to be less than 1 part per million (ppm), the FID results ranged from 11.5 ppm to 523 ppm. The PID results ranged from 4.5 ppm to 105 ppm. The highest results were from the 6 to 8 feet range from soil boring 783SB12.

On September 21, 2000, 3 monitoring wells were installed and soil samples (Sample IDs: 783MW015004, 783MW025025, and 783MW85057.5) were collected and analyzed for TCL VOCs, TCL SVOCs, and TAL metals. Monitoring well 783MW01 was installed near 783SB13 in the leach field area where the fuel from the spill would have drained. Monitoring well 783MW02 was installed in a downgradient direction and 783MW03 was installed near 783SB10. The locations of the wells are shown on Figure 3-9 and the survey results for the wells are presented in Table 3-15. Groundwater samples were collected from each of the 3 monitoring wells along with a duplicate on October 12, 2000 (Sample IDs: 783MW01GW01, 783MW02GW01, 783MW03GW01, and 783MW03GW51). The groundwater samples were analyzed for TCL VOCs, TCL SVOCs, and TAL metals. A drinking water sample (Sample ID: BLDG 783112100) was collected from a drinking water well on November 21, 2000. The laboratory data and COCs are presented in Appendices I and J, the soil analytical results are summarized in Table 3-35, and the analytical results from the groundwater samples collected from the direct-push borings are summarized in Table 3-36.

Water levels were collected from the wells located at AOC 49 on September 29, 2000. The water levels are presented in Table 3-37 and the potentiometric map developed from the data is presented as Figure 3-10.

As shown in Table 3-38, 18 metals were detected in the soil at AOC 49. Selenium was detected above background. Selenium was, however, detected below its PRG. Arsenic was detected above both background and the PRG. Arsenic is within an order of magnitude of its PRG, and therefore, within the target risk range. All other metals were detected below their respective PRG or were essential nutrients. Eleven organic compounds were detected in soil. This included detection of TCE in the soil sample from 783MW02 and detection of DCE in the soil samples from 783MW01 and 783MW02. All organic compounds were detected below their respective PRG screening criteria. As shown in Table Q-6 (Appendix Q), no detected chemicals exceeded the SSLs.

As shown in Table 3-39, 10 metals were detected in the groundwater at AOC 49. Seven metals (aluminum, barium, iron, lead, manganese, sodium, and zinc) were detected above background. Aluminum, barium, iron, and manganese were also above the PRGs. Lead and zinc were detected below the screening value. Sodium is considered an essential nutrient. Arsenic was detected below background. Three VOCs were detected in groundwater. Chloroform was detected above the PRG. The remaining two VOCs (acetone and carbon disulfide) were detected below their respective PRG. As shown in Table 3-40, the cumulative non-cancer hazard estimate was above 1, primarily due to manganese. The cumulative cancer risk estimate was below the target risk. As shown in Table 3-36, chloroform is below the MCL, while arsenic is above the MCL

Further action is recommended for AOC 49. An additional investigation should be conducted to determine if higher concentrations of contaminants are present. TCE, DCE, and several SVOCs were detected in the soil samples and there is not a well located directly downgradient of the AOC. An additional downgradient well should be installed between 783MW01 and 783MW02 to determine if the groundwater contains significant concentrations of organic compounds.

3.4 AOC 55 - Possible Waste Disposal Location

AOC 55 was included as an AOC because a 1950 aerial photograph indicated the presence of disturbed earth. No other information was available for this area and current aerial photographs indicate this site is not currently being farmed, although immediately adjacent land has been used for growing crops. This could indicate the presence of rubble or other debris that would not be conducive to using farm machinery in the area.

Because the location of this AOC was not readily apparent, map coordinates (northing and easting) were obtained from the digitized aerial photograph. The location of the AOC was established in the field using a Global Positioning System (GPS) unit.

Three soil borings (55SB01, 55SB02, and 55SB03) were drilled at AOC 55 on November 15, 1999 and are shown on Figure 3-11. One soil sample from each boring (Sample IDs: O55SB01SO01, O05SB02SO04, and O55SB03SO04) was analyzed for TCL VOCs, TCL SVOCs, TAL metals, and pesticides/PCBs. The borings penetrated the water table, but there was insufficient yield to collect a groundwater sample in the time frame specified in the work plan (two hours). The laboratory data and COCs are presented in Appendices I and J and the soil analytical results are summarized in Table 3-41.

NDAI status is recommended for AOC 55. As shown in Table 3-42, 17 metals were detected in soil. All metals were detected below background except calcium, magnesium, manganese, potassium, selenium, and thallium. Selenium and thallium were below their respective PRG. The others are considered essential nutrients. One organic compound, methylene chloride, was detected in soil. Its maximum concentration was detected below the PRG. As shown in Table Q-7 (Appendix Q), all chemicals were below the SSLs, if available.

3.5 AOC 55A - Possible Waste Disposal Location

AOC 55A was included as an AOC because a 1950 aerial photograph indicated the presence of disturbed earth. This site was not initially included in the scope of work, but was added during a meeting with CRAA to discuss the nature of the other AOCs. No other information was available for this area and current aerial photographs indicate this site is being farmed.

Because the location of this AOC was not readily apparent, map coordinates (northing and easting) were obtained from the digitized aerial photograph. The location of the AOC was established in the field using a GPS unit.

Three soil borings (055ASB01, 055ASB02, and 055ASB03) were drilled at AOC 55A on November 11, 1999 and are shown on Figure 3-12. One soil sample from each boring (Sample IDs: 055ASB01SO06, 055ASB02SO01, and 055ASB03SO05) was collected and analyzed for TCL VOCs, TCL SVOCs, TAL metals, and pesticide/PCBs. The borings penetrated the water table, but there was insufficient yield to collect a groundwater sample in the time frame specified in the work plan (two hours). The laboratory data and COCs are presented in Appendices K and L and the soil analytical results are summarized in Table 3-43.

NDAI status is recommended for AOC 55A. As shown in Table 3-44, 15 metals were detected in soil. All the metals were detected below background except several essential nutrients. Six organic compounds were detected in soil. All maximum concentrations were detected below the PRG. As shown in Table Q-8 (Appendix Q), all detected chemicals were below SSLs, if available.

3.6 AOC 56 and AOC 72 - Possible Waste Disposal Location

AOC 56 and AOC 72 were included as AOCs because aerial photographs dated 1950 and 1964 indicated the presence of disturbed earth. The disturbed earth noted in the 1950 aerial photograph was labeled as AOC 56 and the disturbed earth noted in the1964 aerial photograph was labeled as AOC 72. These areas are very close to one another and likely represent one site. Personal communications with AFBCA indicate that this area was used for municipal type waste disposal (office waste, kitchen waste, etc.) from Lockbourne AFB. The Archive Search Report (USACE, 1997) indicates that the area was used as a landfill for lumber, paper and scrap metal and disposals were conducted from approximately 1942 to 1951.

Because the location of these AOCs were not readily apparent, map coordinates (northing and easting) were obtained from the digitized aerial photograph. The location of the AOCs was established in the field using a GPS unit.

Three soil borings (56SB01, 56SB02, and 56SB03) were drilled at AOC 56 and AOC 72 on November 15, 1999 and are shown on Figure 3-13. One soil sample from each boring and a duplicate (Sample IDs: 56SB01SO01, 56SB01SO51, 56SB02SO04, and 56SB03SO04) was collected and analyzed for TCL VOCs, TCL SVOCs, TAL metals, and pesticide/PCBs. The borings penetrated the water table, but there was insufficient yield to collect a groundwater sample in the time frame specified in the work plan (two hours). The laboratory data and COCs are presented in Appendices I and J and the soil analytical results are summarized in Table 3-45.

NDAI status is recommended for AOC 56 and AOC 72. As shown in Table 3-46, 18 metals were detected in soil. Calcium, copper, magnesium, and thallium were detected above background. Copper and thallium are below PRGs; calcium and magnesium are essential nutrients. Arsenic was detected above both background and the PRG. Arsenic is with an order of magnitude of its PRG, and therefore, is within the target risk range. All other metals were detected below their respective PRG, if available. Five organic compounds were detected in soil. All maximum concentrations were detected below the PRG. As shown in Table Q-9 (Appendix Q), all detected chemicals were below the SSLs, if available.

3.7 AOC 57 - Possible Waste Disposal Location

AOC 57 was included as an AOC because a 1950 aerial photograph indicated the presence of disturbed earth. No other information was available for this area and current aerial photographs indicate this site is being farmed.

Because the location of this AOC was not readily apparent, map coordinates (northing and easting) were obtained from the digitized aerial photograph. The location of the AOC was established in the field using a GPS unit.

Three soil borings (57SB01, 57SB02, and 57SB03) were drilled at AOC 57 on November 11, 1999 and are shown on Figure 3-14. One soil sample from each boring (sample ID: 057SB01SO05, 057SB02SO01, and 057SB03SO05) was analyzed for TCL VOCs, TCL SVOCs, TAL metals, and pesticides/PCBs. A groundwater sample was scheduled to be collected from one boring, however, groundwater was not present in any of the borings. The laboratory data and COCs are presented in Appendices I and J and the soil analytical results are summarized in Table 3-47.

NDAI status is recommended for AOC 57. As shown in Table 3-48, 16 metals were detected in soil. All metals except calcium, magnesium, and potassium were detected below background. These compounds are considered essential nutrients. Three organic compounds were detected in soil. All maximum concentrations were detected below the PRG. As shown in Table Q-10 (Appendix Q), all detected chemicals were below the SSLs, if available.

3.8 AOC 65 - Horse Barn

The horse barn (Building 788) was included as an AOC because it was used between 1980 and 1982 to store transformers prior to their disposal off-site. The building was demolished between 1984 and 1989.

The approximate location of AOC 65 is shown on Figure 3-15. Because the building is no longer standing, map coordinates (northing and easting) were obtained from site drawings. The location of the building was established in the field using a GPS unit.

On November 16, 1999, 37 surficial soil samples and 4 duplicates (Sample IDs: 065SS01SO01 through 065SS37SO01, 065SS01SO51, 065SS11SO51, 065SS21SO51, and 065SS31SO51) were collected from AOC 65 and analyzed for PCBs. Soil sampling locations were determined in accordance with USEPA guidance, "Field Manual for Grid Sampling of PCB Sites to Verify Cleanup" (USEPA, 1986). In accordance with this guidance, a hexagonal grid was imposed within the smallest circle containing all surfaces to be sampled. The radius of the circle was used to determine distance between adjacent sampling points (s) and the distance between successive rows (u). The area to be sampled was assumed to be the area encompassing Building 788 and extending to the driveway area.

Assuming this area, the radius (r) of the smallest circle was determined to be approximately 85 feet. In accordance with Table 1 of the guidance, a 37 point hexagonal sampling design was selected based on the size of the sampling circle radius. Using the recommended sample spacings of .30r (approximately 25.5 feet) and a row spacing, u, of .26r (approximately 22 feet) for a 37-point hexagonal sample design. The sample locations are shown on Figure 3-15. Sample points were located by first locating the center point using a GPS unit and then taping off the remaining points. There were no areas of dark stained soil visible during the sampling that would cause a sample to be moved or an additional sample to be collected.

NDAI status is recommended for the Former Horse Barn. Soil samples were only analyzed for PCBs; no PCBs were detected in any of the 37 soil samples. The laboratory data and COCs are presented in Appendices I and J.

3.9 AOC 68 - Possible Waste Disposal Location

AOC 68 was included as an AOC because a 1964 aerial photograph indicated the presence of disturbed earth. Air Force Center for Environmental Excellence (AFCEE) personnel indicated it may have served as a parking lot for an adjacent picnic area. No other information was available for this area.

Because the location of this AOC was not readily apparent, map coordinates (northing and easting) were obtained from the digitized aerial photograph. The location of the AOC was established in the field using a GPS unit.

Three soil borings (68SB01, 68SB02, and 68SB03) drilled at AOC 68 on November 15, 1999 and are shown on Figure 3-16. One soil sample from each boring and a duplicate (Sample IDs: 068SB01SO05, 068SB01SO55, 068SB02SO01, and 068SB03SO05) were analyzed for TCL VOCs, TCL SVOCs, TAL metals, and pesticide/PCBs. A groundwater sample was scheduled to be collected from one boring, however, no groundwater was present in any of the borings. The laboratory data and COCs are presented in Appendices I and J and the soil analytical results are summarized in Table 3-49.

NDAI status is recommended for AOC 68. As shown in Table 3-50, 17 metals were detected in soil. Calcium, magnesium, selenium, and thallium were detected above background. Selenium and thallium are below the PRG; calcium and magnesium are considered essential nutrients. All other metals were detected below background. One organic compound was detected in soil. Its maximum concentration was detected below the PRG. As shown in Table Q-11 (Appendix Q), all detected chemicals were below the SSLs, if available.

3.10 AOC 69 - Possible Waste Disposal Location

AOC 69 was included as an AOC because a 1964 aerial photograph indicated the presence of disturbed earth. AFCEE personnel indicated that this area served as a staging and parking area for contractors. A visual inspection of the site indicated the presence of a gravel base, with some concrete and asphalt rubble.

Three soil borings (69SB01, 69SB02, and 69SB03) were drilled at AOC 68 on November 15, 1999 and are shown on Figure 3-17. One soil sample from each boring (Sample IDs: 069SB01SO01, 069SB02SO05, and 069SB03SO04) were analyzed for TCL VOCs, TCL SVOCs, TAL metals, and pesticide/PCBs. The borings penetrated the water table, but there was insufficient yield to collect a groundwater sample in the time frame specified in the work plan (two hours). The laboratory data and COCs are presented in Appendices I and J and the soil analytical results are summarized in Table 3-51.

NDAI status is recommended for AOC 69. As shown in Table 3-52, 17 metals were detected in soil. Calcium, magnesium, selenium, and thallium were detected above background. Selenium and thallium were below PRGs; calcium and magnesium are essential nutrients. All other metals were detected below background. Arsenic was detected above both background and the PRG. Arsenic is within an order of magnitude of its PRG, and therefore, is within the target risk range. All other metals were detected below their respective PRG. Seven organic compounds were detected in soil. All maximum concentrations were detected below the PRG. As shown in Table Q-12 (Appendix Q), all detected chemicals were below the SSLs, if available.

3.11 AOC 75 - Indoor Firing Range

AOC 75 (Building 687) was included as an AOC because of the possibility of lead being present. The building is in disrepair and the floor is covered with approximately 6 inches to 3 feet of sand. The Archive Report (USACE, 1997) concluded that the indoor firing range was an "Area with potential, but not likely to contain ordnance."

The indoor firing range is approximately 40 ft by 80 ft (Figure 3-18). An approximate area of 40 ft by 60 ft of the floor is covered with approximately 6 inches to 3 feet of sand and gravel fill. The flooring below the fill is part of a runway that was built in 1942. A 10 ft by 10 ft grid was laid out and 9 grab samples of the sand and gravel fill (Sample IDs: 075SS01SO01 through 075SS09SO01) were collected at nine grid nodes as shown in Figure 3-19. The samples were collected from the entire depth of the fill and analyzed for TAL metals. The laboratory data and COCs are presented in Appendices I and J and the analytical results are summarized in Table 3-53.

As shown in Table 3-54, 18 metals were detected in sand in the building. Calcium, copper, magnesium, potassium, thallium, and zinc were detected above background but below their respective PRG or are essential nutrients. Antimony was above both background and the PRG. Lead was detected above both background and the screening level of 800 mg/kg. All other metals were below background.

To characterize the sand and gravel fill for possible disposal, a composite sample (Sample ID: 075COMPSO01) was collected from all nine grid nodes and analyzed for TCLP metals. The laboratory data and COCs are presented in Appendices I and J and the analytical results are summarized in Table 3-55. Lead was detected at 104 mg/L, which is above the TCLP regulatory level of 5.0 mg/L. Therefore, the sand and gravel fill is classified as a hazardous waste, and AOC 75 is recommended for further action.

3.12 AOC 94 - Stained Soil Near Precision Maintenance Lab

AOC 94 was included as an AOC because CRAA personnel (or their contractor) had noticed an area of stained soil during a visual site inspection. During a visual inspection conducted by Shaw, no stained soil was evident. This building has been demolished and is no longer present at the site.

Since the facility has been demolished and no drawings could be located that indicated the placement of doorways, bays, and other areas where releases most likely would have occurred, proposed sampling locations were determined using the estimated groundwater flow direction. One boring (94SB03) was placed downgradient of the former building location and the two remaining sampling points (94SB01 and 94SB02) were spaced evenly around the building. The soil borings were drilled on November 9, 1999 and the sampling locations for AOC 94 are shown on Figure 3-20. One soil sample from each boring and a duplicate (Sample IDs: 094SB01SO01, 094SB02SO04, 094SB03SO04, and 094SB03SO54) were analyzed for TCL VOCs, TCL SVOCs, and TAL metals. A groundwater sample (Sample ID: 094SB03GW01) was collected from boring 94SB03 on November 10, 1999 and was analyzed for TCL VOCs and TCL SVOCs. The laboratory data and COCs are presented in Appendices I and J. The soil analytical results are summarized in Table 3-56 and the groundwater results are summarized in Table 3-57.

As shown in Table 3-58, 17 metals were detected in soil. Barium, calcium, magnesium, potassium, thallium, and zinc were detected above background. Barium, thallium, and zinc were below the PRGs; calcium, magnesium, and potassium are considered essential nutrients. Arsenic was detected above both background and the PRG. Arsenic is within an order of magnitude of the PRG, and therefore, is within the target risk range. All other metals were detected below background. Four organic compounds were detected in soil. All maximum concentrations were detected below the PRG. As shown in Table Q-13 (Appendix Q), methylene chloride was detected above the SSL. Methylene chloride was not detected in groundwater.

As shown in Table 3-59, two VOCs were detected in groundwater. TCE was above the PRG, while acetone was below the PRG. As shown in Table 3-57, TCE was detected below the MCL; no MCL is available for acetone.

Further action is recommended for AOC 94. Barium was detected in soil above background; therefore, sampling of groundwater is recommended. Although detected VOC concentrations in the groundwater sample were below respective screening criteria, the limited nature of investigations completed to date can not rule out the potential that higher VOC concentrations exist. An additional investigation should be conducted to determine if higher concentrations of TCE and acetone are present.

3.13 AOC 96 - Well No. 2

AOC 96 was originally included as an AOC because it was thought that the well had not been properly abandoned and could act as a conduit for contamination to reach groundwater. However, during site work it was discovered that the well had been closed. The well was inspected by the sampling team and was determined to be grouted. The AFCEE Field Engineer confirmed that the well had been abandoned with the other supply wells. The CRAA and Air Force records were checked for an abandonment form, but one could not be located. NDAI status is recommended.

3.14 AOC 97 - Sewage Treatment Facility and Lagoon

AOC 97 was included as an AOC because of the potential for toxic or hazardous materials to have been discharged to the sewage treatment facility and eventually discharged to the environment. The sewage treatment facility (Facilities 780 and 781) is a package aeration plant that processed sewage generated from temporary quarters that housed personnel assigned to the base. The package plant consists of two concrete tanks in series. The first appears to be a primary settling basin. Effluent from this tank is piped to the smaller tank. Standing water is currently present in both tanks. Effluent from the package treatment plant was discharged to an unlined lagoon. Dick Haines, AFCEE Field Engineer, interviewed Dave Edwards of the Air Force (who used to be in charge of the base sewage operations) about the lagoon. Mr. Edwards indicated that they never had to remove sludge from the lagoon because most of it was removed by the package plant treatment systems at the trailer court and the dog kennel. The sludge that accumulated in the package plants was generally removed by a vacuum truck and taken to the City of Columbus sewage plant. On several occasionally the sludge was removed and disposed of in an on-base sanitary sewer and was subsequently treated at the on-base treatment plant. The location of AOC 97 is shown on Figure 3-21.

On November 17, 1999, a water sample with a duplicate (Sample IDs: 097SW03SW01 and 097SW03SW51) and a sediment grab sample (Sample ID: 097SD01SD01) were collected from the primary settling tank (Facility 780). A water sample (Sample ID: 097SW02SW01) was collected from the secondary tank at Facility 781. No sediment was present in the secondary tank, so a sediment sample could not be collected. The samples were analyzed for TCL VOCs, TCL SVOCs, pesticides/PCBs, and TAL metals. Additionally, 3 sediment grab samples and a duplicate (Sample IDs: 097SD04SD01, 097SD04S051, 097SD05SD01, and 097SD06SD01) were collected from the lagoon. No water was present in the lagoon, so surface water samples could not be collected. Sediment samples were analyzed for TCL VOCs, TCL SVOCs, TAL metals, and pesticide/PCBs. The laboratory data and COCs are presented in Appendices IK and J and the sediment sample results are summarized in Table 3-60 and the water sample results are summarized in Table 3-61. Fifteen attempts to install a piezometer down gradient (south) of the lagoon each resulted in refusal at approximately 4 to 5 feet bgs. This area is heavily wooded and tree roots might be responsible for refusal.

NDAI status is recommended for AOC 97. Sediment sampled from the lagoon and tank was compared to background soil concentrations and industrial soil PRGs. As shown in Table 3-62, nine metals were detected in sediment from the tanks. Aluminum, calcium, chromium, iron, lead manganese, and zinc were detected above background. All were below their respective PRG; calcium has no PRG, but is considered an essential nutrient. Arsenic and copper were detected below background, if available. Seven organic compounds were detected in the tank sediment. All maximum concentrations were detected below the PRG.

Water in the treatment tanks were compared to surface water background and tap water PRGs. As shown in Table 3-63, eight metals were detected in the tank water. Zinc was detected above background but below the PRG. Iron and manganese were detected above the PRG. The remaining seven metals were either considered essential nutrients or were below their respective background. Five organic compounds were detected in the treatment tank water. All maximum concentrations were below the PRG. As shown in Table 3-61, no chemicals were detected above the MCL, if available.

As shown in Table 3-64, 17 metals were detected in the sediment from the lagoon. All metals were detected above background except cadmium and lead. With the exception of arsenic, all metals were detected below their respective PRG, if available. Nineteen organic compounds were detected in the sediment from the lagoon. With the exception of benzo(a)pyrene and Aroclor-1260, all maximum concentrations were detected below the PRG. The maximum detected concentration of Aroclor-1260 is slightly above the Toxic Substance Control Act (TSCA) clean-up level of 1 ppm. As shown in Table 3-65, the cumulative non-cancer hazard estimate is below 1. The cumulative cancer risk estimate is the target risk goal, primarily due to arsenic. As shown in Table Q-14 (Appendix Q), all detected chemicals were below the SSLs, if available.

The chemicals that exceeded the screening criteria were Aroclor 1260, Benzo(a)pyrene, and Endrin Aldehyde. PCBs bind to soil and would not be expected to migrate to groundwater at low concentrations. The detection of Benzo(a)pyrene in one of the three samples, at a low concentration, is normal given the ubiquitous occurrence of PAHs in the environment. Similar to PCBs, PAHs bind to soil and would not be expected to migrate to groundwater at low concentrations.

3.15 AOC 98 - Base Communication Center and Transmitter Facility

AOC 98 was included as an AOC because the leach field could have been used for disposal of toxic or hazardous materials (Figure 3-22). A visual inspection of the facility revealed the presence of three transformers located on a concrete pad adjacent to the transmitter facility.

The following media were sampled:

- Transformers
- Transformer pad
- Soil near transformer pad
- Soil at leach field
- Groundwater.

On November 11, 1999, 3 soil borings (98SB01, 98SB02, and 98SB03) were drilled in the leach field area. The sampling locations are shown on Figure 3-22. One soil sample from each boring and a duplicate (Sample IDs: 098SB01SO01, 098SB02SO04, 098SB02SO54, and 098SB03SO04) were analyzed for TCL VOCs, TCL SVOCs, and TAL metals. The borings penetrated the water table, but there was insufficient yield to collect a groundwater sample in the time frame specified in the work plan (two hours). The laboratory data and COCs are presented in Appendices K and L and the soil analytical results are summarized in Table 3-66.

On November 16, 1999, one grab sample was collected of the oil from each of the three transformers located at the facility (Sample IDs: 098TR01TO01, 098TR02TO01, and 098TR03TO01) and analyzed for PCBs. The sample locations are provided on Figure 3-23. The laboratory data and COCs are presented in Appendices K and L and the analytical results are summarized in Table 3-67. Transformer No. 1 oil contained Aroclor 1260 at a concentration of 8,500 μg/kg. The oil in Transformers No. 2 and No. 3 did not contain PCBs above the reporting limit, which is well below the PRG.

A composite sample of the concrete from the transformer pad (Sample ID: 098TP01CO01) was collected to determine if the pad had been contaminated with PCBs. The laboratory data and COCs are presented in Appendices I and J and the analytical results are summarized in Table 3-68. The composite sample did not contain PCBs above the reporting limit, which is well below the PRG.

In addition, four surface soil samples (Sample IDs: 098SS01SO01, 098SS02SO01, 098SS03SO01, and 098SS04SO01) were collected from the area surrounding the transformer pad. The sample locations are provided on Figure 3-23. The laboratory data and COCs are presented in Appendices I and J and the analytical results are summarized in Table 3-69. The soils surrounding the transformer pads did not contain PCBs above the reporting limit, which is well below the PRG.

As shown in Table 3-70, 16 metals were detected in soil. Calcium, magnesium, and selenium were detected above background; all other metals were detected below background. Selenium was detected below the PRG; calcium and magnesium are essential nutrients. Eleven organic compounds were detected in soil. All organics were detected below the PRG. As shown in Table Q-15 (Appendix Q), all detected chemicals were below the SSLs, if available. On December 7, 2000, the three transformers located at Building 607 were removed. Additionally, an electrical switch, containing PCBs, located at Building 1074 was removed at this time. Information on the three transformers and the electric switch is provided in Appendix M.

Prior to removing the equipment for disposal, the dielectric fluids were pumped from the units into 55-gallon drums. The units were then transported off-site. The metals were cleaned and recycled, and the oils were incinerated. The removal and disposal work was performed by

Trans-Cycle Industries, Inc., from Pell City, Alabama. The disposal information is provided in Appendix N.

NDAI status is recommended for this site based on the risk screening and removal of PCB-containing materials.

3.16 AOC 99 – Package Aeration Plant (formerly called Lift Station)

AOC 99 was included as an AOC because of the potential for toxic or hazardous materials to have been discharged to the sewage treatment system. AFBCA personnel indicated that this was not a lift station, but a package aeration plant that serviced the dog kennel located in this area.

The location of the package aeration plant is shown on Figure 3-21. On November 17, 1999, one water sample (Sample ID: 099SW01SW01) was collected from the package aeration plant. The sample was analyzed for TCL VOCs, TCL SVOCs, TAL metals, and pesticide/PCBs. The laboratory data and COCs are presented in Appendices I and J and the analytical results are summarized in Table 3-71.

NDAI status is recommended for AOC 99. Impounded water at the station was compared with surface water background and tap water PRGs. As shown in Table 3-72, 12 metals were detected in the water. Chromium, copper, lead, and zinc were detected above background levels. All metals were detected below their respective PRG, if available, with the exception of copper. Three metals had no PRG available for comparison but are considered essential nutrients (calcium, magnesium, and sodium). Six organic compounds were detected in the water. With the exception or heptachlor, all maximum concentrations were below the PRG. As shown in Table 3-71, all maximum concentrations were below the MCL, if available, except lead. Lead was detected slightly above USEPA's action level from the National Primary Drinking Water Regulations (USEPA, 2004).

3.17 AOC 108 - Dry Cleaning Operations

The dry cleaning operations building (Building 314) was included as an AOC because of the general nature of activities presumed to have occurred within the building. Solvents were likely used during the performance of activities in this building. This building has been demolished. A large soil stockpile is currently located over part of the site.

This facility was demolished and no drawings could be located that indicated the placement of doorways, bays, and other areas where releases most likely would have occurred. Because this information was not available, sampling locations were determined using the estimated groundwater flow direction. One boring location (108SB03) was placed downgradient of the former building location and the two remaining boring locations (108SB01 and 108SB02) were distributed evenly around the former building location. Sampling was performed on November 11, 1999 and the boring locations for AOC 108 are shown on Figure 3-24. One soil sample from each boring and a duplicate (Sample IDs: 108SB01SO04, 108SB02SO05, 108SB03SO01, and 108SB03SO04) were analyzed for TCL VOCs. A groundwater sample (Sample ID: 108SB03GW01) was collected and analyzed for TCL VOCs. The laboratory data and COCs are presented in Appendices I and J, respectively. The soil analytical results are summarized in Table 3-73 and the groundwater analytical results are summarized in Table 3-74.

NDAI status is recommended for Building T-314. As shown in Table 3-75, four organic compounds were detected in soil. All maximum concentrations were detected below the PRGs. As shown in Table Q-16 (Appendix Q), all detected chemicals were below the SSLs, if available.

As shown in Table 3-76, four organic compounds were detected in groundwater. All maximum concentrations were detected below the PRGs. As shown in Table 3-74, all detected chemicals were below the MCLs, if available.

3.18 Investigative Derived Waste Disposal

On March 9, 2001, the IDW, 3.24 tons of groundwater and decontamination water and 2.88 tons of soil cuttings, was shipped to Suburban South Recycling facility at 3415 Township Road 447, Glenford, Ohio, for disposal as special waste. The waste profiles for the materials are provided in Appendix O. The waste manifest (No. 0034100) is provided in Appendix P.

4.0 Recommendations

Each of the 21 sites has been evaluated using the criteria described in Sections 2.0 and 3.0 of the report. Of the sites, 14 are recommended for no further action, and seven are recommended for further evaluation. Relevant site history and numbers of sampling locations, along with a summary of the screening results, are tabulated (Table 3-1). As noted in Table 3-1, at most sites, at least one chemical is above screening criteria. In many cases, as discussed in the text, concentrations are below background (e.g., arsenic) or not considered to be a significant health threat The PAHs are also believed to be present due to normal past and present commercial/industrial types of operations such as aircraft and vehicle traffic. As discussed in Section 3.0, PAHs resulting from aircraft and vehicle operations are exempt from regulation under CERCLA.

Of the 21 sites investigated, 14 sites are recommended for NDAI status because there is either no indication of a release or no release that would constitute a threat to human health or the environment:

- AOC 9 - Photo lab
- AOC 55 - Possible waste disposal location
- AOC 55A - Possible waste disposal location
- AOC 56 and 72 - Possible waste disposal locations
- AOC 57 - Possible waste disposal location
- AOC 65 - Horse barn and stable
- AOC 68 - Possible waste disposal location
- AOC 69 Possible waste disposal location
- AOC 96 - Well No. 2
- AOC 97 - Sewage treatment facility and lagoon
- AOC 98 - Base communication center and transmitter facility
- AOC 99 - Lift station
- AOC 108 - Dry cleaning operations.

Seven sites are recommended for further action:

- AOC 17 - Base engineer's shop
- AOC 18 - Base engineer's maintenance and inspection
- AOC 19 - Engine cleaning building
- AOC 49 - Small arms firing range
- AOC 75 - Indoor firing range

- AOC 94 - Stained soil near Precision Maintenance Lab
- AOC 103 - Battery maintenance facility.

4.1 Proposed Further Actions for AOCs 17, 18, 19, and 103

As presented in Section 3.2, because of the risks associated with residual contamination at AOCs 17, 18, 19, and 103, these AOCs need further evaluation to determine the potential need for remediation or additional investigation. These AOCs are being considered together because of their geographic proximity (as shown in Figure 3-2) and the similarity in the nature of contamination. The buildings associated with these AOCs are as follows:

- AOC 17 - Base engineer's shop (Building T-530),
- AOC 18 - Base engineer's maintenance and inspection (Building T-532),
- AOC 19 - Engine cleaning building (Building T-535)
- AOC 103 - Battery shop (Building T-531)

The facilities located at AOCs 17, 19, and 103 have been demolished. Lane Aviation currently occupies AOC 18.

4.1.1 Summary of Soil Contamination at AOCs 17, 18, 19, and 103

Table 4-1 presents a summary of soil contamination at AOCs 17, 18, 19, and 103. This table presents only those compounds identified in Section 3.2.4 as exceeding a screening criterion (such as USEPA Region 9 preliminary remediation goals [PRGs] for industrial/commercial soil). As can be seen from this table, almost all chemicals of potential concern in soil were found in surficial soils (0 to 2 feet) and appear to be related to surface runoff from nearby road surfaces and other anthropogenic activity. However, Ohio EPA has recommended that deeper samples be collected at the locations of 17SB02 to confirm that the PAHs are only at the surface. The one exception was arsenic found in 6 to 8-foot interval at 19SB01. Based on these results, it appears that soil contamination at these AOCs is surficial and confined to limited areas. The area has been redeveloped, so additional sampling would be required to establish current conditions.

4.1.2 Summary of Groundwater Contamination at AOCs 17, 18, 19, and 103

As presented in Section 3.2, groundwater contamination at these 4 AOCs appear to be the result of multiple release events. AOC 17 does not appear to have any groundwater contamination associated with it; thus, AOC 17 will not be discussed further.

Table 4-2 presents a summary of groundwater contamination at AOC 19, which appears to have contamination unrelated to the other AOCs. Table 4-2 presents only those compounds for AOC 19 identified in Section 3.2.4 as exceeding a screening criterion (such as USEPA Region 9 PRGs for tap water and maximum contaminant levels [MCLs] for drinking water) and includes all data collected at this site, including non-validated data. Figure 4-1 shows the location of monitoring wells at AOC 19 and the contamination detected at each well. As can be seen from this figure, it appears that the original spill of trichloroethene (TCE) may have been in the vicinity of 19SB202. Postulating that local groundwater flow was in the direction from 19SB202 towards 18MW03, it can be seen that the TCE has undergone significant biodegradation over the years leading to accumulation of the TCE degradation daughter products, 1,2-DCE and VC down-gradient of 19SB202. The TCE degradation is more pronounced with increased distance from the postulated TCE spill location. Thus, the highest 1,2-DCE and VC contamination can be seen at 19SB114. As is the case in every site investigated at RANGB, the low permeability of the soil coupled with low groundwater hydraulic gradients and low recharge rates (the site is paved over) have resulted in a very slow migration of the contaminants. The maximum downgradient extent of contamination appears to be only 130 feet from 19SB202.

Groundwater contamination at AOC 18 and 103 appear to be contiguous; thus, these two AOCs are discussed as one unit and Table 4-3 presents a summary of chemicals detected in the groundwater at these two AOCs. This table presents only those compounds for AOCs 18 and 103 identified in Section 3.2.4 as exceeding a screening criterion (such as USEPA Region 9 PRGs for tap water and MCLs for drinking water) and includes data collected from monitoring wells and soil borings. Figure 4-2 shows the location of these monitoring wells and soil borings and the contamination detected at each location. As can be seen from this figure, the highest level of contamination was found at 103SB03 (TCE at 19,000 µg/L). Significantly lower contamination levels were detected at the only other monitoring point (103MW01) in the vicinity of this soil boring. Lower levels of contamination were also detected at other boring locations around Building 532 (AOC 18).

4.1.3 Recommendation of Further Action for AOC 19

Additional sampling should be conducted at AOC 19 to assess current groundwater conditions. Some of the wells were abandoned during redevelopment, so some wells may need to be replaced and additional wells might be needed to fully assess the site.

4.1.4 Recommendation of Further Action for AOC 18 and AOC 103

AOC 18 and AOC 103 have the same physical site characteristics as AOC 19. Thus, contamination migration at this site is also likely to be slow. However, the extent of contamination downgradient from 103SB03 has not been fully delineated beyond the confirmation that it does not extend beyond 103MW03 approximately 180 feet away. Given the high levels of contamination found in 103SB03, additional borings appear warranted to better delineate the contamination.

4.2 Recommended Further Action for AOC 75

As presented in Section 3.11, 18 metals were detected in the sand and gravel fill located in the Indoor Firing Range. Antimony, copper, magnesium, thallium, and zinc were detected above background but below their respective PRG, if available. Arsenic was detected above the PRG but below background. Lead was detected above both background and the PRG. A composite sample collected of the sand and gravel fill material was analyzed for TCLP metals. Lead was detected at 104 mg/L, which is above the TCLP regulatory level of 5.0 mg/L. Based on this result, the sand and gravel fill is classified as a hazardous waste, and it is recommended that the sand and gravel be removed for proper disposal. Additional samples should be collected to ensure all of the hazardous waste has been removed. Given that prior use of the building as a range resulted in high levels of lead in the sand, it is likely that the interior walls and ceiling are contaminated. It is recommended that the inside of the building be tested. The building consists of an unpainted wooden frame covered with corrugated metal siding. Decontamination of the wooden frame may not be technically practical or feasible, or might be very costly. After additional testing, it may be found that demolition and disposal of the entire structure might be the only technically practical approach or at least a more cost-effective alternative to interior decontamination. The building sits on a portion of the abandoned 1942 runway. The runway surface should also be sampled and might also need to be decontaminated or demolished. If the runway surface is contaminated and is in poor condition, sampling of the underlying soil and groundwater should be considered.

4.3 Recommended Further Action for AOCs 49 and 94

At AOC 49, the Small Arms Firing Range, and AOC 94, the Precision Maintenance Lab, VOCs were detected in the groundwater. All the detected compounds were below the Tap Water PRGs. Based on the results to date, NDAI status would appear to be likely. However, due to the limited nature of these initial investigations, the possibility exists that higher concentrations of VOCs are present. Therefore, additional sampling is recommended for both sites to better establish the maximum concentrations of VOCs present and to help determine if NDAI status is appropriate.

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CH2MHILL

Executive Summary

The US Army Corps of Engineers (USACE), Louisville District contracted CH2M HILL to document the remedial investigation (RI) and other prior investigation activities conducted at the former Lockbourne Air Force Base (AFB) landfill near Columbus, Ohio. The former Lockbourne AFB is located east of Interstate 71 in Franklin and Pickaway counties, just east of the Village of Lockbourne, Ohio (Figure 1-1). Environmental response actions at this site conform to the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, 42 United States Code 9601 et seq., the National Oil and Hazardous Substance Pollution Contingency Plan, commonly called the National Contingency Plan (NCP), and Army Regulation 200-1, as applicable.

This RI report summarizes previous investigative activities conducted at the former Lockbourne AFB landfill and presents an interpretation and evaluation of available data. A discussion of the nature and extent of impact (i.e., types, concentrations, and distribution of constituents detected in different media sampled), their migration pathways, and environmental fate and transport mechanisms for constituents of waste materials identified on the property are presented herein. The RI documents the potential human health and environmental risk associated with current site conditions and evaluates potential future exposure. This report contains discussions and conclusions that supersede those in prior RI reports, particularly regarding risk assessment.

Environmental impacts were found during previous investigations (2003, 1998, 1997, and 1995 sampling events) in surface and subsurface soil, surface water, sediment, and groundwater. The primary constituents at the site are semivolatile organic compounds (SVOCs), dioxins, arsenic, and lead. No volatile organic compounds (VOCs) in any of the samples collected exceeded their respective regional screening levels (RSLs). Exceedances in SVOCs were seen in all media. Dioxins were detected above their RSLs in surface soil and groundwater. Arsenic and lead were detected in the majority of the well locations, including background wells.

The primary fate and transport mechanisms for the constituents of interest were identified based on a review of the nature and extent of the analytical data relative to the environmental setting, physical and chemical properties of the site-related constituents of interest, and comparison to screening levels. Based on this review, it was determined that there is one primary migration pathway, which is runoff of impacted soil because of precipitation and subsequent transport to downgradient drainage ditches.

The entire site was divided into two areas of concern (AOCs) based on whether wastes were detected during a recent site investigation that required installation of test pits. AOC 1 includes areas where waste is present, and AOC 2 is an area where no waste was found. The human health risk assessment (HHRA) was performed for each AOC to evaluate potential current and future risks associated with exposure to surface soil, subsurface soil, sediment, surface water, and groundwater at the former Lockbourne AFB landfill based on potential but unlikely conservative receptor populations and exposure scenarios. Under current land-use conditions, maintenance worker exposures to surface soil, offsite industrial worker exposures to particulate emissions from surface soil, and trespasser/visitor exposures to surface soil, sediment, and surface water were evaluated. Under future conditions, facility worker exposures to surface soil and indoor air (applicable for AOC 2 only), construction worker exposures to subsurface soil, sediment, surface water, and groundwater, and offsite resident exposure to groundwater were evaluated. Maintenance worker, offsite industrial worker, and trespasser/visitor exposures were assumed the same under future land-use conditions as those under current land-use conditions.

The exposure scenarios that do exceed risk targets are identified in the following table along with the risk drivers. AOC 1 includes areas where waste is present. AOC 2 is an area where no waste was found during investigation activities.

Exposure Scenarios that Exceed Risk Targets

Exposure Area	Exposure Medium	Human Receptors	Risk Drivers
AOC 1	Surface soil	Current/future maintenance, trespasser/visitor	PAHs, PCBs
AOC 1	Total soil	Future construction worker	PAHS, PCBs, lead
AOC 1	UWBZ Groundwater	Future construction worker and offsite residents	PAHs, phthalates, dioxins, metals (aluminum, arsenic, cadmium, cobalt, copper, iron, manganese, thallium, vanadium, and lead), VOCs (methylene chloride)
AOC 1	IDA Groundwater	Future offsite residents	PAHs, phthalates, dioxins, metals (iron and manganese)
AOC 2	UWBZ Groundwater	Future construction worker	PAHs, dioxins
Off-Landfill	IDA Groundwater	Future offsite residents	PAHs, dioxins

AOC = Area of Concern
cPAH = carcinogenic polynuclear aromatic hydrocarbons
PCB = polychlorinated biphenyl
SVOC = semivolatile organic compound
VOC = volatile organic compound

For the groundwater exposure scenarios that exceed target risk goals (i.e., future construction workers and offsite residents), risks are driven primarily by PAHs and dioxins, and to a lesser extent by metals, VOCs, and SVOCs. These exposure scenarios include future construction workers and offsite residents. Lead concentrations in AOC 1 upper water-bearing zone (UWBZ) groundwater would exceed the criterion for blood lead level (BLL) in future children exposed to offsite groundwater.

The ecological risk assessment (ERA) was performed to evaluate the actual or potential ecological effects from exposures at AOC 1 and AOC 2. This multi-pathway analysis was based on reasonable, protective assumptions about the potential for ecological receptors (lower-trophic [i.e., benthic invertebrates /soil invertebrates] and upper-trophic [i.e., birds, mammals, and fish] receptors) to be exposed to and be adversely affected by exposure to COPCs.

The upper-trophic receptors were selected as surrogate species representing estimated exposure and, subsequently, risk to other species within comparable feeding guilds. Key wildlife receptors include the deer mouse, American robin, mourning dove, short-tailed shrew, red-tailed hawk, red fox, mallard, marsh wren, muskrat, belted kingfisher, and mink.

The results of the ERA are summarized below, including the exposure area, medium, and chemicals of potential concern (COPCs), which are those chemicals that exceed the ecological hazard quotients (HQs) of 1 and where the lines of evidence (i.e., habitat, frequency of exceedances, background contributions) support the ecological quotient exceedances.

Summary of Ecological Risks

Exposure Area	Exposure Medium	Receptors	Chemicals of Potential Concern
AOC 1	Surface soil (0–4 feet)	Terrestrial Mammals	Thallium, PAHs, PCBs, Dioxins/Furans
		Terrestrial Birds	Lead, PCBs
		Lower-Trophic Receptors	Aluminum, chromium, lead, mercury, selenium, thallium, zinc, DDT, PCBs, PAHs, Dixons/Furans
AOC 2	Surface soil (0–4 feet)	Terrestrial Mammals	NR
		Lower-Trophic Receptors	NR
East Ditch	Surface water	Lower-Trophic Receptors	NR
		Upper-Trophic Receptors	NR
	Sediment	Lower-Trophic Receptors	PAHs
		Upper-Trophic Receptors	NR
West Ditch	Surface water	Lower-Trophic Receptors	Dioxins/Furans
	Sediment	Lower-Trophic Receptors	Arsenic, DDD, DDE, DDT, PCBs, PAHs, Dioxins/Furans

Note: NR = negligible risk as determined in the ERA

Based on the results of the ERA, potential ecological risks were identified with respect to lower-trophic and upper-trophic terrestrial receptors within AOC 1 and AOC 2, and lower-trophic receptors within the West Ditch and East Ditch. No further evaluation was recommended for AOC 1 or the East or West Ditch because the presumptive remedy identified for AOC 1 will address the ecological risk identified above. Additionally, based on the results of the refinements to the COPCs identified within AOC 2, it is unlikely that lower or upper-trophic receptors are at risk and as a result, no further evaluation is warranted. Furthermore, possible future redevelopment of AOC 2 for commercial and/or industrial use will also limit habitat present onsite.

Based on the results, potential risk is present at AOC 1 that warrants remedial action. A presumptive remedy involving containment is considered applicable and will be evaluated in a focused feasibility study. This approach for a presumptive remedy and a focused feasibility study has been discussed as a viable next step between the Ohio Environmental Protection Agency (Ohio EPA) and United States Army Corps of Engineers (USACE). In addition to a soil cover at AOC 1, future land use will be restricted to industrial/ commercial use along with potable groundwater use restriction in the form of environmental covenants for AOC 1 and AOC 2.

Contents

Tables

Figures

Appendices

Acronyms and Abbreviations

°C	degrees Celsius
°F	degrees Fahrenheit
µg/dL	micrograms per deciliter
µg/L	micrograms per liter
$\mu g/m^3$	micrograms per cubic meter
AF	adherence factor
AFB	Air Force Base
ALM	adult lead methodology
ANG	Air National Guard
AOC	area of concern
AST	aboveground storage tank
ASTM	American Society for Testing and Materials
ATSDR	Agency for Toxic Substances and Disease Registry
BAF	bioaccumulation factor
BCF	bioconcentration factor
BERA	baseline ecological risk assessment
bgs	below ground surface
BLL	blood lead level
$CaCO_3$	calcium carbonate
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
cm/sec	centimeters per second
COPC	chemical of potential concern
COPEC	chemical of potential ecological concern
cPAH	carcinogenic polynuclear aromatic hydrocarbon
CRAA	Columbus Regional Airport Authority
CSF	cancer slope factor
CSM	conceptual site model
C_{source}	vapor concentration at the source of contamination
DCE	dichloroethene

DDD	dichlorodiphenyl dichloroethane
DDE	dichlorodiphenyl dichloroethylene
DDT	dichlorodiphenyl trichloroethane
DoD	United States Department of Defense
DPT	direct push technology
E&E	Ecology and Environment, Inc.
Eco-SSL	ecological soil screening level
EEG	Ellis Environmental Group, LC
ELCR	excess lifetime carcinogenic risk
EM	electromagnetic
EPC	exposure point concentration
EqP	equilibrium partitioning
ERA	ecological risk assessment
ER-L	effect range low value
ES	Engineering Science
ESL	ecological screening level
EWH	exceptional warmwater habitat
f_{oc}	soil organic carbon weight fraction
FOD	frequency of detect
ft/day	feet per day
ft/ft	foot per foot
ft/min	feet per minute
FUDS	Formerly Used Defense Sites
g/cm^3	grams per cubic centimeter
GI	gastrointestinal
GSD	geometric standard deviation
H	Henry's law constant
HEAST	Health Effects Assessment Summary Tables
HHRA	human health risk assessment
HI	hazard index
HMW	high molecular weight
HQ	hazard quotient
HU	heavily used area

IDA	intermediate depth aquifer
IDW	investigation-derived waste
IEUBK	Integrated Exposure Uptake Biokinetic
IRIS	Integrated Risk Information System
IRP	Installation Restoration Program
IT	IT Corporation
IUR	inhalation unit risk
J&E	Johnson and Ettinger
K	hydraulic conductivity
K_d	soil water distribution coefficient
K_{oc}	organic partition coefficient
K_{ow}s	octanol-water partition coefficient
L/kg	liters per kilogram
LAW	LAW Environmental Services, Inc.
LEL	lowest effect level
LMW	low molecular weight
LOAEL	lowest adverse effect level
MATC	maximum allowable toxic concentration
MCL	maximum contaminant level
MET	minimal effect threshold
MF	modifying factor
mg	milligram
mg/day	milligrams per day
mg/kg	milligrams per kilogram
MMOA	mutagenic mode of action
MSW	municipal solid waste
NCEA	National Center for Environmental Assessment
NCP	National Contingency Plan
NFRAP	No Further Remedial Action Planned
NOAEL	no observed adverse effect level
NOEC	no observed effect concentration
NR	negligible risk
NTU	nephelometric turbidity units

NWI	National Wetlands Inventory
OAC	Ohio Administrative Code
ODNR	Ohio Department of Natural Resources
Ohio EPA	Ohio Environmental Protection Agency
OMZM	outside mixing zone maximum
ONHP	Ohio Natural Heritage Program
OSWER	Office of Solid Waste and Emergency Response
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PEC	probable effect concentration
PESI	Parsons Engineering Science, Inc.
PID	photoionization detector
PMC	Program Management Company
ppm	parts per million
PPRTV	Provisional Peer Reviewed Toxicity Value
PRG	preliminary remediation goal
QA/QC	quality assurance/quality control
QHEI	Qualitative Habitat Evaluation Index
RAGS	*Risk Assessment Guidance for Superfund*
RANGB	Rickenbacker Air National Guard Base
RBP	Rapid Bioassessment Protocol
RCRA	Resource Conservation and Recovery Act
Rf	retardation factors
RfC	reference concentration
RfD	reference dose
RI	remedial investigation
RME	reasonable maximum exposure
RSL	regional screening level
RTV	reference toxicity value
S	water solubility
SARA	Superfund Amendments and Reauthorization Act
SERA	screening ecological risk assessment
SI	site investigation

SQAL	sediment quality advisory level
SQG	sediment quality guideline
SRV	sediment reference value
STL	Severn Trent Laboratory
STSC	Superfund Health Risk Technical Support Center
SVOC	semivolatile organic compound
TAL	target analyte list
TCDD	tetrachlorodibenzo-p-dioxin
TCL	target compound list
TCLP	toxicity characteristic leaching procedure
TEC	threshold effect concentration
TEF	toxic equivalency factor
TEL	threshold effect level
TEQ	toxic equivalent
TRV	toxicity reference value
UCL	upper confidence limit
UF	uncertainty factor
UMU	unused to moderately used area
URF	unit risk factor
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
UTL	upper tolerance limit
UWBZ	upper water-bearing zone
UXO	unexploded ordnance
VOC	volatile organic compound
WHO	World Health Organization

SECTION 1

Introduction

The US Army Corps of Engineers (USACE), Louisville District contracted CH2M HILL to document the remedial investigation (RI) and other prior investigation activities conducted at the former Lockbourne Air Force Base (AFB) landfill near Columbus, Ohio (Figure 1-1), under Contract No. W912QR-04-D-0020, Delivery Order No. 0029. The former Lockbourne AFB landfill is part of a Formerly Used Defense Site (FUDS) and is designated as G05 OH0007. Environmental response actions at FUDS conform to the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, 42 United States Code 9601 et seq., the National Oil and Hazardous Substance Pollution Contingency Plan, commonly called the National Contingency Plan (NCP), and Army Regulation 200-1, as applicable.

1.1 Objectives

The data collection, data analysis, and report preparation for RI has been conducted in accordance with the *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (Interim Final)* (U.S. Environmental Protection Agency [USEPA] 1988). This report summarizes previous investigative activities conducted at the former Lockbourne AFB landfill and presents an interpretation and evaluation of data. In 2008, CH2M HILL conducted a site investigation (SI) that included geophysical measurements, installing test pits, measuring methane at select locations, and evaluating the absence or presence of groundwater seeps at the site. The results of that investigation are presented in detail in the SI report (CH2M HILL 2009) and considered during data evaluation.

The sections that follow discuss the nature and extent of impact (i.e., types, concentrations, and distribution of constituents detected in different media sampled), their migration pathways, and transport mechanisms for soil and groundwater at the site. In addition, potential human health and environmental risks associated with current site conditions and potential future exposure are evaluated.

The RI assumed that a presumptive remedy involving containment would be implemented in the future. The scope of the RI included evaluating surface and subsurface soil, groundwater, surface water, sediment, and seeps within the site boundaries. The data were evaluated to determine if isolated areas of impact exist that are harmful to surface receptors and aquatic biota.

1.2 Site Description and Background

1.2.1 Facility Description

The former Lockbourne AFB is located east of Interstate 71 in Franklin and Pickaway counties, just east of the Village of Lockbourne, Ohio (Figure 1-1). The former AFB covers approximately 4,371 acres, and the site is now occupied by the Columbus Regional Airport Authority (CRAA), the 121st Air Refueling Wing of the Ohio Air National Guard (ANG), the Ohio Army National Guard, Lane Aviation, various retail and service businesses, and a Naval Reserve Center. The former Lockbourne AFB landfill is located within an area of approximately 146 undeveloped acres west of the developed portion of the former Lockbourne AFB.

A site features map is provided as Figure 1-2. The site is bordered by Vause Road to the north, Tank Truck Road to the southeast, and CSX Railroad tracks to the southwest. A high-tension power line crosses the northwest side of the site approximately parallel to Tank Truck Road. An inactive power line corridor runs east to west from Tank Truck Road through the site, ending shortly after crossing the main site access road. Rural residential areas are on the north and south of the site. East of the site is Rickenbacker ANG Base (RANGB), while west of the site is the Village of Lockbourne, Ohio. CRAA maintains control of entry to the site.

1.2.2 Site History

Historical activities at the former Lockbourne AFB site date back to 1942 and include aircraft fueling, preparation, supplying, arming, and air-delivered ordnance removal and handling. Historical documentation reviewed concerning the former Lockbourne AFB landfill indicates that from 1951 to 1979, 51 of the 146 acres, historically referred to as the “heavily used area (HU),” were used for burning and burying wastes from the base. The remaining acres, historically referred to as the “unused to moderately used area (UMU),” were used for surface disposal of various wastes, primarily construction and demolition debris. The terms “heavily used” and “unused to moderately used” are historical terms that have been carried forward only for consistency.

The former Lockbourne AFB landfill received municipal solid waste (MSW), construction and demolition debris, and lime sludge from the base. MSW is believed to have been generated from base housing and other buildings on base. Construction and demolition debris is believed to have been generated during base renovations. Pavement debris is visible at the surface at some locations of the former Lockbourne AFB landfill. Lime sludge generated by the base water treatment plant also is present. Information obtained during the Phase I SI records search (LAW Environmental Services, Inc. [LAW] 1995a) suggests that the former Lockbourne AFB landfill may have received pesticides and herbicides, ammunition, airplane parts, toxic and hazardous materials, household-type garbage, and construction debris. The wastes were reportedly disposed in trenches and on the ground surface. No further historical information relating to the actual types of solid waste in the former Lockbourne AFB landfill is available.

Aerial photographs from 1950, 1957, 1960, 1964, 1971, 1980, 1996, and 2003 (Appendix A); geophysical survey data; soil gas survey data; and surface and subsurface soil data (as summarized later in this report) provide information indicative of the extent and characteristics of disposal. Based on these historical data and site inspection, the former Lockbourne AFB landfill apparently contains construction and demolition debris, industrial waste from AFB processes, and household wastes. In March 1978, the Ohio Environmental Protection Agency (Ohio EPA) inspected the former Lockbourne AFB landfill and recommended restricting use to construction debris disposal only. The inspection report also indicated the presence of approximately 200 feet of permeable sand and gravel deposits beneath the former Lockbourne AFB landfill and noted the presence of the Village of Lockbourne water supply wells less than 0.25 mile to the west (LAW 1995a). The Village of Lockbourne supply well, identified by the Ohio Department of Natural Resources (ODNR) as No. 413418, is located between Commerce, Decker, and Landis streets, and is no longer being used.

1.2.3 Previous Investigations

A reverse chronological list of investigations conducted at the site is presented below and discussed in detail in Section 2.

Period	Entity Conducting the Investigations	Nature of Investigation	Activities Completed
September and October 2008	CH2M HILL	Additional SI	CH2M HILL conducted additional SI work, including the following: – Installation of test pits – Geophysical survey work involving electromagnetic (EM) induction – Sampling for landfill gas
July and August 2003	Ellis Environmental Group, LC (EEG)	RI	EEG conducted the RI, which included the following: – Installation of two upper water-bearing zone (UWBZ) groundwater monitoring wells and collection of one subsurface soil sample from each of two groundwater monitoring wells installed – Installation of one temporary groundwater monitoring well – Collection of 24 surface soil samples, three collocated surface water and sediment samples, one additional sediment sample, one seep sample, and six geotechnical samples from outside the former Lockbourne AFB landfill – Groundwater sampling from 17 groundwater monitoring wells
1997 and 1998	Program Management Company (PMC)	Phase II SI	Phase II investigation during 1997 included the following: – Installation and sampling of three UWBZ and four intermediate depth aquifer (IDA) groundwater monitoring wells – Installation of three piezometers – Subsurface soil sampling at four locations, which were sampled during the Phase I SI – Collection of five collocated surface water and sediment samples, three additional sediment samples, and three seep samples Phase II investigation during 1998 included : – Collection of samples from six groundwater monitoring wells (three UWBZ and three IDA) – Collection of seven surface soil locations

Period	Entity Conducting the Investigations	Nature of Investigation	Activities Completed
1995	Parsons Engineering Science, Inc. (PESI) and LAW	Installation Restoration Program (IRP) SI	• PESI investigated five IRP sites, adjacent to and upgradient from the former Lockbourne AFB landfill, and presented the findings in a separate report (PESI 1995) • LAW (1995a) investigated an additional IRP site
1995	IT Corporation (IT)	Environmental Baseline Survey Investigation	IT conducted a clay layer investigation to determine if the gray clay/silt zone between the UWBZ and IDA at the RANGB is laterally continuous across the former AFB.
1994 and 1995	LAW	Phase I SI	LAW conducted a two-stage Phase I SI Stage 1, conducted in October and November 1994, included the following: – Passive soil gas survey – Geophysical survey – Unexploded ordnance survey Stage 2, conducted in May and June 1995, included the following: – Installation and sampling of three UWBZ groundwater monitoring wells and four IDA groundwater monitoring wells – Collection of hand-augured soil samples from the upper 3 feet of soil at 12 locations – Collection of three collocated surface water and sediment samples from the ditch along the western border of the former Lockbourne AFB landfill – Collection of two seep samples from the eastern bank of the drainage ditch
July 1986	Ecology and Environment, Inc. (E&E)	Site Screening Investigation	USEPA field investigation contractor, E&E, conducted a site screening investigation at the former Lockbourne AFB landfill (E&E 1986), including: – Soil and sediment sampling along the southwestern and northern sides of the former Lockbourne AFB landfill – Groundwater sampling from the Village of Lockbourne residential water supplies

1.3 Report Organization

The report is organized as follows:

- Section 2 presents a summary of site investigation activities.
- Section 3 presents the physical characteristics of the site.
- Section 4 summarizes the analytical results and describes the nature of impact at the site.
- Section 5 discusses the fate and transport of site-specific constituents of interest.
- Section 6 discusses the human health risk assessment (HHRA) for the site.
- Section 7 discusses the ecological risk assessment (ERA) for the site.
- Section 8 presents a summary of the findings and conclusions of the RI.
- Section 9 presents a list of references for this report.

SECTION 2

Study Area Investigation

The present report summarizes the information obtained from previous investigations. A chronological list of the investigation activities is presented in Section 1.2.3. The Phase I and II SIs were followed by the RI activities completed in 2003. The Phase I SI was completed to determine if chemical contaminants are present at the site, their migration potential, and the necessity for additional investigation. Based on the findings of Phase I SI, a Phase II SI was completed to collect additional data. The RI was completed to define the nature and extent of wastes at the landfill and characterize risk. CH2M HILL completed an additional SI in 2008 to further determine the limits of waste disposal and to collect landfill gas samples and seep samples, if available.

This section presents a summary of investigation activities conducted at the site. The most recent SIs are presented first. A summary of all samples collected during the RI and Phase I and II SIs are presented in Tables 2-1a through 2-1e for soil, surface water, sediment, seep, and groundwater, respectively.

2.1 Additional SI Completed in 2008 by CH2M HILL

The intent of the additional SI completed by CH2M HILL during 2008 was to supplement prior data and support completion of the RI process. The SI field activities and procedures were in accordance with the procedures outlined in the *Former Lockbourne AFB Landfill Site Investigation Work Plan* (CH2M HILL 2008) and were approved by USACE and Ohio EPA. The SI report (CH2M HILL 2009) includes the results of the following additional investigation:

- Installation of test pits for better characterization of the limits of wastes at the site and evaluation of the relationship of these findings to previously observed electromagnetic (EM) anomalies
- Geophysical survey work, involving EM in select areas to assist in mapping waste disposal extents
- Collection of landfill gas samples to determine if the former Lockbourne AFB landfill is generating methane gas

Seeps from around the former Lockbourne AFB landfill also were to be investigated; however, multiple attempts over 6 months were made to locate the seeps, but they could not be found. Representatives of CH2M HILL, Ohio EPA, and USACE agreed that the seeps did not exist as persistent features and were excluded from the scope of the SI report. Since the seeps were not present, and the data gathered from previous investigation could not be replicated, and assessment of risk was not conducted using the historical seep data. Presence of seeps was identified by previous consultants, but could not be found nor confirmed by CH2M HILL. An explanation as to what happened to the seeps is speculation, but it may be attributed to changes in the migration of groundwater flow to the surface.

Based on previous investigations and observations made during the SI, CH2M HILL redefined the entire site into two areas of concern (AOCs): AOC 1 and AOC 2 (Figure 1-2). AOC 1 includes areas where waste was present, and includes previously identified HUs and UMUs. AOC 2 is an area where no wastes were identified during the test pitting activities.

2.2 RI Completed in 2003 by EEG

In 2003, EEG completed RI activities at the site in accordance with the project plans approved by USACE and Ohio EPA. Data collected by EEG was presented to Ohio EPA in draft format, but the document was not finalized.

The primary objectives of the field activities completed by EEG during the RI were as follows:

- Collect additional data necessary to determine the nature and extent of impacts at the former Lockbourne AFB landfill
- Identify potential impacts to the drainage ditch located at the site and characterize potential offsite transport of constituents of interest

2.2.1 RI Phase I Field Operations

RI field operations by EEG began on December 3, 2002. In an effort to determine the extent of impact at the former Lockbourne AFB landfill, exploratory trenching near the transmitter property was conducted to determine the horizontal interface of the native material and the former Lockbourne AFB landfill. The trenching report, including photographs and a map, is included as Appendix B1. The draft report was submitted to USEPA, Ohio EPA, and CRAA for review.

Trenching activities were conducted on the east, south, and west corners of the transmitter building property. Visual inspection of the trenches revealed only native material with no evidence of landfill debris. The north corner fell on the access road to the transmitter building, and all parties agreed that no burial of debris was likely to have occurred in the area. At that point, Ohio EPA, USACE, RANGB, and Rickenbacker Port Authority representatives agreed that trenching for transmitter property delineation had been completed and was documented in an Ohio EPA letter dated November 10, 2005.

2.2.2 RI Phase 2 Field Operations

Between July 18 and August 15, 2003, EEG completed the RI Phase 2 activities, and the investigation included collecting and analyzing samples of surface and subsurface soil, surface water, sediment, seep water, and groundwater. Tables 2-1a through 2-1e list the samples collected during the RI.

Field Efforts

The following tasks were performed as part of the RI:

- Installed two groundwater monitoring wells to a depth of 16 feet below ground surface (bgs) and one temporary monitoring well

- Collected 17 groundwater samples (from 15 previously installed monitoring wells and two newly installed wells)
- Collected 24 surface soil samples
- Collected eight subsurface soil samples as follows:
  - Two subsurface soil samples (one sample from each of the two newly installed monitoring wells)
  - Six subsurface soil samples from outside of the former Lockbourne AFB landfill (three samples each from the northern and southern areas of investigation) for geotechnical analysis
- Collected three surface water samples
- Collected four sediment samples
- Collected one seep sample

The analyses conducted on the collected samples are indicated below.

Sample Type	Technique	Analysis
Surface soil	Grab = VOCs only Composite = All remaining fractions	VOCs, SVOCs, TAL metals, pesticides, PCBs, dioxins, explosives
Subsurface soil associated with monitoring well installations	Grab = VOCs only Composite = All remaining fractions	VOCs, SVOCs, TAL metals, pesticides, PCBs, explosives
Subsurface soil outside landfill	Direct push technology (DPT) acetate sleeves	Atterberg limits (ASTM D4318-00), moisture content (ASTM D4959), organic content, bulk density, pH, and sieve analysis for grain size and particle distribution (ASTM D422-63)
Surface water	Grab	All samples - SVOCs, TAL metals, pesticides, and PCBs Only EEGLKB-SW/SD01 – Dioxins and explosives in addition to the above
Sediment	Grab = VOCs only Composite = All remaining fractions	All samples – VOCs, SVOCs, TAL metals, pesticides, and PCBs Only EEGLKB-SW/SD01 – Dioxins and explosives in addition to the above Only EEGLKB-SD04 – Explosives in addition to the above
Seep	Grab	VOCs, SVOCs, TAL metals, pesticides, PCBs, dioxins, explosives
Groundwater	Low flow sampling	All wells - VOCs, SVOCs, TAL metals, pesticides, PCBs LCKMW-4, 15, and 16 – Dioxins and explosives in addition to the above LCKMW-7 and 13 – Dioxins in addition to the above

Sample Type	Technique	Analysis
IDW (water)	Grab	Total analytes
IDW (soil)	Grab	Full TCLP

IDW – investigation-derived waste
SVOC – semivolatile organic compound
TCLP – toxicity characteristic leaching procedure
PCB – polychlorinated biphenyl
TAL – target analyte list
VOC – volatile organic compound

The following appendices include pertinent information related to RI activities:

- B2 - Analytical results
- B3 - Sampling protocols followed during RI
  - B3-1 – Data Validation Report by EEG
  - B3-2 – Investigation-derived waste manifests and laboratory analysis
- B4 – Chain-of-custody forms
- B5 - Photographs related to installation of two new monitoring wells
- B6 – Field forms
- B7 – Boring logs and well construction logs
- B8 - Field change request forms
- B9 - Geotechnical results

Installation of Two Monitoring Wells and One Temporary Well

Two shallow monitoring wells were installed during the RI. Monitoring well LCKMW-15 is located in the northwest section of the site, while LCKMW-16 is located in the southeast section. Both wells are installed outside and downgradient of the former Lockbourne AFB landfill (Figure 2-1). The locations were selected as areas most likely to be representative of the upper water-bearing zone (UWBZ) in the former Lockbourne AFB landfill. The two shallow monitoring wells were installed using hollow-stem auger drilling methods, and each boring was advanced to a depth of 16 feet bgs.

An attempt was also made to install one temporary well, LCKTW-1 (Figure 2-1), during the installation of the other site monitoring wells. The total depth of LCKTW-1 was 7.86 feet bgs before refusal. Water was encountered at 6.76 feet bgs. The initial attempt to sample this well was unsuccessful, as approximately 12 ounces of brown viscous mud were recovered before the well went dry. After consultation with USACE, no further attempts were made to reinstall and sample the temporary well, and the boring was abandoned. Completed field change request forms are included in Appendix B8.

Surface and Subsurface Soil Sampling

Surface soil sampling locations were based upon previous soil gas data, stressed vegetation, and obvious burn areas. Subsurface soil sampling locations immediately outside the former Lockbourne AFB landfill were based on volatile organic compound (VOC) screening and absence of landfill debris in DPT acetate liners. Belasco Drilling Services, Inc. of Columbus, Ohio, was contracted for DPT borings and monitoring well installations. Figures 2-2 and 2-3 show the surface and subsurface soil sample locations.

Geotechnical analyses were performed to determine the engineering properties of soil beneath the site. The RI included six geotechnical samples collected from two DPT borings outside the former Lockbourne AFB landfill (EEGLKB-DPT-02S and EEGLKB-DPT-03N). Both DPT borings terminated in clayey sand at 16 feet bgs.

Samples were collected from both DPT borings at 2- to 4-foot bgs interval. The 2- to 4-foot bgs interval from EEGLKB-DPT-02S was classified as sandy lean clay, while the 2- to 4-foot bgs interval from EEGLKB-DPT-03N was classified as a fat clay with sand. A geotechnical sample was collected from EEGLKB-DPT-02S at 5- to 7-foot bgs interval and one from EEGLKB-DPT-03N at 6- to 8-foot bgs interval. Both of these samples were classified as sandy lean clay to lean clay with sand. Geotechnical samples were collected in both borings from the 10- to 12-foot bgs horizon; both were classified as clayey sand units. These classifications are consistent with silty clay with interbedded sand lenses of the unconsolidated surficial deposit that is laterally continuous under the former Lockbourne AFB landfill area. Soil classifications of the samples collected in association with monitoring well installations and DPT borings were consistent.

The six geotechnical samples were submitted to Midwest Testing Laboratories in Fargo, North Dakota, for analysis. Samples were submitted in sealed (capped and taped) acetate liners. The following geotechnical analyses were performed on the six samples:

- Grain-size distribution in accordance with American Society for Testing and Materials (ASTM) D422-63
- Atterberg limits in accordance with ASTM D4318-00; this analysis determined the liquid limit, plastic limit, and plasticity index of the soil
- Bulk density, moisture content, soil pH, organic content, and percent solids

Results of the geotechnical soil analyses are provided in Appendix B9.

Although samples were collected for geotechnical analyses, no samples were collected for laboratory chemical analysis during subsurface soil sampling outside the former Lockbourne AFB landfill. Sample collection for chemical analyses was performed during the subsurface soil sampling associated with monitoring well installation only.

The subsurface soil samples associated with monitoring well installations were obtained using the split-spoon sampling technique employed with the hollow-stem auger drilling method. The borings were advanced until groundwater was encountered. Samples from LCKMW-15 were collected from the 4- to 6-foot bgs interval because of high photoionization detector (PID) readings. Samples from LCKMW-16 were collected immediately above the water table (8 to 10 foot bgs interval). Soil samples were field classified in accordance with the Unified Soil Classification System and recorded on a monitoring well boring log (Appendix B7).

Surface Water and Sediment Sampling

EEG collected three surface water and four sediment samples from the drainage ditch at locations between a reinforced concrete structure and where the ditch enters the junction box under the intersection of Vause Road and Canal Road (Figure 2-4). The justifications for the sample locations were as follows:

- EEGLKB-SW01 and EEGLKB-SD01 were selected to characterize surface water and sediment at the ditch outfall from the former Lockbourne AFB landfill.
- EEGLKB-SW03 and EEGLKB-SD03 were selected to characterize surface water and sediment at the downstream end of the concrete structure.
- EEGLKB-SW02 and EEGLKB-SD02 were selected approximately midway between the other two sample locations to best characterize sediment and surface water along the ditch.
- Sediment sample EEGLKB-SD04 was collected offsite adjacent to Canal Road, north of the former Lockbourne AFB landfill drainage ditch.

Surface water and sediment samples were collected during non-storm conditions, and from mid-stream and at mid-depth. Field measurements of pH, specific conductance, temperature, and turbidity were collected at each sampling location and recorded on a surface water sampling form (Appendix B6). The collocated sediment samples were collected after surface water was sampled to eliminate the potential for inclusion of resuspended sediment in water samples. Sediment samples were collected using a stainless steel trowel. The VOC fraction was placed directly in the sample container. For all other analyses, sediment was placed into a stainless steel bowl, homogenized using the sampling trowel, and then transferred into the appropriate sampling containers. A sediment sampling form (Appendix B6) was completed for each sample collected.

Seep Sampling

The length of the ditch and banks on the southeast and southwest boundaries of the former Lockbourne AFB landfill were inspected for seeps on August 7, 2003. One active seep was located approximately 1,050 feet northwest of the reinforced concrete structure (Figure 2-5). No other seeps were located. A field change request form regarding seep sample collection is included in Appendix B8, as originally up to five samples were proposed.

The single seep sample was collected by grab method using the laboratory-supplied sample containers. Field measurements of pH, conductivity, temperature, and turbidity were collected and recorded on the seep sampling field data form (Appendix B6). Samples were placed immediately in a pre-chilled cooler and shipped to Severn Trent Laboratory (STL) in Chicago.

Groundwater Sampling

Groundwater samples were collected from the two new monitoring wells and from previously installed monitoring wells during initial (August 2003) and subsequent quarterly sampling events. The new monitoring wells and existing monitoring wells are listed below (Figure 2-1).

Existing Wells	New Wells
LCKMW-1, LCKMW-2, LCKMW-3, LCKMW-4, LCKMW-5, LCKMW-6, LCKMW-7, LCKMW-8, LCKMW-9, LCKMW-10, LCKMW-11, LCKMW-12A, LCKMW-13, LCKMW-14, RB25MW-7	LCKMW-15, LCKMW-16

LCKMW-7 is located west of the drainage ditch, on the east side of the Village of Lockbourne. There are seven well pairs at the site, with one monitoring well screening in the UWBZ and the other screening in the IDA. These well pairs are:

- LCKMW-1 (IDA) and LCKMW-2 (UWBZ)
- LCKMW-3 (IDA) and RB25-MW7 (UWBZ)
- LCKMW-4 (UWBZ) and LCKMW-14 (IDA)
- LCKMW-5 (IDA) and LCKMW-6 (UWBZ)
- LCKMW-8 (IDA) and LCKMW-9 (UWBZ)
- LCKMW-10 (IDA) and LCKMW-11 (UWBZ)
- LCKMW-12A (IDA) and LCKMW-13 (UWBZ)

Wells LCKMW-1, LCKMW-2, LCKMW-8, and LCKMW-9 are located upgradient; all other wells are located on the western half of the site.

Groundwater level measurements were collected from site wells, and potentiometric surface maps of the UWBZ and IDA were created using water level measurements. The water level measurement log forms are included in Appendix B6.

2.2.3 Surveying

An Ohio-licensed surveyor identified the horizontal coordinates of the ground surface at each soil, seep, surface water, and sediment sampling point, and the natural ground surface and the top of the casing elevations of each groundwater monitoring well (including the temporary well). The horizontal coordinates were surveyed to an accuracy of ±1 foot within the Ohio State Plane Coordinate System using the North American Datum of 1983. The elevations were surveyed to within ±0.01-foot referenced to the National Geodetic Vertical Datum survey of 1929. The surveyed coordinates of RI sampling locations are listed in Table 2-2. EEG used hand-held global positioning system units to locate the DPT sampling locations and locations of other field observations as needed.

2.3 Phase II SI Completed in 1997 and 1998 by PMC

PMC conducted a Phase II SI during 1997 and 1998. Tables 2-1a through 2-1e list the samples collected during the Phase II SI. The overall objective of the Phase II SI was to determine the presence or absence of impacts that may have resulted from U.S. Department of Defense (DoD)-related activities. Specific objectives of the Phase II SI were as follows:

- Implement a groundwater investigation plan to address specific data gaps from the Phase I SI
- Identify site-specific background levels of constituents in groundwater
- Determine if migration of constituents of interest from the former Lockbourne AFB landfill is occurring
- Perform a risk screening analysis
- Determine if the former Lockbourne AFB landfill qualifies as a site eligible for a presumptive remedy
- Make appropriate recommendations regarding additional investigation

1997 Field Efforts

The following tasks were performed as part of the Phase II SI:

- Seven monitoring wells (three UWBZ wells and four IDA wells) were strategically installed to supplement existing well locations and provide UWBZ and IDA groundwater quality information at upgradient and downgradient locations, relative to the former Lockbourne AFB landfill location (Figure 2-1):
  - Three UWBZ wells (LCKMW-9, LCKMW-11, and LCKMW-13) were installed to depths of 13.63, 15.52, and 26.57 feet bgs, respectively.
  - Four IDA wells (LCKMW-8, LCKMW-10, LCKMW-12A, and LCKMW-14) were installed to depths of 71.33, 86.85, 74.91, and 91.10 feet bgs, respectively.
- Three piezometers (LCKPZ-1, LCKPZ-2, and LCKPZ-3) were installed along the southwestern bank of the creek to evaluate groundwater flow conditions to the creek (Figure 2-1).
- Surface and subsurface soil samples were collected from four locations (LCKSO-1, LCKSO-6, LCKSO-7, and LCKSO-8) (Figures 2-2 and 2-3) that were previously sampled during the Phase I SI and analyzed for select constituents (dioxins and metals) to augment the data collected during the Phase I SI. These four locations were selected for resampling, as the Phase I SI samples collected from these locations contained the highest concentrations of constituents of interest. Additional surface and subsurface soil samples were analyzed for target compound list (TCL) VOCs, TCL semivolatile organic compounds (SVOCs), target analyte list (TAL) metals, polychlorinated biphenyls (PCBs), pesticides, dioxins, explosives, total and amenable cyanide, sulfate, and nitrate.

- Five collocated surface water and sediment samples were collected from the drainage ditch bordering the former Lockbourne AFB landfill (Figure 2-4). Collocated surface water and sediment samples were analyzed for TCL VOCs, TCL SVOCs, TAL metals (total and dissolved), pesticides and PCBs, explosives, total and amenable cyanide, sulfate, and nitrate.
- Three seeps were sampled to evaluate the potential migration of chemicals of potential concern (COPCs) from the former Lockbourne AFB landfill (Figure 2-5). Seep samples were analyzed for TCL VOCs, TCL SVOCs, TAL metals (total and dissolved), PCBs and pesticides, explosives, total and amenable cyanide, sulfate, and nitrate.
- The seven new wells and nine existing wells were surveyed and sampled. Groundwater samples were analyzed for TCL VOCs, TCL SVOCs, TAL metals (total and dissolved), PCBs and pesticides, dioxins, explosives, and total and amenable cyanide.

1998 Field Efforts

Based on the results of the 1997 Phase II SI field efforts, additional site characterization efforts were conducted in 1998 (PMC 2000) to:

- Determine off-landfill concentrations of dioxins in soil
- Establish the nature and concentration of dioxins in groundwater at select locations
- Investigate potential sources of dioxins detected in environmental media

The results were used to determine potential human health risks posed by dioxins detected in soil and groundwater.

The 1998 field efforts consisted of the following tasks:

- Seven surface soil samples were collected to establish offsite soil dioxin levels and assess potential point source contributions of dioxins from upgradient sources.
- Three sediment samples (LCKSD-10, LCKSD-11, and LCKSD-12) (Figure 2-4) were collected from drainage features upgradient of the former Lockbourne AFB landfill but downgradient of potential dioxin sources, such as a former coal-burning heating plant and areas where burning occurred.
- Six groundwater monitoring wells (LCKMW-7, LCKMW-10, LCKMW-11, LCKMW-12A, LCKMW-13, and 14-MW1) (Figure 2-1) were sampled to determine total and dissolved dioxin concentrations in groundwater.

2.4 Phase I SI Completed in 1994 and 1995 by LAW

LAW (1995a) conducted a two-stage Phase I SI at the former Lockbourne AFB landfill during 1994 and 1995. Tables 2-1a through 2-1e list the samples collected.

1994 Field Efforts

The initial part of the Phase I SI consisted of a geophysical survey, passive soil gas survey, and unexploded ordnance (UXO) survey conducted at the former Lockbourne AFB landfill during October and November 1994 (LAW 1995a). The results of these surveys were the basis for determining subsequent sampling locations. The results of the geophysical survey indicated that the greatest density of geophysical anomalies was located primarily within a 51-acre area believed to have been used for burning and disposal of wastes from the former AFB. A conductive plume search was performed in two areas along the presumed downgradient boundary of the former Lockbourne AFB landfill, but none was noted. Additionally, landfilling activity beyond the presumed downgradient boundary was not noted (LAW 1995a).

The most prevalent compounds detected during the soil gas survey were benzene, toluene, ethylbenzene, xylenes, and total petroleum hydrocarbons (LAW 1995a). The results of the soil gas survey were interpreted as indicative of a release of petroleum products near the northern border of the transmitter station, and other sporadically distributed localized surface or subsurface releases of common petroleum products and solvents. Most of the detected soil gas concentrations corresponded with geophysical anomalies. Analyses for other landfill gases, such as methane, were not performed during the Phase I SI soil gas survey.

During the UXO survey, nonhazardous UXO-related materials, classified as training materials, were encountered in two locations in the eastern half of the site. One object, a primer ribbon from an air-to-surface missile, was found in the low-lying grass area in the north-central section of the former Lockbourne AFB landfill (LAW 1995a).

1995 Field Efforts

Stage 2 of the Phase I SI was performed during May and June 1995. This effort consisted of the following activities:

- Installing and sampling three shallow UWBZ monitoring wells (LCKMW-2, LCKMW-4, and LCKMW-6) and four IDA monitoring wells (LCKMW-1, LCKMW-3, LCKMW-5, and LCKMW-7) (Figure 2-1)
- Collecting hand-augered soil samples from the upper 3 feet of soil at 12 locations (Figures 2-2 and 2-3)
- Collecting three collocated surface water and sediment samples from the drainage ditch along the western boundary of the former Lockbourne AFB landfill (Figure 2-4)
- Collecting two seep samples from the eastern bank of the west drainage ditch (Figure 2-5)

Sample Analysis

- Groundwater samples collected from seven wells were tested for VOCs, SVOCs, PCBs, pesticides, 11 inorganics (arsenic, barium, cadmium, chromium, iron, lead, manganese, mercury, sodium, selenium, and zinc), explosives, nitrate, and sulfate (LAW 1995b).
- Soil samples were tested for VOCs, SVOCs, PCBs, pesticides, nine inorganics (arsenic, barium, cadmium, chromium, lead, mercury, silver, selenium, and zinc), and explosives (LAW 1995b).

- Surface water samples were analyzed for VOCs, SVOCs, PCBs, pesticides, nine inorganics (arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver, and zinc), explosives, nitrate, and sulfate (LAW 1995b).
- Sediment samples were analyzed for VOCs, SVOCs, PCBs, pesticides, eight inorganics (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver), and explosives (LAW 1995b).
- Seep samples were analyzed for VOCs, SVOCs, PCBs, pesticides, nine inorganics (arsenic, barium, cadmium, chromium, lead, mercury, silver, selenium and zinc), explosives, nitrate, and sulfate (LAW 1995b).

2.5 Background Concentrations

The background data were evaluated to distinguish between chemical concentrations that may be related to past or current activities at the site and those that appear representative of naturally occurring conditions or that may be attributable to non-site-related anthropogenic activities (e.g., the historical, widespread, and routine application of pesticides). Background soil concentrations were obtained during the *Supplemental Phase II Environmental Baseline Survey Investigation* (IT 1995). In order to establish the soil background concentrations for the site, statistical calculations were performed to determine the number of detections in the data set for each analyte, the maximum concentration detected, the distribution of the background values (i.e., whether the distribution is normal or lognormal), and the 95th percentile. The representative background concentration was identified as the 95th percentile or the maximum detected value if the maximum detected value was less than the 95th percentile. The procedure of using the 95th percentile for soil background concentrations differs from the background calculation methodology recommended by Ohio EPA (Ohio EPA 2004a, 2004b). Ohio EPA recommends calculating the background concentration levels as the upper cutoff value of the data set defined as the upper quartile (i.e., 75th percentile) + 1.5 (interquartile range).

A comparison was performed between sediment and surface water concentrations to the upgradient concentrations from collocated surface water and sediment samples collected during Phase II from each branch of the ditch. Surface water sample LCKSW-1 and sediment sample LCKSD-1 were collected from the East Ditch and used as background comparison criteria for samples collected in the East Ditch. Surface water sample LCKSW-3 and sediment sample LCKSD-3 were collected from the West Ditch and used as background comparison criteria for samples collected in the West Ditch. Three additional sediment samples (LCKSD-10, LCKSD-11, and LCKSD-12) were collected from drainage areas upgradient of the former Lockbourne AFB landfill (Figure 2-4).

For groundwater, background samples were collected from five upgradient wells: LCKMW-1, LCKMW-2, LCKMW-8, LCKMW-9, and 14-MW1 (Figure 2-1). Four of these wells are located along the northern edge of the former Lockbourne AFB landfill. The fifth well is located adjacent to the northern end of the runway. These wells are upgradient of the former Lockbourne AFB landfill and are not considered to be impacted by activities at the former Lockbourne AFB landfill. Three of these wells were screened in the UWBZ, and two were completed in the IDA. Background concentrations from the IDA were used as comparison criteria for samples collected from monitoring wells in the IDA. Groundwater background levels from the UWBZ were used as background comparison criteria for the sample collected from monitoring wells in the UWBZ and were used as background comparison criteria for seep data. Soil, surface water, and groundwater background concentrations are presented in Tables 2-3a through 2-3c.

The representative background concentrations for groundwater were not calculated using the upper quartile method recommended by Ohio EPA (2004b). Instead, background concentrations were calculated as upper tolerance limits (UTLs) using guidance recently released by USEPA (USEPA 2007a). The groundwater data for each constituent were evaluated with regard to sample size, distribution, and variability to determine an appropriate statistical method as described in USEPA guidance (USEPA 2007a) and applied in ProUCL software (Version 4.0). These were targeted to be 95/95 UTLs (which are 95 percent upper confidence limits of the 95th percentile of the background population), although the inability to assign an assumption of normality to some cases resulted in a nonparametric approach including the Kaplan Meier approach. The Kaplan Meier approach is a nonparametric alternative when non-detects are present that does not require proxy substitutions for non-detects, and tends to provide 95 percent upper confidence limits of a lower percentile. In summary, the representative background concentrations for groundwater were identified as the 95/95 UTLs or the maximum detected value if the maximum detected value was less than 95/95 UTL.

Uncertainties associated with the calculation of soil and groundwater background concentrations (e.g., selection of COPCs and hot spots) are discussed in Section 6.7.4. Evaluations of analytical results with respect to background concentrations are also detailed in Section 6.

2.6 Adjacent IRP Site Activities

IRP Sites 7, 9, 20, 25, 26, and 27 (Figure 1-2) were screened against a commercial/industrial reuse scenario, applicable during the time of sampling. These sites were identified because of the potential that releases associated with these sites contribute to background conditions for the former Lockbourne AFB landfill. Although monitoring wells associated with the adjacent IRP sites were not installed to directly monitor the former Lockbourne AFB landfill, two monitoring wells (RB25-MW7 and RB25-MW9) were sampled as part of the Phase I and Phase II SI sampling activities. The sample results from these wells are discussed in Section 4. A brief summary for each site and their closure status is provided below.

Site 7 – No. 2 Fuel Oil Tank

Site 7 is a No. 2 fuel oil aboveground storage tank (AST) located near the center of the former Lockbourne AFB landfill (Figure 1-2). A release of approximately 200 to 500 gallons of No. 2 fuel oil reportedly occurred at this site. The Air Force conducted investigations at the site, and subsequently a No Further Remedial Action Planned (NFRAP) Decision Document was signed for this site.

Site 9 – Salvage Yard

COPCs detected in soil samples collected from this site were polynuclear aromatic hydrocarbons (PAHs), priority pollutant metals, and pesticides (upper 3 feet of soil only). COPCs detected in groundwater at this site were dissolved metals (antimony, arsenic, lead, nickel, and thallium) and pesticides (aldrin, Endosulfan II, and heptachlor epoxide), which were found in only one well. The presumed sources of impact include a documented fire and release of pesticides and undocumented releases of previously stored materials. An NFRAP Decision Document was signed for this site. Findings for Site 9 were reported in the *Final Remedial Investigation Phase I Data Report* (Parsons Engineering Science, Inc. [PESI] 1995) and the *Final Phase II RI Report* (IT 1998).

Site 20 – South Coal Pile

COPCs detected in soil collected from this site were PAHs and priority pollutant metals. COPCs detected in groundwater at this site were dissolved metals (arsenic, copper, cadmium, chromium, zinc, and lead). Presumed sources of impact include runoff from the South Coal Pile and other coal-related activities. An NFRAP Decision Document was signed for this site. Findings for Site 20 were reported in the *Final Remedial Investigation Phase I Data Report* (PESI 1995) and the *Final Phase II RI Report* (IT 1998).

Site 25 – Drainage System, Southwest Quadrant

COPCs detected in soil collected from this site were VOCs, SVOCs, and metals (lead, mercury, and zinc, one sample each). COPCs detected in ditch sediment were VOCs, SVOCs, pesticides, and priority pollutant metals, particularly lead and mercury. COPCs detected in groundwater were toluene, dichloroethene (DCE), dissolved lead, thallium, and arsenic. COPCs detected in surface water were SVOCs, pesticides, and priority pollutant metals. Presumed sources of impact include runoff from coal piles, runoff from Site 9, ash fallout from the old coal-burning heating plant, releases from Sites 3 and 4 (old pump houses), and smaller releases from aircraft maintenance and parking areas, runoff from runways, and possibly the old landfill. A Decision Document was issued in September 2001 stating that no further action would be required at the Site 25 Drainage System. Findings for Site 25 were reported in the *Final Phase II RI Report* (IT 1998) and the *January 1996 Remedial Investigation Phase I Data Report, Addendum Sites 25 and 27* (PESI 1996).

Site 26 – Transformer Storage

No further action was recommended for this site, since no PCBs were detected in soil samples (LAW 1995a). An NFRAP Decision Document was signed for this site. Findings for Site 26 were reported in the *Final Remedial Investigation Phase I Data Report* (PESI 1995).

Site 27 – Drainage Ditch Near Landfill Gate

COPCs detected in soil samples collected from this site were VOCs, SVOCs, and zinc (one sample only). COPCs detected in ditch sediment were VOCs, SVOCs, pesticides, and metals (arsenic, cadmium, chromium, lead, selenium, and zinc). COPCs detected in groundwater were toluene and dissolved metals (arsenic, copper, thallium, and zinc). COPCs detected in surface water were acetone and priority pollutant metals. Presumed sources of impact include point and nonpoint source releases to the ditch system and an August 1982 release of an unidentified industrial solvent. A Decision Document was issued in September 2001 stating that no further action would be required. Findings for Site 25 were reported in the *January 1996 Remedial Investigation Phase I Data Report, Addendum Sites 25 and 27* (PESI 1996).

2.7 USEPA Site Screening Investigation

In July 1986, the USEPA field investigation contractor, Ecology and Environment, Inc. (E&E), conducted a site screening investigation of the former Lockbourne AFB landfill. The investigation consisted of soil and sediment sampling along the southwestern and northern sides of the former Lockbourne AFB landfill and groundwater sampling from the Village of Lockbourne residential water supplies. Analytical results indicated presence of organic and inorganic analytes above background levels in soil and sediment samples. Inorganic analytes were detected in groundwater samples, but they were at concentrations below background levels (E&E 1986).

SECTION 3

Physical Setting

This section presents a summary of the physical characteristics of the site, including physiography, soils, drainage, geology, hydrogeology, climate, and land use. The summary is based on previous investigation activities conducted at the site. The main landfill investigation area consists of approximately 146 acres of partially open areas surrounded by densely wooded and overgrown areas. A portion of the 146 acres was used for waste disposal. Grass and low weeds cover large areas of the former Lockbourne AFB landfill with tall, dense brush, trees, and visible construction and demolition debris in intervening areas. The ground surface is generally hummocky because of disturbance and uneven settling of the ground surface in the area of former waste disposal trenches.

3.1 Physiography

The former Lockbourne AFB is located in the Central Lowland Province, which is characterized by low relief and elevation, and is located in the western half of Ohio. The Central Lowland Province consists of the Lake Plain and Till Plains physiographic sections. The former Lockbourne AFB lies within the Till Plains section of the Central Lowland Province. The Till Plains are extensive areas with a flat to slightly undulating terrain, consisting of a mixture of clay, sand, gravel, and boulders deposited by glaciers of the Pleistocene Age.

3.2 Soils

The U.S. Department of Agriculture Soil Conservation Service has described the soils near the former Lockbourne AFB landfill to be of two series: the Crosby series and the Kokomo series (National Cooperative Soil Survey 1980). The Crosby series consists of deep, somewhat poorly drained, slowly permeable soils formed in high-lime glacial till on uplands; slope ranges from 0 to 6 percent. The Kokomo series consists of deep, very poorly drained, moderately slowly permeable soils formed in high-lime Wisconsin Age glacial till on uplands; slope ranges from 0 to 2 percent.

3.3 Drainage

The former Lockbourne AFB is located on the drainage divide between Big Walnut Creek and Walnut Creek, with the former Lockbourne AFB landfill site lying within the Big Walnut Creek basin. Surface drainage at the site is controlled through an extensive network of storm drains, which include corrugated metal, concrete drainage pipes, and open drainage ditches. Surface water is routed through an oil/water separator prior to release into the surrounding surface streams (Engineering Science [ES] 1992).

The greater Columbus area is situated in the center of the state and in the drainage area of the Ohio River. Two rivers, the Scioto and Olentangy, flow through and near the city. The former Lockbourne AFB landfill is within the Scioto River watershed. Elevation is 833 feet at Columbus and 730 feet at the former Lockbourne AFB landfill.

3.4 Geology

As stated in the Phase II SI report (PMC 2000), the former Lockbourne AFB area is characterized by approximately 200 feet of Pleistocene glacial drift, which fills a pre-glacial bedrock valley. Shales of the Ohio and Olentangy formations and limestones of the Columbus and Delaware formations underlie the area. The shale and limestone bedrock are Devonian Age. The surficial tills are mainly associated with ground moraine. Alluvial deposits are found in association with Walnut and Big Walnut creeks. The soils near the former Lockbourne AFB consist of medium textured glacial till and glacial outwash, mainly derived from limestone and dolomite.

The geology of the former Lockbourne AFB landfill area has been based upon field logs prepared during the Phase II SI and previous investigations conducted by ES (1992), IT (1995), and LAW (1995a). The uppermost unconsolidated unit consists of about 80 feet of clayey, silty till with alternating sand and gravel deposits. This till is underlain by two sand and gravel deposits, which are approximately 50 to 100 feet deep and separated by a layer of clay and silt, which is up to 60 feet thick. Shale and limestone bedrock underlies the unconsolidated deposits.

Shallow wells screened in the uppermost, unconsolidated geologic unit reveal a shallow water table with flow directed west and southwest. Logs from private wells north of the former Lockbourne AFB landfill and an abandoned water supply well for the heating plant northeast of the former Lockbourne AFB landfill (Figure 1-2) indicate clay deposits from the ground surface to about 60 to 70 feet bgs. This is underlain by sand and gravel deposits to the completion depths of the wells (ranging from 62 to 100 feet bgs) (Figures 3-1, 3-2, and 3-3). Figure 3-1 presents a plan view of two cross-section locations constructed across the unconsolidated stratigraphy of the site, and Figures 3-2 and 3-3 presents the east-west and north-south cross-sections, respectively. The cross-sections and the plan view were obtained from the Phase II SI report (PMC 2000). The geology at the former Lockbourne AFB consists of clayey silty till alternating with relatively extensive sand and gravel deposits. Underlying the unconsolidated glacial deposits are Devonian shales (ES 1992).

3.4.1 Geotechnical Analyses Completed in 2003

Subsurface soil samples were collected during RI from the northern and southern investigation areas to evaluate the character of downgradient soil, ascertain that the borings were outside the former Lockbourne AFB landfill, and help locate two additional downgradient monitoring wells. No chemical analysis was associated with subsurface soil sampling outside the former Lockbourne AFB landfill.

Northern Area of Investigation

Of the three DPT borings completed, samples were collected only from boring EEGLKB-DPT-03N to evaluate the soil characteristics. Soil boring EEGLKB-DPT-03N was advanced to 12 feet bgs, with groundwater encountered at approximately 8 feet bgs. The boring log for EEGLKB-DPT-03N is in Appendix B7. PID readings ranged from 8.1 parts per million (ppm) (surface to 2-foot bgs interval) to 68.3 ppm (4- to 6-foot bgs interval). No odor was detected in the samples. No evidence of landfill debris was encountered in the boring.

Geotechnical samples representing distinct lithologies were collected from 2- to 4-foot bgs, 6- to 8-foot bgs, and 10- to 12-foot bgs horizons. Geotechnical analysis, performed by Midwest Testing Laboratories in Fargo, North Dakota, determined the lithology and characteristics of boring EEGLKB-DPT-03N (Table 3-1 and Appendix B9).

The samples are believed to be representative of an uppermost silty clay unit and of sand lenses that are scattered across or interbedded in the clay, and are consistent with the boring logs. Monitoring well LCKMW-15 was installed approximately 6 feet west-southwest of boring EEGLKB-DPT-03N.

Southern Area of Investigation

The southern area of sampling outside the former Lockbourne AFB landfill was densely forested. Two DPT borings were completed in the southern area of investigation, and no evidence of landfill debris was found in the second boring. Geotechnical samples were collected from one boring from the 2- to 4-foot bgs, 5- to 7- foot bgs, and 10- to 12- foot bgs horizons. No odor or evidence of landfill debris was detected in the samples. Geotechnical analysis determined the lithology and characteristics of boring EEGLKB-DPT-02S (Table 3-1).

The samples are representative of an uppermost silty clay unit and of sand lenses that are scattered across or interbedded in the clay, and are consistent with the boring logs. LCKMW-16 was installed approximately 6 feet northeast of boring EEGLKB-DPT-02S.

3.4.2 Phase II SI Soil Boring Sample Results

Soil samples were collected for geotechnical analyses, including grain size, moisture content, and Atterberg limits. Soil classification results based on geotechnical data obtained from grain size and Atterberg limits are listed in Table 3-2. The results obtained indicate:

- Evidence of uppermost silty clay unit:
  - Uppermost sample from boring LCKSB-8, collected between 22 and 24 feet bgs, was classified as sandy silty clay, and the sample collected from the 58- to 63-foot bgs interval was classified as lean clay with sand.
  - Soil samples collected from the 8- to 10-foot depth interval of boring LCKSB-9 were classified as clayey sand with gravel.
  - Samples collected from boring LCKSB-13 between 6 and 6.5 feet bgs were classified as poorly graded sand with silt. Samples collected between 18 and 18.5 feet bgs in the same boring were classified as lean clay with sand.
  - Samples collected from LCKSB-14 between 5.5 and 29 feet bgs and between 63.5 and 64 feet bgs were classified as predominantly sand with varying amounts of silt and clay. Samples collected from the same boring between 43.5 and 44 feet bgs were classified as lean clay with sand.

- Nature of the soils in the IDA:
  - The IDA was evident in samples collected between 74.5 and 78 feet bgs from LCKSB-8.
  - The deepest sample collected from boring LCKSB-10 was taken at the 80- to 85-foot depth interval. This sample was classified as silty clayey sand.
  - The deepest sample collected from boring LCKSB-14 was taken from the 78.5- to 79-foot depth interval. This sample was classified as silty clayey sand with gravel.
- Evidence of interbedded sand lenses that exist throughout the unconsolidated silty clay:
  - Four of the samples collected from boring LCKSB-8 were classified as predominantly sand with varying amounts of silt and clay. Three of these samples were collected between 38 and 58 feet bgs.
  - Five samples collected from boring LCKSB-10 between 9 and 69.5 feet bgs were classified as predominantly sand with varying amounts of silt and clay.
  - Samples collected from boring LCKSB-12 between 7.5 and 70 feet bgs were classified as predominantly sand with varying amounts of silt and clay and occasional gravel.

3.5 Hydrogeology

The hydrogeologic setting of the former Lockbourne AFB landfill area is characterized by the presence of three water-bearing zones that are separated by relatively impermeable sediment. The three zones are the UWBZ, IDA, and the deep sand aquifer, which are described below.

UWBZ groundwater exists at depths ranging between 4 and 16 feet bgs in interbedded sand lenses of the upper silty clay unit. The upper silty clay unit is present from the ground surface to depths ranging from approximately 55 feet to more than 80 feet in the area of the former Lockbourne AFB landfill (Figures 3-2 and 3-3). Geotechnical analyses have characterized the grain size of the gray clay layer within this unit as silty lean clay that would typically have permeability of approximately $5x10^{-8}$ to $2.5x10^{-7}$ centimeters per second (cm/sec) (IT 1998). This gray clay layer appears to be laterally continuous throughout the former Lockbourne AFB landfill and RANGB where its thickness is more than 20 feet. The gray clay layer within the upper silty clay unit is believed to be an effective aquitard (a zone within the earth that restricts the flow of groundwater from one aquifer to another) between the shallow water-bearing zone and the lower water-bearing zones (IT 1998).

The IDA is present in the sand and gravel deposits at depths exceeding 50 feet bgs, where it is under confined conditions. The deep sand aquifer is separated from the IDA by a silt and clay layer that inhibits interconnection between the aquifers.

3.5.1 Monitoring Wells Installed at Landfill

Seven monitoring wells (LCKMW-1 through LCKMW-7) were installed at the former Lockbourne AFB landfill as part of the Phase I SI (LAW 1995a). The depths of the UWBZ wells ranged between 19 and 23 feet bgs, while the depths of the IDA wells ranged between 56 and 80 feet bgs (Table 3-3).

To supplement previous well locations and provide additional UWBZ and IDA groundwater quality information, seven monitoring wells (LCKMW-8 through LCKMW-14) were installed during the Phase II SI. The depths of the UWBZ wells ranged between 13.5 and 26.5 feet bgs, while the depths of the IDA wells ranged between 71 and 91 feet bgs (Table 3-3).

Two additional UWBZ monitoring wells (LCKMW-15 and LCKMW-16), located immediately outside the former Lockbourne AFB landfill, were installed during the RI. Both wells were screened in shallow sand lenses within the uppermost silty clay (in the UWBZ) and were drilled to 16 feet bgs (Table 3-3). LCKMW-15 penetrated a saturated zone at 7 feet bgs, and LCKMW-16 penetrated a saturated zone at 10 feet bgs. These were installed in the sandy intervals occurring within the uppermost silty clay.

Thirteen monitoring wells were installed at areas adjacent to the former Lockbourne AFB landfill as part of IRP site characterization activities. These existing monitoring wells are less than 20 feet deep and have revealed the presence of a shallow, topographically controlled water table with a gradient and flow direction to the west-southwest and within silty clay till surficial deposits (ES 1992).

3.5.2 Groundwater Flow

Of the 17 wells monitored during the initial RI groundwater monitoring event, nine were completed in the UWBZ. Of these nine monitoring wells, five (LCKMW-2, LCKMW-9, LCKMW-11, LCKMW-15, and RB25-MW7) encountered water at less than 10 feet. The remaining four UWBZ wells encountered water at less than 22 feet. UWBZ potentiometric surface maps, using groundwater elevation data collected during the RI field operations and the subsequent three quarters of groundwater monitoring, confirm groundwater flow direction is generally to the west-southwest at the former Lockbourne AFB landfill (Figures 3-4 through 3-7). During each monitoring event, groundwater elevation data were collected from LCKTW-1 (August 2003 only), LCKMW-2, LCKMW-4, LCKMW-6, LCKMW-9, LCKMW-11, LCKMW-13, LCKMW-15, LCKMW-16, and RB25-MW7 (three subsequent quarters only).

Phase II SI groundwater elevation data were collected from eight UWBZ monitoring wells (LCKMW-2, LCKMW-4, LCKMW-6, LCKMW-9, LCKMW-11, LCKMW-13, RB25-MW-7, and RB25-MW-9). Three stream gauges installed in the west drainage ditch were used to determine surface water elevations. A Phase II SI potentiometric surface map of the UWBZ was prepared using groundwater elevation data from the shallow monitoring wells, the stream gauges, and the piezometers (Figure 3-8). Groundwater flow in the shallow unconsolidated deposits is toward the west and southwest at the former Lockbourne AFB landfill. The average hydraulic gradient of the shallow potentiometric surface was reported to be approximately 0.0075 foot per foot (ft/ft) (PMC 2000).

RI groundwater potentiometric surface maps, using groundwater elevation data from each quarterly sampling event, confirm IDA groundwater flow is to the west and–southwest (Figures 3-9 through 3-12). Groundwater elevation data were collected from LCKMW-1,

LCKMW-3, LCKMW-5, LCKMW-7, LCKMW-8, LCKMW-10, LCKMW-12A, and LCKMW-14 during each quarterly monitoring event.

Phase II SI groundwater elevation data were collected from eight IDA monitoring wells (LCKMW-1, LCKMW-3, LCKMW-5, LCKMW-7, LCKMW-8, LCKMW-10, LCKMW-12A, and LCKMW-14). A Phase II SI potentiometric surface map of the IDA was prepared using groundwater elevation data from the IDA monitoring wells (Figure 3-13). Similar to that seen in the UWBZ, groundwater flow in the IDA is toward the west and southwest at the former Lockbourne AFB landfill. The average hydraulic gradient of the potentiometric surface in IDA was reported to be approximately 0.004 ft/ft (PMC 2000).

Groundwater water level measurements indicate that the groundwater potentiometric surface in the IDA wells is approximately 20 to 30 feet bgs, while the depth to the sand and gravel deposits of the aquifer is greater than 50 feet bgs. This suggests the IDA is under confined conditions. Finally, upon comparing the potentiometric heads at the UWBZ and IDA monitoring wells, a downward gradient was identified.

3.5.3 Permeability Test Data

Upper Water-Bearing Zone

In situ permeability tests (slug tests) were conducted during the Phase I and Phase II SIs. During the Phase I SI, slug testing of wells screened in the shallow water bearing zone produced hydraulic conductivity (K) values that ranged from 9.7×10^{-5} to 9.7×10^{-4} feet per minute (ft/min) (LAW 1995a). These values indicate silty sand and were interpreted as representing sand lenses within the silty clay.

Slug tests were conducted on each Phase II SI-installed monitoring well, including both slug-in (falling head) and slug-out (rising head) tests. Slug test results from the Phase II SI wells showed that the shallow wells (total depth less than 25 feet bgs) had K values that ranged from 6.9×10^{-4} to 2×10^{-2} ft/min. These values are indicative of clayey or silty sands and are representative of sand stringers within the unconsolidated silty clay unit.

Intermediate Depth Aquifer

Phase I SI slug tests of the IDA determined a K value of approximately 9.7×10^{-4} ft/min (LAW 1995a). Slug tests from the intermediate wells installed during the Phase II SI had K values that ranged from approximately 3.5×10^{-4} to 1.3×10^{-2} ft/min. This value is consistent with the results from the Phase I SI and confirms the presence of silty sands within sand and gravel aquifer.

During the Phase II SI, vertical and horizontal falling head permeability testing was conducted in the laboratory on samples taken from the shallow water-bearing zone. Six undisturbed soil samples were collected using 3-inch-diameter Shelby tube samplers. These undisturbed samples were submitted to H.C. Nutting Company for vertical and horizontal permeability testing. The K values of LCKSB-8 samples collected between 4 and 14 feet bgs ranged from 6.1×10^{-8} to 2×10^{-6} ft/min for vertical permeability and from 5.9×10^{-8} 5.5×10^{-7} ft/min for horizontal permeability. These values are indicative of clay materials and represent the uppermost silty clay. The K values for sample LCKSB-12, collected between 16 and 18 feet bgs, were 3.2×10^{-6} ft/min for vertical permeability and 5.5×10^{-7} ft/min for horizontal permeability. The K values for samples LCKSB-12 (4 to 5.9 feet bgs) and LCKSB-14 (8 to 9.5 feet bgs) ranged from $3.3\text{x}10^{-5}$ to $7.7\text{x}10^{-5}$ ft/min for vertical permeability. Horizontal permeability for LCKSB-12 (4 to 5.9 feet bgs) was $4.9\text{x}10^{-5}$ ft/min. These values are indicative of clayey, silty sands and represent the sand lenses within the uppermost silty clay.

3.5.4 Conceptual Hydrogeologic Model

The Phase II SI report (PMC 2000) compiled and interpreted hydrogeologic data to provide the following description of the former Lockbourne AFB landfill hydrogeologic model:

- The uppermost unconsolidated material consists of silty clay with sand lenses.
- Groundwater elevation data from the shallow monitoring wells indicate that a shallow water table exists within the silty clay ranging in depth from approximately 4 to 16 feet bgs, and is possibly under perched water conditions.
- Groundwater flow in the shallow saturated zone is generally toward the west-southwest with a horizontal gradient of approximately 0.0075 ft/ft.
- The K values derived from slug testing of the shallow wells range from approximately 1 to 28 feet per day (ft/day).
- The upper silty clay unit contains a gray clay layer that occurs at depths ranging from approximately 18 to 48 feet bgs; is laterally continuous, more than 20 feet thick, and dense; and has a low permeability. Thus, it is considered an effective aquitard separating the shallow water-bearing zone from the lower aquifers.
- Below the silty clay is a sand and gravel unit, which comprises the IDA.
- Groundwater elevation data demonstrate that the groundwater surface in the IDA wells is approximately 20 to 30 feet bgs, and the IDA exists under confined conditions.
- The groundwater flow in the IDA is also generally toward the west-southwest with a horizontal gradient of approximately 0.004 ft/ft.
- The K values derived from slug testing of the IDA wells range from approximately 0.5 to 18 ft/day.
- The K values derived from vertical and horizontal permeability testing of the intermediate wells range from 0.0001 to 0.1 ft/day.
- A clay unit is present at a depth of approximately 130 feet bgs, which separates the IDA from a lower (deep) sand and gravel aquifer (ES 1992).
- The bedrock beneath the site occurs at approximately 200 feet bgs.

3.6 Climate

The greater Columbus area is located in an area of dynamic weather. Cold air masses from central and northwest Canada frequently invade the region. Tropical Gulf masses often reach central Ohio during the summer but to a much lesser extent in the fall and winter.

Columbus-area rivers and creeks provide variations in the microclimate of the area, contributing to the formation of shallow ground fog at daybreak in the summer and fall. The following are the average monthly temperatures and precipitation amounts in Columbus, Ohio.

Month	Low	High	Precipitation
January	20.3°F	36.2°F	2.53 inches
February	23.5°F	40.5°F	2.20 inches
March	32.2°F	51.7°F	2.89 inches
April	41.2°F	62.9°F	3.25 inches
May	51.8°F	73.3°F	3.88 inches
June	60.7°F	81.6°F	4.07 inches
July	64.9°F	85.3°F	4.61 inches
August	63.2°F	83.8°F	3.72 inches
September	55.9°F	77.1°F	2.92 inches
October	44.0°F	65.4°F	2.31 inches
November	34.9°F	52.4°F	3.19 inches
December	25.9°F	41.0°F	2.93 inches

Source: http://www.rssweather.com/climate/Ohio/Columbus/#temp
°F – degrees Fahrenheit

ODNR has summarized estimates of groundwater recharge rates in different basins (Dumouchelle and Schiefer 2002). Statewide, these recharge rates range from 3 to 16 inches per year, with a median rate of 6 inches. Data for the Big Walnut Creek basin indicate that precipitation is approximately 37 inches per year, but groundwater recharge is 4 to 5 inches per year, based on relatively low-permeability soils in this area.

3.7 Land and Water Use

The Village of Lockbourne began receiving potable water from the City of Columbus municipal water system in 1993. In January 1999, the Agency for Toxic Substances and Disease Registry (ATSDR), recommended that residents of Lockbourne use municipal drinking water rather than their private wells, if completed in the UWBZ, as their source of drinking water.

In 1996, Ohio EPA collected and analyzed groundwater from five of seven private wells. These five private wells drew water from the UWBZ. Two of the seven wells drew water from the deeper IDA and were deemed unnecessary to sample. Water from the five tested wells met federal and state drinking water standards (Waters 1996).

Currently, the Village of Lockbourne receives water from the Franklin County Water Department, based on CH2M HILL’s communication with the Water Department of Franklin County, Ohio, on April 8, 2009; the Village of Lockbourne on April 13, 2009; and the Water Department of Columbus, Franklin County, Ohio, on April 27, 2009. The county's largest public water system is the City of Columbus. The city uses surface water from the Scioto River, Big Walnut Creek, Hoover Creek, and Alum Creek reservoirs for its supply, along with groundwater from the south well field area in southeast Franklin County. The Village of Lockbourne is no longer using the supply well (No. 413418) located between Commerce, Landis, and Decker streets, which is within 0.25 mile of the former Lockbourne AFB landfill.

SECTION 4

Nature and Extent

This section presents investigation data for media sampled during the Phase I and Phase II SIs and RI field activities, and interpretation of the results to delineate the vertical and horizontal nature and extent of impact. The investigations did not identify any deviations to the scope that affected quality, except those included in Appendix B8.

Data validation for data collected by EEG during the 2003 sampling event, except for the three quarters of groundwater data collected between November 2003 and May 2004, was conducted by STL in Chicago, Illinois, and West Sacramento, California, and certified by the USACE Missouri River Division laboratory validation program (Attachment 1 of Appendix B3). CH2M HILL validated the last three quarters of data, and the data validation report is included as Appendix E.

4.1 Additional SI Completed in 2008 by CH2M HILL

Observations and conclusions made during the SI included:

- Waste encountered during trenching included MSW, construction and demolition debris, lime sludge, and black material that was similar in appearance to coal ash.
- The EM survey data were consistent with results expected for trench-and-fill landfill techniques, and identified anomalies consistent with buried construction debris.
- Based on EM survey and test pits, it was estimated that approximately 40 acres, located at the north and northeast portion of the site, contain no waste material.
- Temporary landfill gas monitoring points were installed, and landfill gas measurements indicated that methane concentrations were below the action level of 1.25 percent (as listed in Ohio Administrative Code [OAC] 3745-27-12).

4.2 Surface Soil Sampling Results

Samples collected from the 0- to 1-foot bgs interval were designated as surface soil samples. Table 4-1 presents the concentrations of constituents detected in surface soil samples collected during the RI and SIs (Phases I and II). Sampling locations are shown on Figure 2-2.

4.2.1 Results Obtained from 2003 Investigation Activities

Twenty-four surface soil samples and five quality assurance/quality control (QA/QC) samples were collected from 0 to 1 foot bgs (Table 2-1a). Of the 24 samples, 20 were collected from AOC 1 and four were collected from AOC 2 (Figure 2-2). Table 4-2 lists surface soil samples collected, their locations, and the rationale for location selection. Rationale includes:

- Sample locations based on 2003 current conditions (e.g., stressed vegetation)

- Phase I SI geophysical and passive soil gas data
- Phase II SI sampling of four Phase I SI sample locations that exhibited no signs of stressed vegetation, burn areas, apparent debris, or other indications of landfill activity

Three VOCs (acetone, toluene, and trichlorofluoromethane) were detected in the samples analyzed during the RI. The maximum concentrations of the detected VOCs were low. Only acetone and trichlorofluoromethane were detected in more than 50 percent of the samples analyzed. A total of 24 SVOCs were detected in the samples analyzed during the RI, and 15 of these SVOCs were found in more than 50 percent of the samples. Based on this observation, SVOCs are more prevalent in the surface soil samples collected from the former Lockbourne AFB landfill. These SVOCs are acenaphthene; anthracene; benz(a)anthracene; benzo(a)pyrene; benzo(b)fluoranthene; benzo(ghi)perylene; benzo(k)fluoranthene; chrysene; dibenz(ah)anthracene; dibenzofuran; fluoranthene; indeno(1,2,3-cd)pyrene; 2-methylnaphthalene; phenanthrene; and pyrene.

In the 24 surface soil samples collected, five pesticides (alpha-chlordane; gamma-chlordane; p,p′-dichlorodiphenyl dichloroethane [p,p′-DDD]; p,p′-dichlorodiphenyl dichloroethylene [p,p′-DDE]; and p,p′-dichlorodiphenyl trichloroethane [p,p′-DDT]) and four PCBs (PCB 1242, PCB 1248, PCB 1254, and PCB 1260) were detected. The occurrence of these compounds was not widespread, as they were detected in less than 30 percent of the surface soil samples collected.

Only two explosives were detected in the samples analyzed (1,3-5-trinitrobenzene and 2,4,6-trinitrotoluene). The detected concentrations were low. A total of 12 dioxin/furan congeners were detected in the surface soil samples. TCDD-TEQ is a calculated number used for risk assessment. The World Health Organization (WHO) dioxin toxic equivalency factors (TEFs) were used to calculate the 2,3,7,8-TCDD toxic equivalent (TCDD-TEQ) concentration for each sample where dioxins or furans were detected. The concentration of each dioxin congener is adjusted to a TEQ concentration of 2,3,7,8-TCDD using the TEF. The TEQ concentrations of all of the dioxin congeners are then added to determine the TCDD-TEQ concentration, which is used in the risk assessment, along with the 2,3,7,8-TCDD toxicity values to calculate risks associated with exposure to the dioxins. In the case of non-detects, one-half the reporting limit for the dioxin congener is multiplied by the TEF for that congener, and included in the calculation of the sample TCDD-TEQ concentration.

The occurrence of dioxins/furans was not widespread, as they were detected in less than 20 percent of the surface soil samples collected (Figure 4-1). The maximum number of occurrences was observed with two dioxins (heptachlorodibenzo-p-dioxin and octachlorodibenzo-p-dioxin), and these dioxins were detected in four samples each.

A total of 23 metals were detected in the surface soil samples analyzed during the RI. Out of these 23 metals, 13 were detected in all the samples analyzed (aluminum, barium, calcium, chromium, cobalt, iron, lead, magnesium, manganese, nickel, potassium, vanadium, and zinc).

4.2.2 Results Obtained from 1997 and 1998 Investigation Activities

Two VOCs (acetone and methylene chloride) were detected in the surface soil samples collected during the Phase II SI. Acetone was detected at two locations, while methylene chloride was detected in one sample only. Of the 15 SVOCs that were detected in the surface soil samples collected during the Phase II SI, none of the SVOCs was detected in more than three samples. Pyrene was detected in three samples, while anthracene; benz(a)anthracene; benzo(a)pyrene; benzo(b)fluoranthene; benzo(ghi)perylene; benzo(k)fluoranthene; chrysene; dibenz(ah)anthracene; fluoranthene; indeno(1,2,3-cd)pyrene; and phenanthrene were each detected in two samples.

Two pesticides (p,p′-DDD and p,p′-DDE) were detected above their reporting limits, but no PCBs were detected in any of the samples analyzed. Twenty-four dioxin/furan congeners were detected in the collected samples, and 18 of these were detected in more than 10 samples. No explosives were detected above their reporting limits. Finally, 19 metals were detected in the surface soil samples collected during the Phase II SI, with eight metals detected in more than 10 samples. These metals were aluminum, arsenic, barium, calcium, iron, lead, magnesium, and zinc.

4.2.3 Results Obtained from 1995 Investigation Activities

Four VOCs (acetone; trans 1,3-dichloropropane; methylene chloride; and toluene) were detected in the surface soil samples collected during the Phase I SI. Among these detected VOCs, methylene chloride was detected in 12 samples, and acetone was detected in six samples. Although 21 SVOCs were detected in the surface soil samples analyzed, 10 SVOCs were detected in more than 50 percent of the samples. These SVOCs showed exceedances: benz(a)anthracene; benzo(a)pyrene; benzo(b)fluoranthene; benzo(ghi) perylene; benzo(k)fluoranthene; chrysene; fluoranthene; indeno(1,2,3-cd)pyrene; phenanthrene; and pyrene.

Although three pesticides (p,p′-DDD; p,p′-DDE; and p,p′-DDT) were detected above their reporting limits, no PCBs were detected in any of the samples collected during the Phase I SI. In addition, no explosives were detected above their reporting limits. Samples were not submitted for dioxin analysis. Finally, nine metals were detected in the surface soil samples analyzed. Five of them were detected in all the samples. These metals are arsenic, barium, chromium, lead, and zinc.

4.3 Subsurface Soil Sampling Results

Samples collected from depths greater than 1 foot bgs were designated as subsurface soil samples. Table 4-3 presents the concentrations of different constituents detected in subsurface soil samples collected during the Phase I and Phase II SIs and RI. Sampling locations are shown on Figure 2-3.

4.3.1 Results Obtained from 2003 Investigation Activities

Samples were collected from two locations during the RI, with one location being in the 4- to 6-foot bgs interval, while the other is in the 8- to 10-foot bgs interval. Two VOCs (acetone and trichlorofluoromethane) were detected in the subsurface soil samples collected. Eight SVOCs (benzo(a)pyrene; benzo(b)fluoranthene; benzo(ghi)perylene; benzo(k)fluoranthene; chrysene; fluoranthene; phenanthrene; and pyrene) were detected in only the sample collected from LCKMW-16, while no SVOCs were detected in the sample collected from LCKMW-15.

Three pesticides (p,p′-DDD; p,p′-DDE; and p,p′-DDT) were detected in the subsurface sample collected from LCKMW-16, although no PCBs were detected in any of the samples collected. Samples were not analyzed for dioxins. Finally, 20 metals were detected above their reporting limits at both the locations.

4.3.2 Results Obtained from 1997 and 1998 Sampling Events

Six VOCs (acetone; 1,2-dichloroethene; methyl ethyl ketone; methylene chloride; trichloroethene; and vinyl chloride) were detected above their respective reporting limits, with four VOCs being detected at one location each. Only methylene chloride was detected in four samples. The concentrations of the detected VOCs were low. Ten SVOCs were detected in the subsurface soil samples analyzed, and only fluoranthene was observed in more than one sample.

No pesticides/PCBs were detected above their reporting limits. Twenty-six dioxin/furan congeners were detected in the collected samples, with 16 of these dioxins/furans occurring in more than 50 percent of the samples (Figure 4-1). Hexachlorodibenzo-p-dioxins, heptachlorodibenzo-p-dioxins, and octachlorodibenzo-p-dioxin were detected in all the samples analyzed during the 1997 sampling event. Finally, 20 metals were detected in the subsurface soil samples collected, with 14 metals occurring in all the samples analyzed. These metals are aluminum, arsenic, barium, calcium, chromium, cobalt, iron, lead, magnesium, manganese, nickel, potassium, vanadium, and zinc.

4.3.3 Results Obtained from 1995 Sampling Event

Six VOCs (acetone; trans 1,3-dichloropropene; ethylbenzene; methylene chloride; toluene; and xylenes) were detected during the Phase I SI. Only methylene chloride was detected in all the sample locations collected. Acetone, the next most frequently detected constituent, was detected in 50 percent of the samples. The concentrations of detected VOCs were low. Although 23 SVOCs were detected in the subsurface soil samples analyzed, only eight SVOCs were detected in 50 percent or more of the samples analyzed. They are benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, fluoranthene, phenanthrene, and pyrene.

Four pesticides (p,p′-DDD; p,p′-DDE; and p,p′-DDT) and one PCB (PCB 1254) were detected in the samples analyzed above their respective reporting limits. Subsurface soil samples were not analyzed for dioxins. Finally, among the eight metals detected, arsenic, barium, chromium, lead, and zinc were detected in all the samples analyzed.

4.4 Surface Water Sampling

Table 4-4 presents the concentrations of different constituents detected in surface water samples collected during the Phase I and Phase II SIs and RI sampling events. Sampling locations are shown on Figure 2-4.

4.4.1 Results Obtained from 2003 Sampling

Three surface water samples (EEGLKB-SW01, EEGLKB-SW02, and EEGLKB-SW03) were collected and were collocated with sediment samples (discussed in next section). Figure 2-4 depicts Phase I and Phase II SIs and RI surface water and sediment sample locations. Surface water samples were not analyzed for VOCs. Only two SVOCs (benzoic acid and bis[2-ethlyhexyl]phthalate) were detected at one location (EEGLKB-SW02). Only the sample collected from EEGLKB-SW01 was analyzed for dioxins, and no dioxins were detected at this location. Ten metals were detected in the surface water samples collected during RI, and nine out of these 10 metals were detected at three locations. These metals are aluminum, barium, calcium, copper, magnesium, manganese, potassium, sodium, and zinc.

4.4.2 Results Obtained from 1997 and 1998 Sampling Events

Surface water samples were collected from five locations during these sampling events. Two VOCs (carbon disulfide and 1,2-dichloroethene) were detected in one sample each. No SVOCs were detected in any of the samples collected. Ten dioxin/furan congeners were detected in the samples analyzed, with octachlorodibenzo-p-dioxin detected in all the samples analyzed. Twelve metals were detected in the surface water samples collected. The most frequently occurring metals were barium, calcium, iron, magnesium, manganese, and sodium as they were detected in each samples collected. Arsenic, barium, calcium, magnesium, manganese, potassium, sodium, thallium, and zinc also were detected in the dissolved state.

4.4.3 Results Obtained from 1995 Sampling Events

Samples were collected from three locations during the Phase I SI. Among the detected VOCs, methylene chloride was detected at three samples, while acetone was detected in one sample. Two SVOCs (diethyl phthalate and di-n-butyl phthalate) were detected in one sample only. Samples were not analyzed for dioxins. Surface water samples were analyzed for only five metals (arsenic, barium, lead, selenium, and zinc) and all five metals were detected in the samples collected. Barium, lead, and zinc were detected in all the samples analyzed.

4.4.4 Variability Observed Between Sampling Events

Most of the VOCs and SVOCs detected in surface water samples collected during the Phase I SI were not detected subsequently in Phase II SI or RI samples. Not all dioxins detected in Phase II SI samples were detected in samples collected during the RI. More metals also were detected in Phase II SI samples compared to RI samples. This variability in results obtained from different phases of investigations is probably attributable to the sampling techniques, such as retaining different amounts of suspended solids in the collected samples. In addition, it is known that Phase I SI surface water samples were collected during the day after a rain event, which could increase the suspended solids. The amount of rainfall could not be quantified. No rain event occurred during the week prior to collecting the Phase II SI surface water samples.

4.5 Sediment Sampling

Table 4-5 presents the concentrations of different constituents detected in sediment samples collected during the Phase I and Phase II SIs and RI. Sampling locations are shown on Figure 2-4.

4.5.1 Results Obtained from 2003 Sampling Event

Three sediment samples (EEGLKB-SD01, EEGLKB-SD02, and EEGLKB-SD03), which were collocated with surface water samples (EEGLKB-SW01, EEGLKB-SW02, and EEGLKB-SW03), were collected during the RI sampling event. In addition, a fourth sediment sample (EEGLKB-SD04) was collected from an offsite location, north of the Vause Road and Canal Road bridge.

Considering the samples collected from SD-01, SD-03, and SD-04, four VOCs (acetone, chloroethane, toluene, and trichlorofluoromethane) were detected at concentrations above reporting limits. Fourteen SVOCs were detected in the samples collected from SD-01, SD-03, and SD-04. More SVOCs were detected at SD-03 compared to SD-01 and SD-04.

A pronounced oil sheen and hydrocarbon odor were observed at SD-02. Besides acetone, 17 SVOCs were detected at SD-02.

Three pesticides (p-p′-DDD; p-p′-DDE; and p-p′-DDT) were detected in samples collected at SD-02, SD-03, and SD-04, while one PCB (PCB 1260) were detected at SD-01. Only the sample collected from SD-01 was analyzed for dioxins, and the following dioxins were detected above their respective reporting limits in that sample: heptachlorodibenzo-p-dioxins, octachlorodibenzo-p-dioxins, tetrachlorodibenzofurans, and tetrachlorodibenzo-p-dioxins.

Twenty-one metals were detected in the sediment samples analyzed during RI, and 19 of these metals were detected in all the samples analyzed.

4.5.2 Results Obtained from 1997 and 1998 Sampling Events

During the Phase II SI, background samples were collected along with sediment samples from the East and West ditches. Samples were collected from eight locations, with five from the 1997 sampling event (LCKSD-1 through LCKSD-5) and three from the 1998 sampling event (LCKSD-10 through LCKSD-12). Samples collected during the 1998 sampling event were analyzed for dioxins only. Three VOCs (acetone, carbon disulfide, and methyl ethyl ketone) were detected in background and ditch samples. Seven SVOCs (benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, fluoranthene, phenanthrene, and pyrene) were detected in the samples collected. Among these, benzo(b)fluoranthene, chrysene, fluoranthene, and pyrene occurred most frequently.

Although no PCBs were detected, two pesticides (p-p′-DDD and p-p′-DDT) were detected in the samples collected. Twenty-four dioxins were detected in both background samples and those collected from the East and West ditches. Among the most frequently occurring dioxins were heptachlorodibenzo-p-dioxins, hexachlorodibenzofurans, hexachlorodibenzo-p-dioxins, octachlorodibenzo-p-dioxins, and tetrachlorodibenzo-p-dioxins (TCDD).

As indicated in Section 2, background samples collected from LCKSD-1 (East Ditch) during the 1997 sampling event and the three samples (LCKSD-10, LCKSD-11, and LCKSD-12) collected during the 1998 sampling event were located upgradient of the former Lockbourne AFB landfill but downgradient of potential dioxin sources. Sample LCKSD-10 was collected along a ditch that ran by the former heating plant settling pond. This sample contained the highest dioxin concentration of the three samples collected in 1998. Sample LCKSD-11 was collected along a ditch that receives drainage from a former coal storage area. Dioxins were detected in this sample at a higher concentration than in sample LCKSD-12, which was collected along a ditch downgradient of runways and an aircraft parking apron. Based on review of available data, it appears there are sources that may have contributed to surface water and sediment dioxin loading upgradient of the Lockbourne AFB Landfill. Finally, 16 metals were detected in the background samples and the ditch samples, and 13 of these metals were detected in all the samples analyzed.

4.5.3 Results Obtained from 1995 Sampling Event

Three VOCs (acetone, methylene chloride, and toluene) were detected in the sediment samples collected during Phase I SI above their respective reporting limits. Although 13 SVOCs were detected in the samples collected, only three SVOCs (bis(2-ethylhexyl phthalate, fluoranthene and pyrene) were detected in more than one sample. Although no PCBs were detected in the samples analyzed, two pesticides (p,p'-DDD and p,p'-DDT) were detected above their respective reporting limits. The sediment samples were analyzed for seven metals, and six metals were detected in the samples analyzed, with arsenic, barium, chromium, and lead being the most frequently occurring metals.

4.6 SI Seep Sampling

In previous investigations, seeps were identified and samples were collected for analysis; however, four attempts were made by CH2M HILL to locate these previously identified seeps during the two September 2008 events, the October 2008 event, and the February 2009 event. Representatives of CH2M HILL, Ohio EPA, and USACE agreed at an onsite meeting that the seeps do not exist and, thus, excluded them from the scope of the SI report. *Previous seep sampling and investigative efforts are presented herein for reference only.*

During the 2003 sampling event, one seep was located and sampled (EEGLKB-SP01), and was compared to two seep samples during the Phase I SI (LCK-SW4 and LCK-SW5) and three during the Phase II SI (LCKSP-1, LCKSP-2, and LCKSP-3). During the Phase I SI, the two seep samples were located in the West Ditch (Figure 2-5). The seeps were identified following a significant rain event the previous day. During the Phase II SI, LCKSP-3 was in the East Ditch downgradient of IRP Sites 9 (salvage yard), 26 (transformer storage), and 25 and 27. The other two were in the West Ditch (Figure 2-5). Samples were collected by making a small depression in the ditch bank below the seep and allowing the beaker to fill. All seep samples were collected from the AOC 1 area.

Table 4-6 presents the concentrations of different constituents detected in seep samples collected during the Phase I and Phase II SIs and RI. Sampling locations are shown on Figure 2-5.

4.7 Groundwater Sampling

Table 4-7 presents the concentrations of different constituents detected in groundwater samples collected during the Phase I and Phase II SIs and the RI. Sampling locations are shown on Figure 2-1. Monitoring wells RB25-MW7 and RB25-MW9 were installed in 1986 (ES 1992). Monitoring wells LCKMW-1 through LCKMW-7 were installed during the Phase I SI, and monitoring wells LCKMW-8 through LCKMW-14 were installed during the

Phase II SI. Monitoring wells LCKMW-15, LCKMW-16 and LCKTW-1 were installed during the RI.

4.7.1 RI Groundwater Sampling

In August 2003, groundwater samples were collected from two monitoring wells installed during the RI and from 15 existing monitoring wells. These monitoring wells were also sampled in November 2003, February 2004, and May 2004. Four VOCs (acetone, carbon disulfide, methylene chloride, and toluene) were detected during the RI groundwater sampling. Only acetone was detected in 13 samples, while the other three were detected in only one sample. Twelve SVOCs were detected in samples collected during the RI. Dibenz(ah)anthracene and indeno(1,2,3-cd)pyrene were most frequently detected, followed by benzo(a)pyrene and benzo(b)fluoranthene. No explosives were detected in RI groundwater samples. Twenty metals were detected in the groundwater samples collected during the RI. The most commonly occurring metals were aluminum, arsenic, barium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, potassium, sodium, and zinc. Arsenic was detected primarily in the UWBZ, and generally near the reporting limit. However, the first quarterly sample collected (August 2003) from LCKMW-4 had an arsenic concentration of 73 micrograms per liter (µg/L). IDA arsenic concentrations from site wells were similar to concentrations in IDA background wells.

Five wells (LCKMW-4, LCKMW-7, LCKMW-13, LCKMW-15, and LCKMW-16) were selected for dioxin analysis for the August 2003 RI sampling events. Only LCKMW-7 was screened in the IDA. In RI samples, only TCDDs at LCKMW-15 and LCKMW-16 and octachlorodibenzo-p-dioxin at LCKMW-4 were detected.

4.7.2 Phase II SI Groundwater Sampling Results

During the 1997 field effort, groundwater samples were collected from 16 monitoring wells, 12 of which were located downgradient from the former Lockbourne AFB landfill. Two upgradient well pairs (LCKMW-1 and LCKMW-2, LCKMW-8 and LCKMW-9) were sampled to provide information on background groundwater constituent concentrations. Two individual wells and five UWBZ/IDA well pairs, located along the northern and southwestern site boundaries, were sampled to provide information on downgradient groundwater quality. The groundwater samples were analyzed for VOCs, SVOCs, PCBs/pesticides, dioxins, explosives, and metals (total and dissolved).

During the 1998 field effort, six groundwater monitoring wells were sampled, three screened in the UWBZ (14-MW1, LCKMW-11, and LCKMW-13) and three screened in the IDA (LCKMW-7, LCKMW-10, and LCKMW-12A). Monitoring well 14-MW1 is approximately 2 miles northeast of the northeast corner of the former Lockbourne AFB landfill. In order to determine the fraction containing dioxins, unfiltered and filtered groundwater samples were collected from each of the six above-mentioned wells and analyzed for total and dissolved dioxins, respectively.

Dioxins and furans were detected in groundwater more frequently in the Phase II SI samples compared with the RI samples. The dioxins and furans congeners detected in unfiltered samples were hexachlorodibenzofurans, octachlorodibenzo-p-dioxins, and tetrachlorodibenzo-p-dioxins at LCKMW 7, LOCKMW-10, LCKMW-11, and LCKMW-13.

The only dioxin that was detected in the filtered samples was octachlorodibenzo-p-dioxin, and it was detected in samples collected from LCKMW-12A and LCKMW-13.

Among VOCs, carbon disulfide and toluene were detected in five and one samples respectively. No SVOCs or pesticides/PCBs were detected in any of the wells sampled. Seventeen metals were detected in the groundwater samples, and nine of these metals (arsenic, barium, calcium, copper, iron, magnesium, manganese, potassium, and sodium) were detected in dissolved state in the samples.

4.7.3 Phase I SI Groundwater Sampling Results

Groundwater samples from the seven monitoring wells installed during the Phase I SI were analyzed for VOCs, SVOCs, pesticides/PCBs, metals; explosives, nitrate, and sulfate. Only one VOC (methylene chloride) was detected above its reporting limit. Five SVOCs (bis[2-ethylhexyl]phthalate, butylbenzyl phthalate, diethyl phthalate, di-n-octyl phthalate, and phenol) were detected in the groundwater samples. No pesticides or PCBs were detected. Dioxins were not analyzed during the Phase I SI.

Nine metals were detected in groundwater samples collected from seven monitoring wells, with arsenic, barium, iron, lead, manganese, and sodium being the most frequently detected ones. The Phase I SI report (LAW 1995a) documented final water purged from the development of monitoring wells LCKMW-2 and LCKMW-6 as being slightly turbid or brown and silty. This report also documented groundwater samples from wells LCKMW-2, LCKMW-3, LCKMW-4, LCKMW-5, and LCKMW-6 as appearing silty, very silty, and/or brown. Water purged from LCKMW-7 was noted as clear; however, the turbidity of the water sampled was 150 nephelometric turbidity units (NTU).

SECTION 5

Fate and Transport Evaluation

The fate and transport of chemicals detected in the environmental media (i.e., surface soil, subsurface soil, surface water, sediment, and groundwater) was qualitatively evaluated. This involved analyzing the comprehensive site characterization database of information with respect to the site physical and source characteristics. The purpose of understanding the trends of constituents of potential interest with respect to the migration potential of chemicals allows for determining whether:

- Residual chemicals in landfill surface soil can impact groundwater as a result of infiltration
- Landfill surface soil can impact downgradient surface water and the perimeter drainage ditch as a result of groundwater discharge from the UWBZ or from surface runoff
- Leaching from the waste materials is potentially a source that may lead to offsite migration of chemicals of interest by evaluating the surface water and groundwater data

This section provides an overview of the conceptual site model (CSM), including sources and factors at the site that influence migration pathways.

5.1 Sources

As indicated earlier in Section 2, CH2M HILL has redefined the site into two AOCs: AOC 1 and AOC 2. AOC 2 is the area where no waste was encountered during recent test pit activities, while AOC 1 is the area where landfill operations were concentrated.

Releases of constituents of potential interest from the site have occurred principally as a result of the former practices of burning and disposal of wastes from the base and surface disposal of various wastes, including pesticides and herbicides, ammunition, airplane parts, toxic and hazardous material, and household-type garbage (LAW 1995a). In addition, construction debris was disposed of in trenches and on the ground surface. These areas were not constructed with liners or low permeability covers, thus infiltration in this area is assumed similar to native soil.

No direct measurements of soil samples provide data on potential leaching from the subsurface materials; however, since the depth to groundwater ranges from approximately 4 to 16 feet bgs and landfill activities began over 50 years ago, groundwater data may be used to infer whether a significant source to groundwater can be identified from leaching.

5.2 Migration Pathways

A chemical migration pathway is a route by which a chemical travels following a release or spill from a source. This section highlights sources and migration pathways relevant for this site. The fate and transport of constituents at the site are determined by their physical, chemical, and biological interactions with the environment. The mobility and persistence of the constituents at the site are two key characteristics in determining their probable behavior. Mobility is the potential for a constituent to migrate in environmental media, and persistence is a measure of how long a constituent will remain in the environment in its current form. The primary fate and transport mechanisms that control the mobility and persistence of the constituents are aqueous solubility, sorption, volatility, and degradation.

The potential chemical migration pathways from the source areas along with the receiving media are summarized below.

Release Source Analysis for Current Site Conditions

Chemical Sources	Release Mechanisms	Receiving Media
Former landfill sources:		
Waste piles / Buried wastes	Discharges and spills during disposal, trenching, and burning	Surface and subsurface soil, and surface water
Current potential sources:		
Surface soil	Runoff Leaching	Surface water / Sediment Subsurface soil
Subsurface soil and waste	Leaching	Groundwater
UWBZ groundwater	Solute transport	Intermediate groundwater
IDA groundwater	Solute transport	Offsite intermediate groundwater

A migration pathway is complete if a chemical present in a source is detected in multiple media at concentrations that illustrate a trend (i.e., increasing or decreasing). If a trend does not exist or illustrate that a specific chemical process is taking place (i.e., degradation, dilution, etc.), then a separate source area or another reason for the presence of a chemical (i.e., laboratory cross contamination, anomaly, etc.) may be indicated.

A primary objective of assessing the potential fate and transport of surface contents of the former Lockbourne AFB landfill is to determine if constituents detected in surface soil have the potential of impacting the underlying groundwater zones or downgradient receptors via surface runoff, infiltration, or air dispersion of volatiles or dust.

Another potential migration pathway for the site-related constituents is potential release of site-related soil constituents to air via mechanical disturbance or wind. Three primary mechanisms of releases to air could be associated with the site: dust generation via mechanical disturbance or wind, volatilization of organic compounds, and landfill gas generation and migration. The release of site-related soil constituents to air via mechanical disturbance or wind was not considered a migration pathway of concern because of the heavy vegetative cover in most of the former Lockbourne AFB landfill, except for an area in the northwest part of the former Lockbourne AFB landfill that is devoid of vegetation. This is the area of the former lime-sludge dumping area. As indicated in Section 4.2, the VOC content in the samples of surface soil was low. Finally, as discussed in Section 4.1, landfill gas generation was minimal (less than 0.1 percent). Because of the above evidence, any releases to air from the site are considered to be minimal. Therefore, this potential pathway is considered to be of lesser significance.

5.2.1 Surface Soil to Surface Water/Sediment

For the surface soil to surface water/sediment migration pathway, an analysis of the data was conducted to determine if chemicals present in surface soil also are present in drainage ditch sediment because of surface runoff and/or in drainage ditch surface water. The primary chemicals identified in the surface soil include SVOCs, pesticides, dioxins, and metals. Arsenic, barium, chromium, lead, and zinc are the five most detected metals. The key constituents in surface water are dioxins and metals, with barium, calcium, magnesium, manganese, and sodium being the five most detected. Upon comparison of the primary chemicals detected in surface soil and surface water, it appears that dioxins are common to both media. Although metals were detected in both media, the most frequently detected constituents in surface soil and surface water are different.

The key constituents in sediment are SVOCs, pesticides, dioxins, and metals. Aluminum, arsenic, calcium, chromium, and lead are the five most detected metals. Upon comparison of the key constituents detected in surface soil and sediment, SVOCs, pesticides, dioxins, arsenic, chromium, and lead are common to both surface soil and sediment. Based on the above comparison, the impact on surface water from surface soil is considered to be less significant compared to the impact on sediment.

5.2.2 Surface Soil to Subsurface Soil

In order to determine the surface soil to subsurface migration pathway, an analysis of the data was conducted to determine if chemicals present in surface soil also are present in subsurface soil because of leaching. The primary chemicals identified in surface soil include SVOCs, pesticides, dioxins, and metals (arsenic, barium, chromium, lead, and zinc). The key constituents in subsurface soil are SVOCs, dioxins, and metals, with arsenic, barium, chromium, lead, and zinc being the five most detected. Upon comparison of the key constituents detected in surface and subsurface soil, SVOCs, dioxins, arsenic, barium, chromium, lead, and zinc are common to the two media. Based on the above comparison, the impact on subsurface soil can be considered to be significant.

5.2.3 Subsurface Soil to Groundwater

This migration route was evaluated by reviewing analytical data to determine if landfill contents are affecting the UWBZ. The key constituents in subsurface soil are SVOCs, dioxins, and metals, with arsenic, barium, chromium, lead, and zinc being the five most detected. The key constituents in UWBZ groundwater are VOCs, SVOCs, dioxins, and metals, with barium, calcium, magnesium, manganese, and sodium being the five most detected. Upon comparison of the key constituents detected in subsurface soil, SVOCs, dioxins, and barium are common to the two media. Based on the above comparison, the impact on groundwater is considered to be moderate.

5.3 Physical-Chemical-Specific Discussions Related to Migration

The physical-chemical properties of the chemicals present at the site strongly influence their fate and transport processes. These properties dictate environmental partitioning and chemical mobility. Some of these properties also affect the chemical behavior of the compounds and their susceptibilities to degradation induced by physical and biological agents. Because there are many complex factors that control the partitioning of a constituent in the environment, the measured concentrations at the source areas can only represent site conditions at a discrete point in time. In addition, while the above historical release sources were identified, they may not have resulted in significant impact; thus, an understanding of the general fate and transport characteristics of the constituents present at the site is important when predicting future exposures, linking sources with currently impacted media, and identifying potentially complete pathways to site media.

A summary of the physical-chemical properties of the organic and inorganic constituents present at the site with respect to fate and transport are presented in Tables 5-1 and 5-2, respectively. Table 5-1 presents three most influential physical-chemical properties of the organic constituents detected at the site. These properties influence the fate and transport of organic chemicals in the environment. These are organic partition coefficient (K_{oc}), water solubility (S), and Henry's law constant (H). K_{oc} provides a measure of the extent of chemical partitioning between organic carbon and water at equilibrium. The higher the K_{oc} (measured in liters per kilogram [L/kg]), the more likely a chemical is to bind to soil than to remain in water. Henry's law constant provides a measure of the extent of chemical partitioning between air and water at equilibrium. The higher the constant, the more likely a chemical is to volatilize than to remain in the water.

Table 5-2 presents the physical chemical properties of the inorganic constituents. The properties presented are atomic weight, water solubility, soil water distribution coefficient (K_d), and boiling and melting points. The K_d value is a measure of how readily one species sorbs to a surface. The higher the K_d value is, the more readily the species is sorbed to the surface.

5.3.1 Organic Constituents

SVOCs

High molecular weight SVOCs were detected in soil at the site. Using benzo(a)pyrene as a representative constituent (detected in surface and subsurface soil, sediment, and groundwater), SVOCs at the site could be due to the former site use (burning and disposal of waste materials). As shown in Table 5-1, the high molecular weight SVOCs have high K_{oc}s, which indicates these compounds have a strong affinity to remain bound to soil. With the knowledge of K_{oc} values, one can calculate retardation factors (Rf), which is the ratio of velocity of water and velocity of the contaminant species. This is a bulk property that describes the overall migration of the chemical species with respect to the water and can be thought of as a chemical front moving somewhere behind the water front, but retarded by the various chemical interactions. If none of a particular species was retarded, then the Rf equals 1 and the contaminant travels along with the water at the groundwater flow rate.

When Rf is large, as for benzo(a)pyrene, the contaminant can take a long time to migrate offsite. Rf values are directly proportional the K_{oc} values. Since the SVOCs have high K_{oc} values, they also have high Rf values; therefore, migration of site SVOCs to groundwater, or through groundwater to surface water, is not considered a primary pathway of concern.

Because of the former site activities (burning and disposal of wastes), SVOCs (primarily PAHs) could have migrated from source areas to downgradient locations through overland runoff during precipitation events. Migration of site-related constituents has occurred as indicated by the presence of elevated SVOC levels in surface soil, and in sediment of the West and East ditches. Additional migration of SVOCs from surface soil to subsurface soil and groundwater could have occurred through infiltration.

Dioxins

Overall detections of dioxin concentrations in groundwater decreased for each successive sampling event. During the 1997 Phase II SI, dioxins were detected in all 19 samples. In the 1998 SI event, dioxins were detected in four of seven samples collected. In the 2003 RI event (first quarter sampling), dioxins were detected in three of six samples collected, and the concentrations of the detected dioxins were lower compared to that observed during the Phase II SI. The trend in lower dioxin concentrations between the 1997 Phase II SI versus the 1998 Phase II SI and 2003 RI may be in part because of the difference in sample collection techniques: bottom-emptying bailer sample collection during the 1997 sampling event versus low-flow sampling collection during the 1998 and 2003 sampling events.

Like SVOCs, dioxins have a strong affinity to bind to soil and are relatively insoluble in water. Higher concentrations were detected in selected samples in AOC 1. Dioxins do not migrate in the dissolved phase (Rf greater than 100,000) and do not form groundwater "plumes"; however, these were detected widely in unfiltered groundwater samples. The detected levels, if valid, would be associated with suspended soil particulates in the sample. Groundwater samples with detections, regardless of location, have similar low-level detections of dioxins; these detections were within and, at times, below the range of reporting limits for all samples evaluated. This type of distribution does not typically represent migration in groundwater.

Comparing the unfiltered dioxin concentrations detected in well pair LCKMW-10 (IDA well) and LCKMW-11 (UWBZ well), LCKMW-11 contained the highest concentrations of total dioxins among the wells sampled during the 1997 Phase II SI event. This observation was also made with 1998 Phase II SI groundwater dioxin data, though the dioxin concentration detected in LCKMW-11 in 1998 was nearly an order of magnitude lower than the concentration detected in the same well in 1997. Considering the small portion of the former Lockbourne AFB landfill that is upgradient of LCKMW-10 and LCKMW-11, it is considered unlikely that the former Lockbourne AFB landfill is contributing to groundwater dioxin concentrations at LCKMW-11 (PMC 2000). The dioxin data may represent temporal and spatial variability of groundwater concentrations, particularly at the exceptionally low concentrations. A similar pattern was observed at IDA well LCKMW-12A and UWBZ well LCKMW-13. The concentrations were three orders of magnitude lower than the levels detected in LCKMW-11, and four orders of magnitude lower than the 1997 levels detected in LCKMW-1 and LCKMW-2, which can be considered as upgradient wells. Thus, the former Lockbourne AFB landfill does not appear to be contributing to groundwater dioxin concentrations in the area of well pair LCKMW-12A and LCKMW-13 (PMC 2000).

EEG collected five groundwater samples, four from onsite wells (LCKMW-13, LCKMW-15 and field duplicate, and LCKMW-16) and one from LCKMW-7, which is located in the Village of Lockbourne, for a total versus dissolved comparison of total dioxin concentrations. All five filtered samples were below detection for total dioxins, which reconfirms the dioxins are bound to soil particulates in the total samples. Based on these results, the infiltration of total dioxins from surface soil to the UWBZ is highly unlikely as these compounds do not readily solubilize in water and have a strong affinity to remain bound to soil.

The distribution of dioxins/furans suggests dioxins may be present in the East Ditch sediment as a result of upgradient sources, as illustrated by dioxin results being higher in upgradient samples (i.e., LCKSD-10, LCKSD-11, and LCKSD-12); however, dioxins in the West Ditch could be due to the former Lockbourne AFB landfill operations, since burning activities had occurred at AOC 1. As with SVOCs, a more detailed spatial analysis can be conducted as part of the focused feasibility study to determine the areal extent of elevated concentrations relative to the area of impact to sediment.

5.3.2 Metals

Metals are frequently detected since they are often associated with the natural conditions of the area (i.e., representative of the inorganics associated with the regional lithology). Thus, to determine whether the presence of metals in soil is related to the former Lockbourne AFB landfill or is representative of natural background conditions, it is important to compare site concentrations against background concentrations, as well as understand the regional soil characteristics and site redox conditions. The specific physical-chemical properties of the metals with respect to fate and transport depend on the existing environmental conditions and predominant species of each metal. For example, arsenic under reducing conditions exists primarily as As(III), which is more mobile, compared to As(V) found primarily under more oxidizing conditions. Redox processes, dissolution/precipitation, complexation, and adsorption affect the environmental fate and transport behavior of inorganic constituents, and the oxidation states of the metals can vary.

Arsenic has been detected consistently in all media and in background and site wells. Specifically, arsenic is detected as one of the most frequently detected in surface and subsurface soil and sediment but is also identified in groundwater. The presence of arsenic may be representative of background conditions and not because of waste disposal. In accordance with *Closure Plan Review Guidance For RCRA Facilities* developed by Ohio EPA's Division of Hazardous Waste Management (Ohio EPA 2008a), Ohio EPA acknowledges that the concentrations of total arsenic in background soil is often highly variable in Ohio, and this heterogeneity makes the designation of a generic standard difficult. Based on statistical analyses, any concentration of arsenic in a background soil above 13 milligrams per kilogram (mg/kg) (*Guidance for Developing Ecological Soil Screening Levels*, OSWER Directive 9285.7-55 [USEPA 2003]) may indicate that the sampling area has been affected by a specific source. However, based on the soil background study presented in the *Supplemental Phase II Environmental Baseline Survey Investigation* (IT 1995), which has been approved by Ohio EPA, the background concentration for arsenic in the soil related to the site is 22 mg/kg. The maximum concentration detected in the collected surface soil samples was 21 mg/kg, and 12 samples had values greater than 13 mg/kg. The maximum concentration detected in the collected subsurface soil samples was 25.8 mg/kg, and seven samples had values greater than 13 mg/kg.

Thallium has been detected primarily in surface soil samples and sediment samples downgradient from the landfill. Thallium has also been detected in surface water samples. Major releases of thallium to the environment are from processes such as coal burning and smelting, in which thallium is a trace contaminant of the raw materials, rather than from facilities producing or using thallium compounds. Thallium is a nonvolatile heavy metal, and if released to the atmosphere by anthropogenic sources, may exist as an oxide (thallium oxide), hydroxide, sulfate, or as sulfide (http://www.atsdr.cdc.gov/toxprofiles/tp54.html). Thallium oxides are less soluble in water, and may be subject to only atmospheric dispersion and gravitational settling. Thallium tends to be sorbed to soils and sediments, and to bioconcentrate in aquatic plants, invertebrates, and fish. Due to this, migration of thallium to groundwater from soil is limited. This is also observed at the site, where thallium is primarily detected in surface soil and sediment but not in groundwater. Although thallium is detected in surface water, it can be due to surface runoff.

Lead is considered one of the most frequently detected constituents in surface and subsurface soil and sediment at the site. Lead also has been detected in surface water and groundwater. The background concentration of lead in soil for the site is 29 mg/kg (IT 1995). The maximum concentration of lead detected in surface soil was 150 mg/kg during the RI, 9,340 mg/kg during the Phase II SI, and 41 mg/kg during the Phase I SI. Concentrations of lead in subsurface soil samples also exceeded background concentration during the Phase I and Phase II SI, but not during the RI. The detection of lead in sediment samples and in other media (subsurface soil and groundwater) may be because of the high concentrations of lead detected in soil. Lead may have reached the surface drainages via overland runoff.

The amount of soluble lead in surface waters depends upon the pH of the water and the dissolved salt content. A significant fraction of lead carried by surface water bodies is expected to be in an undissolved form, which can consist of colloidal particles or larger undissolved particles of lead carbonate, lead oxide, lead hydroxide, or other lead compounds incorporated in other components of surface particulate matters from runoff. Lead may occur either as sorbed ions or surface coatings on sediment mineral particles, or it may be carried as a part of suspended living or nonliving organic matter in water. The fate of lead in soil is affected by the adsorption at mineral interfaces, the precipitation of sparingly soluble solid forms of the compound, and the formation of relatively stable organic-metal complexes or chelates with soil organic matter.

Finally, based on the K_d values of arsenic, lead, and thallium (Table 5-2), it appears that sorption of thallium and lead on soil will be appreciable with a K_d value of 1,500 and 900. Although the K_d value of arsenic is lower than lead, it is still expected that mobility of arsenic will be limited. The mobility of arsenic is further dictated by reducing and oxidizing conditions. It is not unusual to have reducing conditions in the landfill because of the presence of organic wastes. There is a good possibility that arsenic can be mobilized under these reducing conditions and, therefore, can raise the concentrations of arsenic in groundwater. However, as groundwater flows downgradient, it might encounter more oxidizing conditions, which will lead to natural attenuation (via precipitation) of arsenic.

5.4 Summary of Significant Migration Routes

Based on a review of the nature and extent of the analytical data relative to the environmental setting, and physical and chemical properties of the site-related constituents, the primary fate and transport mechanisms are identified for the site. The presence of site-related chemicals throughout the former Lockbourne AFB landfill are principally the result of runoff of impacted soil and subsequent transport to downgradient drainage ditches.

The primary migration pathways are from surface soil to sediment via surface runoff and to subsurface soil via leaching. There is also evidence of migration of site constituents from surface soil to surface water via runoff, and from subsurface soil to groundwater via leaching.

A comparison of the constituents in groundwater (Table 4-7) and surface water (Table 4-4) suggests that discharge of shallow groundwater to surface water is not significant, as the dissolved phases of chemicals in groundwater were not observed in the dissolved phase surface water at concentrations above background landfill conditions.

SECTION 6

Human Health Risk Assessment

This section presents the results of the HHRA for soil, sediment, surface water, and groundwater at the former Lockbourne AFB landfill. The objective of this HHRA is to determine the magnitude and probability of actual or potential harm to public health, safety, and welfare posed by the threatened or actual release of hazardous substances at or from the site in the absence of additional remedial action. The results of this risk assessment will be used to determine if there is a potential current or future risk to human health that warrants remedial action at the site.

The HHRA has been prepared following USEPA guidance (including *Risk Assessment Guidance for Superfund* [RAGS] Part A, Part D, Part E, Part F; USEPA 1991, 2001, 2004a, 2009a), as well as Ohio EPA guidance (Ohio EPA 2004c). Table 6-1 lists the samples that were evaluated in the risk assessment. The supporting tables for this HHRA are presented in RAGS Part D format (USEPA 2001), in Appendix C. Additional supporting tables (e.g., ProUCL Version 4.0 output) are presented in Appendix D.

6.1 Conceptual Site Model

The CSM presents an overview of site conditions, potential contaminant migration pathways, and exposure pathways to potential receptors. The site description and history are provided in Section 1.2; and a discussion of land use is included in Section 3.7. Figure 6-1 presents the CSM for human exposure for the former Lockbourne AFB landfill associated with soil, sediment, surface water, and groundwater. Table 6-2 and Appendix C, Table 1 summarizes the potential exposure pathways and scenarios considered for the site.

Section 4 discusses multiple attempts made during the SI (CH2M HILL 2009) to locate seeps from the former Lockbourne AFB landfill, but no seeps were identified. Seep sampling locations from previous investigations are depicted on Figure 2-5. If seeps reoccur in the future, exposures would be limited because of the transient and localized nature of the seeps. Therefore, potential exposures to seeps are considered insignificant and were not evaluated in the risk assessment.

The former Lockbourne AFB landfill has been divided into AOC 1 and AOC 2 based on the distribution of waste material found within the former Lockbourne AFB landfill. AOC 1 includes areas where waste has been encountered; however, not all portions of AOC 1 contain waste materials, and it includes previously identified HU and UMU areas. AOC 2 is the area where no waste was encountered during the recent test pit activities. AOC 1 is approximately 106 acres and occupies the western half of the site. AOC 2 is approximately 40 acres and occupies the eastern half of the site. Plans for the site include redeveloping AOC 2, and that might include construction of an intermodal facility. Potential current receptors include maintenance workers who periodically check security and other site conditions, trespassers/visitors from the nearby residential area, and offsite industrial workers. The maintenance workers and trespassers/visitors may come in contact with surface soil in AOC 1 and AOC 2. Exposure routes may include incidental ingestion of the surface soil, dermal contact with the surface soil, and inhalation of particulate and volatile emissions from the surface soil. Trespassers/visitors may also come in contact with sediment and surface water in the ditches at the east and west boundaries of the former Lockbourne AFB landfill. Exposure routes may include incidental ingestion and dermal contact. Offsite industrial workers may be exposed to airborne particulates in fugitive dust generated from surface soil in AOC 1 and AOC 2 via inhalation.

Potential future receptors include the current receptors (i.e., maintenance workers, trespassers/visitors, and offsite industrial workers), and future onsite facility workers, onsite construction workers, and offsite residents. The maintenance workers, trespassers/visitors, and offsite industrial workers may be exposed to the same media under future land use conditions as those under current land use conditions. The future onsite facility workers may be present at AOC 2 if the site is developed for future industrial use and may come in contact with surface soil. Exposure routes may include incidental ingestion, dermal contact, and inhalation of particulate and volatile emissions. The future onsite facility worker also may be exposed to volatile constituents in indoor air through vapor intrusion of constituents from soil into indoor air and from groundwater into indoor air. The future construction workers are assumed to be exposed to total soil (i.e., surface and subsurface soil combined [0 to 10 feet]) if future industrial buildings or piping are constructed at AOC 2.

Although there are no plans for future development at AOC 1, as a conservative evaluation, it was assumed that construction workers could engage in soil disturbing activities at AOC 1. Exposure routes for the construction worker may include incidental ingestion, dermal contact, and inhalation of particulate and volatile emissions. Because of the shallow groundwater depth (i.e., less than 10 feet bgs), construction workers could be exposed to the groundwater through inhalation of volatiles and dermal contact in an excavation during construction activities. Construction workers were assumed to come in contact with sediment and surface water in the ditches at the east and west boundaries of the former Lockbourne AFB landfill. Exposure routes may include incidental ingestion and dermal contact.

Future residential exposures for the former Lockbourne AFB landfill area were not evaluated because it is not a reasonable foreseeable scenario. There are no plans for residential development; land use will remain industrial, and an environmental covenant will be used, as necessary, with remedy implementation to restrict use. An environmental covenant will be obtained for the former Lockbourne AFB landfill limiting land use to nonresidential activities. Use of groundwater from beneath AOC 1 or AOC 2 will not be permitted.

Groundwater at the former Lockbourne AFB landfill is not used for potable purposes. As discussed in Section 3.7, the Village of Lockbourne has been receiving potable water from the City of Columbus municipal water system since 1993. A call to the Franklin County Department of Water confirmed that the residences of the Village of Lockbourne have access to public water supplies (Franklin County 2009). Franklin County Department of Water also confirmed that residences along Vause Road, which borders the north side of the former Lockbourne AFB landfill, have access to public water supplies (Franklin County 2009). According to Village of Lockbourne officials, the Village of Lockbourne public supply well is no longer in use (Lockbourne 2009). However, it could not be determined whether all off-base residents are using public water supplies or some off-base residents may still be obtaining drinking water from private wells. In January 1999, the ATSDR recommended that residents of Lockbourne use municipal drinking water rather than use their private wells, if completed in the UWBZ, as their source of drinking water. Because there is the potential that some off-base residents may still be using private wells, a potable use scenario was evaluated in this risk assessment. It was assumed that offsite residents use groundwater from both the shallow (UWBZ) and intermediate (IDA) aquifers downgradient of the former Lockbourne AFB landfill. The residents would be exposed through ingestion, and dermal contact and inhalation while showering. The future offsite resident also may be exposed to volatile constituents in indoor air from vapor intrusion of volatile constituents from groundwater into indoor air. No significant concentrations of VOCs were detected in groundwater.

Groundwater was divided into three potable use and vapor intrusion exposure units for the offsite resident evaluation: off-landfill IDA groundwater, AOC 1 UWBZ groundwater, and AOC 1 IDA groundwater. The off-landfill IDA groundwater exposure unit consists of groundwater data collected from monitoring well LCKMW-7. As seen on Figure 2-1, LCKMW-7 is located at the eastern edge of the Village of Lockbourne. Groundwater data from LCKMW-7 were conservatively assumed to be representative of groundwater concentrations in offsite private wells. The AOC 1 UWBZ groundwater exposure unit consists of groundwater data collected from monitoring wells installed within the boundary of AOC 1 and screened in the UWBZ. The AOC 1 IDA groundwater exposure unit consists of groundwater data collected from monitoring wells installed within the boundary of AOC 1 and screened in the IDA. As stated in Section 3.5, groundwater flow in the shallow saturated zone (i.e., UWBZ) and the IDA is generally toward the west and southwest. It was conservatively assumed that groundwater beneath AOC 1 was representative of future groundwater concentrations in offsite private wells. Data from groundwater wells installed in AOC 2 were not used to evaluate offsite residential exposures. These wells are used to characterize groundwater from the side of the former Lockbourne AFB landfill where waste has not been encountered.

A discussion of potential human receptors and exposure pathways is presented in Section 6.4.

6.2 Scope of Risk Assessment

The primary objective of the HHRA is to assess the health risks associated with exposure to the former Lockbourne AFB landfill for soil, sediment, surface water, and groundwater under current site conditions and potential future sites conditions. The risk assessment is comprised of the following components:

- **Identification of COPCs**—identification of the contaminants found onsite and selection of the COPCs. COPCs identified in this screening were the focus of the subsequent evaluation in the risk assessment.
- **Exposure Assessment**—Identification of the potential pathways of human exposure, characterization of the potentially exposed populations (e.g., maintenance workers,

industrial workers, construction workers, and trespassers), and estimation of the magnitude, frequency, and duration of exposures.

- **Toxicity Assessment**—Assessment of the potential adverse effects of the COPCs and compilation of the toxicity values used for developing numerical risk estimates.
- **Risk Characterization**—Integration of the results of the exposure assessment and toxicity assessment to develop numerical estimates of health risks.
- **Uncertainty Assessment**—Identification and discussion of sources of uncertainty associated with the data, methodology, and the values used in the risk assessment.

These components are described briefly in the following sections.

6.3 Identification of Chemicals of Potential Concern

The data evaluated in the HHRA consisted of soil, sediment, surface water, and groundwater samples collected during the Phase I and Phase II SIs, and RI. Sample analyses for VOCs, SVOCs, pesticides/PCBs, herbicides, explosives, dioxins/furans, and inorganics were used in the HHRA.

6.3.1 Data Summary and Evaluation

Detailed results of the sampling at the former Lockbourne AFB landfill were presented in Section 4. Although filtered and unfiltered surface water and groundwater samples were collected, only unfiltered samples were analyzed in the risk assessment.

Details on data quality for the samples collected during the SIs are provided in the Phase I SI report (LAW 1995a) and the Phase II SI report (PMC 2000). EEG validated the RI data collected through August 2003; the results were presented in the *Quality Control Summary Report* (EEG 2004). CH2M HILL validated three quarters of groundwater data collected during the RI by EEG (November 2003, February 2004, and May 2004; Appendix D). Data validation qualifiers for these three-quarters of data are shown on Appendix C, Tables 2.1 through 2.18; the laboratory qualifiers are shown on these tables for Phase I and Phase II data.

A review of the data identified the following criteria for data usability:

- Estimated values flagged with a J qualifier were treated as unqualified detected concentrations.
- Data qualified with an R (rejected) were not used in the risk assessment.
- For conservatism, blank (B)-qualified data were included in the evaluation.
- A-, a-, C-, CON-, D-, E-, I-, H-, L-, M-, N-, PR-, Q-, and *-qualified data were treated as unqualified detected concentrations. These qualifiers are defined in Appendix C, Tables 2-1 through 2-18.
- For duplicate samples, the maximum concentration between the two samples was used as the sample concentration.

Soil

As discussed in the CSM, the site was divided into two soil exposure units (i.e., AOC 1 and AOC 2) based on distribution of waste material found within the former Lockbourne AFB landfill. The site was further divided by applicable potential receptor groups. Human health risk evaluations were conducted for each exposure area presented in Table 1 of Appendix C and summarized below:

- AOC 1, Surface Soil – Surface soil samples (collected from 0 to 1 foot bgs) were used for the evaluation of current/future maintenance worker, trespasser/visitor, and offsite industrial worker scenarios. Thirty-seven surface soil samples were used in the HHRA; samples were collected in May 1995, July 1997, and July 2003. Soil samples were analyzed for VOCs, SVOCs, explosives, metals, pesticides/PCBs, herbicides, and/or dioxins/furans. Table 6-1 summarizes the AOC 1 surface soil samples used in the HHRA.
- AOC 2, Surface Soil – Surface soil samples (collected from 0 to 1 foot bgs) were used for the evaluation of current/future maintenance worker, trespasser/visitor, and offsite industrial worker scenarios and the future onsite facility worker scenario. Ten surface soil samples were used in the HHRA; samples were collected in May 1995, July 1997, and July 2003. Soil samples were analyzed for VOCs, SVOCs, explosives, metals, pesticides/PCBs, herbicides, and/or dioxins/furans. Table 6-1 summarizes the AOC 2 surface soil samples used in the HHRA.
- AOC 1, Total Soil – Surface soil samples (collected from 0 to 1 foot bgs) and subsurface soil samples (collected from 1 to 10 feet bgs) combined were used for the evaluation of the future construction worker scenario. Thirty-seven surface soil samples and 19 subsurface soil samples were used in the HHRA; samples were collected in May 1995, July 1997, July 2003, and August 2003. Soil samples were analyzed for VOCs, SVOCs, explosives, metals, pesticides/PCBs, herbicides, and/or dioxins/furans. Table 6-1 summarizes the AOC 1 surface soil and subsurface soil samples used in the HHRA.
- AOC 2, Total Soil – Surface soil samples (collected from 0 to 1 foot bgs) and subsurface soil samples (collected from 1 to 10 feet bgs) combined were used for the evaluation of the future construction worker scenario and onsite future facility worker scenario (volatiles only). Ten surface soil samples and seven subsurface soil samples were used in the HHRA; samples were collected in May 1995, July 1997, and July 2003. Soil samples were analyzed for VOCs, SVOCs, explosives, metals, pesticides/PCBs, herbicides, and/or dioxins/furans. Table 6-1 summarizes the AOC 2 surface soil and subsurface soil samples used in the HHRA.

Sediment and Surface Water

As discussed in the CSM, the site is bordered by a drainage ditch system located southeast and southwest of the site. The drainage ditch was divided into two exposure units – the drainage ditch to the southeast of the site, which is referred to as the East Ditch, and the drainage ditch to the southwest of the site, which is referred to as the West Ditch. Human health risk evaluations conducted for each exposure media presented in Table 1 of Appendix C are summarized below:

- East Ditch, Sediment – Sediment samples from the East Ditch were used for the evaluation of the current/future trespasser/visitor scenario and the future construction worker scenario. One sediment sample was used in the HHRA; the sample was collected in August 1997 and was analyzed for VOCs, SVOCs, explosives, metals, and pesticides/PCBs. Table 6-1 identifies the East Ditch sediment sample used in the HHRA.

- East Ditch, Surface Water – Surface water samples from the East Ditch were used for the evaluation of the current/future trespasser/visitor scenario and the future construction worker scenario. One surface water sample was used in the HHRA; the sample was collected in August 1997 and was analyzed for VOCs, SVOCs, explosives, metals, and pesticides/PCBs. Table 6-1 identifies the East Ditch surface water sample used in the HHRA.

- West Ditch, Sediment – Sediment samples from the West Ditch were used for the evaluation of the current/future trespasser/visitor scenario and the future construction worker scenario. Eight sediment samples were used in the HHRA; samples were collected in May 1995, August 1997, and July 2003. Samples were analyzed for VOCs, SVOCs, explosives, metals, pesticides/PCBs, herbicides, and/or dioxins/furans. Table 6-1 summarizes the West Ditch sediment samples used in the HHRA.

- West Ditch, Surface Water – Surface water samples from the West Ditch were used for the evaluation of the current/future trespasser/visitor scenario and the future construction worker scenario. Eight surface water samples were used in the HHRA; samples were collected in May 1995, August 1997, and July 2003. Samples were analyzed for VOCs, SVOCs, explosives, metals, pesticides/PCBs, herbicides, and/or dioxins/furans. Table 6-1 summarizes the West Ditch surface water samples used in the HHRA.

Groundwater

The site was divided into five groundwater exposure units based on potential receptor groups: off-landfill IDA groundwater, AOC 1 UWBZ groundwater, AOC 1 IDA groundwater, AOC 2 UWBZ groundwater, and AOC 2 IDA groundwater. Human health risk evaluations were conducted for each exposure area presented in Table 1 of Appendix C and summarized below:

- Off-Landfill Groundwater (IDA) – Off-landfill groundwater samples from monitoring well LKWMW-7 were used for the evaluation of the future offsite resident scenarios (potable use and indoor air). Seven groundwater samples were used in the HHRA; samples were collected in June 1995, September 1997, November 1998, August and November 2003, and February and May 2004. Samples were analyzed for VOCs, SVOCs, explosives, metals, pesticides/PCBs, herbicides, and/or dioxins/furans. Table 6-1 summarizes the off-landfill groundwater samples used in the HHRA.

- AOC 1 UWBZ Groundwater – AOC 1 groundwater samples from the UWBZ were used for the evaluation of the future offsite resident scenarios (potable use and indoor air) and the construction worker scenario. Thirty-one groundwater samples from eight monitoring wells were used in the HHRA; samples were collected in June 1995, September 1997, November 1998, August and November 2003, and February and May 2004. Samples were analyzed for VOCs, SVOCs, explosives, metals, pesticides/PCBs, herbicides, and/or dioxins/furans. Table 6-1 summarizes the AOC 1 UWBZ groundwater samples used in the HHRA.
- AOC 1 IDA Groundwater – AOC 1 groundwater samples from the IDA were used to evaluate future offsite resident scenarios (potable use and indoor air). Twenty-four groundwater samples from four monitoring wells were used in the HHRA; samples were collected in June 1995, September 1997, November 1998, August and November 2003, and February and May 2004. Samples were analyzed for VOCs, SVOCs, explosives, metals, pesticides/PCBs, herbicides, and/or dioxins/furans. Table 6-1 summarizes the AOC 1 IDA groundwater samples used in the HHRA.
- AOC 2 UWBZ Groundwater – AOC 2 groundwater samples from the UWBZ were used to evaluate future construction worker scenarios and the future onsite facility worker (indoor air) scenarios. Six groundwater samples from one monitoring well were used in the HHRA; samples were collected in September 1997, November 1998, August and November 2003, and February and May 2004. Samples were analyzed for VOCs, SVOCs, explosives, metals, pesticides/PCBs, and/or dioxins/furans. Table 6-1 summarizes the AOC 2 UWBZ groundwater samples used in the HHRA.
- AOC 2 IDA Groundwater – AOC 2 groundwater samples from the IDA were used to evaluate future onsite facility worker (indoor air) scenarios. Six groundwater samples from one monitoring well were used in the HHRA; samples were collected in September 1997, November 1998, August and November 2003, and February and May 2004. Samples were analyzed for VOCs, SVOCs, explosives, metals, pesticides/PCBs, and/or dioxins/furans; however, only volatile organics were used in the evaluation. Table 6-1 summarizes the AOC 2 IDA groundwater samples used in the HHRA.

6.3.2 Selection of Chemicals of Potential Concern

All of the detected constituents were screened following the procedures described below. The maximum detected concentration of inorganic constituents was compared to background concentrations. If the maximum concentration was below the background concentration, the constituent was not selected as a COPC. The maximum detected concentration of each constituent in each medium, including inorganics exceeding background concentrations, was compared to the health-based criteria discussed below to select the COPCs. If the maximum concentration exceeded the criteria, the constituent was selected as a COPC. Additionally, for constituents that were not detected, the reporting limit was compared to the risk-based screening criteria to identify those constituents with reporting limits above the criteria. These constituents were not retained as COPC for quantitative evaluation in the risk assessment. As discussed in Section 6.7.1, excluding non-detected chemicals whose reporting limit are greater than the screening level from quantification may result in an underestimation of risks. The COPC screening is presented in Appendix C, Tables 2.1 through 2.18.

Comparison to Background Concentrations

The maximum detected concentrations of naturally occurring inorganic constituents were compared to background concentrations for each media. Soil concentrations were compared to the background soil concentrations (Tables 2.3a through 2.3c for inorganic constituents established in the *Supplemental Phase II Environmental Baseline Survey Investigation* [IT 1995]). Sediment and surface water concentrations were compared to upgradient concentrations from collocated surface water and sediment samples collected during the Phase II SI from each branch of the ditch. Samples LCKSW-1 and LCKSD-1 were collected from the East Ditch and used as background comparison criteria for samples collected in the East Ditch. Samples LCKSW-3 and LCKSD-3 were collected from the West Ditch and used as background comparison criteria for samples collected in the West Ditch. The sediment and surface water background levels are presented in Tables 2-3a and 2-3b, respectively. Background groundwater data were collected from four monitoring wells located along the northern edge of the former Lockbourne AFB landfill: LCKMW-1 and LCKMW-8 from the UWBZ, and LCKMW-2 and LCKMW-9 from the IDA. The groundwater background levels are presented in Table 2-3c. Groundwater background concentrations from the UWBZ wells were used as comparison criteria for samples collected from monitoring wells in the UWBZ. Background concentrations from the IDA were used as comparison criteria for samples collected from monitoring wells in the IDA. A detailed discussion of soil, sediment, surface water, and groundwater background data are provided in Section 2.

As discussed in Section 2.5, the method recommended by Ohio EPA to calculate background concentration levels (i.e., the upper cutoff value of the data set defined as the upper quartile + 1.5 times the interquartile range) was not used for soil, groundwater, surface water, and sediment background levels. Soil background concentrations were identified as the 95th percentile or the maximum detected value if the maximum detected value was less than the 95th percentile. Groundwater background concentrations were identified as the 95/95 UTLs or the maximum detected value if the maximum detected value was less than 95/95 UTL. For surface water and sediment, too few samples were collected to calculate background concentrations; therefore, the maximum detected concentrations were used as representative background concentrations for these media. Uncertainties in the selection of COPCs that are associated with the calculation of soil and groundwater background concentrations are discussed in Section 6.7.4.

Comparison with Health-based Criteria for Soil

Soil data were compared to the USEPA regional screening levels (RSLs) table for residential soil (USEPA 2008). RSLs based on non-carcinogenic effects were divided by 10 to account for exposure to multiple constituents. RSLs based on carcinogenic effects were used as presented in the USEPA RSL table. If more recent toxicity values were available for a constituent, a new RSL was calculated using the equations from the USEPA RSL table and the updated toxicity values. Although current and expected future land use at the former Lockbourne AFB landfill is industrial, the soil data were screened against residential soil RSLs. Residential soil RSLs are more conservative (i.e., lower) than industrial soil RSLs, and, therefore, are protective of all potential receptors (i.e., maintenance workers, trespasser/visitors, offsite industrial workers, onsite facility worker, and construction workers).

Comparison with Health-based Criteria for Indoor Air (from Soil)

Soil vapor concentrations, as described below, were calculated using bulk soil data; the soil vapor concentrations were then compared to screening levels derived by applying a soil gas-to-indoor air attenuation factor to the USEPA indoor air RSLs assuming an industrial exposure scenario for AOC 2 (USEPA 2008). A soil gas-to-indoor air attenuation factor of 0.1 was used for soil samples. The soil gas RSLs were based on a target risk of 1×10^{-6} and a target non-cancer hazard quotient (HQ) of 0.1. The soil vapor RSLs are provided in Table 6-3. This screening was performed only for VOCs detected in soil.

Soil vapor concentrations (i.e., C_{source}) at the source of contamination (i.e., the maximum detected bulk soil concentration) was estimated using the methodology presented in Section 2.2 of the *Vapor Intrusion User's Guidance* (USEPA 2004b).

The following formula was used to estimate C_{source}:

$$C_{source} = (H'_{TS} \times C_r \times \rho_b)/(\theta_w + K_d \times \rho_b + H'_{TS} \times \theta_a)$$

Where:

C_{source} = vapor concentration at the source of contamination, micrograms per cubic meter (µg/m^3)

H'_{TS} = Henry's law constant at the system soil temperature, dimensionless (13.7 degrees Celsius [°C], soil temperature was assumed to be equal to site-specific groundwater temperature)

C_r = Initial soil concentrations, mg/kg (maximum detected concentration for COPCs)

ρ_b = Soil dry bulk density, grams per cubic centimeter (g/cm^3) (1.66 - default value for sand from Johnson and Ettinger [J&E] model)

θ_w = Soil water-filled porosity, cm^3/cm^3 (0.054 default value for sand from J&E model)

K_d = Soil-water partition coefficient, cm^3/g (=$K_{oc} \times f_{oc}$)

θ_a = Soil air-filled porosity, cm^3/cm^3 (0.321; default value for sand from J&E model)

K_{oc} = Soil organic carbon partition coefficient, cm^3/g (chemical-specific; source J&E model)

f_{oc} = Soil organic carbon weight fraction (0.002; default value for sand from J&E model)

Comparison with Health-based Criteria for Sediment

Sediment data were compared to the USEPA RSLs for residential soil (USEPA 2008). RSLs based on non-carcinogenic effects were divided by 10 to account for exposure to multiple constituents. RSLs based on carcinogenic effects were used as presented in the RSL table. If more recent toxicity values were available for a constituent, a new RSL was calculated using the equations from the USEPA RSL table and the updated toxicity values.

Comparison with Health-based Criteria for Groundwater

Groundwater data were compared to the USEPA tap water RSLs. RSLs that are based on non-carcinogenic effects were divided by 10 to account for exposure to multiple constituents. RSLs based on carcinogenic effects were used as presented in the RSL table. If more recent toxicity values were available for a constituent, a new RSL was calculated using the equations from the USEPA RSL table and the updated toxicity values.

Comparison with Health-based Criteria for Indoor Air (from Groundwater)

Groundwater data were compared to the target groundwater concentrations for protection of indoor air provided in Table 2c of the USEPA's *Draft Vapor Intrusion Guidance* (USEPA 2002a). The groundwater screening levels were based on a target risk of 1×10^{-6} and a target non-cancer HQ of 0.1 (Table 6-4). As noted in Table 6-4, the groundwater screening levels were updated using new toxicity data, where applicable, using the methodology presented in Appendix D of the 2002 USEPA *Draft Vapor Intrusion Guidance* (USEPA 2002a). This screening was performed only for VOCs detected in groundwater.

Comparison with Health-based Criteria for Surface Water

Surface water data were compared to the USEPA tap water RSLs. RSLs that are based on non-carcinogenic effects were divided by 10 to account for exposure to multiple constituents. RSLs based on carcinogenic effects were used as presented in the RSL table. If more recent toxicity values were available for a constituent, a new RSL was calculated using the equations from the USEPA RSL table and the updated toxicity values.

Comparison of Lead Concentrations

Lead concentrations in groundwater and surface water were compared to the federal action level of 15 µg/L (USEPA 2004c). Lead concentrations in soil and sediment were compared to a soil screening level of 400 mg/kg (USEPA 1994a, 2008), a conservative approach that is considered protective of human health under residential land use. If the lead concentration exceeded the screening value, it was retained as a COPC for the risk assessment.

Essential Human Nutrients

Constituents that are considered essential nutrients, present at low concentrations (i.e., only slightly elevated above naturally occurring levels), and toxic only at very high doses were eliminated from the quantitative risk analysis. These constituents include calcium, magnesium, potassium, and sodium.

The WHO dioxin toxic equivalency factors were used to calculate the 2,3,7,8-TCDD toxic equivalent (TCDD TEQ) concentration for each sample where dioxins or furans were detected, as shown on Appendix C, Tables 2.1 through 2.20. The TCDD TEQ concentration was used in the screening process. The individual dioxin/furan congeners are presented in the COPC screening tables for information purposes only.

The screening levels were calculated for two detected chemicals (dibenzofuran and di-n-octylphthalate) not listed on the RSL tables. Provisional Peer Reviewed Toxicity Values (PPRTVs; USEPA 2007b) provided by USEPA Region 2 were used to calculate the dibenzofuran screening level. Toxicity values presented in the 2004 USEPA Region 9 preliminary remediation goals (PRGs) table were used to calculate the screening levels for di-n-octylphthalate.

6.3.3 Summary of COPCs

Analytes that exceeded background concentrations (inorganics) and exceeded risk-based screening levels were identified as COPCs for specific exposure areas. The dioxin/furan congeners are included in the screening tables for information purposes only. As discussed in Section 6.2.2, TCDD TEQ concentrations were calculated using the dioxin/furan congener data. The TCDD TEQ was used to quantify risks in the HHRA evaluation. Table 6-5 identifies the constituents that were selected as COPCs for each of the media.

In summary, the following COPCs were identified for surface soil, total soil, sediment, surface water, and groundwater:

- **AOC 1, Surface Soil (0 to 1 foot bgs) —** Nine PAHs [benz(a)anthracene; benzo(a)pyrene; benzo(b)fluoranthene; benzo(k)fluoranthene; chrysene; dibenz(a,h)anthracene; fluoranthene; indeno(1,2,3-cd)pyrene; naphthalene; and pyrene], three PCBs (PBC 1242, PCB 1248, and PCB 1260), dioxins/furans (which will be quantified as TCDD TEQ), one SVOC (dibenzofuran), and three inorganics (lead, silver, and thallium) exceeded the screening criteria and were identified as COPCs (Appendix C, Table 2.1). Carbazole was selected as a COPC because it lacks an RSL for comparison. Five inorganics (aluminum, arsenic, cobalt, iron, and manganese) exceeded the RSLs; however, the concentrations of these inorganics were less than background concentrations, and they were eliminated as COPCs.
- **AOC 2, Surface Soil (0 to 1 foot bgs) —** Four PAHs [benz(a)anthracene; benz(a)pyrene; benzo(b)fluoranthene; and dibenz(a,h)anthracene], dioxins/furans (as TCDD TEQ), and three inorganics (cobalt, manganese, and thallium) exceeded the screening criteria and were identified as COPCs (Appendix C, Table 2.2). Three inorganics (aluminum, arsenic, and iron) exceeded the RSLs; however, the concentrations of these inorganics were less than background concentrations, and they were eliminated as COPCs.
- **AOC 1, Total Soil (0 to 10 feet bgs) —** Ten PAHs [benz(a)anthracene; benzo(a)pyrene; benzo(b)fluoranthene; benzo(k)fluoranthene; chrysene; dibenz(a,h)anthracene; fluoranthene; indeno(1,2,3-cd)pyrene; naphthalene; and pyrene], four PCBs (PBC 1242, PCB 1248, PCB 1254, and PCB 1260), dioxins/furans (as TCDD TEQ), one SVOC (dibenzofuran), and five inorganics (aluminum, lead, mercury, silver, and thallium) exceeded the screening criteria and were identified as COPCs (Appendix C, Table 2.3). Carbazole was selected as a COPC because it lacks an RSL for comparison. Four inorganics (arsenic, cobalt, iron, and manganese) exceeded the RSLs; however, the concentrations of these inorganics were less than background concentrations, and they were eliminated as COPCs.

- **AOC 2, Total Soil (0 to 10 feet bgs) —** Four PAHs [benz(a)anthracene; benz(a)pyrene; benzo(b)fluoranthene; and dibenz(a,h)anthracene], dioxins/furans (as TCDD TEQ), and four inorganics (arsenic, cobalt, manganese, and thallium) exceeded the screening criteria and were identified as COPCs (Appendix C, Table 2.4). Two inorganics (aluminum and iron) exceeded the RSLs; however, the concentrations of these inorganics were less than background concentrations, and they were eliminated as COPCs.
- **AOC 2, Indoor Air (Vapor Intrusion from Total Soil) —** Two VOCs (trans-1,3-dichloropropene and methylene chloride) and one PAH (naphthalene) exceeded the screening criteria and were identified as COPCs (Appendix C, Table 2.5).
- **East Ditch, Sediment —** One inorganic (manganese) exceeded the screening criteria and was identified as a COPC (Appendix C, Table 2.6). Three inorganics (arsenic, cobalt, and iron) exceeded the RSLs; however, the concentrations of these inorganics were less than background concentrations, and they were eliminated as COPCs.
- **West Ditch, Sediment —** Two PAHs [benzo(a)pyrene and benzo(b)fluoranthene] and six inorganics (aluminum, arsenic, cobalt, iron, manganese, and thallium) exceeded the screening criteria and were identified as COPCs (Appendix C, Table 2.7).
- **East Ditch, Surface Water —** One inorganic (thallium) exceeded the screening criteria and was identified as a COPC (Appendix C, Table 2.8).
- **West Ditch, Surface Water —** One SVOC [bis(2-ethylhexyl)phthalate], one VOC (methylene chloride), dioxins/furans (as TCDD TEQ), and three inorganics (arsenic, lead, and thallium) exceeded the screening criteria and were identified as COPCs (Appendix C, Table 2.9).
- **Off-Landfill, IDA Groundwater —** Five PAHs [benz(a)anthracene; benz(a)pyrene; benzo(b)fluoranthene; dibenz(a,h)anthracene; and indeno(1,2,3-cd)pyrene], dioxins/furans (as TCDD TEQ), and three inorganics (iron, lead, and manganese) exceeded the screening criteria and were identified as COPCs (Appendix C, Table 2.10). One inorganic (arsenic) exceeded the RSL; however, the concentration of this inorganic was less than the background concentration, and arsenic was eliminated as a COPC.
- **AOC 1, UWBZ Groundwater —** One SVOC [bis(2-ethylhexyl)phthalate], one VOC (methylene chloride), six PAHs [benz(a)anthracene; benz(a)pyrene; benzo(b)fluoranthene; dibenz(a,h)anthracene; indeno(1,2,3-cd)pyrene; and naphthalene], dioxins/furans (as TCDD TEQ), and 13 inorganics (aluminum, arsenic, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, thallium, and vanadium) exceeded the screening criteria and were identified as COPCs (Appendix C, Table 2.11).
- **AOC 1, IDA Groundwater —** One SVOC [bis(2-ethylhexyl)phthalate], five PAHs [benz(a)pyrene; benzo(b)fluoranthene; dibenz(a,h)anthracene; indeno(1,2,3-cd)pyrene; and naphthalene], dioxins/furans (as TCDD TEQ), and six inorganics (aluminum, chromium, cobalt, iron, lead, and manganese) exceeded the screening criteria and were identified as COPCs (Appendix C, Table 2.12). Two inorganics (arsenic and barium)

exceeded the RSL; however, the concentration of these inorganics were less than the background concentration, and they were eliminated as COPCs.

- **AOC 2, UWBZ Groundwater —** Five PAHs [benz(a)anthracene; benz(a)pyrene; benzo(b)fluoranthene; dibenz(a,h)anthracene; and indeno(1,2,3-cd)pyrene], dioxins/furans (as TCDD TEQ), and eight inorganics (aluminum, arsenic, cobalt, iron, lead, manganese, nickel, and vanadium) exceeded the screening criteria and were identified as COPCs (Appendix C, Table 2.13). One inorganic (chromium) exceeded the RSL; however, the concentration of this inorganic was less than the background concentration, and it was eliminated as a COPC.
- **Off-Landfill, Indoor Air (Vapor Intrusion from Groundwater - IDA) —** No volatile constituents exceeded the screening criteria; therefore, no COPCs were selected (Appendix C, Table 2.14).
- **AOC 1, Indoor Air (Vapor Intrusion from Groundwater - UWBZ) —** No volatile constituents exceeded the screening criteria; therefore, no COPCs were selected (Appendix C, Table 2.15).
- **AOC 1, Indoor Air (Vapor Intrusion from Groundwater - IDA) —** No volatile constituents exceeded the screening criteria; therefore, no COPCs were selected (Appendix C, Table 2.16).
- **AOC 2, Indoor Air (Vapor Intrusion from Groundwater - UWBZ) —** No volatile constituents exceeded the screening criteria; therefore, no COPCs were selected (Appendix C, Table 2.17).
- **AOC 2, Indoor Air (Vapor Intrusion from Groundwater - IDA) —** No volatile constituents exceeded the screening criteria; therefore, no COPCs were selected (Appendix C, Table 2.18).

6.4 Exposure Assessment

Exposure assessment is the estimation of the likelihood, magnitude, frequency, duration, and routes of exposure to a chemical. Exposure refers to the potential contact of an individual (or receptor) with a chemical. Exposure can occur when contaminants migrate from a source to an exposure point, or when a receptor comes into direct contact with contaminated media.

The three components of exposure assessment include:

- Characterization of exposure setting
- Identification of exposure pathways
- Quantification of exposure

6.4.1 Characterization of Exposure Setting

Characterization of exposure setting consists of two parts: (1) characterization of the site with respect to the physical characteristics, and (2) characterization of the site with respect to human populations at or near the site.

Physical Characteristics

The former Lockbourne AFB landfill is located at the western base boundary adjacent to the Village of Lockbourne. Currently, the site is covered with native grass, weeds, and tree overgrowth. The site is fenced on the north perimeter, with a drainage ditch to the southeast and southwest acting as a natural barrier (Figure 1-2).

A description of landfill is included in Section 1. Section 3 describes the physical setting of the site, including the physiography, climate, surface water hydrology, topography, geology, hydrogeology, and land and water use.

Potentially Exposed Populations

The former Lockbourne AFB landfill is unused. Table 6-2 summarizes the potentially exposed populations at the site. The receptors were discussed in Section 6.1.1.

6.4.2 Identification of Exposure Pathways

An exposure pathway can be described as the physical course that a COPC takes from the point of release (or source) to a receptor. To be complete, an exposure pathway must have all of the following components:

- A source (e.g., constituent residues in soil)
- A mechanism for chemical release and migration (e.g., leaching)
- An environmental transport medium (e.g., groundwater)
- A point or site of potential human contact (exposure point, for example, drinking water)
- A route of intake (e.g., ingestion of groundwater used as a drinking water source)

In the absence of any one of these components, an exposure pathway is considered incomplete and, by definition, there is no risk or hazard. In some cases, a receptor may contact a source directly, eliminating the release and transport pathways.

The potential exposure pathways for the former Lockbourne AFB landfill were identified in the CSM (Figure 6-1) and are shown in Table 6-2 and Appendix C, Table 1. The following subsections discuss the elements of the exposure pathways for the former Lockbourne AFB landfill.

Contaminant Sources

As shown on Figure 6-1, the source of contamination at the former Lockbourne AFB landfill was the burning, trenching/filling, and landfarming of waste.

Release and Transport Mechanisms

The fate and transport of chemicals in site media were determined by the physical characteristics of the site, as well as by the chemical and physical properties of the constituents. A detailed description of the fate and transport analysis for the site was included in Section 5.

Exposure Points and Exposure Routes

Exposure points are the locations where humans could contact site-related contamination. Onsite exposure points include soil, sediment, surface water, and groundwater. Offsite exposure points are groundwater and ambient air downgradient of the site.

Table 6-2 lists the exposure pathways that were evaluated in the risk assessment. Appendix C, Table 1, includes the exposure pathways that were considered, and presents the rational for evaluation of the exposure pathway.

Section 6.1.1 identifies the potential receptors and exposure pathways. In summary, the current land use exposure routes for quantitative evaluation include the following:

- Maintenance Worker — incidental ingestion, dermal contact, and inhalation of particulates and volatiles from surface soil at AOC 1 and AOC 2.
- Trespasser/Visitor (youth) — incidental ingestion, dermal contact, and inhalation of particulates and volatiles from surface soil at AOC 1 and AOC 2; incidental ingestion of and dermal contact with sediment in the East Ditch and West Ditch; and incidental ingestion of and dermal contact with surface water in the East Ditch and West Ditch.
- Offsite Industrial Worker — inhalation of particulates and volatiles from surface soil at AOC 1 and AOC 2.

The future land use exposure routes include current exposure routes and the following:

- Onsite Facility Worker — incidental ingestion, dermal contact, and inhalation of particulates from surface soil and inhalation indoor air (vapor intrusion) from total soil at AOC 2.
- Construction Worker — incidental ingestion, dermal contact, and inhalation of particulates and volatiles from total soil at AOC 1 and AOC 2; dermal contact and inhalation of volatiles from shallow groundwater at AOC 1 and AOC 2; incidental ingestion of and dermal contact with sediment in the East Ditch and West Ditch; and incidental ingestion of and dermal contact with surface water in the East Ditch and West Ditch.
- Offsite Resident (adult and child) — incidental ingestion, dermal contact, and inhalation of groundwater from the shallow aquifer (UWBZ) and intermediate aquifer (IDA) at AOC 1. In addition, off-landfill groundwater also was evaluated for offsite residential exposures. This exposure unit consists of one monitoring well, LCKMW-7, which is adjacent to the Village of Lockbourne and is screened in the IDA. Inhalation of indoor air (vapor intrusion) from groundwater was not evaluated because no COPCs were identified for this media.

6.4.3 Quantification of Exposure

Exposure is quantified by estimating the exposure point concentrations (EPCs) of COPCs in environmental media and COPC intake by the receptor.

Exposure Concentrations

EPCs are estimated constituent concentrations that a receptor may contact and are specific to each exposure medium and exposure unit. EPCs may be directly measured or estimated using environmental fate and transport models. Constituent concentrations in soil, sediment, surface water, and groundwater were measured for this assessment. Fate and transport modeling conducted for the risk assessment included (1) estimating volatile emissions from groundwater while showering using the Andelman Model as modified by Schaum et al. (Andelman 1990; Schaum et al. 1994) for residential receptors (Appendix C, Tables 7.17.RME Supplement B through 7.21.RME Supplement B), and (2) estimating volatile emissions from groundwater in an open excavation for a construction scenario using a Two-Film Volatilization Model (Appendix C, Table 7.10.RME Supplement B).

The EPCs for each exposure area are provided in Appendix C, Tables 3.1 through 3.13. For each COPC where five or more samples were available in the dataset, the upper confidence limit (UCL) on the mean concentration was calculated using the most recent version of ProUCL (Version 4.00.02; USEPA 2007c). The recommended UCL identified in the ProUCL output was used as the EPC if the UCL did not exceed the maximum detected concentration. If the UCL exceeded the maximum detected concentration, then the maximum detected concentration was used as the EPC. The ProUCL output for the COPCs is provided in Appendix D, Attachment 1.

Indoor air concentrations for vapor intrusion from total soil to indoor air were calculated using the USEPA's version (2004b) of the J&E model (Johnson and Ettinger 1991). Because the location of future building at AOC 2 is unknown at this time, the maximum detected concentrations of the three COPCs from total soil at AOC 2 were used to calculate the indoor air concentrations. The output from J&E model for the COPCs identified in AOC 2 total soil for the vapor intrusion pathway is included Appendix D, Attachment 2. The input parameters used for this model are listed in Table 6-6 for the industrial scenario (i.e., future onsite facility worker).

Estimation of Chemical Intakes

Chemical intake is the amount of the chemical constituent entering the receptor's body. The quantification of exposure is based on an estimate of the average daily intake, the average amount of the chemical contaminant entering the receptor's body per day. Chemical intakes are generally expressed as follows:

$$ADI = \frac{C \times CR \times CF \times EF \times ED}{BW \times AT}$$

Where:

ADI = average daily intake (mg/kg-day)
C = chemical concentration (µg/L, mg/kg)
CR = contact rate (L/day, mg/day)
CR = conversion factor (mg/L, mg/kg)
EF = exposure frequency (days/year)
ED = exposure duration (years)
BW = body weight (kg)
AT = averaging time (days)

The intake equation requires exposure parameters that are specific to each exposure pathway. Many of the exposure parameters have default values, which were used for this assessment. These assumptions, based on estimates of body weights, media intake levels, and exposure frequencies and duration, are provided in USEPA guidance. Appendix C, Tables 4.1.RME through 4.15.RME identify the exposure parameters and intake equations for each of the scenarios evaluated in the risk assessment.

For chemicals that act via a mutagenic mode of action (MMOA), carcinogenicity was evaluated using age-dependent adjustment factors (USEPA 2005a). All carcinogenic PAHs (cPAHs) are considered by USEPA to follow the MMOA. Age groups and associated exposure parameters used in the HHRA for the MMOA calculations are presented in Table 4.14.RME Supplement A and Table 4.14.RME Supplement B.

To estimate exposure via dermal contact with soil and sediment, two additional parameters are necessary. The first parameter, the dermal absorption fraction, estimates the amount of a constituent in soil or sediment that would be absorbed by the skin. The absorption fractions used for the COPCs are from USEPA's RAGS Part E (USEPA 2004a) and presented in Appendix C, Table 4 Supplement A. The second additional parameter necessary to estimate dermal expose to constituents in soil and sediment is the adherence factor (AF). The AF estimates the amount of soil and sediment that adheres to the skin per unit of surface area. The AFs were obtained from USEPA RAGS Part E (USEPA 2004a) and are included in Appendix C, Tables 4.1, 4.3, 4.7, 4.8, and 4.12.

The methods presented in the USEPA RAGS Part E (USEPA 2004a) for estimating dermal exposure to water were used to evaluate dermal exposure to surface water and groundwater. The models are shown in Appendix C, Tables 4.6, 4.10, 4.13, and 4.14. Values for the chemical-specific parameters used in the models were obtained from USEPA's RAGS Part E (USEPA 2004a) and are presented in Appendix C, RAGS Part D Table 7 series.

6.5 Toxicity Assessment

Toxicity assessment defines the relationship between the magnitude of exposure and possible severity of adverse effects, and weighs the quality of available toxicological evidence. Toxicity assessment generally consists of two steps: hazard identification and dose-response assessment. Hazard identification is the process of determining the potential adverse effects from exposure to the constituent along with the type of health effect involved. Dose-response assessment is the process of quantitatively evaluating the toxicity information and characterizing the relationship between the dose of the constituent administered or received and the incidence of adverse health effects in the exposed population. Toxicity criteria (e.g., reference doses [RfDs], reference concentrations [RfCs], cancer slope factors [CSFs], and inhalation unit risks [IURs]) are derived from the dose-response relationship.

Health effects are divided into two broad groups: non-carcinogenic and carcinogenic effects. This division is based on the different mechanisms of action currently associated with each category. This section discusses non-carcinogenic and carcinogenic effects separately, and how these effects were assessed in this HHRA.

USEPA recommends that a tiered approach be used to obtain the toxicity values (RfDs, RfCs, CSFs, and IURs) used to calculate non-cancer and cancer risks, respectively (USEPA 2003a). The following hierarchy of sources was used to obtain toxicity data for COPCs:

- USEPA's Integrated Risk Information System (IRIS) database (USEPA 2009b)
- Provisional Peer Reviewed Toxicity Value (PPRTV) database maintained by USEPA's National Center for Environmental Assessment (NCEA) and the Superfund Health Risk Technical Support Center (STSC)
- Other USEPA and non-USEPA sources including NCEA, ATSDR, Health Effects Assessment Summary Tables (HEAST; USEPA 1997a), California Environmental Protection Agency, USEPA's Office of Water, and WHO

The use of provisional toxicity values, such as those from the PPRTV database, increases the uncertainty of the quantitative risk estimate. If no toxicity values were available for a detected constituent, surrogate constituents were selected and their RSLs were used for the COPC selection process.

6.5.1 Toxicity Information for Non-carcinogenic Effects

Non-carcinogenic health effects include a variety of toxic effects on body systems, such as renal toxicity (toxicity to kidney) and central nervous system disorders. The toxicity of a constituent was assessed by reviewing toxic effects noted in short-term (acute) animal studies, long-term (chronic) animal studies, and epidemiological investigations.

USEPA (1989a, 1989b) defines the chronic RfD as an estimate of a daily exposure to the human population, including sensitive subpopulations, which is likely to be without appreciable risk of deleterious effects during a lifetime. Chronic RfDs are developed to be protective for long-term exposure to a compound (7 years to a lifetime). Chronic RfDs may be overly protective if used to evaluate the potential for adverse health effects resulting from short-term exposure. NCEA develops subchronic RfDs for short-term exposure (2 weeks to 7 years). Subchronic RfDs have been peer-reviewed by USEPA and outside reviewers, but they have not undergone verification by an intra-USEPA workgroup, and as a result, are considered interim rather than verified toxicity values. Subchronic RfDs were used to evaluate the non-carcinogenic risks to the construction worker. If a subchronic RfD was not available, the chronic RfD was used. Chronic RfDs were used for all other receptors.

USEPA-derived oral and inhalation chronic and subchronic RfDs and RfCs, and associated uncertainty factors (UFs) and modifying factors (MFs), for the COPCs are listed in Appendix C, Tables 5.1 and 5.2 in.

6.5.2 Toxicity Information for Carcinogenic Effects

Potential carcinogenic effects are quantified using oral CSFs and IUR factors. CSFs may be derived from the results of chronic animal bioassays, human epidemiological studies, or both. Animal bioassays are usually conducted at dose levels much higher than are likely to be encountered in the environment. This design detects possible adverse effects in the relatively small test populations used in the studies. These high dose levels must be extrapolated to lower doses. A number of mathematical models and procedures have been developed to extrapolate from the high doses used in the studies to the low doses typically associated with environmental exposures.

USEPA-derived oral and inhalation CSFs and IUR factors are listed in Appendix C, Tables 6.1 and 6.2.

6.5.3 Derivation of Dermal RfDs and Slope Factors

Oral RfDs and CSFs were converted to dermal RfDs and CSFs using an oral to dermal adjustment factor. This factor is designed to convert the orally administered dose toxicity factors to dermally absorbed dose toxicity factors (USEPA 2004a). The oral RfDs were converted to dermal RfDs by multiplying by the oral to dermal adjustment factor (gastrointestinal [GI] absorption factor) and the oral CSFs were converted to dermal CSFs by dividing by the GI absorption factor. If a chemical-specific GI absorption factor was not available or was greater than 50 percent, a GI absorption factor of 100 percent was assumed. The dermal RfDs are included in Appendix C, Table 5.1. The dermal CSFs are presented in Appendix C, Table 6.1.

6.5.4 Constituents Without Available USEPA Toxicity Values

Most of the constituents detected at the former Lockbourne AFB landfill have toxicity factors and USEPA RSLs. Detected constituents that did not have RSLs were compared to RSLs for appropriate surrogate constituents during the COPC selection process. Surrogates were selected based on previous recommendations from USEPA. The surrogates are identified in Appendix C, Tables 2.1 through 2.18.

Quantitative oral toxicity criteria are not available for lead. An interim approach to assessing risks associated with adult exposures to lead was developed by USEPA's Technical Review Workgroup for Lead (USEPA 2003b) and updated in 2005. This methodology is a variation of the Integrated Exposure Uptake Biokinetic (IEUBK) model used to evaluate lead exposures to children. The adult lead methodology (ALM) is used to evaluate risks associated with nonresidential adult exposures to lead in soil. The model focuses on estimating fetal blood lead levels (BLLs) in women exposed to lead in soil (USEPA 2003b). It was used in this risk evaluation to be protective of potentially sensitive receptors within a maintenance worker population and a construction worker population. Because the lead model is a probabilistic model, several of the USEPA default parameters are based on central tendency (i.e., average) values (USEPA 2003b). Therefore, the arithmetic mean for the lead concentration served as the input value for the soil concentration.

For the maintenance worker, the default exposure parameters used in the ALM for ingestion (50 mg/kg) and exposure frequency (219 days per year) were used to evaluate direct contact with soil. For the construction worker, the exposure parameters used in the ALM for ingestion and exposure frequency are the same as those that were used to evaluate direct contact with soil for the other COPCs. The soil ingestion rate of 330 milligrams per day (mg/day) and an exposure frequency of 250 days per year were assumed for the construction worker.

The ALM uses different sets of geometric standard deviation (GSD) and baseline BLLs for various ethnic groups and regions of the United States. The GSD is a measure of the inter-individual variability in BLLs in a population whose members are exposed to the same nonresidential environmental lead levels. The baseline BLL is intended to represent the best estimate of a reasonable central value of BLL in women of childbearing age that are not exposed to lead-contaminated nonresidential soil or dust at the site (USEPA 2003b). In this analysis, geometric means for all ethnic groups and regions were used.

ALM spreadsheets provided by USEPA (2005b) were used to calculate BLLs for the various scenarios, as needed. The model results are expressed as the predicted geometric mean BLL for adults (i.e., women of childbearing age), the corresponding 95th percentile fetal BLLs, and the percent of the fetal population potentially experiencing concentrations above 10 micrograms per deciliter (µg/dL; below which adverse manifestations are not expected).

The potential risks associated with residential exposures to lead are assessed using the IEUBK Lead Model for Windows®, Version 1.0, Build 264 (USEPA 1994a, 2002b, 2005c). The IEUBK model was designed to provide predictions of the probability of elevated BLLs for children. This model addresses three components of environmental risk assessments: the multimedia nature of exposures to lead, lead pharmacokinetics, and significant variability in exposure and risk, through estimation of probability distributions of BLLs for children exposed to similar environmental concentrations. The arithmetic mean of the lead concentration in groundwater, along with the default input parameters, was used to evaluate site-specific exposures to lead.

6.6 Risk Characterization

Risk characterization combines the results of the previous elements of the risk assessment to evaluate the potential health risks associated with exposure to the COPCs. The risk characterization is then used as an integral component in remedial decision making and selection of potential remedies or actions, as necessary.

6.6.1 Non-carcinogenic and Carcinogenic Risk Estimation Methods

Potential human health risks are discussed independently for carcinogenic and non-carcinogenic constituents because of the different toxicological endpoints, relevant exposure duration, and methods used to characterize risk. Some constituents may produce both non-carcinogenic and carcinogenic effects, and were evaluated in both groups. The methodology used to estimate non-carcinogenic hazards and carcinogenic risks are described below. Following the description of the methodology, the non-carcinogenic hazards and carcinogenic risks for the former Lockbourne AFB landfill are discussed.

Non-carcinogenic Hazard Estimation

Non-carcinogenic health risks are estimated by comparing the calculated intake to an RfD or RfC. The calculated intake divided by the RfD or RfC is equal to the HQ:

$$\text{HQ} = \text{Intake} / \text{RfD}$$

The intake and RfD represent the same exposure period (i.e., chronic or subchronic) and the same exposure route (i.e., oral intakes are divided by oral RfDs). An HQ that exceeds 1 (i.e., the intake exceeds the RfD) indicates that there is a potential for adverse health effects associated with exposure to that constituent.

To assess the potential for non-carcinogenic health effects posed by exposure to multiple constituents, a hazard index (HI) approach is used (USEPA 1986). This approach assumes that non-carcinogenic hazards associated with exposure to more than one constituent are additive. Synergistic or antagonistic interactions between constituents are not considered. The HI may exceed 1 even if all of the individual HQs are less than 1. HIs also are added across exposure routes and media to estimate the total non-carcinogenic health effects to a receptor posed by exposure through multiple routes and media. A HI greater than 1 indicates that there is some potential for adverse non-carcinogenic health effects associated with exposure to the contaminants of concern. However, if the HI is greater than 1, separate HIs for the different target organs/effects are calculated, to determine if the HI for a specific target organ/effect is greater than 1. If the HI for each target organ/effect is not above 1, it can be assumed that there is no unacceptable non-carcinogenic hazard to the receptor.

6.6.2 Carcinogenic Risk Estimation

The potential for carcinogenic effects because of exposure to site-related constituents is evaluated by estimating the excess lifetime carcinogenic risk (ELCR). ELCR is the excess incremental increase in the probability of developing cancer during one's lifetime as a result of the assumed exposures to the site over an individual's risks without exposure to the site.

Estimated daily intakes averaged over a lifetime of exposure were multiplied by CSFs to calculate the incremental risks of hypothetical receptors developing cancer. The following formula was used to estimate ELCR from site exposures:

$$\text{ELCR} = \text{Intake x CSF}$$

Daily average indoor air and ambient air concentrations (from soil and groundwater) were multiplied by the inhalation unit risk factor (URF) (USEPA 2009a) to calculate incremental risks of hypothetical receptors developing cancer. The following formula was used to estimate potential ELCR from inhalation exposure:

$$\text{ELCR} = \text{Air Concentration} \times \text{URF}$$

The combined risk from exposure to multiple constituents was evaluated by adding the risks from individual constituents. Risks also were added across the exposure routes and media if an individual would be exposed through multiple routes and to multiple media.

When a cumulative carcinogenic risk to an individual receptor under the assumed reasonable maximum exposure (RME) exposure conditions at the site exceeds 100 in a million (i.e., 10^{-4} excess carcinogenic risk), CERCLA generally requires remedial action to reduce risks at the site (USEPA 1991). If the cumulative risk is less than 10^{-4}, action generally is not required, but may be warranted if a risk-based chemical-specific standard (e.g., maximum contaminant level [MCL]) is exceeded. Ohio EPA's target risk level is $1\text{x}10^{-5}$ (Ohio EPA 2004). Therefore, the total estimated ELCR for each receptor group is compared to a target level of $1\text{x}10^{-5}$.

6.6.3 Risk Assessment Results

The results of the risk characterization are presented below by receptor. The risks are calculated in Appendix C, Tables 7.1.RME through 7.22.RME. The risks are summarized in Appendix C, Tables 9.1.RME through 9.22.RME. A summary of the RME results is provided in Table 6-7. Appendix C, Tables 10.1.RME through 10.13.RME show the receptor scenarios with a total HI greater than 1.0 and/or total carcinogenic risks greater than 1 x 10^{-5}. Constituents that contribute HIs greater than 0.1 or carcinogenic risks greater than 1x10^{-6} are included in the table.

Current/Future Maintenance Worker

The risk assessment assumed that a current/future maintenance worker could be exposed to surface soil in AOC 1 and AOC 2 through incidental ingestion, dermal contact, and inhalation of particulates. Appendix C, Tables 9.1.RME and 9.2.RME summarize the hazard and risk to the current/future maintenance workers exposures to surface soil in AOC 1 and AOC 2, respectively.

- **AOC 1, Surface Soil**: The RME non-carcinogenic hazard (0.017) is less than Ohio EPA's target HI of 1. The RME carcinogenic risk (1.9x10^{-4}) exceeds Ohio EPA's target risk level of 1x10^{-5}. The carcinogenic risk is primarily associated with ingestion and dermal contact with PAHs and, to a smaller extent, PCBs. Seven individual COPCs exceed an ELCR of 1x10^{-6}: benz(a)anthracene; benzo(a)pyrene; benzo(b)fluoranthene; benzo(k)fluoranthene; dibenz(a,h)anthracene; indeno(1,2,3-cd)pyrene; and PCB 1248.

  Lead was identified as a COPC in AOC 1 surface soil. Site-specific lead exposures were evaluated for adult maintenance workers using the ALM. The input parameters are provided in Appendix C, Table 11.1a. The results of the model are presented in Appendix C, Table 11.1b. The mean soil lead concentration of 318 mg/kg results in geometric mean BLLs ranging from 1.8 to 2.4 µg/dL for women of childbearing age in various populations. The corresponding 95th percentile fetal blood lead concentrations range from 5.5 to 7.6 µg/dL. The probabilities that the fetal BLLs exceed 10 µg/dL range from 0.7 to 2.4 percent. These values are less than the BLL goal as described in the 1994 Office of Solid Waste and Emergency Response (OSWER) Directive of no more than 5 percent of children (fetuses of exposed women) exceeding 10 µg/dL blood lead.

- **AOC 2, Surface Soil**: The RME non-carcinogenic hazard (0.018) is less than Ohio EPA's target HI of 1. The RME carcinogenic risk (2.0x10^{-7}) is less than Ohio EPA's target risk level of 1x10^{-5}.

Current/Future Youth Trespasser/Visitor

The risk assessment assumed that a current/future youth trespasser/visitor could be exposed to surface soil in AOC 1 and AOC 2 through incidental ingestion, dermal contact, and inhalation of particulates; and sediment and surface water in the East and West ditches through incidental ingestion and dermal contact. Appendix C, Tables 9.3.RME through 9.6.RME, summarize the hazards and risks for the current/future youth trespasser/visitor exposures to surface soil, sediment and surface water.

- **AOC 1, Surface Soil**: The RME non-carcinogenic hazard (0.025) is less than Ohio EPA's target HI of 1. The RME carcinogenic risk (1.1x10^{-4}) exceeds Ohio EPA's target level of 1x10^{-5}. The carcinogenic risk is primarily associated with ingestion and dermal contact with PAHs and, to a smaller extent, PCBs. Six individual COPCs exceed an ELCR of 1x10^{-6}: benz(a)anthracene; benzo(a)pyrene; benzo(b)fluoranthene; dibenz(a,h) anthracene; indeno(1,2,3-cd)pyrene; and PCB 1248.

- **AOC 2, Surface Soil**: The RME non-carcinogenic hazard (0.029 is less than Ohio EPA's target HI of 1. The RME carcinogenic risk ($1.2x10^{-7}$) is less than Ohio EPA's target level of $1x10^{-5}$.
- **East Ditch, Sediment**: The RME non-carcinogenic hazard (0.00072) is less than Ohio EPA's target HI of 1. None of the COPCs is carcinogenic; therefore, carcinogenic risks were not calculated.
- **East Ditch, Surface Water**: The RME non-carcinogenic hazard (0.014) is less than Ohio EPA's target HI of 1. None of the COPCs is carcinogenic; therefore, carcinogenic risks were not calculated.
- **West Ditch, Sediment**: The RME non-carcinogenic hazard (0.043) is less than Ohio EPA's target HI of 1. The RME carcinogenic risk ($3.1x10^{-6}$) is less than Ohio EPA's target level of $1x10^{-5}$. One individual COPC (arsenic) exceeded an ELCR of $1x10^{-6}$.
- **West Ditch, Surface Water**: The RME non-carcinogenic hazard (0.15) is less than Ohio EPA's target HI of 1. The RME carcinogenic risk ($2.7x10^{-6}$) is less than Ohio EPA's target level of $1x10^{-5}$. One COPC (TCDD TEQ) exceeded an ELCR of $1x10^{-6}$.
- **Total Cumulative Risk**: Risks for the current/future youth trespasser were added across the exposure media to evaluate potential cumulative risk across multiple routes and multiple media. Only the maximum risk estimate from each media (e.g., AOC 1 or AOC 2 surface soil) was included in the cumulative risk estimate so that the cumulative risks were not overestimated. The potential maximum cumulative RME non-carcinogenic hazard associated with youth trespasser/visitor exposures to surface soil, sediment, and surface water (0.22) is less than Ohio EPA's target HI of 1. The cumulative RME carcinogenic risk (1.1×10^{-4}) exceeds Ohio EPA's target level of $1x10^{-5}$, primarily because of PAHs and PCBs in AOC 1 surface soil.

Current/Future Offsite Industrial Worker

The risk assessment assumed that a current/future offsite industrial worker could be exposed to surface soil in AOC 1 and AOC 2 through inhalation of particulates. Appendix C, Tables 9.7.RME and 9.8.RME summarize the hazard and risk for the current/future offsite industrial worker exposures to surface soil in AOC 1 and AOC 2, respectively.

- **AOC 1, Surface Soil**: The RME non-carcinogenic hazard (0.0049) is less than Ohio EPA's target HI of 1. The RME carcinogenic risk ($2.4x10^{-7}$) is less than Ohio EPA's target level of $1x10^{-5}$.
- **AOC 2, Surface Soil**: The RME non-carcinogenic hazard (0.012) is less than Ohio EPA's target HI of 1. The RME carcinogenic risk ($3.6\ x10^{-8}$) is less than Ohio EPA's target level of $1x10^{-5}$.

Future Onsite Facility Worker

The risk assessment assumed that a future onsite facility worker could be exposed to surface soil in AOC 2 through incidental ingestion, dermal contact, and inhalation of particulates if AOC 2 is developed in the future. Exposure via inhalation of volatiles that have migrated from total soil to indoor air through vapor intrusion also was assumed. Appendix C, Table 9.9.RME summarizes the hazard and risk to the future onsite facility worker exposed to surface soil in AOC 2.

- **AOC 2, Surface Soil**: The RME non-carcinogenic hazard (0.031) is less than Ohio EPA's target HI of 1. The RME carcinogenic risk ($1.4x10^{-6}$) is less than Ohio EPA's target level of $1x10^{-5}$. None of the COPCs exceeded an ELCR of $1x10^{-6}$.
- **AOC 2, Indoor Air (Vapor Intrusion from Total Soil)**: The RME non-carcinogenic hazard (0.21) is less than Ohio EPA's target HI of 1. The RME carcinogenic risk ($7.2x10^{-6}$) is less than Ohio EPA's target level of $1x10^{-5}$. Three individual COPCs exceed an ELCR of $1x10^{-6}$: trans-1,3-dichloropropene; methylene chloride; and naphthalene.
- **Total Cumulative Risk**: Risks for the future onsite facility worker were added across the exposure media to evaluate potential cumulative risk across multiple routes and multiple media. The potential maximum cumulative RME non-carcinogenic hazard associated with onsite facility worker exposures to surface soil and indoor air (0.24) is less than Ohio EPA's target HI of 1. The cumulative RME carcinogenic risk (8.6×10^{-6}) is less than Ohio EPA's target level of $1x10^{-5}$.

Future Construction Worker

The risk assessment assumed that a future adult construction worker could be exposed to total soil (i.e., combined surface and subsurface soil) in AOC 1 and AOC 2 through incidental ingestion, dermal contact, and inhalation of particulates, to groundwater through dermal contact and inhalation of vapors, and to sediment and surface water in the East and West ditches through incidental ingestion and dermal contact. Appendix C, Tables 9.10.RME through 9.13.RME summarize the hazards and risks for the future adult construction worker exposures to surface soil, sediment, surface water, and groundwater.

- **AOC 1, Total Soil**: The RME non-carcinogenic hazard (0.39) is less than Ohio EPA's target HI of 1. The RME carcinogenic risk ($1.0x10^{-4}$) exceeds Ohio EPA's target level of $1x10^{-5}$. The carcinogenic risk is primarily associated with ingestion and dermal contact with PAHs and, to a smaller extent, PCBs. Six individual COPCs exceed an ELCR of $1x10^{-6}$: benz(a)anthracene; benzo(a)pyrene; benzo(b)fluoranthene; dibenz(a,h) anthracene; indeno(1,2,3-cd)pyrene; and PCB 1248.
- Lead was selected as a COPC in AOC 1 total soil. Site-specific lead exposures were evaluated for adult construction workers using the ALM. The input parameters are provided in Appendix C, Table 11.2a. The results of the model are presented in Appendix C, Table 11.1b. The mean soil lead concentration of 223 mg/kg results in geometric mean BLLs ranging from 3.8 to 4.4 µg/dL for women of childbearing age in various populations. The corresponding 95th percentile fetal blood lead concentrations range from 11.3 to 14.5 µg/dL. The probabilities that the fetal BLLs exceed 10 µg/dL range from 7.1 to 11.5 percent. These values are greater than the BLL goal as described in the 1994 OSWER Directive of no more than 5 percent of children (fetuses of exposed women) exceeding 10 µg/dL blood lead.

- **AOC 2, Total Soil**: The RME non-carcinogenic hazard (0.33) is less than Ohio EPA's target HI of 1. The RME carcinogenic risk ($1.1x10^{-6}$) is less than Ohio EPA's target level of $1x10^{-5}$. One individual COPC (arsenic) exceeded an ELCR of $1x10^{-6}$.
- **AOC 1, UWBZ Groundwater**: The RME non-carcinogenic hazard (2.5) exceeds Ohio EPA's target HI of 1. The primary contributor to hazard is TCDD TEQ (HI=2.4). One target organ exceeds the target HI of 1 (developmental, HI=2.4). The RME carcinogenic risk ($1.4x10^{-5}$) exceeds Ohio EPA's target level of $1x10^{-5}$. The carcinogenic risk is primarily associated with dermal contact with PAHs and dioxins/furans. Three individual COPCs exceed an ELCR of $1x10^{-6}$: benzo(a)pyrene; dibenz(a,h)anthracene; and TCDD TEQ.
- **AOC 2, UWBZ Groundwater**: The RME non-carcinogenic hazard (3.1) exceeds Ohio EPA's target HI of 1. The primary contributor to hazard is TCDD TEQ (HI=3.1). One target organ exceeds the target HI of 1 (developmental, HI=3.1). The RME carcinogenic risk ($3.0x10^{-5}$) exceeds Ohio EPA's target level of $1x10^{-5}$. The carcinogenic risk is primarily associated with dermal contact with PAHs and dioxins/furans. Four individual COPCs exceed an ELCR of $1x10^{-6}$: benzo(a)pyrene; dibenz(a,h)anthracene; indeno(1,2,3-cd)pyrene; and TCDD TEQ.
- **East Ditch, Sediment**: The RME non-carcinogenic hazard (0.00040) is less than Ohio EPA's target HI of 1. None of the COPCs is carcinogenic; therefore, carcinogenic risks were not calculated.
- **East Ditch, Surface Water**: The RME non-carcinogenic hazard (0.011) is less than Ohio EPA's target HI of 1. None of the COPCs is carcinogenic; therefore, carcinogenic risks were not calculated.
- **West Ditch, Sediment**: The RME non-carcinogenic hazard (0.019) is less than Ohio EPA's target HI of 1. The RME carcinogenic risk ($5.8x10^{-8}$) is less than Ohio EPA's target level of $1x10^{-5}$.
- **West Ditch, Surface Water**: The RME non-carcinogenic hazard (0.18) is less than Ohio EPA's target HI of 1. The RME carcinogenic risk ($3.3x10^{-7}$) is less than Ohio EPA's target level of $1x10^{-5}$.
- **Total Cumulative Risk**: Risks for the future adult construction worker were added across the exposure media to take into account potential cumulative risk across multiple routes and multiple media. Only the maximum risk estimate from each media was included in the cumulative risk estimate so that the cumulative risks were not overestimated. The potential cumulative RME non-carcinogenic hazard associated with future adult construction worker exposures to total soil, groundwater, sediment, and surface water (3.7) exceeds Ohio EPA's target HI of 1, primarily because of dioxins/furans in AOC 2 (UWBZ) groundwater. The cumulative RME carcinogenic risk (1.3×10^{-4}) exceeds Ohio EPA's target level of $1x10^{-5}$, primarily because of PAHs and PCBs in AOC 1 total soil and PAHs in AOC 2 UWBZ groundwater. The hazard and risk estimates for AOC 1 UWBZ groundwater also exceed Ohio EPA's target HI and risk goal.

Future Offsite Adult Resident (Non-carcinogenic Hazard)

The risk assessment assumed that a future offsite adult resident could be exposed to surficial aquifer (UWBZ) groundwater and intermediate aquifer (IDA) groundwater used as a potable water supply through ingestion, and dermal contact and inhalation while showering. Groundwater data were grouped into three exposure units: groundwater from an offsite monitoring well adjacent to the Village of Lockbourne (off-landfill IDA groundwater), groundwater from the UWBZ monitoring wells in AOC 1 (AOC 1 UWBZ groundwater), and groundwater from the IDA monitoring wells in AOC 1 (AOC 1 IDA groundwater). Appendix C, Tables 9.14.RME, 9.17.RME, and 9.20.RME, summarize the hazards to the future adult resident. Carcinogenic risks were not calculated for an adult resident but were calculated for a lifetime resident, following USEPA guidance.

- **Off-Landfill, IDA Groundwater**: The RME non-carcinogenic hazard (5.7) exceeds Ohio EPA's target HI of 1. The primary contributor to the hazard is TCDD TEQ (HI=5.4). One target organ exceeds the target HI of 1 (developmental, HI=5.4).

  Lead was identified as a COPC in off-landfill groundwater; however, site-specific lead exposures were not evaluated for adult residents. Exposures were evaluated for the more-conservative child residential scenario using the IEUBK model. The results of the IEUBK model, described below for the future child resident, indicate that lead concentrations in off-landfill groundwater are less than the criterion for BLLs in exposed children (residential scenario).

- **AOC 1, UWBZ Groundwater**: The RME non-carcinogenic hazard (28) exceeds Ohio EPA's target HI of 1. The primary contributors to the hazard are arsenic (HI=2.2), iron (HI=1.9), manganese (HI=2.2), thallium (HI=3.7), and TCDD TEQ (HI=15), all with HIs above 1. Target organs with HIs exceeding 1 include blood (HI=3.7), GI (HI=1.9), nervous system (HI=2.4), skin (HI=2.2), and developmental (HI=15).

  Lead was identified as a COPC in AOC 1 UWBZ groundwater; however, site-specific lead exposures were not evaluated for adult residents. Exposures were evaluated for the more-conservative child residential scenario using the IEUBK model. The results of the IEUBK model, described below for the future child resident, indicate that lead concentrations in AOC 1 UWBZ groundwater exceed the criterion for BLLs in exposed children (residential scenario).

- **AOC 1, IDA Groundwater**: The RME non-carcinogenic hazard (7.7) exceeds Ohio EPA's target HI of 1. The primary contributors to hazard are naphthalene (HI=1.5) and TCDD TEQ (HI=4.4). Two target organs exceed the target HI of 1 – respiratory (HI=1.5) and developmental (HI=4.4).

  Lead was identified as a COPC in AOC 1 IDA groundwater; however, site-specific lead exposures were not evaluated for adult residents. Exposures were evaluated for the more-conservative child residential scenario using the IEUBK model. The results of the IEUBK model, described below for the future child resident, indicate that lead concentrations in AOC 1 IDA groundwater is less than the criterion for BLLs in exposed children (residential scenario).

Future Child Resident (Non-carcinogenic Hazard)

The risk assessment assumed that a future child resident could be exposed to surficial aquifer (UWBZ) groundwater and intermediate aquifer (IDA) groundwater used as a potable water supply through ingestion, and dermal contact and inhalation while showering. Groundwater data were grouped into three exposure units: groundwater from an offsite monitoring well adjacent to the Village of Lockbourne (off-landfill IDA groundwater), groundwater from the UWBZ monitoring wells in AOC 1 (AOC 1 UWBZ groundwater), and groundwater from the IDA monitoring wells in AOC 1 (AOC 1 IDA groundwater). Appendix C, Tables 9.15.RME, 9.18.RME, and 9.21.RME summarize the hazards to the future child resident. Carcinogenic risks were not calculated for a child resident but were calculated for a lifetime resident, in accordance with USEPA guidance.

- **Off-Landfill, IDA Groundwater**: The RME non-carcinogenic hazard (13) exceeds Ohio EPA's target HI of 1. The primary contributor to hazard is TCDD TEQ (HI=12). One target organ exceeds the target HI of 1 (developmental, HI=12).

  Site-specific lead exposures were evaluated for residential children using the IEUBK model. This calculation was based on the arithmetic mean concentration of lead detected in off-landfill groundwater (15.1 µg/L) and the IEUBK model default soil concentration. The results of the model are presented in Appendix C, Table 11.3a. The corresponding input parameters and distribution probability plot are provided in Appendix C, Table 11.3b. The predicted geometric mean BLL for a young child was 3.6 µg/dL, with 1.5 percent of the population potentially experiencing concentrations exceeding 10 µg/dL, below which adverse manifestations are not expected. These results indicate that the percent of the exposed population with a BLL exceeding 10 µg/dL (0.06 percent) would be less than the 5 percent level considered by USEPA to be protective of human health.

- **AOC 1, UWBZ Groundwater**: The RME non-carcinogenic hazard (63) exceeds Ohio EPA's target HI of 1. The primary contributors to the hazard are arsenic (HI=5.2), cobalt (HI=1.6), iron (HI=4.4), manganese (HI=5.4), thallium (HI=8.6), and TCDD TEQ (HI=34). Target organs with HIs exceeding 1 include blood (HI=8.6), GI (HI=4.5), kidney (HI=1.4), nervous system (HI=5.8), skin (HI=5.2), developmental (HI=34), and thyroid (HI=1.6).

  Lead was identified as a COPC in AOC 1 UWBZ groundwater. The results of the IEUBK model, based on the arithmetic mean concentration (28.4 µg/L) of lead detected in AOC 1 UWBZ groundwater, are presented in Appendix C, Table 11.4a. The corresponding input parameters and distribution probability plot are provided in Appendix C, Table 11.4b. The predicted geometric mean BLL for a young child was 5.1 µg/dL, with 7.8 percent of the population potentially experiencing concentrations exceeding 10 µg/dL, below which adverse manifestations are not expected. These results indicate that the percent of the exposed population with a BLL exceeding 10 µg/dL (0.06 percent) would be greater than the 5 percent level considered by USEPA to be protective of human health.

- **AOC 1, IDA Groundwater**: The RME non-carcinogenic hazard (17) exceeds Ohio EPA's target HI of 1. The primary contributors to hazard are iron (HI=1.3), manganese (HI=2.0), naphthalene (HI=2.6), and TCDD TEQ (HI=9.8). Target organs with HIs exceeding 1 include GI (HI=1.3), nervous system (HI=2.1), respiratory (HI=2.6), and developmental (HI=9.8).

Lead was identified as a COPC in AOC 1 IDA groundwater. The results of the IEUBK model, based on the arithmetic mean concentration (15.6 µg/L) of lead detected in AOC 1 groundwater (IDA), are presented in Appendix C, Table 11.4a. The corresponding input parameters and distribution probability plot are provided in Appendix C, Table 11.4b. The predicted geometric mean BLL for a young child was 4.3 µg/dL, with 3.4 percent of the population potentially experiencing concentrations exceeding 10 µg/dL, below which adverse manifestations are not expected. These results indicate that the percent of the exposed population with a BLL exceeding 10 µg/dL (0.06 percent) would be less than the 5 percent level considered by USEPA to be protective of human health.

Future Lifetime Resident (carcinogenic risk)

The risk assessment assumed that a lifetime resident could be exposed to surficial aquifer (UWBZ) groundwater and intermediate aquifer (IDA) groundwater used as a potable water supply through ingestion, and dermal contact and inhalation while showering. Groundwater data were grouped into three exposure units: groundwater from an offsite monitoring well adjacent to the Village of Lockbourne (off-landfill IDA groundwater), groundwater from the UWBZ monitoring wells in AOC 1 (AOC 1 UWBZ groundwater), and groundwater from the IDA monitoring wells in AOC 1 (AOC 1 IDA groundwater). Appendix C, Tables 9.16.RME, 9.19.RME, and 9.22.RME summarize the RME carcinogenic risk to the future lifetime resident.

- **Off-Landfill, IDA Groundwater**: The RME carcinogenic risk ($7.6x10^{-3}$) exceeds Ohio EPA's target level of $1x10^{-5}$. The carcinogenic risk is primarily associated with ingestion and dermal contact with PAHs and TCDD TEQ. Six individual COPCs exceed an ELCR of $1x10^{-6}$: benz(a)anthracene; benzo(a)pyrene; benzo(b)fluoranthene; dibenz(a,h)anthracene; indeno(1,2,3-cd)pyrene; and TCDD TEQ.

- **AOC 1, UWBZ Groundwater**: The RME carcinogenic risk ($9.2x10^{-3}$) exceeds Ohio EPA's target level of $1x10^{-5}$. The carcinogenic risk is primarily associated with ingestion, dermal contact, and inhalation with PAHs, TCDD TEQ, metals, VOCs, and SVOCs. Ten individual COPCs exceed an ELCR of $1x10^{-6}$: arsenic; benz(a)anthracene; benzo(a)pyrene: benzo(b)fluoranthene: bis(2-ethylhexyl) phthalate: dibenz(a,h)anthracene: indeno(1,2,3-cd)pyrene: methylene chloride: naphthalene: and TCDD TEQ.

- **AOC 1, IDA Groundwater**: The RME carcinogenic risk ($7.6x10^{-3}$) exceeds Ohio EPA's target level of $1x10^{-5}$. The carcinogenic risk is primarily associated with ingestion, dermal contact, and inhalation with PAHs, TCDD TEQ, metals, and SVOCs. Seven individual COPCs exceed an ELCR of $1x10^{-6}$: benzo(a)pyrene: benzo(b)fluoranthene: bis(2-ethylhexyl) phthalate: dibenz(a,h)anthracene: indeno(1,2,3-cd)pyrene: naphthalene: and TCDD TEQ.

6.7 Uncertainty Associated with Human Health Assessment

The risk measures used in HHRAs are not fully probabilistic estimates of risk, but are conditional estimates given that a set of assumptions about exposure and toxicity are realized. Thus, it is important to specify the assumptions and uncertainties inherent in the risk assessment to place the risk estimates in proper perspective (USEPA 1989a).

6.7.1 Uncertainty Associated with Data Evaluation

The datasets for each media at the site represent a compilation of several subsets. These subsets consist of samples that were collected at various times for different investigations and were analyzed by different laboratories. Combining these datasets involves some uncertainty in the HHRA. However, the degree of potential overestimation or underestimation of risk resulting from combining all of the data is unknown.

The age of the analytical data contributes some uncertainty to the HHRA. Historical data collected in 1995, 1997, and 1998 were included in the datasets. These data may no longer be representative of site conditions since volatilization and degradation most likely has occurred over time. The degree of potential overestimation of site concentrations, and therefore risks associated with the site, is unknown.

The general assumptions used in the COPC selection process were conservative to ensure that true COPCs were not eliminated from the quantitative risk assessment and that the highest possible risk was estimated. RSLs based on residential assumptions were used to select the COPCs for all of the scenarios, including nonresidential scenarios.

A limited number of samples were collected for sediment, in particular the East Ditch in which one sample was collected. It is unlikely that one sample can adequately represent exposure and risk for the East Ditch.

During the COPC selection process, inorganics that were detected at concentrations consistent with background levels were eliminated as COPCs. Exclusion of chemicals present at concentrations consistent with background concentrations does not have an impact on potential site-related risk estimates. Organics were not eliminated as COPCs based on background concentrations. Dioxin/furan samples were collected during the Phase II SI from off-landfill locations for soil, sediment, surface water, and groundwater. Dioxin/furan concentrations from samples collected on the former Lockbourne AFB landfill were compared to the concentrations from the samples collected from off-landfill locations, as presented below. As can be seen in the table, concentrations of dioxins/furans from media within the former Lockbourne AFB landfill are generally similar to concentrations from off-landfill locations.

Turbidity levels in groundwater data collected in 1995 and 1998 are considered high, with a number of measurements above 200 NTU and as high as 1,000 NTU. Highly turbid groundwater may not be representative of the exposure to actual well users, particularly inorganics.

PAHs are one of the primary risk drivers in groundwater. As seen in Appendix C, Tables 2.11 through 2.14, PAHs were detected infrequently. In off-landfill IDA groundwater, the frequency of detect (FOD) for cPAHs was one detection out of five samples. The FOD for cPAHs in AOC 1 UWBZ groundwater was 6 out of 30 samples, or less; the FOD for cPAHs in AOC 1 IDA groundwater was 2 out of 22 samples or less; and the FOC for cPAHs in AOC 2 UWBZ groundwater was one out of five samples.

Medium	Landfill	TCDD-TEQ Conc. Range*	Off-Landfill	TCDD-TEQ Conc. Range*
Surface Soil	AOC 1	9.12E-07 – 1.20E-05	Northern perimeter (SB-08, SB-09)	1.73E-06 – 1.81E-06
	AOC 2	1.30-06 – 4.63E-06	RANGB (14MW1, SO-49, SO-323)	1.91E-06 – 8.37E-06
			Railroad (SO-24, SO-25)	1.84E-06 – 6.11E-06
			Village of Lockbourne (SO-22, SO-23)	3.16E-06 – 5.14E-06
Groundwater	UWBZ	1.10E-09 – 4.93E-08	UWBZ (14MW1, MW-02, MW-09)	3.60E-09 – 8.92E-09
	IDA	1.46E-09 – 9.68E-09	IDA (MW-01, MW-08)	3.82E-09 – 5.18E-09
Sediment	West Ditch	1.46E-06 – 4.06E-06	Upstream (SD-01, SD-03, SD-10, SD-11, SD-12)	1.53E-06 – 3.12E-05
Surface Water	West Ditch	1.07E-09 – 5.44E-09	Upstream (SW-01, SW-03)	6.35E-09 – 7.22E-09

*All concentrations are mg/kg for soil and sediment and mg/L for groundwater and surface water; all water results are reported as unfiltered results.

Laboratories typically report concentrations that are below the reporting limits but above the method detection limit. Any concentration that was above the method detection limit but below the reporting limit is J qualified and was used in the risk assessment as a detected concentration. However, constituents that were not detected (were below the detection limit) were not quantitatively evaluated in the risk assessment, even if the detection limit was above the screening level. Use of data below the reporting limit (i.e., J-qualified data) may result in an under- or over-estimation of risk. The exclusion of non-detected constituents whose reporting limits are greater than the screening level may result in an underestimation of risks.

Chemicals that were not detected in any of the samples within an environmental medium were not selected as COPCs. However, sample-specific reporting limits were compared to screening levels (Appendix D, Attachment 3). The majority of the reporting limits for soil were below the screening criteria, with the exception of various SVOCs, pesticides/PCBs, and a few VOCs. The majority of the reporting limits for sediment were below the screening criteria, with the exception of various SVOCs, and a few VOCs and metals. A number of surface water reporting limits were above the screening criteria, including SVOCs, VOCs, pesticides/PCBs, metals, and a few explosives and dioxins/furans. The surface water screening levels are very conservative and are based on groundwater screening criteria, while the sediment screening levels are based on soil screening criteria. The majority of the reporting limits for groundwater were below the screening criteria, with the exception of various SVOCs, VOCs, pesticides/PCBs, and a few dioxins/furans, explosives, and metals.

6.7.2 Uncertainty Associated with Exposure Assessment

Site-related contamination is expected to decrease with time because of naturally occurring attenuation processes (e.g., degradation because of weathering, volatilization, advection, dispersion, leaching because of infiltrating precipitation, etc.). The risk assessment assumed concentrations would remain constant throughout the exposure period and that these concentrations occur everywhere throughout the site. This assumption likely results in an overestimation of risk, particularly since some of the data included in the risk assessment were collected more than 10 years ago.

The exposure factors used for the quantitation of exposure were conservative and reflect worst-case or upper bound assumptions on the exposure. The reliability of the values chosen for the exposure factors also contributes substantially to the uncertainty of the resulting risk estimates. Because most of the exposure factors are worst-case or upper bound assumptions, the resulting risks are worst case and likely overestimate the actual risk.

EPCs were calculated when there were at least five sample available. However, 95 percent UCLs are not reliable when the sample size is as small as five. USEPA (2007c) recommends that eight or more samples be used in the 95 percent UCL calculation. As eight samples were not available for all of the data sets evaluated in the risk assessment, there is uncertainty associated with the EPCs used in the risk assessment, which most likely over-estimate the true mean.

6.7.3 Uncertainty Associated with Toxicity Assessment

Uncertainty associated with the non-carcinogenic toxicity factors is included in Appendix C, Tables 5.1 and 5.2. Several UFs were applied by USEPA to extrapolate dose points from animal studies to humans. These UFs range between 1 and 3,000. Additional modification factors also are used based on the professional judgment of USEPA. Therefore, there is a high degree of uncertainty in the non-carcinogenic toxicity criteria, based on the available scientific data for each constituent. The non-carcinogenic toxicity factors are most likely an overestimate of actual toxicity.

The uncertainty associated with CSFs is mostly associated with the low dose extrapolation where carcinogenicity at low doses is assumed to be a linear response. This is a conservative assumption, which introduces a high uncertainty into slope factors that are extrapolated from this area of the dose-response curve. The CSFs are based on the assumption that there is no threshold level for carcinogenicity; however, most of the experimental studies indicate existence of a threshold level. Therefore, CSFs developed by USEPA represent upper bound estimates. Carcinogenic risks generated in this assessment should be regarded as an upper bound estimate on the potential carcinogenic risks, rather than an accurate representation of carcinogenic risk. The true carcinogenic risk is likely to be less than the predicted value (USEPA 1989a). Uncertainty is also associated with the application of the MMOA for the cPAHs; this may overestimate risks.

Additional uncertainty is in the prediction of relative sensitivities of different species of animals and the applicability of animal data to humans.

There is a large degree of uncertainty associated with the oral to dermal adjustment factors (based on constituent-specific GI absorption factors) used to transform the oral RfDs and

CSFs based on administered doses to dermal RfDs and CSFs based on absorbed doses. It is not known if the adjustment factor results in an underestimation or overestimation of the actual toxicity associated with dermal exposure.

Surrogate chemicals were used for detected constituents without screening levels and toxicity values. The use of surrogate chemicals may underestimate or overestimate the potential risks or hazards. Carbazole has no screening level or toxicity values available. Exclusion of this constituent from the evaluation may underestimate potential risks or hazards.

6.7.4 Uncertainty in Risk Characterization

The uncertainties identified in each component of risk assessment ultimately contribute to uncertainty in risk characterization. The addition of risks and HIs across pathways and chemicals contributes to uncertainty based on the interaction of chemicals such as additivity, synergism, potentiation, and susceptibility of exposed receptors. The simple assumption of additivity used for this site may or may not be accurate and may overestimate or underestimate risk; however, a better alternative is not available at this time.

As discussed in Sections 2.5 and 6.3.2, the methodology recommended by Ohio EPA to calculate background concentrations was not used in the risk assessment. Background concentrations calculated following Ohio EPA methodology could result in values higher or lower than those used in the risk assessment, thus adding or eliminating inorganic COPCs. In addition, hot spots could have been missed. In the case of AOC 2, use of lower background concentrations could result in the addition of COPCs and higher risk estimates. However, seven of the 10 inorganic constituents in surface soil originally eliminated as COPCs based on background would be eliminated as COPCs because they are below the RSLs. In total soil, six of the eight constituents originally eliminated as COPCs based on background would be eliminated as COPCs because they are below the RSLs. The concentrations of the inorganics exceeding RSLs (aluminum, arsenic, and iron) would not result in risks above the target goals for either surface soil or total soil. Adding inorganic COPCs to the risk evaluation would not affect the decision to implement a remedy for AOC 1 soil and sitewide groundwater because the risks are already above the target risk goal. Eliminating some of the COPCs from the risk evaluation would not reduce the risks for sitewide groundwater and soil at AOC 1 to below the acceptable target risk levels; the primary risk drivers in these two media are organics (e.g. dioxins/furans, PAHs).

6.8 Human Health Risk Summary

This HHRA was performed to evaluate potential current and future risks associated with detected constituents at the former Lockbourne AFB landfill. Surface soil, subsurface soil, sediment, surface water, and groundwater analytical data were evaluated in the HHRA. Potential risks were evaluated for the exposure pathways presented in the following table.

Exposure Area	Exposure Medium	Human Receptors
AOC 1	Surface soil	Current/Future Maintenance, Trespasser/Visitor, and Offsite Industrial Worker
AOC 1	Total soil*	Future Construction Worker
AOC 1	UWBZ Groundwater	Future Construction Worker and Offsite Residents
AOC 1	IDA Groundwater	Future Offsite Residents
AOC 1	Indoor Air (Vapor intrusion from Groundwater - UWBZ) [1]	Future Offsite Residents
AOC 1	Indoor Air (Vapor intrusion from Groundwater - IDA) [1]	Future Offsite Residents
AOC 2	Surface soil	Current/Future Maintenance, Trespasser/Visitor, and Offsite Industrial Worker
		Future Onsite Facility Worker
AOC 2	Total soil*	Future Construction Worker
AOC 2	Indoor Air (vapor intrusion from Total Soil*)	Future Onsite Facility Worker
AOC 2	UWBZ Groundwater	Future Construction Worker
AOC 2	Indoor Air (Vapor intrusion from Groundwater - UWBZ) [1]	Future Onsite Facility Worker
AOC 2	Indoor Air (Vapor intrusion from Groundwater - IDA) [1]	Future Onsite Facility Worker
East Ditch	Sediment and Surface water	Current/Future Trespasser/Visitor
		Future Construction Worker
West Ditch	Sediment and Surface water	Current/Future Trespasser/Visitor
		Future Construction Worker
Off-Landfill	IDA Groundwater	Future Offsite Residents
Off-Landfill	Indoor Air (Vapor intrusion from Groundwater - IDA)[1]	Future Offsite Residents

* Total Soil – surface soil and subsurface soil combined (0 to 10 feet bgs.)

[1] No COPCs were identified for indoor air (vapor intrusion from groundwater).

Table 6-7 and Appendix C, Tables 9.1.RME through 9.22.RME summarize the RME cancer risks and hazard indices. Tables 10.1.RME through 10.13.RME show only the constituents that contributed HIs above 0.1 to total cumulative receptor HIs or target organs greater than 1 or carcinogenic risks greater than 10^{-6} to total cumulative receptor carcinogenic risks greater than 10^{-5}.

The exposure scenarios that do not exceed risk targets (i.e., risk target of $1x10^{-5}$ and hazard target of 1) are identified in the following table.

Exposure Scenarios that do not Exceed Risk Targets

Exposure Area	Exposure Medium	Human Receptors
AOC 1	Surface soil	Offsite Industrial Worker
AOC 2	Surface soil	Current/Future Maintenance, Trespasser/Visitor, and Offsite Industrial Worker Future Onsite Facility Worker
AOC 2	Total soil	Future Construction Worker
AOC 2	Indoor Air (vapor intrusion from Total Soil)	Future Onsite Facility Worker
East Ditch	Sediment and Surface water	Current/Future Trespasser/Visitor Future Construction Worker
West Ditch	Sediment and Surface water	Current/Future Trespasser/Visitor Future Construction Worker

The exposure scenarios do exceed risk targets are identified in the following table along with the risk drivers.

Exposure Scenarios that Exceed Risk Targets

Exposure Area	Exposure Medium	Human Receptors	Risk Drivers
AOC 1	Surface soil	Current/Future maintenance, trespasser/visitor	PAHs, PCBs
AOC 1	Total soil	Future construction worker	PAHS, PCBs, lead
AOC 1	UWBZ Groundwater	Future construction worker and offsite residents	PAHs, phthalates, dioxins, metals (aluminum, arsenic, cadmium, cobalt, copper, iron, manganese, thallium, vanadium, and lead), VOCs (methylene chloride)
AOC 1	IDA Groundwater	Future offsite residents	PAHs, phthalates, dioxins, metals (iron and manganese)
AOC 2	UWBZ Groundwater	Future construction worker	PAHs, dioxins
Off-Landfill	IDA Groundwater	Future offsite residents	PAHs, dioxins

For soil exposure scenarios that exceed the risk target goals (i.e., AOC 1 current/future maintenance and trespasser/visitor, and future construction worker), risks are driven primarily by cPAHs and PCBs. Exposure to lead in the AOC 1 soil by future construction workers would result in BLLs in children (fetuses of exposed construction workers) that exceed the acceptable criterion for BLLs for fetuses.

For groundwater exposure scenarios that exceed risk target goals (i.e., future construction workers and offsite residents), risks are driven primarily by PAHs and dioxins, and to a lesser extent by metals, VOCs, and phthalates. Lead concentrations in AOC 1 UWBZ groundwater would exceed the criterion for BLL in future children exposed to offsite groundwater.

SECTION 7

Ecological Risk Assessment

This section presents the ERA that was conducted to assess the risk to potential risk to ecological receptors at the former Lockbourne AFB landfill site from exposure to site-related constituents. The ERA for the site consists of a screening ecological risk assessment (SERA; Steps 1 and 2 of the ERA process) and the first step (Step 3) of the baseline ecological risk assessment (BERA). This ERA was conducted in accordance with EM 200-1-4, *Risk Assessment Handbook: Volume II – Environmental Evaluation* (USACE 1996) and *Ecological Risk Assessment Guidance Document* (Ohio EPA 2008b), as well as incorporating input from the following documents:

- *Guidelines for Ecological Risk Assessment* (USEPA 1998)
- *Ecological Risk Assessment Guidance for Superfund* (USEPA 1997c)
- *Framework for Ecological Risk Assessment* (USEPA 1992)
- *Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities* (USEPA 1999)
- *USEPA Region 3: Interim Ecological Risk Assessment Guidelines* (USEPA 1994b)
- *Wildlife Exposure Factors Handbook, Volume I of II* (USEPA 1993a)
- *RAGS, Volume II: Environmental Evaluation Manual* (USEPA 1989b)
- EP 200-1-15, *Standard Scopes of Work for HTRW Risk Assessments*, Final (USACE 2001b)
- *Tri-Service Remedial Project Manager's Technical Handbook for Ecological Risk Assessment*. (Wentsel et al. 2000)
- Ecological Risk Assessment Issue Papers (USEPA 1994c)
- ECO Updates, Volumes 1 and 2 (OSWER) (USEPA 1991-1994)

The objective of this ERA is to determine whether COPCs are present at the site, and if present, whether additional action/evaluation is warranted. This section is comprised of the following subsections:

- **Section 7.1 – Problem Formulation** – Characterizes the site setting and develops an ecological CSM, including an identification of assessment endpoints and measures of effects and selection of receptors for evaluation.
- **Section 7.2** – **Screening Assessment –** Completes the SERA.
- **Section 7.3** – **Refined Risk Characterization –** Completes the first step (Step 3) of the BERA.

- **Section 7.4** – **Risk Description –** Evaluates the outcomes of the SERA and Step 3 of the BERA and identifies uncertainties associated with those risk estimates.
- **Section 7.5** – **Ecological Risk Conclusions –** Summarizes the outcome of the ERA.

7.1 Problem Formulation

The problem formulation established the goals, scope, and focus of the ERA. As part of the screening problem formulation, the environmental setting of the site was characterized in terms of the habitats and biota known or likely to be present. The types and concentrations of constituents present in ecologically relevant media also were described based on available analytical data. A CSM was developed that describes potential source areas, transport pathways and exposure media, exposure pathways and routes, and receptors. Assessment endpoints and measures of effects were selected to evaluate those receptors for which critical exposure pathways exist. The fate, transport, and toxicological properties of the constituents present, particularly the potential for bioaccumulation, also were considered during this process.

7.1.1 Ecological Setting

Historic aerial photographs of the former Lockbourne AFB landfill taken in 1964, 1971, 1980, 1996, and 2003 (Appendix A) show the re-colonization of the vegetative communities over time throughout AOC 1 and AOC 2

In 1964, the former Lockbourne AFB landfill area was generally barren of trees, except for a small, uncut plot in the northeast corner of the site and a probable fence line running north to south. Landfilling operations were scattered throughout the central portion of the site but were concentrated mainly along the western boundary of the site. In 1971, the site remained largely devoid of trees, but tree re-colonization was commencing in the southern corner of the site where landfill operations appeared to be largely closed down, along the eastern boundary of the site, and between the western perimeter ditch and the railroad tracks. In 1980, this same pattern of re-vegetation continued with areas slowly filling in with trees, particularly between the perimeter ditch and the railroad tracks. Landfill operations were concentrated in the northwestern corner of the site. In 1996, trees continued to fill in the southern corner of the site, the northeast corner and along the eastern boundary, and west of and along the perimeter ditch. What were heavily used landfill areas remained devoid of vegetation. Photography of the former Lockbourne AFB landfill taken in 2003 shows the former Lockbourne AFB landfill to be largely wooded. Ruderal areas currently occur in the locations in the northwest and approximate center of the site that historic photos indicate were the most heavily used portions of the former Lockbourne AFB landfill.

CH2M HILL conducted an ecological site visit in March 2009 to identify the status of habitats and ecological communities present on the site. The following habitat characterizations are based on observations made during that site visit.

Habitat Identification

Terrestrial Habitat

The 146-acre former Lockbourne AFB landfill study area consists of essentially two terrestrial habitats: ruderal/old field and wooded. Each is discussed below.

Ruderal / Old Field. There are two major ruderal/old field areas within the site, with the larger and smaller areas comprising approximately 21 and approximately 6 acres, respectively. Areas within the ruderal habitat located in the northwest corner of the site that are considered "lime sludge" areas are devoid of vegetation. The dominant vegetation of the ruderal areas consists of common teasel (*Dipsacus sylvestris*), Queen Anne's lace (*Daucus carota*), goldenrod (*Solidago* spp.), common burdock (*Arctium minus*), and grasses.

Wooded Habitat. The wooded portion of the site is approximately 100 acres. The canopy of the wooded portions of the site is dominated by eastern cottonwood (*Populus deltoides*) followed by box elder (*Acer negundo*). Additional canopy trees include elms (*Ulmus* spp.), maples (*Acer* spp.), and eastern sycamore (*Platanus occidentalis*). The invasive Amur honeysuckle (*Lonicera maackii*) dominates the understory.

Aquatic Habitat

There is no natural surface water on the former Lockbourne AFB landfill site. Historically the site perimeter ditch may have been an intermittent headwater, however, presently it functions as a surface water/storm water ditch excavated along the eastern and western boundaries of the site, and has functioned in this capacity for at least the past four decades. This ditch also receives stormwater runoff from the Rickenbacker Airport property and RANGB.

The ditch varies in size along its course. On the eastern site boundary, the East Ditch is a ranges from 2 to 5 feet wide and overgrown with various shrubs and vines. The East Ditch at its widest point (10 feet) confluences with the western drainage ditch at the southwestern edge of the site. Sediment within the East Ditch is comprised of silt and sand with an abundant of organic debris.

The West Ditch originates offsite as a drainage ditch along the roadway. Upon confluence with the East Ditch, the West Ditch widens to about 15 to 20 feet. Upon reaching the oil water separator, the ditch narrows to about 10 feet wide. There is an approximately 6- to 8-foot drop in water elevation from upstream to downstream of the oil/water separator.

The steep-sided banks of the perimeter ditch are colonized by scouring rush (*Equisetum* spp), cottonwood, sycamore, various shrubs and vines, and grasses. The steepest bank slopes are largely devoid of vegetation because of erosion. Water depth is generally 1 to 3 feet. Bottom sediments are firm and range from gravel to sand or silt. The channel is nearly straight in all reaches, with a marked lack of sinuosity, indicating the dredged nature of the watercourse.

The perimeter ditch terminates at a junction box under the intersection of Vause and Canal roads. From this junction point, drainage from the north along Canal Road and the perimeter ditch divert to a 60-inch corrugated metal culvert that discharges to a drainage behind the Village of Lockbourne, with eventual discharge to Big Walnut Creek. The junction box/culvert system essentially isolates the perimeter ditch from any potential upstream migration of aquatic organisms.

The drainage ditch system contains two IRP sites (PMC 2000): Site 25 is the drainage system in the southwest quadrant, and Site 27 is the drainage ditch near the former Lockbourne AFB landfill gate. Presumed sources of contaminants included runoff from previously existing facilities, runoff from aircraft maintenance, and parking areas. Both sites were recommended for no further remedial action.

Wetland Habitat

Eight wetland areas are identified on the National Wetlands Inventory (NWI) maps for the site. The areas identified on the maps consisted of one 0.3-acre of PFO1C (palustrine, forested, broad-leaved deciduous, seasonally flooded), one 0.9-acre area of PFO1A (palustrine, forested, broad-leaved deciduous, temporarily flooded), and 5.3 acres of PEMC (palustrine, emergent, seasonally flooded areas) spread among six sites (Figure 7-1). A formal wetland delineation was not conducted as part of the ecological site visit in March 2009.

Ecological Resources

The information presented in the Ecological Site Description subsection is essential to developing a realistic conceptual model and selecting appropriate assessment endpoints, measures of effects, and target receptors for evaluation in this ERA. A site visit was conducted in November 2003 by IT to identify the potential wildlife communities and the species present in each habitat type in the vicinity of the former Lockbourne AFB site. Subsequently, CH2M HILL conducted a site visit in March 2009 to verify the species identified by IT and to assess the aquatic habitats present on site. The following narrative describes the terrestrial and aquatic ecological resources for the study area.

Terrestrial Habitat

Birds observed on site that are year-round residents of Ohio in the study area included northern cardinal (*Cardinalis cardinalis*), Carolina chickadee (*Parus carolinensis*), blue jay (*Cyanocitta cristata*), white-breasted nuthatch (*Sitta carolinensis*), American robin (*Turdus migratorius*), red-tailed hawk (*Buteo jamaicensis*), American kestrel (*Falco sparverius*), mourning dove (*Zenaida macroura*), common flicker (*Colaptes auratus*), American crow (*Corvus brachyrhynchos*), European starling (*Sturnus vulgaris*), and killdeer (*Charadrius vociferous*). Dark-eyed junco (*Junco hyemalis*) and yellow-rumped warbler are common migrant and winter resident species.

White-tailed deer (*Odocoileus virginianus*) were observed onsite. Numerous woodchuck (*Marmota monax*) burrows and a couple of woodchuck skulls onsite indicate the presence of this burrowing mammal, although none was observed. Fox (*Vulpes vulpes*) also are known to occur onsite.

Aquatic Habitat

An assessment of the habitat and biota in the perimeter ditches was performed during the March 2009 ecological site visit. Stream habitat quality was determined using two habitat assessment methods, Ohio EPA's Qualitative Habitat Evaluation Index (QHEI) (Rankin 1989) and USEPA's Rapid Bioassessment Protocol (RBP) For Use in Streams and Wadeable Rivers (Barbour et al. 1999). The QHEI is used to assess the quality of instream habitat for fish. A higher QHEI score represents a more diverse habitat for colonization of fish species. The RBP method is used nationwide to provide an overall assessment of the quality of available habitat for all aquatic organisms. As with the QHEI, a higher RBP score indicates better habitat for aquatic organisms. QHEI scores for the East Ditch and West Ditch were 25 and 46, respectively. The low QHEI scores for the East and West ditches indicate a lack of suitable habitat to sustain a viable diverse fish population. RBP scores for the East Ditch and West Ditch were 47 (indicating poor habitat quality) and 69 (indicating marginal habitat quality), respectively.

The macroinvertebrate population was assessed using a semi-quantitative method, which included collecting macroinvertebrates via a D-frame net using the jab and sweep method. Macroinvertebrates were field identified and immediately returned to the respective ditch. Within each ditch, the only macroinvertebrates identified were midge larva, black fly larva, and aquatic worms. Minnow (species could not be identified) were noted in a small pool at the East Ditch confluence with the West Ditch.

In 1996, Ohio EPA conducted a biological and water quality study of Big Walnut Creek and Walnut Creek tributaries. The 1996 study sampled 795 fish, representing 40 species and 2 hybrids, from Big Walnut Creek. The Walnut Creek tributaries evaluated, including a manmade channel 0.5 mile long, contained fish populations deemed “fair, marginally good, good, very good, and very good/exceptional” by Ohio EPA’s exceptional warmwater habitat (EWH) criteria (Ohio EPA 1998). Based on the results of the habitat and biota assessments of the West Ditch and East Ditch, it is unlikely that these tributaries could support a viable fish population to be an appreciable source for human consumption, thus they were not considered to be of concern for human health (ATSDR 2000).

Rare, Threatened, and Endangered Species

The U.S. Fish and Wildlife Service (USFWS) and the Ohio Natural Heritage Program (ONHP) maintain records and databases of rare and endangered species for the state. USFWS listed the Indiana bat (*Myotis sodalist)* and running buffalo clover (*Trifolium stoloniferum)* as endangered species in Ohio and eastern prairie fringed orchid (*Platanthera leucophea)*, lakeside daisy (*Hymenoxys herbacea)*, northern wild monkshood (*Aconitum noveboracense),*small whorled pogonia *(Isotria medeoloides),* and Virginia spiraea *(Spiraea virginiana)* as threatened species in Ohio (USFWS 2008). ONHP has listed only two special-status species as being observed within 1 mile of the study area: river redhorse (*Moxostoma carinatum*) and the upland sandpiper (*Bartramia longicauda*) (ODNR 2004). The river redhorse is of special concern, which indicates that either it might become threatened in Ohio under continued or increased stress or it is a species or subspecies for which there is some concern but for which information is insufficient to permit an adequate status evaluation. The sandpiper is threatened throughout its range in Ohio.

The dark-eyed junco *(Junco hyemalis),* also identified by ONHP as a state-listed species, was observed during the November 2003 site visit conducted by IT, but was not observed during the March 2009 site visit conducted by CH2M HILL. It is likely that these birds were migrants, given that the junco is not known to breed in Ohio outside of the northeastern counties. It is primarily a seed-eater but also will consume insects, most likely during the breeding season. A target receptor protective of an herbivorous bird (i.e., feeding guild of herbivore or higher) was selected to ensure that risks to the junco were considered in this Tier I ERA.

There are no existing or proposed state nature preserves at the site, and there are no known unique ecological sites, geologic features, breeding or non-breeding animal concentrations, champion trees, state parks, state forests, scenic rivers, or wildlife areas within the project area (ODNR 2004).

7.1.2 Conceptual Site Model

The CSM relates potentially exposed receptor populations with potential source areas based upon physical site characteristics and complete exposure pathways. Important components of the CSM are identifying potential source areas, transport pathways, exposure media, exposure pathways and routes, and receptor groups. Actual or potential exposures of ecological receptors associated with a site were determined by identifying the most likely, and most important, pathways of contaminant release and transport. A complete exposure pathway has three components: (1) a source of constituents that results in a release to the environment; (2) a pathway of constituent transport through an environmental medium; and (3) an exposure or contact point for an ecological receptor. The main objective of the CSM in the SERA was to identify any complete and critical exposure pathways that may be present. Figure 7-2 illustrates a diagrammatic terrestrial ecological CSM and Figure 7-3 illustrates the aquatic ecological CSM for the site. Key components of the CSM are discussed in the following subsections.

Potential Source Areas

The initial tier of the CSM describes the primary sources and the mechanisms by which contaminants from these source areas are released and distributed within the habitats of the former Lockbourne AFB site. A number of source areas are associated with historical operations and waste disposal practices and were provided in the description of the site history (Section 1.2).

A complete description of the potential source areas associated and the contaminants associated with these areas was discussed in Section 1.2. Historical contaminant releases to the aquatic and terrestrial habitats of the former Lockbourne AFB site have occurred principally as a result of the former practices of burning and burying wastes from the base, surface disposal of various wastes, and disposal of pesticides and herbicides, ammunition, airplane parts, toxic and hazardous material, household-type garbage, and construction debris in trenches and on the ground surface.

Migration and distribution of chemical of potential ecological concern (COPECs) throughout the terrestrial and aquatic habitats are principally the result of volatilization/particulates, and runoff of contaminated soil from the current potential source areas and migration of groundwater to surface water.

Transport Pathways and Exposure Media

A transport pathway describes the mechanisms whereby site-related constituents, once released, may be transported from a source to ecologically relevant media (surface soil, sediment, and surface water) where exposures may occur. The primary mechanisms for constituent transport from the source areas include the following:

- Direct release during historic site activities to site surface soil

- Transport of stormwater runoff via surficial runoff and/or direct release of constituents to the East and West ditches
- Infiltration of chemicals that have been released to surface soil and/or that have been released directly to subsurface soil into groundwater with subsequent discharge to surface water
- Uptake by biota such as invertebrates, plants, and small mammals from surface soil, sediment, and/or surface water and transfer through the food chain to upper-trophic level receptors (i.e., birds, mammals, and fish) via the consumption of contaminated prey

Exposure Pathways and Routes

An exposure pathway links a source with one or more receptors through exposure via one or more media and exposure routes, and it is assumed that receptors are exposed to media regardless of contamination. Exposure, and thus potential risk, can only occur if complete exposure pathways exist. Figures 7-2 and 7-3 presents the potentially complete exposure pathways to ecological receptors at and adjacent to the site and are discussed below. An exposure route describes the specific mechanism(s) by which a receptor is exposed to a constituent present in an environmental medium and are discussed below.

Soil

Soil pathways include direct contact of contaminated soil by invertebrates and small mammals and birds as well as uptake of soil contaminants by plants. Food chain transfer of COPCs in soil to herbivorous, invertivorous, and carnivorous birds and mammals provides a pathway of indirect exposure.

Surface Water

Surface water pathways include the direct contact and absorption of contaminants in fish, aquatic invertebrates, and aquatic plants as well as the consumption of water from these streams by mammals and birds to meet hydration requirements or incidental to the foraging of prey. In addition, the transfer of bioaccumulative chemicals in surface water through the food chain represents a potentially significant mechanism of exposure to aquatic and terrestrial species.

Sediment

Sediment pathways include direct contact of contaminated sediment by invertebrates and small mammals and birds as well as uptake of sediment contaminants by plants. Food chain transfer of COPCs in sediment to invertivorous and piscivorous birds and mammals provides a pathway of indirect exposure. Taxa evaluated in the East and West ditches therefore include surface water biota such as aquatic plants, fish and invertebrates, as well as piscivorous birds and mammals and predators that feed on them.

Based on the general fate properties (e.g., relatively high adsorption to solids) of the most common site-related constituents and the protection offered by hair or feathers, potential dermal exposures for upper-trophic level receptors are not considered significant relative to ingestion exposures and were not evaluated in this ERA. The upper-trophic level receptors considered in this ERA are unlikely to be exposed to significant airborne sources of constituents via inhalation because the primary constituents present (metals) typically adsorb to soil and do not volatilize, suggesting that exposure via inhalation is limited. Incidental ingestion of soil during feeding, preening, or grooming activities, however, was considered in the risk estimates.

Assessment Endpoints and Measures of Effects

The problem formulation includes selecting ecological endpoints, which are based on the CSM. Two types of endpoints, assessment endpoints and measures of effects, are defined as part of the ERA process (USEPA 1997c). An assessment endpoint is an explicit expression of the environmental component or value that is to be protected. Measures of effects are measurable ecological characteristics that are related to the component or value chosen as the assessment endpoint. The considerations for selecting assessment endpoints and measures of effects are summarized by USEPA (1997c) and discussed in detail in Suter (1989 and 1993).

Endpoints for this ERA were selected to address the potential for both direct and indirect impacts to the environment because of COPEC contamination in soil, surface water, and sediment. For example, organisms inhabiting or using the perimeter drainage ditches as a water or food supply may be exposed through direct contact with surface water and sediment, ingestion of contaminated surface water and/or sediment, and indirectly by incorporation of contaminants into the aquatic food chain.

Although additional relevant endpoints could be used logically to evaluate potential risks from COPECs, endpoints were selected for evaluation that would, in a focused approach, best characterize the ecological risks using data and information currently available for this site.

Assessment Endpoints and Measures of Effects Selected for Lockbourne AFB Landfill

Target Receptors or Communities	Assessment Endpoints	Measures of Effects
Benthic invertebrate community in the eastern and western perimeter drainage ditches.	Survival, reproduction, growth, and indigenous community composition of benthic organisms in eastern and western perimeter drainage ditches.	Comparisons of chemical concentrations in sediment and surface water with criteria and guidance values for freshwater sediment and surface water.
Fish community in the eastern and western perimeter drainage ditches.	Survival, reproduction, growth, and indigenous community composition of fish species in the eastern and western perimeter drainage ditches.	Comparisons of chemical concentrations in surface water to criteria and guidance values.
Herbivorous and piscivorous birds foraging in the eastern and western perimeter drainage ditches.	Survival, reproduction, and growth of herbivorous and piscivorous birds foraging in the eastern and western perimeter drainage ditches.	Modeling of algae, aquatic vegetation, aquatic invertebrate, and fish tissue chemical accumulation, and avian (mallard and kingfisher) dietary exposure modeling. Comparison of dietary exposure doses with reference toxicity values (RTVs) for birds.
Herbivorous and piscivorous mammals foraging in the eastern and western perimeter drainage ditches.	Survival, reproduction, and growth of herbivorous and piscivorous mammals foraging in the eastern and western perimeter drainage ditches.	Modeling of algae, aquatic vegetation, aquatic invertebrate, and fish tissue chemical accumulation, and mammalian (muskrat and mink) dietary exposure modeling. Comparison of dietary exposure doses with RTVs for mammals.

Assessment Endpoints and Measures of Effects Selected for Lockbourne AFB Landfill

Target Receptors or Communities	Assessment Endpoints	Measures of Effects
Vegetation in the ruderal/old-field and wooded areas of the former Lockbourne AFB landfill.	Survival, germination, and growth of plants in the ruderal/old-field and wooded areas of the former Lockbourne AFB landfill.	Comparison of chemical concentrations in soil with phtyotoxic effects thresholds found in literature for plants.
Soil fauna in the ruderal/old-field and wooded areas of the former Lockbourne AFB landfill.	Survival, reproduction, and growth of soil fauna in ruderal/old-field and wooded areas of the former Lockbourne AFB landfill.	Comparison of chemical concentrations in soil with toxic effects thresholds found in literature for soil invertebrates.
Insectivorous and carnivorous birds foraging in the ruderal/old-field and wooded areas of the former Lockbourne AFB landfill.	Survival, reproduction, and growth of birds foraging in the ruderal/old-field and wooded areas of the former Lockbourne AFB landfill.	Modeling of plant and soil invertebrate tissue chemical accumulation, and avian (American robin and red-tailed hawk) dietary exposure modeling. Comparison of dietary exposure doses with RTVs for birds.
Herbivorous, invertivorous, and carnivorous mammals foraging the ruderal/old-field and wooded areas of the former Lockbourne AFB landfill.	Survival, reproduction, and growth of mammals foraging in the ruderal/old-field and wooded areas of the former Lockbourne AFB landfill.	Modeling of plant and soil invertebrate tissue chemical accumulation, and mammalian (deer mouse, short-tailed shrew, and red fox) dietary exposure modeling. Comparison of dietary exposure doses with RTVs for mammals.

Receptors

Receptors are the components of an ecosystem that are potentially affected by a chemical or other stressor. Endpoints are characteristics of an ecological component that may be affected by a stressor. It is difficult, if not impossible, to assess potential impacts to every endpoint for every possible receptor; therefore, "key" receptors and endpoints were selected to be representative species in the major feeding guilds and habitats onsite.

The focus of the receptor selection process was on individual species, groups of species (such as lower-trophic receptors [i.e., benthic invertebrates /soil invertebrates] and upper-trophic receptors [i.e., birds, mammals, and fish]), or functional groups (i.e., feeding guilds) potentially at risk, rather than on higher organizational levels such as communities and ecosystems. Each trophic level is comprised of many different species and encompasses numerous feeding guilds; e.g., upper-trophic level receptors include a variety of birds and mammals in various feeding guilds such as herbivores, insectivores, and carnivores. After evaluating the types of populations, communities, and habitats present on the site, key receptor species were selected considering the following (USACE 1996; States et al. 1978):

- Likelihood of exposure
- Sensitivity to the COPECs
- Critical to the structure and function of the particular ecosystem which they inhabit
- Threatened, endangered, or of special concern

- Recreational value
- Indicative of important changes in the ecosystem
- Amount of exposure and/or toxicity data that are available for evaluation

The species selected as receptors of concern represent a range of feeding relationships within the habitats occurring on and surrounding the former Lockbourne AFB landfill (see Sections 7.1.1 for habitat identification and ecological resource descriptions). It is important to note that even though a select few receptor species were chosen for evaluation in this ERA, they serve as common representative species for the site and subsequently will represent risk to other species within comparable feeding guilds (i.e., the American robin will represent the feeding guild of other invertivorous birds).

Birds and mammals within several feeding guilds were selected from the Ohio EPA list of receptors to serve as key receptors in this ERA (see the following table). Species were selected based upon the criteria noted above as well as on assessment endpoints, onsite habitats, and feeding habits.

Key Wildlife Receptors

	Target Species by Habitat	
Feeding Guild	**Terrestrial Habitat**	**Aquatic Habitat**
Herbivore	Deer mouse (*Peromyscus maniculatus)*, Mourning dove (*Zenaida macroura)*	Mallard (*Anas platyrhynchos)*, muskrat (*Ondatra zibethicus*)
Invertivore	American robin (*Turdus migratorius*), short-tailed shrew *(Blarina brevicauda)*	Marsh wren (*Cistothorus palustris)*
Carnivore	Red-tailed hawk (*Buteo jamaicensis)*, red fox (*Vulpes vulpes)*	---
Piscivore	---	Belted kingfisher (*Ceryle alcyon)*, mink (*Mustela vison)*

7.2 Screening Assessment

The following sections complete the SERA for the evaluation of potential impacts to lower-trophic level species (i.e., plants and invertebrates) and wildlife from the presence of chemicals in soil, sediment, and surface water. Section 7.2.1 summarizes the data used for the evaluation, Section 7.2.2 provides an overview of the approach used to screen for lower-trophic level and wildlife risks, Section 7.2.3 discusses the approach used to estimate receptor exposure, Section 7.2.4 summarizes the literature-based toxicity values used for comparison to evaluate the potential for adverse effect, and Section 7.2.5 presents the approach used to characterize risks in the SERA.

7.2.1 Analytical Data Summary and Selection

The first step in the ERA was to determine which data would be included in the evaluation. Detailed results of the sampling at the former Lockbourne AFB landfill were presented in Sections 2 and 4.

Details on data quality for the samples collected during the SIs were provided in the Phase I SI (LAW 1995a) and the Phase II SI (PMC 2000). EEG validated the RI data collected through August 2003; the results were presented in the *Quality Control Summary Report* (EEG 2004). CH2M HILL validated three quarters of groundwater data collected by during the RI by EEG (November 2003, February 2004, and May 2004) (Appendix E).

A review of the data identified the following criteria for data usability:

- Estimated values flagged with a J qualifier were treated as unqualified detected concentrations.
- Data qualified with an R (rejected) were not used in the risk assessment.
- For conservatism, B-qualified data were included in the evaluation.
- A-, a-, C-, CON-, D-, E-, I-, H-, L-, M-, N-, PR-, Q-, and *-qualified data were treated as unqualified detected concentrations. These qualifiers are defined in Appendix C, Tables 2-1 through 2-18.
- For duplicate samples, the maximum concentration between the two samples was used as the sample concentration.

For this ERA, datasets were grouped by medium (soil, surface water, and sediment), and habitat use categories (e.g., AOC 1 and AOC 2; East Ditch and West Ditch). Data groupings are as follows:

- <u>Soil</u>
  AOC 1 – Soil 0 to 4 feet deep
  AOC 2 – Soil 0 to 4 feet deep
- <u>Surface water</u>
  East Ditch
  West Ditch
- <u>Sediment (surficial)</u>
  East Ditch
  West Ditch

7.2.2 Screening Assessment Approach

The screening assessment evaluated the potential for adverse effects to both lower-trophic level receptors (plants and invertebrates) from direct exposure to site soil, sediment, and surface water, and the potential adverse effects to upper-trophic level receptors (i.e., birds, mammals, and fish) from the ingestion of prey that have accumulated chemicals via the food web. Preliminary COPECs were identified using the following process for surface soil and surface water:

- Inorganic constituents for each media were compared to background and eliminated if the maximum site concentrations were less than the background maximum and/or upper threshold limit

- Constituents exceeding background or in cases where background data were not available were compared to media specific screening values;
- If maximum constituent concentrations exceeded respective screening values the constituent was retained for further evaluation
- Detected constituents without screening values were also retained for further evaluation
- Non-detected constituents with laboratory reporting limits exceeding respective screening values and non-detected constituents without screening values were not retained as COPECs, but are discussed in the uncertainty section.

For sediment, COPECs were selected using the following screening approach:

- Inorganic constituents for each sediment were compared to the Ohio EPA sediment reference values (SRVs) (Ohio EPA 2008b) and eliminated if the maximum site concentrations were less than the sediment reference value (SRV).
- Inorganic constituents exceeding the respective SRV were compared to background concentration.
- If maximum constituent concentrations exceeded respective background concentration, it was retained as a COPEC.
- Inorganic constituents exceeding background and all other constituents lacking background concentrations were then compared to sediment screening values.
- If maximum constituent concentrations exceeded respective screening value, the constituent was retained for further evaluation.
- Detected constituents without screening values also were retained for further evaluation.
- Non-detected constituents with laboratory reporting limits exceeding respective screening values and non-detected constituents without screening values were not retained as COPECs, but are discussed in the uncertainty section.

7.2.3 Screening Exposure Assessment

The principal activity associated with the exposure assessment is estimating constituent concentrations in applicable media to which the receptors may be exposed. These concentrations are termed EPCs. This is accomplished through the selection of appropriate sets of the available analytical data using a set of criteria (e.g., validation status, sampling date, etc.). Once the analytical datasets are selected, EPCs are calculated as a particular point on the distribution of concentrations. At the screening level (Step 2), the EPC is the maximum detected concentration. To prepare a conservative assessment, the reporting limit for constituents analyzed for but not detected were compared to medium-specific screening values. This was done to ascertain whether detection limits were less than or equal to constituent concentrations at which potential adverse effects to ecological receptors could occur.

EPCs for dioxins and furans were calculated using a TEQ approach. This approach was used to adjust all dioxin/furan concentrations in terms of 2,3,7,8-TCDD by applying TEFs. The TEQs were then summed to a dioxin equivalent, or TEQ. TEQ value was calculated using measured concentrations of dioxins and furans based on WHO-derived TEFs. Van den Berg et al. (1998) was used to calculate TEQs for fish and birds, and Van den Berg et al. (2006) for mammals. Refer to Appendix F for supporting TEQ calculations.

7.2.4 Screening Effects Assessment

The purpose of the screening effects assessment is to establish constituent exposure levels (screening values) that represent conservative thresholds for adverse ecological effects.

Background Comparison

The maximum detected concentrations of naturally occurring inorganic constituents were compared to background concentrations for each given media. Soil concentrations were compared to the background soil concentrations (Tables 7-1 and 7-2) for inorganic constituents established in the *Supplemental Phase II Environmental Baseline Survey Investigation* (IT 1995).

As indicated above, before comparing sediment inorganic results to background, the data were compared to the Ohio EPA SRV. The Ohio EPA SRVs were developed to identify representative background sediment concentrations for lotic water bodies. The same biological reference sites that were used to develop biological criteria in Ohio also were the basis for developing background sediment concentrations, which account for Ohio regional differences. The former Lockbourne AFB site falls within the Eastern Corn Belt Plains region. Although not to be used as a standard or criteria, the maximum sediment concentration values were compared against the SRV screening values to identify site-related contamination. Sediment constituents that exceeded the Ohio EPA SRV were then compared to background sediment samples; LCKSD-1 is the upgradient station for East Ditch, and LCKSD-3 is the upgradient station for West Ditch (Tables 7-3 and 7-4).

Surface water concentrations were compared to upgradient concentrations from collocated surface water and sediment samples from each branch of the ditch (i.e., LCKSW-1 for East Ditch and LCKSW-3 for West Ditch upgradient locations) (Table 7-5).

Medium-Specific Screening Values

Numerous types of screening level ecological toxicity benchmarks have been developed to be protective of organisms using a variety of habitats. Consequently, the ecological benchmarks represent medium-specific contaminant concentrations considered protective of biota inhabiting that medium. Ecological benchmarks were obtained from a variety of sources, including federal and state regulatory values, USEPA and other agency reports, and scientific literature. A list of benchmarks selected for this ERA is provided in Tables 7-6 through 7-8.

The maximum detected concentration of a chemical within a medium was compared with the hierarchal screening benchmark for that medium. If a chemical exceeded its medium-specific benchmark, it was retained as a COPEC. In addition, if a benchmark was not available for a chemical, it also was retained as a COPEC. Within the former Lockbourne

AFB, the potential direct exposure media include soil, surface water, and sediment. As such, the ecological benchmarks summarized in the subsections below were compiled. In addition, for surface soil and sediment PAHs were evaluated based on calculated total high molecular weight (HMW) and total low molecular weight (LMW) classes (for non-detected constituents, one-half the detection limit was used) and total PAHs (sediment only). Total PCB concentrations were calculated following the same methodology as for deriving total PAH concentrations.

Soil Benchmarks

As noted in Ohio EPA 2008b, the following hierarchy of sources was used to obtain soil benchmarks:

- USEPA ecological soil screening levels (Eco-SSLs). (Note: The lower of the two values for plants or invertebrates was selected for direct exposure evaluation of the lower-trophic receptors.) (http://www.epa.gov/ecotox/ecossl/)
- PRGs for ecological endpoints (Efroymson, R.A., G.W. Suter II, B.E. Sample, and D.S. Jones, August 1997, ES/ER/TM-162/R2, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831. (http://www.esd.ornl.gov/programs/ecorisk/ documents/tm162r2.pdf)
- USEPA Region 5 ecological screening levels (ESLs) (USEPA 2003c)

Surface Water Benchmarks

As noted in Ohio EPA 2008a, the following sources, were used to obtain surface water benchmarks. The hierarchy used to select surface water benchmarks is as follows:

- Ohio EPA (2008b), Water Quality Criteria for the Protection of Aquatic Life: When available surface water benchmarks were selected from the list of water quality criteria for the protection of aquatic life as listed in OAC 3745-1. In addition, in accordance with OAC 3745-1, outside mixing zone maximum (OMZM) was used in this ERA given that the surface water data collected from the East and West Ditch were single ambient samples. Note that several of the criteria are hardness- or pH-dependent. The site-specific minimum hardness (an assumed 100 milligrams [mg] of calcium carbonate [$CaCO_3$] per liter) was used to derive all hardness-dependent values. This hardness value will result in the most protective criteria values applicable to site-specific conditions. A pH of 6.5 was used to derive pH-dependent values since site-specific pH data were not available.
- ESLs, USEPA, Region 5, 2003c: Criteria not listed in OAC 3745-1 were supplemented with USEPA Region 5 surface water ESLs.

Sediment Benchmarks

The following sources, in order of preference, were used to obtain sediment benchmarks.

- MacDonald et al. (2000), Consensus-based Values: MacDonald et al. evaluated the predictive ability of previously derived probable effect concentrations for major classes of compounds including metals, PAHs, pesticides, and PCBs. A database was developed from 92 published reports that included 1,657 samples with high-quality matching sediment toxicity and chemistry data. The database was composed primarily of 10- to

14-day or 28- to 42-day toxicity tests with the amphipod *Hyalella azteca* (designated as the HA10 or HA28 tests) and 10- to 14-day toxicity tests with the midges *Chironomus tentans* or *C. riparius* (designated as the CS10 test). Endpoints reported in these tests were primarily survival or growth. From these data, both threshold effect concentrations (TECs) and probable effect concentrations (PECs) were developed. TECs identify contaminant concentrations below which harmful effects on sediment-dwelling organisms are not expected. Only TECs were used in this evaluation. TECs include the following sediment quality guidelines (SQGs): threshold effect levels (TELs), effect range low values (ER-Ls), lowest effect levels (LELs), minimal effect threshold (METs), and sediment quality advisory levels (SQALs). TECs were calculated by determining the geometric mean of the SQGs. Consensus-based TECs were calculated only if three or more published SQGs were available for a chemical.

- USEPA Region 5 (2003c), Resource Conservation and Recovery Act (RCRA) ESLs: The ESLs are the initial tool used in assessing adverse risk to the environment through the RCRA Corrective Action and Permit programs within Region 5. The ESLs provide protective benchmarks for 223 contaminants and four environmental media, including air, water, sediment, and soil. With the exception of a few, the majority of sediment ESLs was derived using the equilibrium partitioning (EqP) equation and the corresponding water ESL.
- Other sources: In cases where benchmarks were not listed in MacDonald et al. or USEPA Region 5 ESLs, benchmarks were obtained from other sources such as the USEPA Region 3 freshwater sediment benchmarks.

Ingestion Screening Values

Food web exposure was assessed for surface soil by direct comparison to the USEPA Eco-SSLs for terrestrial mammals/birds (lower of the two values) and Region 5 ESLs for soil when Eco-SSLs were not available (Table 7-9). The soil ESLs represent a conservative screening value that is the lowest value for a given constituent that is protective from exposure via direct contact, ingestion, or food web exposure. The Region 5 soil ESLs are based predominantly on exposure to a masked shrew (*Sorex cinerus*); therefore, at this stage of the screening, food web exposure was not estimated for upper-trophic level terrestrial receptors. Detected constituents exceeding respective benchmarks, or where benchmarks were not available were retained for further evaluation.

For sediment and surface water, ingestion screening values for these constituents and the receptor species evaluated (or suitable surrogate species) via food web modeling were obtained from the literature. Toxicological information for wildlife species most closely related to the receptor species was used, where available, but was supplemented by laboratory studies of non-wildlife species (such as laboratory mice) where necessary. Toxicity studies involving long-term (i.e., chronic) exposure were used preferentially. Survival, growth, and reproduction were emphasized as toxicological endpoints because these are the most relevant to maintaining viable populations and are generally the most studied chronic toxicological endpoints for ecological receptors. If several chronic toxicological studies were available from the literature, the most appropriate study was selected for each receptor species based upon study design, study methodology, study duration, study endpoint, and test species. For the screening exposure estimates, the uptake of constituents from the abiotic media into these food items was based upon conservative (e.g., 90th percentile) bioconcentration factors (BCFs) or bioaccumulation factors (BAFs) from the literature, where available. The use of 90th percentile values generally is recommended to provide a conservative screening assessment (Sample et al. 1998a, 1998b; Bechtel Jacobs 1998b). Default factors of 1 were used only when data were not available in the literature for a constituent. BCFs and BAFs used in this ERA are presented in Tables 7-10 and 7-11.

For receptor species used in food web modeling, the dietary intake (i.e., dose) of each constituent (in mg constituent per kg of body weight per day) was calculated by using species-specific life history information, where available, and the following formula (modified from USEPA 1993):

$$DI_x = \frac{[[\sum_i (FIR)(FC_{xi})(PDF_i)] + [(FIR)(SC_x)(PDS)]]}{BW}\left(AUF\right)$$

Where:

DI_x = Dietary intake for constituent x (mg constituent/kg body weight/day)
FIR = Food ingestion rate (kg/day, dry-weight)
FC_{xi} = Concentration of constituent x in food item i (mg/kg, dry-weight)
PDF_i = Proportion of diet composed of food item i (dry-weight basis)
SC_x = Concentration of constituent x in soil/sediment (mg/kg, dry-weight)
PDS = Proportion of diet composed of soil/sediment (dry-weight basis)
BW = Body weight (kg, wet-weight)
AUF = Area use factor; percent (decimal) of habitat used by receptor

Receptor-specific values used as inputs to this equation are provided in Table 7-12. It was assumed that constituents were 100 percent bioavailable to the receptor, and it also was assumed that each receptor spent 100 percent of its time at the site (i.e., an area use factor of 1 was assumed). Minimum body weights and maximum ingestion rates were used to develop conservative exposure estimates.

Ingestion-based screening values were derived for both chronic no observed adverse effect level (NOAEL) and chronic lowest adverse effect level (LOAEL) endpoints. The applicable uncertainty factors from Table 7-13 were applied to derive these screening values, where necessary. Ingestion screening values for mammals and birds are summarized in Tables 7-14 and 7-15, respectively.

7.2.5 Screening Risk Calculation

In this step, the maximum exposure concentrations (abiotic media) or exposure doses (upper-trophic level receptor species) were compared with the corresponding screening values to derive screening risk estimates. The outcome of this step is a list of COPECs for each medium-pathway-receptor combination evaluated or a conclusion of acceptable risk.

Identification of COPECs

COPECs were identified using the HQ method. HQs were calculated by dividing the constituent concentration in the medium being evaluated by the corresponding medium-specific screening value, or by dividing the exposure dose by the corresponding ingestion screening value Constituents with HQs greater than 1 were considered a COPC in the SERA. Detected constituents for which toxicological data were not available also were retained as COPCs in the SERA.

HQs exceeding 1 indicate the potential for risk because the constituent concentration or dose (exposure) exceeds the screening value (effect). However, screening values and exposure estimates were derived using intentionally conservative assumptions such that HQs greater than 1 do not necessarily indicate that risks are present or impacts are occurring. Rather, it identifies constituent-pathway-receptor combinations requiring further evaluation. HQs that are less than 1 indicate that risks are very unlikely (USEPA 1997c), enabling a conclusion of no unacceptable risk to be reached with high confidence.

Tables 7-16 through 7-21 summarize the COPECs identified in surface soil (AOC 1 and AOC 2), sediment, and surface water as a result of the direct exposure evaluation. Tables 7-22 and 7-23 present a summary of HQs for food web exposures for terrestrial receptors (based on soil screening levels protective of terrestrial receptors) of AOC 1 and AOC 2, and Tables 7-24 and 7-25 present a summary of HQs for food web exposures (aquatic receptors) for the West Ditch and East Ditch. The following table summarizes the COPECs identified by medium and exposure scenario.

COPEC Summary (STEP 2)

	Direct Exposure[1]						Food Web Exposures			
	Surface Soil		Sediment		Surface Water		Terrestrial Receptors[3]		Aquatic Receptors	
COPEC	AOC 1	AOC 2	W. Ditch	E. Ditch	W. Ditch	E. Ditch	AOC 1	AOC 2	W. Ditch	E. Ditch
Inorganics										
Aluminum	√						NSV[2]			
Antimony							√			
Arsenic		√	√					√	√	
Barium	√									
Cadmium							√			
Chromium, total	√									
Cobalt		√								
Copper	√						√			
Lead	√		√				√	√	√	
Manganese		√								
Mercury	√						√			
Selenium	√	√					√			
Silver							√			
Thallium	√	√					√	√		
Vanadium										
Zinc	√	√					√	√		
Pesticides/PCBs										
Chlordane, gamma-	√						√			
DDD, p,p'-			√							
DDE, p,p'-		√	√					√		
DDT, p,p'-	√	√	√				√	√		
PCB 1242							√			
PCB 1248	√						√			

COPEC Summary (STEP 2)

	Direct Exposure^1						Food Web Exposures			
	Surface Soil		Sediment		Surface Water		Terrestrial Receptors^3		Aquatic Receptors	
COPEC	AOC 1	AOC 2	W. Ditch	E. Ditch	W. Ditch	E. Ditch	AOC 1	AOC 2	W. Ditch	E. Ditch
PCB 1254	√						√			
PCB 1260							√			
Total PCBs	√		√				√		√	
SVOCs										
Acenaphthene	√		√							
Benzo(a)anthracene	√		√				√			
Benzo(a)pyrene	√		√				√			
Benzo(b)fluoranthene	√						√			
Benzoic Acid	NSV^2	NSV^2					NSV^2	NSV^2		
Benzo(k)fluoranthene	√						√			
Butylbenzyl phthalate	NSV^2						NSV^2			
Bis(2-ethylhexyl)phthalate	√		NSV^2				√			
Carbazole	NSV^2						NSV^2			
Chrysene	√		√				√			
Dibenzo(a,h)anthracene	√						√			
Dibenzofuran	NSV^2	NSV^2					NSV^2	NSV^2		
Di-n-butyl phthalate	√						√			
Di-n-butyl phthalate	NSV^2						NSV^2			
Fluoranthene	√		√				√			
Fluorene	√									
Indeno(1,2,3-cd)pyrene	√						√			
Methylnaphthalene-2	√		√				√			
Methylphenol, 3- and/or 4-	NSV^2						NSV^2			
Naphthalene	√	√					√	√		
Phenanthrene	√		√				√			

COPEC Summary (STEP 2)

	Direct Exposure[1]						Food Web Exposures			
	Surface Soil		Sediment		Surface Water		Terrestrial Receptors[3]		Aquatic Receptors	
COPEC	AOC 1	AOC 2	W. Ditch	E. Ditch	W. Ditch	E. Ditch	AOC 1	AOC 2	W. Ditch	E. Ditch
Pyrene	√		√				√			
Total Low Molecular Weight PAHs	√		√	√			√			
Total High Molecular Weight PAHs	√		√	√			√	√		
Total PAHs			√	√						
VOCs										
Acetone	√	√	√				√	√		
Explosives										
Trinitrotoluene, 2,4,6-	NSV[2]						NSV[2]			
Dioxins										
TCDD-TEQ	√	√	√		√		√	√		

Notes:

1 – Direct exposures based on maximum concentration for each media

2 – No screening value available. Constituent was retained as COPEC and further evaluated in the risk characterization section

3 – Food web exposures for terrestrial receptors were based on comparison of maximum constituent concentration to USEPA Region 5 ESL (based on exposure to a masked shrew (*Sorex cinerus*)) and USEPA Eco-SSLs for Mammals and Avian Receptors

7.3 Refined Risk Characterization

The SERA resulted in a set of COPCs for each medium. This set of COPCs includes constituents with HQs exceeding 1 (based upon maximum exposures) and detected constituents lacking screening values.

According to Superfund guidance (USEPA 1997c), Step 3 initiates the problem formulation phase of the BERA (identified as Step 3A by USACE [Wentsel et al. 2000]). The BERA begins with a preliminary step in which the conservative assumptions employed in the SERA are refined and risk estimates are recalculated using the same CSM. In addition, the reevaluation may include consideration of other factors such as background and upgradient data, detection frequency, and constituent-specific bioavailability.

The assumptions, parameter values, and methods that were modified for the preliminary Step 3 re-evaluation were as follows:

- EPCs were based on 95 percent UCLs; in cases where 95 percent UCLs could not be calculated maximum concentrations were used (refer to Appendix G for ProUCL outputs for calculation of 95 percent UCLs).
- A two tiered evaluation was used to evaluate upper-trophic level terrestrial receptors:
  - EPCs based on 95 percent UCLs were compared to the Region 5 ESLs.
  - Constituents exceeding HQs of 1 were retained for evaluation using receptor-specific food web models.
- Risk estimates based upon maximum constituent concentrations were supplemented by risk estimates based upon central tendency estimates (e.g., arithmetic mean). In addition, BAFs and BCFs were based on, or modeled from, central tendency estimates (e.g., median or mean) from the literature as opposed to the maximum or high-end (such as 90th percentile) estimates used in the SERA for many constituents. Revised bioaccumulation factor (BAF) and bioconcentration factor (BCF) values for the identified COPECs used for refinements are provided in Tables 7-26 through 7-28.
- Central tendency estimates (e.g., mean, median, or midpoint) for body weight and ingestion rate were used to develop exposure estimates for upper-trophic level receptors, rather than the minimum body weights and maximum ingestion rates used in the SERA (Table 7-29). Central tendency estimates for these exposure parameters are more relevant for a BERA because these better represent the characteristics of a greater proportion of the individuals in the population. Populations (rather than individual organisms) were emphasized during the development of the assessment endpoints for the ERA.
- The food web exposures presented in the SERA above conservatively identified constituents as COPECs if the estimated dose for at least one upper-trophic level receptor exceeded the NOAEL. The actual dose that is protective of an individual receptor, however, will fall between the NOAEL and the LOAEL. Both the NOAEL and LOAEL were used for comparison in the BERA. Ingestion screening values for aquatic mammals and birds were the same as presented in the SERA above. Ingestion screening values for terrestrial mammals and birds are summarized in Tables 7-30 and 7-31, respectively.

Only complete and critical pathways identified in the SERA were re-evaluated at this stage; similarly, only COPECs and receptors identified in the SERA as requiring further evaluation were considered. Although some aspects of the estimation of exposure were modified in Step 3A (see above), the screening values (effects) used in stage were the same as the values used in the SERA.

7.3.1 Direct Exposures

The comparison of 95 percent UCL COPEC concentrations in surface soil to soil screening levels are presented in Tables 7-32 and 7-33 for AOC 1 and AOC 2. Comparison of 95 percent UCL COPEC concentrations in sediment within the West Ditch to sediment screening values is presented in Table 7-34. Given that insufficient number of samples were available to calculate 95 percent UCL concentrations for sediment (East Ditch) and surface water (West Ditch and East Ditch) the constituents identified in the SERA above as COPECs were retained as COPCs for the refined risk characterization.

AOC 1 – Surface Soil

The following constituents in surface soil within AOC 1 were retained as COPCs based on 95 percent UCL HQs exceeding 1:

- Inorganic – manganese, mercury, selenium, and thallium
- Pesticides/PCBs – DDT, PCB 1248, PCB 1254, and total PCBs
- SVOCs – total LMW PAHs and total HMW PAHs
- VOCs – acetone
- Dioxins and furans

AOC 2 – Surface Soil

The following constituents in surface soil within AOC 2 were retained as COPCs based on 95 percent UCL HQs exceeding 1:

- Inorganic – cobalt, manganese, selenium, and thallium
- Pesticides – DDE and DDT
- VOCs – acetone
- Dioxins and furans

West Ditch - Sediment

The following constituents in sediment within the West Ditch were retained as COPCs based on 95 percent UCL HQs exceeding 1, or for select constituents with insufficient number of samples with maximum HQs exceeding 1:

- Inorganic – arsenic
- Pesticides/PCBs – DDD, DDE, DDT, and total PCBs
- SVOCs – total LMW PAHs, total HMW PAHs, and total PAHs
- VOCs – acetone
- Dioxins and furans

Though acetone exhibited HQs exceeding 1, given the low residence time in soil and sediment, no known sources of acetone onsite; and that acetone is a common laboratory contaminant, no further evaluation of acetone is warranted.

7.3.2 Food Web Exposures

As discussed above, for terrestrial receptors, a two-tiered evaluation was conducted which included an initial comparison of 95 percent UCL concentrations to the USEPA Region 5 ESLs for soil. Constituents with HQs greater than 1 were retained and were evaluated via food web exposure for each terrestrial receptor.

AOC 1 – Terrestrial Receptors

Table 7-35 presents the results of the 95 percent UCL HQs for AOC 1 for the COPECs identified above and constituents with HQs greater than 1 were further evaluated via receptor specific food web models.

Food web exposures were evaluated for all six terrestrial receptors (deer mouse, short-tailed shrew, red fox, American robin, mourning dove, and red-tailed hawk) for exposure to the COPCs listed above. HQs based upon 95 percent UCL food web exposures for these terrestrial receptors are provided in Table 7-36. Based upon a comparison to NOAELs, the 95 percent UCL-based HQs for lead, mercury, thallium, zinc, Aroclor-1248, total PCBs, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, pyrene, and dioxin/furan TEQ – for both mammals and birds, exceeded 1 for one or more receptors.

HQs based on maximum allowable toxic concentrations (MATCs) exceeded 1 (for one or more receptor) for lead, thallium, Aroclor-1248, total PCBs benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, pyrene, and dioxin/furan TEQ – for both mammals and birds. However, HQs based on LOAELs were greater than 1 for lead (for the morning dove and American robin), thallium (for the shrew), Aroclor-1248 (for the shrew) total PCBs (for the shrew, deer mouse, red fox, and American robin), benzo(a)anthracene (for the shrew), benzo(a)pyrene (for the shrew), pyrene (for the shrew), and dioxin/furan TEQ – mammals (for the shrew).

AOC 2 – Terrestrial Receptors

Table 7-37 presents the results of the 95 percent UCL HQs for AOC 2 (maximum concentration used in cases when an insufficient number of samples were available to calculate a 95 percent UCL).

Food web exposures were evaluated for all six terrestrial receptors (deer mouse, short-tailed shrew, red fox, American robin, mourning dove, and red-tailed hawk) for exposure to the COPCs listed above. HQs based upon 95 percent UCL food web exposures and/or maximum concentration for these terrestrial receptors are provided in Table 7-38. Based upon a comparison to NOAELs, HQs for thallium exceeded 1 for the short-tailed shrew and deer mouse, while dioxin/furan TEQ exceeded 1 for only the short-tailed shrew. No other receptors were encountered with HQs greater than 1 for any other constituent.

HQs based on MATCs exceeded 1 for thallium and dioxin/furan TEQ for both the short-tailed shrew; however, HQs based on LOAEL for the shrew exceeded 1 for thallium. All other receptors had MATCs and LOAEL-based HQs less than 1 for all constituents. As a result, thallium was retained as COPCs for omnivorous mammals.

West Ditch – Aquatic Receptors

Food web exposures were evaluated for all five aquatic receptors (mink, muskrat, marsh wren, belted kingfisher, and mallard) for exposure to the COPECs identified in the SERA. HQs based upon 95 percent UCL food web exposures and/or maximum concentrations for these aquatic receptors are provided in Table 7-39. HQs based on the NOAEL and MATCs exceed 1 for total PCBs to the mink; however, the LOAEL was less than 1 for exposure of the mink to total PCBs. No other receptor had HQs based on NOAEL, MATCs, or LOAEL exceeding 1 for any constituent. Given that LOAELs were not exceeded for exposure of any constituent to any aquatic receptor, no constituents were retained as COPCs for upper-trophic aquatic receptors within the West Ditch.

East Ditch – Aquatic Receptors

Based on the results of the SERA presented above, no constituents were retained as COPCs for upper-trophic aquatic receptors within the East Ditch and as a result, further evaluation of these receptors was not required.

7.3.3 Uncertainty Assessment

Uncertainties are present in all ERAs because of the limitations of the available data and the need to make certain assumptions and extrapolations based upon incomplete information. In addition, the use of various models (e.g., uptake and food web exposures) each carries with it some associated uncertainty as to how well the model reflects actual conditions. The uncertainties in this ERA are mainly attributable to the following factors:

- **Duplicate Analyses -** When evaluating samples with field duplicates, the value used in the ERA was always the detected concentration when one result was a detect and the duplicate was a non-detect, regardless of the non-detected value. In these cases, the use of the detect has less uncertainty because it represents an actual measured value (versus an upper limit bound). In situations when both values in the parent and duplicate were both detected or both non-detected, the maximum concentration was used.

- **Ingestion Screening Values/Toxicity Reference Values (TRVs) -** Data on the toxicity of some constituents to the upper-trophic level receptor species were sparse or lacking, requiring the extrapolation of data from other wildlife species or from laboratory studies with non-wildlife species. This is a typical limitation and extrapolation for ERAs because so few wildlife species have been tested directly for most constituents. The uncertainties associated with toxicity extrapolation were minimized by selecting the most appropriate test species for which suitable toxicity data were available. The factors considered in selecting a test species to represent a receptor species included taxonomic relatedness, trophic level, foraging method, and similarity of diet.

- **Direct Exposure Screening Values –** Some chemicals in site-related media were detected but had no available screening value. Even though these chemicals were identified as COPCs, potential risks could not be determined for these chemicals and they are not considered risk drivers. The focus of this assessment was on detected constituents with ecotoxicological (effects) data. These constituents are typically the most common/important risk drivers. While there is some uncertainty with the inability to consider constituents without screening values as part of the risk evaluation in this assessment, that uncertainty is considered low because of the attention paid the COPCs with screening values in the same chemical groups. For constituents with screening values, care was taken to measure concentrations using analytical methods that could measure below appropriate action (screening) levels.

- **Constituent Mixtures and Cumulative Concentrations -** Information on the ecotoxicological effects of constituent interactions is generally lacking, which required (as is standard for ERAs) that the constituents be evaluated on an individual basis during the comparison to screening values. This could result in an underestimation of risk (if there are additive or synergistic effects among constituents) or an overestimation of risks (if there are antagonistic effects among constituents).

For soil and sediment, total LMW and HMW concentrations (and total PAH concentrations) as well as total PCBs were calculated and evaluated as well as addressing individual compounds from these groups. There are a couple types of uncertainty associated with this part of the assessment. First, the practice of using one-half the non-detect value when summing the sample-specific concentrations could have potentially overestimated the concentration, and thus potential for risks. Secondly, assuming a cumulative concentration for these groups could either overestimate risk (assuming additivity) or result in the possibility of overlooking the impacts from individual compounds. However, the uncertainty associated with combining concentrations was considered low because more ecotoxicological data are available for the grouped (totaled) constituents relative to individual constituents.

- **Receptor Species Selection -** Reptiles and amphibians also are potential receptors in association with site habitats, but were not evaluated quantitatively even when exposure pathways were likely to be complete. For food web exposures, these taxonomic groups were evaluated using other fauna (birds and mammals) as surrogates because of the general lack of taxon-specific ingestion-based toxicological data. This represents an uncertainty in the ERA.

  It also was assumed that reptiles and amphibians were not exposed to significantly higher concentrations of constituents and were not more sensitive to constituents than other receptor species evaluated in the ERA. Based upon limited direct comparisons of toxicity, amphibians are generally more sensitive to metals relative to fish in water exposures, but not more sensitive to organic constituents than fish (Birge et al. 2000). For sediment exposures, amphibian-based no observed effect concentration (NOEC) values are higher than typical sediment screening values from the literature (such as the ones used in this ERA) that are based upon data from other aquatic receptors for selected metals. There are few comparable data for reptiles.

  In addition, there is some uncertainty associated with the use of specific receptor species to represent larger groups of organisms (such as guilds).

- **Food Web Exposure Modeling -** Constituent concentrations in aquatic food items (wetland/aquatic plants, benthic invertebrates, fish, and frogs) were modeled from measured media concentrations and were not directly measured. The use of generic, literature-derived exposure models and BAFs introduces some uncertainty into the resulting estimates. The values selected and methodology employed were intended to provide a conservative (screening) or reasonable (baseline) estimate of potential food web exposure concentrations.

  Another source of uncertainty was the use of default assumptions (values) for exposure parameters such as BCFs and BAFs. Although BCFs or BAFs for most bioaccumulative constituents were readily available from the literature and were used in this ERA, the use of a default factor of 1 to estimate the concentration of some constituents in receptor prey items is a source of uncertainty.

- **95 percent UCLs Versus Mean Media Concentrations -** As is typical in an ERA, a finite number of environmental media samples were used to develop the exposure estimates. At the Step 3-level of assessment, 95 percent UCLs were used to represent EPCs; however, some UCLs could not be calculated because of small samples sizes. In these situations, the maximum concentration was used by default. A 95 percent UCL is considered a conservative estimate and could over estimate risks; therefore, some uncertainty exists for these EPCs. However, use of 95 percent UCL ensured that some constituents were not overlooked as COPCs and resulted in a more comprehensive assessment.
- **Detected Constituents lacking screening values –** Several constituents were detected in various media without media – specific screening values. These constituents were primarily SVOC and VOC constituents that have low octanol-water partition coefficients (K_{ow}s) and are not known to be highly bioaccumulative. In addition, these constituents were not widely detected within the various media, further indicating that these are not likely related to historical activities at the site. As a result; though there is uncertainty around these constituents, it is unlikely that at the concentration and frequency detected that these constituents pose unacceptable risk
- **Non-detected constituents with reporting limits exceeding screening values –** Several constituents were not detected; however, laboratory reporting limits exceeded the screening value. Although we do not have detected concentrations for constituents with reporting limits greater than respective screening value, there is some degree of uncertainty with respect to these constituents.

7.4 Risk Description

The risk description is the part of the ERA in which the risk assessors integrate and interpret the available information into conclusions about risks to the assessment endpoints. The integration and interpretation of information is in a qualitative form, given the measures of effects used to evaluate risk and the risk estimation technique employed. Essentially, the risk description is a technical narrative supporting the risk estimates and a critical interpretation of the ecological significance of those estimates.

The risk description has two primary elements. The first is the ecological risk summary, which summarizes the results of the risk estimation and discusses the uncertainties associated with the integral steps of the ERA. This section contains the weight-of-evidence analysis. A weight-of-evidence analysis summarizes the results of the risk estimation and uncertainty analysis and assesses confidence in the risk estimates through a discussion of the different lines of evidence. The second element is the interpretation of ecological significance, which may be described in terms of the spatial and temporal extent of effects and, when possible, as an estimation of the recovery potential once the stressor is removed (Norton et al. 1992). Another element, a discussion of the effect of additional data or analyses on uncertainty, also is provided.

7.4.1 Ecological Risk Summary

As discussed in the problem formulation, a number of endpoints were measured and evaluated to provide a weight-of-evidence approach to the assessment of risk. Not all endpoints are equivalent in their ecological significance.

The role of the weight-of-evidence approach in the risk characterization is to assess the measures of effects findings and their associated uncertainty to determine whether there could be potential impacts to assessment endpoints. Agreement between different lines of evidence increases confidence in the conclusions derived in the risk estimation. When lines of evidence disagree, it is important to distinguish between true inconsistencies and those related to uncertainty and variability associated with each measure of effect. As with assigning qualitative significance ratings to the measures of effects, professional judgment is required when evaluating the various results and conflicting lines of evidence.

The following were considered when evaluating the individual lines of evidence in the weight-of-evidence analysis (USEPA 1997c).

- **Relevance of evidence to the assessment endpoint –** Often lines of evidence that are most closely linked to the assessment endpoints have greater importance than those not as closely linked.
- **Relevance of evidence to the conceptual model –** Some lines of evidence may be particularly useful in verifying points of the conceptual model (e.g., biomarker results may confirm exposure to COPCs).
- **Sufficiency and quality of data and experimental design used in key studies –** For example: Were enough samples collected, and were testing protocols followed?
- **Strength of cause and effect relationships –** Precise attribution of effect to stressor is usually not possible when multiple stressors are present; however, observed or predicted effects should coincide somewhat with current or predicted stressor distribution.
- **Relative uncertainties of each line of evidence –** The limitations of each line of evidence must always be considered when evaluating the relative strength of each line of evidence.

The assessment methods used in this ERA considered only comparisons of media concentrations or modeled doses with benchmark values. Consequently, the measures of effects were roughly equivalent in their ecological significance or in their ability to predict risk. Although only one line of evidence was used in this assessment, a weight-of-evidence approach was presented to help describe the risk at each site. The framework for this approach was developed by the New England Weight of Evidence Workgroup and is detailed in *A Weight-of-Evidence Approach for Evaluating Ecological Risks* (Menzie et al. 1996).

Scoring Measures of Effects

In the weight-of-evidence evaluation, 11 attributes of each measure of effect were evaluated. Each of the 11 attributes considered (Table 7-40) was assigned a weighting factor of high, medium, or low. Subsequently, for each of the measures of effects evaluated in an assessment endpoint (in this case only one per assessment endpoint), a qualitative score was assigned to each attribute (Table 7-41). Based on the scores of the individual attributes (all attributes were considered of equal importance), an overall score of low to high was assigned to each measure of effect indicating how well the measure of effect represents the assessment endpoint. Table 7-42 presents a summary of weights assigned to the modeled exposure and effects the measure of effect associated with all of the assessment endpoints evaluated in this risk assessment. In addition, a brief summary of the rationale used to determine that attribute score is presented.

The endpoint score assigned to each measure of effect was an average of the scores from the 11 attributes. The modeled exposure and effects line of evidence had six medium and four high attribute scores (one attribute was not applicable) and was therefore given an overall score of medium-high.

Magnitude of Response in Measures of Effects

The magnitude of the response in a measure of effect was considered together with the measure of effect weight in judging the overall weight of evidence. The magnitude of response was divided into two questions:

1. Does the measure of effect indicate the presence or absence of harm (yes, no, or undetermined)?
2. Is the response low or high?

The endpoint weight of evidence of harm and magnitudes of responses for all measures of effects are presented by habitat in Tables 7-43 through 7-46.

Terrestrial Habitat. In AOC 1, evidence of harm was indicated for lower-trophic receptors (i.e., plants and invertebrates), herbivorous birds and mammals, and invertivorous birds and mammals. The magnitude of harm was considered low for all of the measures of effects except for lower-trophic receptors and short-tailed shrew, which was considered high (Table 7-43).

In AOC 1 evidence of harm was indicated all receptor groups except for carnivorous birds. The magnitude of harm was considered low for all other receptors except for the short-tailed shrew for which the magnitude of harm was considered high (Table 7-44).

Aquatic Habitat. In the western perimeter ditch, evidence of harm was indicated only for lower-trophic aquatic receptors aquatic from surface water (magnitude high) and sediment (magnitude high) (Table 7-45).

In the eastern perimeter ditch, evidence of harm was indicated only for lower-trophic aquatic receptors from exposure to sediment (magnitude high) (Table 7-46).

Concurrence Among Measures of Effects

The third and final component of the weight-of-evidence approach involved examining concurrence among measures of effects as they related to the assessment endpoint. The methodology for displaying the level of concurrence involved graphically plotting the letter designation of each measure of effect within a matrix that also included the weight of each endpoint and the associated degree of response. Since in this risk assessment only one measure of effect per assessment endpoint was evaluated, the concurrence discussion is not provided.

7.4.2 Interpretation of Ecological Significance

The interpretation of ecological significance evaluated responses observed in the measures of effects and those expected in the assessment endpoints and judged whether any expected response could be considered ecologically significant. It is important to clarify that statistical significance and ecological significance are not synonymous, and that the primary goal of this portion of the risk assessment was to assign significance to responses that could reasonably be expected to affect ecosystem structure and function. The goal of the interpretation of ecological significance was to provide the risk manager with some context for evaluating the risk estimate in the context of determining whether there is an unacceptable baseline risk, and to evaluate the management goals (i.e., protection of ecological and human health), and if remedial action is warranted.

The following five criteria are proposed for evaluating adverse changes in assessment endpoints (USEPA 1997c; USACE 1996; Ohio EPA 2008a).

- Nature of effects
- Intensity of effects
- Spatial scale
- Temporal scale
- Potential for recovery

The extent to which the five criteria were evaluated depended on the scope and complexity of the risk assessment. In evaluating the nature and intensity of effects, the risk assessor distinguished adverse ecological changes that were different than those expected as part of normal ecosystem variability, or that result in little or no significant alteration of the system.

Spatial and temporal scales also need to be considered in assessing the significance of effects. The duration, extent, and pattern of stressors need to be considered in the context of the surrounding landscape. Depending on the types of effects, habitats, and potential receptors present, effects to small areas may be as, if not more, ecologically significant than impacts to larger, less critical areas. The duration of any effect is dependent on the persistence of the stressors as well as how often receptors may come into contact with the stressors. Even short-term effects can be ecologically significant if exposure occurs during critical life stages of receptors, or results in an acute response.

The final consideration in evaluating ecological significance was the rate and extent to which ecosystem recovery is possible. Recovery is defined as the rate and extent of return of a population or community to a condition that existed before the introduction of stressors (USEPA 1997c).

Because ecosystems are dynamic and, even under natural conditions, are constantly changing in response to factors other than anthropogenic stressors, it may be unrealistic to expect that an ecosystem will be able to return to exactly the same state that existed prior to its being disturbed, with or without removal of the stressors.

This discussion evaluated and attributed a level of ecological significance and risk to any adverse response predicted from COPCs associated with the former Lockbourne AFB landfill. It is important to realize that, owing to the complexity of contaminants and environments identified on site, precise attribution of effects to specific chemicals or chemical groups was not attempted. In addition, as noted previously, measures of effects reflecting changes in an individual are appropriate given that toxicity of contaminants to individual organisms can have consequences at the population, community, and ecosystem level (USACE 1996; Ohio EPA 2008a). As such, potential risks to individual target receptors noted below were extrapolated to higher levels of ecosystem organization.

The comparison of soil, sediment, and surface water concentrations to benchmarks resulted in a qualitative evaluation identifying whether potential impacts to the associated floral and faunal communities were possible based on the estimated COPC concentrations in the respective medium. While the ecological significance of these lines of evidence may not be as great as other measures of effects, this endpoint can serve as a tool in establishing causal links between COPCs and effects, as described in following subsections. In general, conservative assumptions were used to evaluate exposure and develop TRVs in the avian and mammalian exposure models.

As presented previously, the overall weight-of-evidence rating of the benchmark comparisons and avian and mammalian receptor modeling is considered medium-high.

Based on the risk calculations represented in Section 7.3, COPCs were identified in media based on direct exposures. The following section presents a detailed discussion of the potential for the COPCs that pose unacceptable risk to receptor populations. Table 7-47 summarizes the findings of ecological significance.

Terrestrial Habitat

AOC 1. Based on a comparison of soil concentrations to benchmarks, lower-trophic receptors may be at risk because of exposure to aluminum, chromium, mercury, selenium, thallium, zinc, DDT, PCBs, PAHs, bis(2-ethylhexyl)phthalate, and dioxins/furans.

Based on results of the food web modeling, invertivorous mammals may be at risk because of thallium, PCBs, benzo(a)anthracene, benzo(a)pyrene, pyrene, and TEQ. Herbivorous mammals and carnivorous mammals may be at risk to PCBs, birds and mammals may be at risk from pesticides, PCBs, PAHs, 2,4,6-trinitrotoluene, bis(2-ethylhexyl)phthalate, lead, silver, and thallium, but herbivorous mammals may be at risk from low molecular weight PAHs only.

AOC 2. Based on a comparison of soil concentrations to benchmarks, potential risk to lower-trophic receptors exists for direct exposure to cobalt, selenium, thallium, DDT, and dioxins/furans. The results of the food web modeling indicated potential risk to insectivorous mammals from exposures to thallium. Herbivorous and carnivorous mammals and birds do thallium, but herbivorous mammals do not appear to be at risk.

Aquatic Habitat

Western Perimeter Ditch. Based on a comparison of surface water to benchmarks, potential risk to lower-trophic aquatic receptors exists for direct exposure to dioxins/furans. Comparisons of sediment concentrations to benchmarks indicate potential risks for lower-trophic aquatic receptors from direct exposure to arsenic, DDD, DDE, DDT, PAHs (LMW, HWM, and total PAHs), and dioxins/furans. The results of the food web modeling indicated that no potential risk to upper-trophic aquatic receptors from exposure to site-related COPCs is present in the West Ditch.

Eastern Perimeter Ditch. Based on a comparison of surface water concentrations to benchmarks, significant ecological risks were not indicated for surface water. Comparison of sediment concentrations to benchmarks indicates potential risk to lower-trophic aquatic receptors from exposure to PAHs (LMW, HMW, and total PAHs). The results of the food web modeling indicated that no potential risk to upper-trophic aquatic receptors from exposure to site-related COPCs is present in the East Ditch.

7.5 Ecological Risk Refinements

This section provides a discussion of the COPCs identified in AOC 2 surface soil and ditches to support risk management decisions. As presented in Section 1, the presumptive remedy for AOC 1 is a landfill cap to address potential risk to terrestrial receptors. As a result, no further refinements will be presented with respect to AOC 1.

As presented above, the following COPCs were identified within AOC 2:

- Potential unacceptable risk to lower-trophic receptors via direct exposure
  - Cobalt
  - Selenium
  - Thallium
  - DDT
  - Dioxins/Furans

- The results of the food web modeling indicated potential risk to insectivorous mammals from exposures to thallium.

Each constituent identified as a COPC was further evaluated with the following consideration:

- Background concentrations,
- Uncertainty of the risk estimates based on conservative screening thresholds, and
- Application of less conservative toxicity reference values to bound the risk estimates.

7.5.1 Background Concentrations

During the COPC selection process, inorganics that were detected at concentrations consistent with background levels were eliminated as COPCs. Exclusion of chemicals present at concentrations consistent with background does not have an impact on potential site-related risk estimates. Organic compounds were not eliminated as COPCs based on background concentrations. However, dioxin/furan samples were collected during the Phase II SI from off-landfill locations for soil, sediment, surface water, and groundwater. Dioxin/furan concentrations from samples collected on the former Lockbourne AFB landfill were compared to the concentrations from the samples collected from off-landfill locations, as presented below. As shown in the table, concentrations of dioxins/furans from media within the former Lockbourne AFB landfill in AOC 1 and AOC 2 are generally similar to concentrations from off-landfill locations. Given that similar concentrations were encountered offsite, dioxins/furans do not appear to be elevated onsite and pose unacceptable risk above local background conditions.

Medium	Landfill	TCDD-TEQ Conc. Range*	Off-Landfill	TCDD-TEQ Conc. Range*
Surface Soil	AOC 1	9.12E-07 – 1.20E-05	Northern perimeter (SB-08, SB-09)	1.73E-06 – 1.81E-06
	AOC 2	1.30-06 – 4.63E-06	RANGB (14MW1, SO-49, SO-323)	1.91E-06 – 8.37E-06
			Railroad (SO-24, SO-25)	1.84E-06 – 6.11E-06
			Village of Lockbourne (SO-22, SO-23)	3.16E-06 – 5.14E-06
Sediment	West Ditch	1.46E-06 – 4.06E-06	Upstream (SD-01, SD-03, SD-10, SD-11, SD-12)	1.53E-06 – 3.12E-05
Surface Water	West Ditch	1.07E-09 – 5.44E-09	Upstream (SW-01, SW-03)	6.35E-09 – 7.22E-09

*All concentrations are mg/kg for soil and sediment and mg/L for surface water; all water results are reported as unfiltered results.

7.5.2 Screening Threshold Values

This ERA was conducted using conservative direct exposure screening values. In some cases, screening values are derived using uncertainty factors due to limited toxicological studies to derive screening values. As a result, of applying uncertainty factors, in many cases risk to lower-receptors is overestimated. This section provides a discussion of the direct screening values for constituents identified as COPCs in AOC 2.

Based on the direct exposure evaluation, cobalt, selenium, thallium, DDT, and dioxins/furans were identified as COPCs in AOC 2. As presented above, onsite concentrations of dioxins/furans were similar to those encountered offsite. In addition, a conservative screening value was used for the direct exposure pathway and the potential risk is likely overestimated. The maximum onsite concentration for 2,3,7,8-TCDD, the congener that is assumed to be the most toxic, concentration was 4.8×10^{-6} mg/kg, or ppm. Reinecke and Nash (1984) reported that two species of earthworms (*Allolobophophora caliginosa* and *Lumbricus rubellus*) showed no adverse effects when held for 85 days in soil containing 5 ppm of 2,3,7,8-TCDD, but both species died at 10 ppm. Because the maximum detected concentration of 2,3,7,8-TCDD was significantly less than concentrations shown to be toxic to soil invertebrates and because the food web modeling showed dioxins/furans to pose no unacceptable risk, no further evaluation is warranted.

Cobalt was detected in all eight surface soil samples; however, only one sample exceeded the screening value of 13 mg/kg. The 95 percent UCL for the data is 19.99 mg/kg, which resulted in a an HQ slightly great than 1. The screening value used in this ERA is the USEPA Eco-SSL for plants (USEPA 2005i). The studies used to derive the screening level were reviewed and the basis for each toxicity value reported for each study was the effects concentration for 20 percent of the population (EC_{20}), as presented below.

Data Used to Derive Eco-SSL for Cobalt			
Reference	**Test Organism**	**Toxicity Parameter**	**Toxicity Value Soil Concentration (mg/kg)**
TN & Associates, Inc. 2000	Alfalfa	EC20	0.6
TN & Associates, Inc. 2000	Barley	EC20	29.8
TN & Associates, Inc. 2000	Radish	EC20	14.5
TN & Associates, Inc. 2000	Alfalfa	EC20	13.4
TN & Associates, Inc. 2000	Barley	EC20	36.4
TN & Associates, Inc. 2000	Radish	EC20	45.2
Data Not Used to Derive Eco-SSL for Cobalt			
Rehab, F.I., 1978	Cotton	LOAEC	100

Notes:
EC_{20} = Effect concentration for 20% of text population

The range of EC_{20} values for the six studies used to derive the Eco-SSL ranged from 0.6 to 45.2 mg/kg. Of these studies, the 95 percent UCL for cobalt falls well below in three of the six. In addition, the 95 percent UCL falls well below LOAEC of 100 mg/kg reported by Rehab 1978 (although this study was not used to derive the Eco-SSL, it met the criteria to be used). Given that only one sample exhibited concentrations of cobalt above the Eco-SSL, and the fact that all concentrations are well below the NOAEC and below three of the six EC_{20} values, it is unlikely that cobalt poses unacceptable risk to lower-trophic receptors.

Selenium was detected in seven of 16 surface soil samples within AOC 2, of which only three exceeded the Eco-SSSL of 0.44 mg/kg. The 95 percent UCL HQ for this data set was 1.02. The Eco-SSL used in this ERA was derived using plant toxicity data from eight studies presented in the table below.

Data Used to Derive Eco-SSL for Selenium			
Reference	**Test Organism**	**Toxicity Parameter**	**Toxicity Value Soil Concentration (mg/kg)**
TN & Associates, Inc. 2000	Alfalfa	EC20	0.1
TN & Associates, Inc. 2000	Barley	EC20	0.2
TN & Associates, Inc. 2000	Brassica	EC20	0.2
Singh et al, 1980a	Raya	MATC	1.4
Singh et al., 1980b	Berseem	MATC	1.6
Wan et al., 1988	Alfalfa	MATC	0.9
Wan et al., 1988	Alfalfa	MATC	0.9
Singh and Singh, 1979	Cowpea	MATC	0.8

Notes:
EC_{20} = Effect concentration for 20% of text population
MATC = Maximum acceptable toxicant concentration

The MATCs listed above range from 0.8 mg/kg to 1.6 mg/kg; when compared to the MATCs, a less conservative toxicity value than the EC_{20}, all surface soil samples exhibited concentrations that were well below these values. Given the low frequency of exceedances of the Eco-SSL, and the fact that all selenium concentrations were below the MATCs, it is unlikely that selenium poses risk to lower-trophic receptors. As a result, no further evaluation with respect to selenium is warranted.

Thallium was detected in four out of eight surface soil samples, all four of which exceeded the soil screening value of 1.0 mg/kg. The 95 percent UCL for this data set exceeded the maximum concentration and, as a result, the maximum value (2.2 mg/kg) was used by default. The soil screening value used in the ERA was based on one plant toxicity study, as reported in Efroymson et al.; as a result, the confidence of this screening value is relatively low. Given the relatively low frequency of detection and low magnitude of exceedances, it is unlikely that thallium poses unacceptable risk to lower-trophic receptors and, therefore, no further evaluation is warranted.

DDT was detected in only three out of 16 surface soil samples, all three of which exceeded the soil screening benchmark of 0.0035 mg/kg. The benchmark used in this ERA was the USEPA Region 5 ecological screening level for surface soil (USEPA 2003c) and is based on exposure to the masked shrew. Eco SSL benchmarks were not available based on exposure to lower-trophic receptors; however, several studies were evaluated (USEPA 2007i) and summarized below.

Plant Toxicity Data for DDT (USEPA 2007i)			
Reference	**Test Organism**	**Toxicity Parameter**	**Toxicity Value Soil Concentration (mg/kg)**
Pareek and Gaur 1970	Common bean	MATC	7.1
Rajanna and De la Cruz 1977	Cotton	NOAEC	50
Rajanna and De la Cruz 1977	Soybean	NOAEC	50
Rajanna and De la Cruz 1977	Corn	NOAEC	50
Rajanna and De la Cruz 1977	Wheat	NOAEC	50
Invertebrate Toxicity Data for DDT (USEPA 2007)			
Harris 1966	Common cricket	LC_{50}	0.08
Harris 1966	Common cricket	LC_{50}	1.75
Harris 1966	Common cricket	LC_{50}	3.1
Harris 1966	Common cricket	LC_{50}	4.1
Harris 1966	Common cricket	LC_{50}	4.3
Harris 1966	Common cricket	LC_{50}	11.4
Harris 1966	Common cricket	LC_{50}	4.2
Harris 1966	Common cricket	LC_{50}	11.8
Harris 1966	Common cricket	LC_{50}	20.4
Harris 1966	Common cricket	LC_{50}	45.3
Harris 1966	Common cricket	LC_{50}	77.2

Notes:
LC_{50} = Concentration lethal to 50% of test population

All surface soil samples exhibited DDT concentrations well below the toxicity values for plants and invertebrates. Given this and the low frequency of detection, no further evaluation of DDT is warranted with respect to lower-trophic receptors.

7.5.3 Toxicity Reference Values

This ERA was conducted using conservative TRV for upper-trophic receptors. In some cases, screening values are derived using uncertainty factors due to limited toxicological studies to obtain screening values. As a result of applying uncertainty factors in many cases, risk to upper-receptors is overestimated. This section provides a discussion of the toxicity reference values for thallium, the only COPC for upper-trophic receptors in AOC 2.

Thallium was identified as a potential COPC, based on the LOAEL HQ of 1.1 for the short-tailed shrew. It is important to note that the HQ was based on the maximum concentration because the 95 percent UCL exceeded the maximum concentration (likely attributed to small sample size). When the mean concentration (1.26 mg/kg) is used in the food web model, the LOAEL HQ was well below 1. Although using a mean concentration on such a small sample size would likely result in an underestimation of risk, the thallium exposure concentration for upper-trophic receptors is likely somewhere between the mean and maximum (i.e., between 1.26 and 2.2 mg/kg).

The TRV used in this ERA for thallium was based on a subchronic LOAEL of 0.74 mg/kg/d (Sample et al. 1996). As indicted above, an uncertainly factor of 4 was applied to the convert the subchronic LOAEL of 0.74 mg/kg/d to a chronic LOAEL of 0.185 mg/kg/d. Removing the uncertainty factors would provide a less conservative exposure assessment. When the subchronic LOAEL is used along with the maximum thallium concentration from AOC 2, the result is an HQ of 0.3. Given that thallium was detected at relatively low concentrations in only 50 percent of the samples, that the LOAEL HQ (using maximum concentration) was slightly above 1, and that the LOAEL HQ using the uncorrected subchronic TRV resulted in an HQ well below 1 for the short-tailed shrew, no further evaluation with respect to thallium is warranted for AOC 2.

7.6 Ecological Risk Conclusions

Based on the results of this ERA, potential ecological risks were identified with respect to lower-trophic and upper-trophic terrestrial receptors within AOC 1 and AOC 2, and lower-trophic receptors within the West Ditch and East Ditch. No further evaluation was recommended for AOC 1 or the East or West Ditch because it is assumed the applicable remedial action for AOC 1 is a landfill cap and reworking of the ditches, which will address the ecological risk identified above.

Based on the results of the refinements to the COPCs identified within AOC 2, it is unlikely that lower- or upper-trophic receptors are at risk and no further evaluation is warranted. Furthermore, AOC 2 will be developed for commercial and/or industrial use and, as a result, it is likely that the current habitat present onsite will become limited or eliminated in some areas resulting in reduced exposure potential as receptors re-locate to areas where adequate habitat is present.

This ERA was performed to evaluate the actual or potential ecological effects from exposures to the former Lockbourne AFB landfill site. This multi-pathway analysis was based on reasonable, protective assumptions about the potential for ecological receptors (lower-trophic and upper-trophic terrestrial and aquatic receptors) to be exposed to and be adversely affected by exposure to COPCs.

The upper-trophic receptors were selected as surrogate species representing estimated exposure and subsequently risk to other species within comparable feeding guilds. Key wildlife receptors include the deer mouse, American robin, mourning dove, short-tailed shrew, red-tailed hawk, red fox, mallard, marsh wren, muskrat, belted kingfisher, and mink.

The results of the ERA are summarized below, including the exposure area, medium, and COPCs, which are those chemicals that exceed the ecological HQs of 1 and where the lines of evidence (i.e., habitat, frequency of exceedances, background contributions) support the ecological quotient exceedances.

Summary of Ecological Risks

Exposure Area	Exposure Medium	Receptors	Chemicals of Potential Concern
AOC 1	Surface soil (0–4 feet)	Terrestrial Mammals	Thallium, PAHs, PCBs, Dioxins/Furans
		Terrestrial Birds	Lead, PCBs
		Lower-Trophic Receptors	Aluminum, chromium, lead, mercury, selenium, thallium, zinc, DDT, PCBs, PAHs, Dixons/Furans
AOC 2	Surface soil (0–4 feet)	Terrestrial Mammals	NR
		Lower-Trophic Receptors	NR
East Ditch	Surface water	Lower-Trophic Receptors	NR
		Upper-Trophic Receptors	NR
	Sediment	Lower-Trophic Receptors	PAHs
		Upper-Trophic Receptors	NR
West Ditch	Surface water	Lower-Trophic Receptors	Dioxins/Furans
	Sediment	Lower-Trophic Receptors	Arsenic, DDD, DDE, DDT, PCBs, PAHs, Dioxins/Furans

Note: NR = negligible risk as determined in the ERA

SECTION 8

Summary

This report evaluates the results of sampling efforts conducted at the former Lockbourne AFB landfill in several investigations. Constituents of interest were identified in soil, sediment, surface water, and groundwater. The interpretations were made by comparing every detected result against readily available RSLs.

8.1 Physical Setting

Several factors influence the potential migration of chemicals at the site. Groundwater is typically 4 to 25 feet bgs, suggesting that in some areas limited attenuation may occur in the unsaturated soil. The f_{oc} of soil was moderate, ranging from 0.014 to 0.036.

As discussed in Section 3, hydrogeologic data collected to date indicate that a three-aquifer system exists at the site.

- **UWBZ –** This zone is overlain by unconsolidated material consisting of silty clay with sand lenses. The shallow water table exists within the silty clay, ranging in depth from approximately 4 to 16 feet bgs, and is possibly under perched water conditions. Groundwater flow in the shallow unconsolidated deposits is toward the west and southwest at the former Lockbourne AFB landfill. The average hydraulic gradient of the shallow potentiometric surface was found to be approximately 0.0075 ft/ft, with K values ranging from approximately 1 to 28 feet per day.
- **IDA –** This zone consists of sand and gravel and exists below the silty clay layer. An upper silty clay unit contains a gray clay layer that occurs at depths ranging from approximately 18 to 48 feet bgs; is laterally continuous, more than 20 feet thick, and dense; and has a low permeability. Thus, it is considered an effective aquitard separating the UWBZ from the lower aquifers (intermediate and deep). The IDA exists under confined conditions, with the groundwater surface approximately 20 to 30 feet bgs, and groundwater flow is generally toward the west-southwest with a horizontal gradient of approximately 0.004 ft/ft, and K values ranging from approximately 0.5 to 18 feet per day.
- **Deep Aquifer –** This zone consists of sand and gravel overlain by a clay unit present at a depth of approximately 130 feet bgs that separates the IDA from a deep aquifer (ES 1992).

Based on the shallow water table of the perched UWBZ and the presence of unconsolidated material consisting of silty clay with sand lenses overlying this zone, the potential exists for soil constituents to leach to the shallow zone.

The former Lockbourne AFB is located on the drainage divide between Big Walnut Creek and Walnut Creek. Surface drainage at the site is controlled through an extensive network of storm drains, which include corrugated metal and concrete drainage pipes, and open drainage ditches. While there is no natural surface water on the former Lockbourne AFB landfill site, the site perimeter ditch functions as a surface water/storm water ditch; this ditch was created by excavation along the eastern and western boundaries of the site and receives stormwater runoff from the Rickenbacker Airport property and RANGB.

8.2 Environmental Impact at the Site

8.2.1 Surface Soil

Surface soil samples were collected from a depth of 0 to 1 foot bgs during the 2003, 1998, 1997, and 1995 sampling events. The following were observed:

- Although a limited number of VOCs were detected in the surface soil samples, the concentrations of the detected VOCs were low. No VOCs in any of the samples collected exceeded their respective RSLs.
- Occurrence of SVOCs was more widespread. The more prevalent SVOCs are PAHs, which are commonly associated with site activities (burning and disposal of wastes). A total of nine SVOCs (benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(ah)anthracene, dibenzofuran, indeno(1,2,3-cd)pyrene, naphthalene) showed exceedances, and these SVOCs were detected throughout the former Lockbourne AFB landfill.
- The more commonly occurring pesticides found at the site were p,p′-DDD; p,p′-DDE; and p,p′-DDT. These pesticides were detected during the RI and both SIs. PCBs also were detected during the RI but not during the Phase I and Phase II SIs. In addition, exceedances were noted with four PCBs (PCB 1242, PCB 1248, PCB 1254, and PCB 1260).
- Although low concentrations of two explosive compounds were detected in soil during the RI, none was detected during the SIs. No explosive compounds were detected in soil above RSLs.
- Dioxin/furan congeners were detected in surface soil samples collected during the RI and Phase II SI. Among the different dioxins that were detected, the most commonly occurring dioxins were heptachlorodibenzo-p-dioxin and octachlorodibenzo-p-dioxin. Based on TCDD-TEQ, exceedances were noted in nine samples.
- The most frequently detected metals were arsenic, barium, chromium, lead, and zinc, and among these, arsenic concentrations were found to be above its RSL in most of the samples collected. Exceedances were also noted with cobalt and lead, but less frequently.

8.2.2 Subsurface Soil

Subsurface soil samples were collected during the 2003, 1997, and 1995 sampling events. The following were observed:

- Although a limited number of VOCs were detected in the subsurface soil samples, the concentrations of the detected VOCs were low. No VOCs in any of the samples collected exceeded their respective RSLs.

- SVOCs were detected more frequently in subsurface samples. The SVOCs, primarily PAHs, detected in subsurface soil samples were similar to that found in surface soil. A total of six PAHs showed exceedances.
- Although PCBs and pesticides were detected, the frequency of occurrence was low as well as the concentrations of the detected pesticides. Concentration of PCB 1254 exceeded its RSL at one location only.
- Dioxin/furan congeners were detected in subsurface soil samples collected during the RI and Phase II SI. Among the different dioxins that were detected, five dioxin/furan congeners exceeded their respective RSLs, including heptachlorodibenzofurans, heptachlorodibenzo-p-dioxins, hexachlorodibenzofurans, hexachlorodibenzo-p-dioxins, and pentachlorodibenzo-p-dioxins. Based on TCDD-TEQ, exceedances were noted in four samples.
- No explosives were detected above their reporting limits.
- The key metals detected in subsurface soil were arsenic, barium, chromium, lead, and zinc, although exceedances were noted only with arsenic.

8.2.3 Surface Water

Surface water samples were collected during the 2003, 1998, 1997, and 1995 sampling events. The following were observed:

- Although no VOCs were detected in the surface water samples during the RI, VOCs were detected in samples collected during the Phase I and II SI; however, detected concentrations were low. Methylene chloride were detected above its RSL in samples collected during Phase I SI.
- Although SVOCs were detected in samples collected during the RI and Phase I SI, only two SVOCs were detected in each investigation. Only bis(2-ethylhexyl phthalate) was detected above its RSL in one sample.
- Significant amounts of dioxins were detected in samples collected during the Phase II SI, while no dioxins were detected in any of the samples collected during the RI. Based on TCDD-TEQ, exceedances were noted in six samples.
- The five most frequently detected metals in surface water were barium, calcium, magnesium, manganese, and sodium. Arsenic, lead, and thallium were detected above their respective RSLs.

8.2.4 Sediment Sampling

Sediment samples were collected during the 2003, 1998, 1997, and 1995 sampling events. The following were observed:

- VOCs were detected in sediment samples collected from the East and West ditches.
- A pronounced oil sheen and hydrocarbon odor were observed at one of the location (SD-02). Seventeen SVOCs were detected at this location.

- SVOCs also were detected above their reporting limits in the sediment samples collected from other locations. Exceedances were noted with two SVOCs during the Phase I SI sampling event, although no such exceedances were noted in the subsequent sampling events.
- The more commonly occurring pesticides in sediment samples were p,p′-DDD; p,p′-DDE; and p,p′-DDT. Although pesticides were detected, the frequency of occurrence was low as well as the concentrations of the detected pesticides. The detection of PCBs was infrequent.
- No dioxins were reported in any of the samples collected during the RI. During the Phase II SI, dioxins were detected in both background samples and those collected from the East and West ditches. Based on TCDD-TEQ, exceedances were noted in five samples. A review of available data suggests there are sources that may have contributed to surface water and sediment dioxin loading upgradient of the Lockbourne AFB Landfill.

The key metals in sediment were aluminum, arsenic, calcium, chromium, and lead. Based on concentrations of metals in the collected sediment samples, it was noted that arsenic concentrations were detected above its RSL. It also was noted that in addition to arsenic, chromium and iron were detected above their respective RSLs in background samples.

8.2.5 Groundwater

Groundwater samples were collected during the 2003, 1998, 1997, and 1995 sampling events. Groundwater samples also were collected in November 2003, February 2004, and May 2004. The following were observed:

- Although VOCs were detected in groundwater samples collected during all investigation activities, concentrations of VOCs detected were low. During the 1995 sampling event, methylene chloride was detected across all media. This can be associated with laboratory contamination and does not appear to be related to the surface contents of the former Lockbourne AFB landfill. The only VOC detected above its RSL was methylene chloride.
- Although no SVOCs were detected during the Phase II sampling event, five SVOCs were detected during the Phase I SI and 12 SVOCs were detected during the RI. A total of nine SVOCs were detected above their respective RSLs.
- Dioxins were detected in groundwater more frequently in the Phase II SI samples compared with the RI samples; overall dioxin detections decreased in each successive sampling event. The trend in lower dioxin concentrations between the 1997 Phase II SI versus the 1998 Phase II SI and 2003 RI may be in part because of the difference in sample collection techniques: bottom-emptying bailer sample collection during the 1997 sampling event versus low-flow sampling collection during the 1998 and 2003 sampling events.
- Metals were detected in the majority of well locations in 2003, including background wells. Arsenic was detected primarily in the UWBZ wells. IDA arsenic concentrations from site wells were similar to concentrations in IDA background wells. All detected

arsenic concentrations, except in LCKMW-7 in the eastern side of Village of Lockbourne, exceeded the RSLs. Metals, besides arsenic, that were detected above their respective RSLs were aluminum, barium, cobalt, iron, and manganese.

- The observed three to four orders of magnitude greater inorganic concentrations detected in groundwater during the Phase I SI compared to the Phase II SI concentrations detected may be the result differences in sampling methods.

8.3 Human Risk Assessment

The HHRA was performed to evaluate potential current and future risks associated with detected constituents at the former Lockbourne AFB landfill. Surface soil, subsurface soil, sediment, surface water, and groundwater analytical data were evaluated in the HHRA. Potential risks were evaluated for the exposure pathways presented in the following table.

Exposure Area	Exposure Medium	Human Receptors
AOC 1	Surface soil	Current/Future Maintenance, Trespasser/Visitor, and Offsite Industrial Worker
AOC 1	Total soil*	Future Construction Worker
AOC 1	UWBZ Groundwater	Future Construction Worker and Offsite Residents
AOC 1	IDA Groundwater	Future Offsite Residents
AOC 1	Indoor Air (Vapor intrusion from Groundwater - UWBZ) [1]	Future Offsite Residents
AOC 1	Indoor Air (Vapor intrusion from Groundwater - IDA) [1]	Future Offsite Residents
AOC 2	Surface soil	Current/Future Maintenance, Trespasser/Visitor, and Offsite Industrial Worker
		Future Onsite Facility Worker
AOC 2	Total soil*	Future Construction Worker
AOC 2	Indoor Air (vapor intrusion from Total Soil*)	Future Onsite Facility Worker
AOC 2	UWBZ Groundwater	Future Construction Worker
AOC 2	Indoor Air (Vapor intrusion from Groundwater - UWBZ) [1]	Future Onsite Facility Worker
AOC 2	Indoor Air (Vapor intrusion from Groundwater - IDA) [1]	Future Onsite Facility Worker
East Ditch	Sediment and Surface water	Current/Future Trespasser/Visitor
		Future Construction Worker
West Ditch	Sediment and Surface water	Current/Future Trespasser/Visitor
		Future Construction Worker
Off-Landfill	IDA Groundwater	Future Offsite Residents

Exposure Area	Exposure Medium	Human Receptors
Off-Landfill	Indoor Air (Vapor intrusion from Groundwater - IDA)[1]	Future Offsite Residents

* Total Soil – surface soil and subsurface soil combined (0 to 10 feet bgs.)

[1] No COPCs were identified for indoor air (vapor intrusion from groundwater).

The exposure scenarios that exceed risk targets are identified in the following table.

Exposure Scenarios that Exceed Risk Targets

Exposure Area	Exposure Medium	Human Receptors	Risk Drivers
AOC 1	Surface soil	Current/Future maintenance, trespasser/visitor	PAHs, PCBs
AOC 1	Total soil	Future construction worker	PAHS, PCBs, lead
AOC 1	UWBZ Groundwater	Future construction worker and offsite residents	PAHs, phthalates, dioxins, metals (aluminum, arsenic, cadmium, cobalt, copper, iron, manganese, thallium, vanadium, and lead, VOCs (methylene chloride)
AOC 1	IDA Groundwater	Future offsite residents	PAHs, phthalates, dioxins, metals (iron and manganese)
AOC 2	UWBZ Groundwater	Future construction worker	PAHs, dioxins
Off-Landfill	IDA Groundwater	Future offsite residents	PAHs, dioxins

For soil exposure scenarios that exceed the risk target goals (i.e., AOC 1 current/future maintenance and trespasser/visitor, and future construction worker), risks are driven primarily by cPAHs and PCBs. Exposure to lead in the AOC 1 soil by future construction workers would result in BLLs in children (fetuses of exposed construction workers) that exceed the acceptable criterion for BLLs for fetuses.

For groundwater exposure scenarios that exceed risk target goals (i.e., future construction workers and offsite residents), risks are driven primarily by PAHs and dioxins, and to a lesser extent by metals, VOCs, and phthalates. Lead concentrations in AOC 1 UWBZ groundwater would exceed the criterion for BLL in future children exposed to offsite groundwater.

8.4 Ecological Risk Assessment

Based on the results of the ERA, potential ecological risks were identified with respect to lower-trophic and upper-trophic terrestrial receptors within AOC 1, and lower-trophic receptors within the West Ditch and East Ditch. The ecological risks will be addressed upon implementation of the presumptive remedy for the site and the remedy includes a landfill cap and reworking of the ditches.

Based on the results of the refinements to the COPCs identified within AOC 2, it is unlikely that lower or upper-trophic receptors are at risk, and as a result no further evaluation is warranted. Furthermore, AOC 2 will be developed for commercial and/or industrial use and as a result, it is likely that the current habitat present onsite will become limited or eliminated in some areas, resulting in reduced exposure potential as receptors are relocated to areas where adequate habitat is present.

This ERA was performed to evaluate the actual or potential ecological effects from exposures to the former Lockbourne AFB landfill site. This multi-pathway analysis was based on reasonable, protective assumptions about the potential for ecological receptors (lower-trophic and upper-trophic terrestrial and aquatic receptors) to be exposed to and be adversely affected by exposure to COPCs.

The upper-trophic receptors were selected as surrogate species representing estimated exposure and subsequently risk to other species within comparable feeding guilds. Key wildlife receptors include the deer mouse, American robin, mourning dove, short-tailed shrew, red-tailed hawk, red fox, mallard, marsh wren, muskrat, belted kingfisher, and mink.

The results of the ERA are summarized below, including the exposure area, medium, and COPCs, which are those chemicals that exceed the ecological HQs of 1 and where the lines of evidence (i.e., habitat, frequency of exceedances, background contributions) support the ecological quotient exceedances.

Summary of Ecological Risks

Exposure Area	Exposure Medium	Receptors	Chemicals of Potential Concern
AOC 1	Surface soil (0–4 feet)	Terrestrial Mammals	Thallium, PAHs, PCBs, Dioxins/Furans
		Terrestrial Birds	Lead, PCBs
		Lower-Trophic Receptors	Aluminum, chromium, lead, mercury, selenium, thallium, zinc, DDT, PCBs, PAHs, Dixons/Furans
AOC 2	Surface soil (0–4 feet)	Terrestrial Mammals	NR
		Lower-Trophic Receptors	NR
East Ditch	Surface water	Lower-Trophic Receptors	NR
		Upper-Trophic Receptors	NR
	Sediment	Lower-Trophic Receptors	PAHs
		Upper-Trophic Receptors	NR
West Ditch	Surface water	Lower-Trophic Receptors	Dioxins/Furans
	Sediment	Lower-Trophic Receptors	Arsenic, DDD, DDE, DDT, PCBs, PAHs, Dioxins/Furans

Note: NR = negligible risk as determined in the ERA

8.5 Extent of Impact

The primary fate and transport mechanisms occurring at the site were identified based on review of the distribution (nature and extent) of the site-related constituents of interest relative to the environmental setting, their physical and chemical properties, and comparison to screening levels. Based on this review, the presence of site-related chemicals throughout the former Lockbourne AFB landfill are principally the result of runoff of impacted soil and subsequent transport to downgradient drainage ditches.

It was determined that the migration pathways from surface soil to subsurface soil and sediment are significant, while the migration pathway from surface soil to groundwater is moderate. Based on the comparison of the analytical data of surface soil and surface water, this migration pathway was considered less significant. Finally, based upon a comparison of the constituents in groundwater and surface water, it was concluded that discharge of shallow groundwater to surface water is not significant.

Migration of constituents from surface soil to surface water and sediment may occur because of surface runoff of impacted soil resulting from precipitation. Migration of constituents from surface soil to subsurface soil and groundwater can occur as a result of infiltration. Finally, any release to air from the site is considered to be minimal.

Landfills can be significant generators of gases because of decomposition of organic waste materials. Because of the age of the former Lockbourne AFB landfill and the depth of waste, significant generation of these gases would not be expected at this site. This is further supported by the gas monitoring study completed as part of the additional SI completed by CH2M HILL.

8.6 Recommendations

As stated earlier, the objectives for the RI report were to present and evaluate the results obtained from previous investigations conducted at the former Lockbourne AFB landfill. This report discussed the nature and extent of impact (i.e., types, concentrations, and distribution of constituents detected in different media sampled), their migration pathways, and transport mechanisms in soil and groundwater at the site. This report also documented the potential human health and environmental risks associated with current site conditions and evaluated potential future exposure.

The RI was completed with the assumption that a presumptive remedy involving containment will be implemented in the future for AOC 1 along with institutional controls restricting future land use and potable groundwater use for AOCs 1 and 2. The objectives of the remedial action for AOC 1 and AOC 2 are:

- Eliminate human and ecological exposure in both AOC 1 and 2;
- Minimize or eliminate potential human exposure to COPCs present in groundwater and minimize downgradient migration of COPCs in groundwater in AOCs 1 and 2;
- Minimize impacts to nearby surface water resources;

- Promote the beneficial reuse of onsite materials during the remedial action and provide for sustainability, to the extent practicable for AOCs 1 and 2;
- Restore the former landfill area to a condition consistent with beneficial reuse; and
- Separate AOC 2 from the remedial action at AOC 1 and develop a separate Proposed Plan and Decision Document for it to achieve No Further Action status. This process will include an environmental covenant for AOC 2 that includes a land use restriction (commercial/industrial usage only) and the restriction of groundwater usage.

The presumptive remedy for AOC 1 involves the installation of a soil cover/cap on the landfill. A focused feasibility study will be conducted to determine the appropriate remedial alternative for the site. The presumptive remedy is based on restricting land use to industrial/commercial use only. The components of the environmental covenants that are proposed include the following:

- Land use at AOC 1 and AOC 2 will be restricted to commercial/industrial activities only;
- Restrict the use of groundwater at AOC 1 and AOC 2 to limit exposure; and
- Intrusive activities will be restricted at the AOC 1 covered/capped area and the cap will be maintained.

SECTION 9

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Tables

TABLE 2-1a

Surface and Subsurface Samples Collected During Phase I, Phase II, and Remedial Investigations

Former Lockbourne Air Force Base, Lockbourne, Ohio

Sample ID	Phase	Sample Date	Type	Depth	Duplicate Name	Resampled
LCK-SO1	Phase I	5/24/1995	Surface Soil	0 - 1		
LCK-SO2	Phase I	5/24/1995	Surface Soil	0 - 1		
LCK-SO2	Phase I	5/24/1995	Surface Soil	0 - 1		Yes
LCK-SO3	Phase I	5/25/1995	Surface Soil	0 - 1		
LCK-SO4	Phase I	5/25/1995	Surface Soil	0 - 1		
LCK-SO5	Phase I	5/24/1995	Surface Soil	0 - 1		
LCK-SO6	Phase I	5/23/1995	Surface Soil	0 - 1		
LCK-SO6	Phase I	5/23/1995	Surface Soil	0 - 1		Yes
LCK-SO7	Phase I	5/23/1995	Surface Soil	0 - 1		
LCK-SO8	Phase I	5/23/1995	Surface Soil	0 - 1		
LCK-SO8	Phase I	5/23/1995	Surface Soil	0 - 1		Yes
LCK-SO9	Phase I	5/24/1995	Surface Soil	0 - 1		
LCK-SO10	Phase I	5/24/1995	Surface Soil	0 - 1		
LCK-SO11	Phase I	5/25/1995	Surface Soil	0 - 1		
LCK-SO12	PhaseI	5/25/1995	Surface Soil	0 - 1		
LCK-SO1	Phase II	7/28/1997	Surface Soil	0 - 1		
LCK-SO6	Phase II	7/24/1997	Surface Soil	0 - 1		
LCK-SO7	Phase II	7/28/1997	Surface Soil	0 - 1		
LCK-SO7	Phase II	7/28/1997	Surface Soil	0 - 1	LCKSO-11	
LCK-SO7	Phase II	7/28/1997	Surface Soil	0 - 1	LCKSO-9	
LCK-SO8	Phase II	7/28/1997	Surface Soil	0 - 1		
LCKSO-22	Phase II	11/10/1998	Surface Soil	0 - 0.5		
LCKSO-23	Phase II	11/10/1998	Surface Soil	0 - 0.5		
LCKSO-24	Phase II	11/10/1998	Surface Soil	0 - 0.5		
LCKSO-25	Phase II	11/10/1998	Surface Soil	0 - 0.5		
LCKSO-49	Phase II	11/10/1998	Surface Soil	0 - 0.5		
LCKSO-49	Phase II	11/10/1998	Surface Soil	0 - 0.5	LCKSO-30	
LCKSO-49	Phase II	11/10/1998	Surface Soil	0 - 0.5	LCKSO-49 Dup	
LCKSB-8	Phase II	7/17/1997	Surface Soil	0 - 0.5		
LCKSB-9	Phase II	7/16/1997	Surface Soil	0 - 0.5		
LCKSB-10	Phase II	7/21/1997	Surface Soil	0 - 0.5		
LCKSB-11	Phase II	7/21/1997	Surface Soil	0 - 0.5		
LCKSB-11	Phase II	7/21/1997	Surface Soil	0 - 0.5	LCKSB-18	
LCKSB-11	Phase II	7/21/1997	Surface Soil	0 - 0.5	LCKSB-15	
LCKSB-12	Phase II	7/25/1997	Surface Soil	0 - 0.5		
LCKSB-13	Phase II	7/24/1997	Surface Soil	0 - 0.5		
LCKSB-13	Phase II	7/24/1997	Surface Soil	0 - 0.5	LCKSB-16	
LCKSB-14	Phase II	7/30/1997	Surface Soil	0 - 0.5		
14MW1	Phase II	11/13/1998	Surface Soil	0 - 0.5		
LCKSO-323	Phase II	11/13/1998	Surface Soil	0 - 0.5		
EEGLKB-SS01	RI	7/29/2003	Surface Soil	0 - 1		
EEGLKB-SS01	RI	7/30/2003	Surface Soil	0 - 1		Yes
EEGLKB-SS02	RI	7/29/2003	Surface Soil	0 - 1		
EEGLKB-SS03	RI	7/29/2003	Surface Soil	0 - 1		
EEGLKB-SS04	RI	7/29/2003	Surface Soil	0 - 1		
EEGLKB-SS05	RI	7/29/2003	Surface Soil	0 - 1		
EEGLKB-SS06	RI	7/29/2003	Surface Soil	0 - 1		

TABLE 2-1a

Surface and Subsurface Samples Collected During Phase I, Phase II, and Remedial Investigations

Former Lockbourne Air Force Base, Lockbourne, Ohio

Sample ID	Phase	Sample Date	Type	Depth	Duplicate Name	Resampled
EEGLKB-SS07	RI	7/29/2003	Surface Soil	0 - 1		
EEGLKB-SS07	RI	7/30/2003	Surface Soil	0 - 1		Yes
EEGLKB-SS08	RI	7/28/2003	Surface Soil	0 - 1		
EEGLKB-SS08	RI	7/28/2003	Surface Soil	0 - 1	EEGLKB-SS08 Dup02	
EEGLKB-SS09	RI	7/29/2003	Surface Soil	0 - 1		
EEGLKB-SS09	RI	7/29/2003	Surface Soil	0 - 1	EEGLKB-SS09 Dup03	
EEGLKB-SS10	RI	7/29/2003	Surface Soil	0 - 1		
EEGLKB-SS11	RI	7/29/2003	Surface Soil	0 - 1		
EEGLKB-SS12	RI	7/29/2003	Surface Soil	0 - 1		
EEGLKB-SS13	RI	7/29/2003	Surface Soil	0 - 1		
EEGLKB-SS14	RI	7/29/2003	Surface Soil	0 - 1		
EEGLKB-SS15	RI	7/29/2003	Surface Soil	0 - 1		
EEGLKB-SS16	RI	7/28/2003	Surface Soil	0 - 1		
EEGLKB-SS17	RI	7/28/2003	Surface Soil	0 - 1		
EEGLKB-SS18	RI	7/28/2003	Surface Soil	0 - 1		
EEGLKB-SS19	RI	7/28/2003	Surface Soil	0 - 1		
EEGLKB-SS20	RI	7/28/2003	Surface Soil	0 - 1		
EEGLKB-SS20	RI	7/28/2003	Surface Soil	0 - 1	EEGLKB-SS20 Dup01	
EEGLKB-SS21	RI	7/28/2003	Surface Soil	0 - 1		
EEGLKB-SS22	RI	7/28/2003	Surface Soil	0 - 1		
EEGLKB-SS23	RI	7/28/2003	Surface Soil	0 - 1		
EEGLKB-SS24	RI	7/28/2003	Surface Soil	0 - 1		
LCKSO-1	Phase I	5/24/1995	Subsurface Soil	2 - 3		
LCKSO-2	Phase I	5/24/1995	Subsurface Soil	2 - 3		
LCKSO-3	Phase I	5/25/1995	Subsurface Soil	2 - 3		
LCKSO-3	Phase I	5/25/1995	Subsurface Soil	2 - 3	LCKSO-3 Dup	
LCKSO-4	Phase I	5/24/1995	Subsurface Soil	2 - 3		
LCKSO-4	Phase I	5/25/1995	Subsurface Soil	2 - 3		Yes
LCKSO-5	Phase I	5/24/1995	Subsurface Soil	2 - 3		
LCKSO-6	Phase I	5/23/1995	Subsurface Soil	2 - 3		
LCKSO-6	Phase I	5/23/1995	Subsurface Soil	2 - 3		Yes
LCKSO-7	Phase I	5/23/1995	Subsurface Soil	2 - 3		
LCKSO-7	Phase I	5/23/1995	Subsurface Soil	2 - 3		Yes
LCKSO-8	Phase I	5/23/1995	Subsurface Soil	2 - 3		
LCKSO-8	Phase I	5/23/1995	Subsurface Soil	2 - 3	LCKSO-8 Dup	
LCKSO-8	Phase I	5/23/1995	Subsurface Soil	2 - 3	LCKSO-8 Dup RE	Yes
LCKSO-9	Phase I	5/24/1995	Subsurface Soil	2 - 3		
LCK-SO10	Phase I	5/24/1995	Subsurface Soil	2 - 3		
LCKSO-11	Phase I	5/25/1995	Subsurface Soil	2 - 3		
LCK-SO12	Phase I	5/25/1995	Subsurface Soil	2 - 3		
LCKSO-12	Phase I	5/25/1995	Subsurface Soil	2 - 3		Yes
LCK-SO12	Phase I	5/25/1995	Subsurface Soil	2 - 3	LCK-SO12 DUP	
LCKSO-1	Phase II	7/28/1997	Subsurface Soil	2 - 3		
LCKSO-6	Phase II	7/24/1997	Subsurface Soil	2 - 3		
LCKSO-7	Phase II	7/28/1997	Subsurface Soil	2 - 3		
LCKSO-8	Phase II	7/28/1997	Subsurface Soil	2 - 3		
LCKSB-8	Phase II	7/17/1997	Subsurface Soil	2 - 4		Yes
LCKSB-9	Phase II	7/16/1997	Subsurface Soil	2 - 4		
LCKSB-10	Phase II	7/21/1997	Subsurface Soil	2 - 4		
LCKSB-11	Phase II	7/21/1997	Subsurface Soil	2 - 4		
LCKSB-12	Phase II	7/25/1997	Subsurface Soil	8 - 10		
LCKSB-13	Phase II	7/24/1997	Subsurface Soil	8 - 10		
LCKSB-14	Phase II	7/30/1997	Subsurface Soil	2 - 4		
LCKMW-15	RI	8/5/2003	Subsurface Soil	4 - 6		
LCKMW-15	RI	8/5/2003	Subsurface Soil	4 - 6		Yes
LCKMW-16	RI	8/6/2003	Subsurface Soil	8 - 10		
LCKMW-16	RI	8/6/2003	Subsurface Soil	8 - 10		Yes

TABLE 2-1b

Surface Water Samples Collected During Phase I, Phase II, and Remedial Investigations

Former Lockbourne Air Force Base, Lockbourne, Ohio

Sample ID	Phase	Sample Date	Location	Duplicate Name	Resampled
LCK-SW1	Phase I	5/26/1995	West Ditch		
LCK-SW2	Phase I	5/26/1995	West Ditch		
LCK-SW2-RE	Phase I	5/26/1995	West Ditch		yes
LCK-SW3	Phase I	5/26/1995	West Ditch		
LCKSW-1	Phase II	8/25/1997	Background		
LCKSW-2	Phase II	8/25/1997	East Ditch		
LCKSW-3	Phase II	8/25/1997	Background		
LCKSW-4	Phase II	8/25/1997	West Ditch		
LCKSW-5	Phase II	8/25/1997	West Ditch		
LCKSW-5	Phase II	8/25/1997	West Ditch	LCKSW-6	
LCKSW-5	Phase II	8/25/1997	West Ditch	LCKSW-7	
EEGLKB-SW01	RI	7/30/2003	West Ditch		
EEGLKB-SW02	RI	7/31/2003	West Ditch		
EEGLKB-SW02	RI	7/31/2003	West Ditch	EEGLKB-SW02 Dup04	
EEGLKB-SW03	RI	7/31/2003	West Ditch		

TABLE 2-1c

Sediment Samples Collected During Phase I, Phase II, and Remedial Investigations

Former Lockbourne Air Force Base, Lockbourne, Ohio

Sample ID	Phase	Date	Area	Duplicate Name	Reanalyzed
LCK-SE1	Phase I	5/26/1995	West Ditch		
LCK-SE1	Phase I	5/26/1995	West Ditch		Yes
LCK-SE2	Phase I	5/26/1995	West Ditch		
LCK-SE2	Phase I	5/26/1995	West Ditch		Yes
LCK-SE3	Phase I	5/26/1995	West Ditch		
LCK-SE3	Phase I	5/26/1995	West Ditch	LCK-SEDUP1	
LCK-SE3 Dup 1	Phase I	5/26/1995	West Ditch	LCK-SEDUP1-RE	
LCKSD-1	Phase II	8/25/1997	Background		
LCKSD-2	Phase II	8/25/1997	East Ditch		
LCKSD-3	Phase II	8/25/1997	Background		
LCKSD-4	Phase II	8/25/1997	West Ditch		
LCKSD-5	Phase II	8/25/1997	West Ditch		
LCKSD-5	Phase II	8/25/1997	West Ditch	LCKSD-6	
LCKSD-5	Phase II	8/25/1997	West Ditch	LCKSD-8	
LCKSD-10	Phase II	11/10/1998	Background		
LCKSD-11	Phase II	11/10/1998	Background		
LCKSD-11	Phase II	11/10/1998	Background	Dup	
LCKSD-11	Phase II	11/10/1998	Background	LCKSD-20	
LCKSD-12	Phase II	11/10/1998	Background		
EEGLKB-SD01	RI	7/30/2003	West Ditch		
EEGLKB-SD02	RI	7/31/2003	West Ditch		
EEGLKB-SD02	RI	7/31/2003	West Ditch	EEGLKB-SD02 Dup04	
EEGLKB-SD03	RI	7/31/2003	West Ditch		
EEGLKB-SD04	RI	7/31/2003	West Ditch		

TABLE 2-1d

Seep Samples Collected During Phase I, Phase II, and Remedial Investigations

Former Lockbourne Air Force Base, Lockbourne, Ohio

Sample ID	Phase	Duplicate Name	Date
LCK-SW4	Phase I		5/26/1995
LCK-SW5	Phase I		5/26/1995
LCK-SW5	Phase I	LCK-SWDUP1	5/26/1995
LCKSP-1	Phase II		8/26/1997
LCKSP-1	Phase II	LCKSP-6	8/26/1997
LCKSP-1	Phase II	LCKSP-7	8/26/1997
LCKSP-2	Phase II		8/26/1997
LCKSP-3	Phase II		8/26/1997
EEGLKB-SP01	RI		8/7/2003

TABLE 2-1e

Groundwater Samples Collected During Phase I, Phase II, and Remedial Investigations

Former Lockbourne Air Force Base, Lockbourne, Ohio

Sample ID	Phase	Sample Date	Acquifer	Location	Duplicate Name
Background Wells					
LCKMW-1[A]	Phase I	6/6/1995	IDA	Background	
LCK-MW2[A]	Phase I	6/6/1995	UWBZ	Background	
LCKMW-1	Phase II	9/24/1997	IDA	Background	
LCKMW-2	Phase II	9/24/1997	UWBZ	Background	
LCKMW-8	Phase II	9/23/1997	IDA	Background	
LCKMW-9	Phase II	9/23/1997	UWBZ	Background	
14MW1	Phase II	11/13/1998	UWBZ	Background	
LCKMW-1	RI	8/11/2003	IDA	Background	
LCKMW-1	RI	8/11/2003	IDA	Background	LCKMW-1 Dup01
LCKMW-1	RI	11/14/2003	IDA	Background	
LCKMW-1	RI	11/14/2003	IDA	Background	LCKMW-1 Dup
LCKMW-1	RI	2/23/2004	IDA	Background	
LCKMW-1	RI	2/23/2004	IDA	Background	LCKMW-1 Dup
LCKMW-1	RI	5/18/2004	IDA	Background	
LCKMW-1	RI	5/18/2004	IDA	Background	LCKMW-1 Dup
LCKMW-2	RI	8/11/2003	UWBZ	Background	
LCKMW-2	RI	11/13/2003	UWBZ	Background	
LCKMW-2	RI	2/23/2004	UWBZ	Background	
LCKMW-2	RI	5/18/2004	UWBZ	Background	
LCKMW-8	RI	8/11/2003	IDA	Background	
LCKMW-8	RI	11/13/2003	IDA	Background	
LCKMW-8	RI	2/26/2004	IDA	Background	
LCKMW-8	RI	5/18/2004	IDA	Background	
LCKMW-9	RI	8/11/2003	UWBZ	Background	
LCKMW-9	RI	11/13/2003	UWBZ	Background	
LCKMW-9	RI	2/26/2004	UWBZ	Background	
LCKMW-9	RI	5/18/2004	UWBZ	Background	
Site Wells					
LCK-MW3[A]	Phase I	6/7/1995	IDA	Site	
LCKMW-4[A]	Phase I	6/7/1995	UWBZ	Site	
LCKMW-5[A]	Phase I	6/6/1995	IDA	Site	
LCKMW-6[A]	Phase I	6/5/1995	UWBZ	Site	
LCKMW-6[A]	Phase I	6/5/1995	UWBZ	Site	DUP
LCKMW-7[A]	Phase I	6/7/1995	UWBZ	Site	
LCKMW-3	Phase II	9/18/1997	IDA	Site	
LCKMW-4	Phase II	9/16/1997	UWBZ	Site	
LCKMW-5	Phase II	9/16/1997	IDA	Site	
LCKMW-5	Phase II	9/16/1997	IDA	Site	LCKMW-15
LCKMW-6	Phase II	9/19/1997	UWBZ	Site	
LCKMW-7	Phase II	9/19/1997	UWBZ	Site	
LCKMW-7	Phase II	11/11/1998	UWBZ	Site	
LCKMW-7	Phase II	11/11/1998	UWBZ	Site	LCKMW-30
LCKMW-10	Phase II	9/22/1997	IDA	Site	
LCKMW-10	Phase II	11/12/1998	IDA	Site	
LCKMW-11	Phase II	9/22/1997	UWBZ	Site	
LCKMW-11	Phase II	11/12/1998	UWBZ	Site	
LCKMW-12A[B]	Phase II	9/17/1997	IDA	Site	
LCKMW-12A[B]	Phase II	9/17/1997	IDA	Site	LCKMW-16
LCKMW-12A[B]	Phase II	11/12/1998	IDA	Site	

TABLE 2-1e

Groundwater Samples Collected During Phase I, Phase II, and Remedial Investigations

Former Lockbourne Air Force Base, Lockbourne, Ohio

Sample ID	Phase	Sample Date	Acquifer	Location	Duplicate Name
LCKMW-13	Phase II	9/17/1997	UWBZ	Site	
LCKMW-13	Phase II	9/17/1997	UWBZ	Site	LCKMW-17
LCKMW-13	Phase II	11/12/1998	UWBZ	Site	
LCKMW-14	Phase II	9/16/1997	IDA	Site	
RB25-MW7	Phase II	9/18/1997	UWBZ	Site	
RB25MW-9	Phase II	9/17/1997	UWBZ	Site	
RB25MW-9	Phase II	9/17/1997	UWBZ	Site	LCKMW-20
LCKMW-3	RI	8/13/2003	IDA	Site	
LCKMW-3	RI	11/13/2003	IDA	Site	
LCKMW-3	RI	2/27/2004	IDA	Site	
LCKMW-3	RI	5/20/2004	IDA	Site	
LCKMW-4	RI	8/12/2003	UWBZ	Site	
LCKMW-4	RI	11/12/2003	UWBZ	Site	
LCKMW-4	RI	2/26/2004	UWBZ	Site	
LCKMW-4	RI	5/19/2004	UWBZ	Site	
LCKMW-5	RI	8/13/2003	IDA	Site	
LCKMW-5	RI	11/12/2003	IDA	Site	
LCKMW-5	RI	2/25/2004	IDA	Site	
LCKMW-5	RI	5/20/2004	IDA	Site	
LCKMW-6	RI	8/13/2003	UWBZ	Site	
LCKMW-6	RI	11/12/2003	UWBZ	Site	
LCKMW-6	RI	2/25/2004	UWBZ	Site	
LCKMW-6	RI	5/20/2004	UWBZ	Site	
LCKMW-7	RI	8/13/2003	UWBZ	Site	
LCKMW-7	RI	11/13/2003	UWBZ	Site	
LCKMW-7	RI	2/24/2004	UWBZ	Site	
LCKMW-7	RI	2/24/2004	UWBZ	Site	LCKMW-7 Dup
LCKMW-7	RI	5/20/2004	UWBZ	Site	
LCKMW-10	RI	8/14/2003	IDA	Site	
LCKMW-10	RI	11/11/2003	IDA	Site	
LCKMW-10	RI	2/24/2004	IDA	Site	
LCKMW-10	RI	5/19/2004	IDA	Site	
LCKMW-11	RI	11/11/2003	UWBZ	Site	
LCKMW-11	RI	2/24/2004	UWBZ	Site	
LCKMW-11	RI	5/19/2004	UWBZ	Site	
LCKMW-12A[B]	RI	8/14/2003	IDA	Site	
LCKMW-12A[B]	RI	11/11/2003	IDA	Site	
LCKMW-12A[B]	RI	2/25/2004	IDA	Site	
LCKMW-12A[B]	RI	5/17/2004	IDA	Site	
LCKMW-13	RI	8/14/2003	UWBZ	Site	
LCKMW-13	RI	11/11/2003	UWBZ	Site	
LCKMW-13	RI	2/25/2004	UWBZ	Site	
LCKMW-13	RI	5/17/2004	UWBZ	Site	
LCKMW-14	RI	8/14/2003	IDA	Site	
LCKMW-14	RI	11/12/2003	IDA	Site	
LCKMW-14	RI	2/26/2004	IDA	Site	
LCKMW-14	RI	5/19/2004	IDA	Site	
LCKMW-15	RI	8/12/2003	UWBZ	Site	
LCKMW-15	RI	8/12/2003	UWBZ	Site	LCKMW-15 Dup02
LCKMW-15	RI	11/10/2003	UWBZ	Site	
LCKMW-15	RI	11/10/2003	UWBZ	Site	LCKMW-15Dup
LCKMW-15	RI	2/24/2004	UWBZ	Site	
LCKMW-15	RI	5/18/2004	UWBZ	Site	
LCKMW-15	RI	5/18/2004	UWBZ	Site	LCKMW-15Dup

TABLE 2-1e

Groundwater Samples Collected During Phase I, Phase II, and Remedial Investigations

Former Lockbourne Air Force Base, Lockbourne, Ohio

Sample ID	Phase	Sample Date	Acquifer	Location	Duplicate Name
LCKMW-16	RI	8/12/2003	UWBZ	Site	
LCKMW-16	RI	11/14/2003	UWBZ	Site	
LCKMW-16	RI	2/27/2004	UWBZ	Site	
LCKMW-16	RI	5/19/2004	UWBZ	Site	
MW-11	RI	8/14/2003	UWBZ	Site	
RB25-MW7	RI	8/11/2003	UWBZ	Site	
RB25-MW7	RI	11/12/2003	UWBZ	Site	
RB25-MW7	RI	2/27/2004	UWBZ	Site	
RB25-MW7	RI	5/20/2004	UWBZ	Site	

[A] - The designation LCK-GW1 and LCKMW-1 are both names of samples from LCKMW-1. The term GW was used in the Phase I assessment. The term MW was used in all subsequent assessments.

[B] - LCKMW-12 was never completed. LCKMW-12A was installed adjacent to LCKMW-12 and sampled during the Phase II and the RI sampling events.

TABLE 2-2

Survey Coordinates Collected During Remedial Investigations

Former Lockbourne Air Force Base, Lockbourne, Ohio

Lockbourne AFB Former Landfill Survey Data

Well ID	Screened Interval (SI)	Northing (Y)	Easting (X)	TOC Elevation (feet)	Ground Surface Elevation (feet)	Total Depth
Monitoring Well Locations						
LCKMW-1	IDA	660296.91	1841487.70	730.75	728.28	80.06
LCKMW-2	UWBZ	660297.46	1841479.16	730.52	727.90	19.10
LCKMW-3	IDA	658628.55	1838946.66	719.71	717.61	69.28
LCKMW-4	UWBZ	657918.48	1839516.60	725.64	723.27	12.98
LCKMW-5	IDA	659680.80	1838207.72	718.45	716.31	79.85
LCKMW-6	UWBZ	659697.37	1838216.94	717.97	715.71	22.63
LCKMW-7	IDA	659161.32	1837652.66	714.33	711.88	56.00
LCKMW-8	IDA	660233.22	1840606.80	726.54	724.36	71.33
LCKMW-9	UWBZ	660235.84	1840601.07	726.49	724.40	13.63
LCKMW-10	IDA	660326.87	1838953.95	718.89	716.68	86.85
LCKMW-11	UWBZ	660323.91	1838960.44	719.00	716.47	15.52
LCKMW-12A	IDA	659137.05	1838613.94	733.02	730.13	74.91
LCKMW-13	UWBZ	659148.36	1838601.29	732.02	729.12	26.57
LCKMW-14	IDA	657924.42	1839505.54	725.68	722.91	91.10
LCKMW-15	UWBZ	660185.94	1838305.75	712.83	710.38	16.00
LCKMW-16	UWBZ	657999.72	1840238.10	725.81	723.45	16.00
LCKMW-TW1	UWBZ	659074.17	1838434.69	713.36	713.36	7.86
RB25-MW7	UWBZ	658611.80	1838950.15	719.80	717.52	19.35
Seep, Sediment, and Surface Water Locations						
EEGLKB-SP1	NA	659174.44	1838425.36	NA	703.17	NA
EEGLKB-SD/SW1	NA	659978.58	1837973.22	NA	699.00	NA
EEGLKB-SD/SW2	NA	659137.54	1838471.41	NA	701.36	NA
EEGLKB-SD/SW3	NA	658621.18	1838910.00	NA	-	NA
EEGLKB-SD4	NA	660365.72	1837988.72	NA	700.03	NA

Notes:

Coordinates are State Plane Coordinate System, Ohio South Zone.

Elevations are in feet above mean sea level, 1929 National Geodetic Vertical Datum.

IDA: Intermediate depth aquifer

MW: Monitoring well

NA: Not applicable

SD/SW: Co-located surface water and sediment sample pair

SI: Screened Interval

SP: Seep Sample

TOC: Top of Casing

TW: Temporary well

UWBZ: Upper water bearing zone

TABLE 2-3a
Soil Background Screening Levels
Former Lockbourne Air Force Base, Lockbourne, Ohio

Parameter	Units	Background Screening Levels
Volatile Organic Compounds		
1,1,2,2 – Tetrachloroethane	mg/kg	0.0042
Methylene Chloride	mg/kg	0.01
Toluene	mg/kg	0.068
Semi-Volatile Organic Compounds		
Benzo(b)fluoranthene	mg/kg	0.25
Di-n-butylphthalate	mg/kg	0.62
Fluoranthene	mg/kg	0.22
Pyrene	mg/kg	0.23
Pesticides and PCBs		None Detected
Metals		
Aluminum	mg/kg	19,000
Arsenic	mg/kg	22.0
Barium	mg/kg	190
Beryllium	mg/kg	1.20
Cadmium	mg/kg	0.990
Calcium	mg/kg	47,000
Chromium	mg/kg	23.0
Cobalt	mg/kg	20.0
Copper	mg/kg	39.0
Iron	mg/kg	41,000
Lead	mg/kg	29.0
Magnesium	mg/kg	15,000
Manganese	mg/kg	1,100
Nickel	mg/kg	67.0
Potassium	mg/kg	2,000
Silver	mg/kg	1.30
Vanadium	mg/kg	45.0
Zinc	mg/kg	120

Note: mg/kg = milligrams per kilogram

Background soil concentrations were obtained during the Supplemental Phase II Environmental Baseline Survey Investigation (IT Corporation [IT] 1995). The representative background concentration was taken to be the 95th percentile or the maximum detected value if the maximum detected value was less than the 95th percentile.

TABLE 2-3b
Surface Water Background Screening Levels
Former Lockbourne Air Force Base, Lockbourne, Ohio

Parameter	Units	LCKSW-1 Background	Qualifier	LCKSW-3 Background	Qualifier
Volatile Organic Compounds					
Acetone	mg/L	0.01	U	0.01	U
Carbon disulfide	mg/L	0.001	U	0.0016	
Dichloroethenes, 1,2-, total	mg/L	0.0013		0.001	U
Methylene chloride	mg/L	0.001	U	0.001	U
Semi-Volatile Organic Compounds					
Benzoic acid	mg/L				
Bis(2-ethylhexyl) phthalate	mg/L	0.01	U	0.01	U
Diethyl phthalate	mg/L	0.01	U	0.01	U
Di-n-butyl phthalate	mg/L	0.01	U	0.01	U
Dioxins					
Heptachlorodibenzo-p-dioxin, 1,2,3,4,6,7,8-	mg/L	7.2E-09	U	4E-09	J
Heptachlorodibenzo-p-dioxins, total	mg/L	7.2E-09	U	4E-09	J
Hexachlorodibenzofuran, 1,2,3,4,7,8-	mg/L	4E-09	U	3.3E-09	U
Hexachlorodibenzofuran, 2,3,4,6,7,8-	mg/L	3.9E-09	U	4.9E-09	
Hexachlorodibenzofurans, total	mg/L	3.7E-09	U	4.9E-09	
Hexachlorodibenzo-p-dioxins, total	mg/L	7E-09	U	4.9E-09	U
Octachlorodibenzofuran	mg/L	1.25E-08	J	1.1E-08	U
Octachlorodibenzo-p-dioxin	mg/L	3.8E-08	J	6.82E-08	
Tetrachlorodibenzofuran, 2,3,7,8-	mg/L	5.8E-09	B	2.6E-09	U
Tetrachlorodibenzofurans, total	mg/L	9.2E-09	BJ	2.6E-09	U
Metals					
Aluminum	mg/L	0.1	U	0.1	U
Arsenic	mg/L	0.005	U	0.005	U
Arsenic, dissolved	mg/L	0.005	U	0.005	U
Barium	mg/L	0.07	J	0.08	J
Barium, dissolved	mg/L	0.08		0.08	
Calcium	mg/L	110	J	95	J
Calcium, dissolved	mg/L	110		97	
Copper	mg/L	0.02	U	0.02	U
Iron	mg/L	0.64	J	0.29	J
Lead	mg/L	0.005	U	0.005	U
Magnesium	mg/L	33	J	30	J
Magnesium, dissolved	mg/L	33		31	
Manganese	mg/L	0.09	J	0.04	J
Manganese, dissolved	mg/L	0.09		0.04	
Potassium	mg/L	5	U	6.2	
Potassium, dissolved	mg/L	5	U	5.6	
Selenium	mg/L	0.005	U	0.005	U
Sodium	mg/L	9.3		4	
Sodium, dissolved	mg/L	9.3		4.2	
Thallium	mg/L	0.005	U	0.006	
Thallium, dissolved	mg/L	0.005	U	0.005	
Zinc	mg/L	0.02	J	0.02	U
Zinc, dissolved	mg/L	0.02		0.02	U

Note:
(dis) = Filtered (dissolved) fraction
J = Estimated value; U = Target analyte not detected
mg/L = milligrams per liter

TABLE 2-3c
Groundwater Background Screening Levels
Former Lockbourne Air Force Base, Lockbourne, Ohio

Parameter	**Units**	**Groundwater Zone**	
		IDA	**UWBZ**
Aluminum	mg/L	0.12	22
Antimony	mg/L	< 0.06	< 0.06
Arsenic	mg/L	0.014	0.006
Barium	mg/L	0.46	0.24
Beryllium	mg/L	< 0.005	< 0.005
Cadmium	mg/L	< 0.005	< 0.005
Calcium	mg/L	110	230
Chromium	mg/L	< 0.01	0.04
Cobalt	mg/L	< 0.01	0.03
Copper	mg/L	0.06	0.09
Iron	mg/L	1.8	49
Lead	mg/L	< 0.005	0.043
Magnesium	mg/L	38	78
Manganese	mg/L	0.04	1.3
Mercury	mg/L	< 0.0002	< 0.002
Nickel	mg/L	< 0.04	0.08
Potassium	mg/L	< 5	7.8
Selenium	mg/L	< 0.005	< 0.005
Silver	mg/L	< 0.01	< 0.01
Sodium	mg/L	14	6.3
Thallium	mg/L	< 0.005	< 0.005
Vanadium	mg/L	< 0.01	0.06
Zinc	mg/L	< 0.02	0.19

Note:

IDA = Intermediate depth aquifer
UWBZ = Upper water-bearing zone
mg/L = milligrams per liter

TABLE 3-1

Geotechnical Data Summary – Remedial Investigation

Former Lockbourne Air Force Base, Lockbourne, Ohio

Sample ID	Depth (ft-bgs)	ASTM Classification	Moisture Content (%)	Liquid Limit	Plastic Limit	Organic Content (%)	Bulk Density (pcf)	pH	<#200 Sieve %	Particle Distribution (%)							
										Gravel (%)		Sand (%)			Fines (%)		
										Coarse	Fine	Coarse	Med.	Fine	Silt	Clay	Colloids
EEGLKB-DPT-02S	2-4	CL	21.8	46	25	3.6	99.6	7.7	64.5	0	5	5	9	16	31	13	21
EEGLKB-DPT-02S	5-7	CL	18	49	22	2	107	7.7	74	0	3	2	6	15	32	11	31
EEGLKB-DPT-02S	10-12	SC	14.9	17	16	1.4	117.9	7.8	18.8	1	5	8	43	24	13	2	4
EEGLKB-DPT-03N	2-4	CH	23.4	51	24	2.2	98.6	6.2	81.2	0	3	2	4	10	32	10	39
EEGLKB-DPT-03N	6-8	CL	16.3	31	22	2.2	112.7	7.4	64.1	0	5	3	8	20	36	9	19
EEGLKB-DPT-03N	10-12	SC	12.4	27	19	1.9	121.4	7.6	48.8	0	8	6	16	21	27	7	15

Key: ft-bgs = feet below ground surface; pcf = pounds per cubic foot

Geotechnical analyses for these samples were performed by Midwest Testing Laboratory, Inc., Fargo, ND

TABLE 3-2

Geotechnical Data Summary – Phase I and Phase II Site Investigations

Former Lockbourne Air Force Base, Lockbourne, Ohio

Borehole	Depth (ft-bgs)	ASTM Description	ASTM Classification	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index %	<#200 Sieve %	% Gravel <75, >4.75	% Sand <4.75, >0.075	% Silt <0.075, >0.0005	% Clay <0.0005
LCKSB-8	22-24	Sandy, Silty Clay	CL-ML	10.8	21	14	7	54.8	5.7	39.5	35.7	19.1
LCKSB-8	38-43	Poorly Graded Sand with Silt	SP-SM	18.1	NP	NP	NP	8.3	0.7	91	7.6	0.7
LCKSB-8	45-47	Silty, Clayey Sand with Gravel	SC-SM	9.3	20	14	6	24.6	21.1	54.3	15.7	8.9
LCKSB-8	53-58	Clayey Sand	SC	11.5	22	14	8	44.5	5.3	50.2	35.9	8.6
LCKSB-8*	58-63	Lean Clay with Sand	CL	11.9	26	16	10		6.1	42.2	24.5	27.2
LCKSB-8	74.5-78	Silty Sand	SM	9.5	18	14	4	25.2	12.2	62.6	19	6.2
LCKSB-9*	8.0-10	Clayey Sand with Gravel	SC	16.6	26	15	11		25.8	34.6	19.4	20.2
LCKSB-10	9.0-13.5	Silty, Clayey Sand	SC-SM	10.4	20	14	6	48.5	6.6	44.9	34.3	14.2
LCKSB-10	23.5-28.5	Silty, Clayey Sand	SC-SM	8.3	19	14	4	44.6	8.6	46.8	40.1	4.5
LCKSB-10	34-39	Clayey Sand	SC	9.9	23	15	7	49.1	7.1	43.8	31.3	17.8
LCKSB-10	44-49	Poorly Graded Sand with Silt and Gravel	SP-SM	10.5	NP	NP	NP	5.1	20.8	74.1	4.6	0.5
LCKSB-10	64.5-69.5	Silty, Clayey Sand	SC-SM	11.5	18	14	4	38.9	6.8	54.3	27	11.9
LCKSB-10*	80-85	Silty, Clayey Sand	SC-SM	10	18	14	4		14	44.1	26.6	15.3
LCKSB-12	7.5-8.0	Poorly Graded Sand with Silt and Gravel	SP-SM	29.5	NP	NP	NP	5.1	14.8	80.1	4.7	0.4
LCKSB-12	13.5-14	Well Graded Sand with Gravel	SW	12.7	NP	NP	NP	3.3	46.4	50.3	2.6	0.7
LCKSB-12	29.5-30	Silty, Clayey Sand with Gravel	SC-SM	13.4	18	14	5	41.6	16.9	41.5	31	10.6
LCKSB-12	44.5-45	Poorly Graded Sand with Silt and Gravel	SP-SM	8.7	NP	NP	NP	6.8	45.7	47.5	4.7	2.1
LCKSB-12	54.5-55	Clayey Sand	SC	9.5	21	14	7	45.6	6.5	47.9	33.6	12
LCKSB-12*	69.5-70	Poorly Graded Sand with Silt	SP-SM	12.3	16	13	3		7.2	80.9	6.7	5.2
LCKSB-13	6.0-6.5	Poorly Graded Sand with Silt	SP-SM	30.8	NP	NP	NP	5.6	9.4	85	5.2	0.4
LCKSB-13*	18-18.5	Lean Clay with Sand	CL	32.1	36	21	15		12.1	29	28.6	30.3
LCKSB-14	5.5-6.0	Clayey Sand with Gravel	SC	NA	44	24	20	30.5	23.3	46.2	16.7	13.8
LCKSB-14	11.5-12	Poorly Graded Sand with Silt	SP-SM	20.8	NP	NP	NP	6.3	3	90.7	5.3	1
LCKSB-14	28.5-29	Silty Sand	SM	15.6	NP	NP	NP	17.6	0	82.4	14.5	3.1
LCKSB-14	43.5-44	Lean Clay with Sand	CL	15	29	18	12	79.2	2.9	17.9	42	37.2
LCKSB-14	63.5-64	Silty, Clayey Sand	SC-SM	9.1	20	14	6	37.4	11	51.6	23.7	13.7
LCKSB-14*	78.5-79	Silty, Clayey Sand with Gravel	SC-SM	11.9	19	14	5		26.1	54	11.8	8.1

*Geotechnical analyses for these samples (with the exception of moisture content) were performed by H.C. Nutting Company.

Key: CL = Lean clay; ML = Silt; SC = Clayey sand; SM = Silty sand; SP = Poorly graded sand with gravel; SW = Well graded sand with gravel

ft-bgs = Feet below ground surface; NA = Sample jar was broken upon receipt, moisture content not analyzed; NP = Sample not plastic

TABLE 3-3

Details of Monitoring Wells

Former Lockbourne Air Force Base, Lockbourne, Ohio

Well ID	Screened Interval	Phase Installed	Total Depth (feet)	Northing	Easting	Ground surface Elevation (feet)	Top of Casing Elevation (feet)	Data Acquired from	Notes
LCKMW-1	IDA	Phase I SI (LAW 1995a)	80.06	660296.91	1841487.70	728.28	730.75	EEG 2003	
LCKMW-2	UWBZ	Phase I SI (LAW 1995a)	19.10	660297.46	1841479.16	727.90	730.52	EEG 2003	
LCKMW-3	IDA	Phase I SI (LAW 1995a)	69.28	658628.55	1838946.66	717.61	719.71	EEG 2003	
LCKMW-4	UWBZ	Phase I SI (LAW 1995a)	12.98	657918.48	1839516.60	723.27	725.64	EEG 2003	
LCKMW-5	IDA	Phase I SI (LAW 1995a)	79.85	659680.80	1838207.72	716.31	718.45	EEG 2003	
LCKMW-6	UWBZ	Phase I SI (LAW 1995a)	22.63	659697.37	1838216.94	715.71	717.97	EEG 2003	
LCKMW-7	IDA	Phase I SI (LAW 1995a)	56.00	659161.32	1837652.66	711.88	714.33	EEG 2003	Located downgradient of landfill
LCKMW-8	IDA	Phase II SI (PMC 2000)	71.33	660233.22	1840606.80	724.36	726.54	EEG 2003	
LCKMW-9	UWBZ	Phase II SI (PMC 2000)	13.63	660235.84	1840601.07	724.40	726.49	EEG 2003	
LCKMW-10	IDA	Phase II SI (PMC 2000)	86.85	660326.87	1838953.95	716.68	718.89	EEG 2003	
LCKMW-11	UWBZ	Phase II SI (PMC 2000)	15.52	660323.91	1838960.44	716.47	719.00	EEG 2003	
LCKMW-12A	IDA	Phase II SI (PMC 2000)	74.91	659137.05	1838613.94	730.13	733.02	EEG 2003	
LCKMW-13	UWBZ	Phase II SI (PMC 2000)	26.57	659148.36	1838601.29	729.12	732.02	EEG 2003	
LCKMW-14	IDA	Phase II SI (PMC 2000)	91.10	657924.42	1839505.54	722.91	725.68	EEG 2003	
LCKMW-15	UWBZ	RI (EEG 2003)	16.00	660185.94	1838305.75	710.38	712.83	EEG 2003	
LCKMW-16	UWBZ	RI (EEG 2003)	16.00	657999.72	1840238.10	723.45	725.81	EEG 2003	
RB25-MW7	UWBZ	IRP site activities	19.35	658611.80	1838950.15	719.80	719.80	EEG 2003	
RB25-MW9	UWBZ	IRP site activities		658346.13	1840658.51	721.8	724.05		Abandoned
LCKPZ-1	UWBZ	Phase II SI (PMC 2000)	17	659653.11	1838064.34	713.87	717.67	PMC 2000	
LCKPZ-2	UWBZ	Phase II SI (PMC 2000)	16	659045.5	1838497.88	712.11	714.86	PMC 2000	
LCKPZ-3	UWBZ	Phase II SI (PMC 2000)	18	657867.45	1839448.78	721.44	724.48	PMC 2000	
14MW01	UWBZ								Located upgradient of landfill
LCKMW-TW1	UWBZ	RI (EEG 2003)	7.86	659074.17	1838434.69	713.36	713.36	EEG 2003	

Key: IDA = Intermediate depth aquifer; MW = Monitoring well; NA = Not applicable; PZ = Piezometer; SG = Stream gauge; SP = Seep

SW/SED = Co-located surface water/sediment pair; UWBZ = Upper water-bearing zone

Notes: Elevations are in feet relative to mean sea level (1929 National Geodetic Vertical Datum).

Coordinates are on the Ohio State Plane Coordinate System (South Zone) North American Datum 1983.

TABLE 4-1

Concentrations of Detected Analytes in Surface Soil

Samples Collected During Phase I, Phase II, and Remedial Investigations

Former Lockbourne Air Force Base, Lockbourne, Ohio

Sample ID	**LCK-SO1**	**LCK-SO2**	**LCK-SO2**	**LCK-SO3**	**LCK-SO4**	**LCK-SO5**	**LCK-SO6**	**LCK-SO6**	**LCK-SO7**	**LCK-SO8**	**LCK-SO8**	**LCK-SO9**	**LCK-SO10**	**LCK-SO11**	**LCK-SO12**
Sample Date	**5/24/1995**	**5/24/1995**	**5/24/1995**	**5/25/1995**	**5/25/1995**	**5/24/1995**	**5/23/1995**	**5/23/1995**	**5/23/1995**	**5/23/1995**	**5/23/1995**	**5/24/1995**	**5/24/1995**	**5/25/1995**	**5/25/1995**
Sample Depth (ft bgs)	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**
Investigation Phase[1]	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**PhaseI**
PARAMETER_NAME			**Resampled**					**Resampled**			**Resampled**				
Volatile Organic Compound (mg/kg)															
Acetone	0.011 U	**0.009 JB**	NA	**0.009**	0.012 U	**0.005 JB**	NA	**0.029 J**	0.012 U	NA	**0.018 JH**	0.012 U	0.012 U	**0.024 JB**	0.013 U
Dichloropropene, 1,3-, trans-	0.006 U	0.006 U	NA	0.006 U	0.006 U	**0.003 JQ**	NA	0.006 U	0.006 U	NA	0.006 U	0.006 U	0.006 U	0.006 U	0.006 U
Methylene chloride	**0.016 JB**	**0.016 JB**	NA	**0.015 JB**	**0.018 JB**	**0.017 JB**	NA	**0.02 JB**	0.026 **JB**	NA	**0.011 JB**	**0.015 JB**	**0.013 JB**	**0.023 JB**	**0.016 JB**
Toluene	0.006 U	**0.002 JQ**	NA	0.006 U	0.006 U	0.007 U	NA	0.006 U	0.006 U	NA	**0.0023 JQ**	0.006 U	0.006 U	0.006 U	**0.003 JQ**
Trichlorofluoromethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Semi-Volatile Organic Compound (mg/kg)															
Acenaphthene	**1.5 JQ**	NA	1 U	0.4 U	0.41 U	0.44 U	0.4 U	NA	0.4 U	0.43 U	NA	0.39 U	**0.26 JQ**	0.4 U	0.41 U
Acenaphthylene	1.8 U	NA	1 U	0.4 U	0.41 U	0.44 U	0.4 U	NA	**0.12 JQ**	0.43 U	NA	0.39 U	0.73 U	0.4 U	0.41 U
Anthracene	**4.4**	NA	1 U	0.4 U	0.41 U	0.44 U	0.4 U	NA	**0.15 JQ**	**0.047 JQ**	NA	**0.096 JQ**	**0.95**	0.4 U	0.41 U
Benz(a)anthracene	**10**	NA	**230**	0.4 U	**0.13 JQ**	0.44 U	**0.043 JQ**	NA	**0.14 JQ**	**0.15 JQ**	NA	**0.47**	**4.8**	0.4 U	0.41 U
Benzo(a)pyrene	**11**	NA	**210**	0.4 U	**0.17 JQ**	0.44 U	0.4 U	NA	**0.42**	**0.18 JQ**	NA	**0.6**	**4.9**	0.4 U	0.41 U
Benzo(b)fluoranthene	**9.7**	NA	**190**	0.4 U	**0.16 JQ**	0.44 U	0.4 U	NA	**0.35 JQ**	**0.14 JQ**	NA	**0.6**	**4.2**	0.4 U	0.41 U
Benzo(ghi)perylene	**4.5**	NA	**76**	0.4 U	**0.11 JQ**	0.44 U	0.4 U	NA	**0.44**	**0.12 JQ**	NA	**0.47**	**2.8**	0.4 U	0.41 U
Benzo(k)fluoranthene	**12**	NA	**220**	0.4 U	**0.13 JQ**	0.44 U	0.4 U	NA	**0.39 JQ**	**0.17 JQ**	NA	**0.6**	**4.5**	0.4 U	0.41 U
Benzoic acid	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-ethylhexyl) phthalate	1.8 U	NA	1 U	0.4 U	0.41 U	0.44 U	**0.21 JQ**	NA	0.4 U	0.43 U	NA	**0.061 JQ**	0.73 U	0.4 U	0.41 U
Carbazole	**2.9**	NA	1 U	0.4 U	0.41 U	0.44 U	0.4 U	NA	**0.058 JQ**	0.43 U	NA	**0.062 JQ**	**0.28 JQ**	0.4 U	0.41 U
Chrysene	**10**	NA	**220**	0.4 U	**0.16 JQ**	0.44 U	**0.046 JQ**	NA	**0.42**	**0.17 JQ**	NA	**0.63**	**4.6**	0.4 U	0.41 U
Dibenz(ah)anthracene	**1.9**	NA	1 U	0.4 U	0.41 U	0.44 U	0.4 U	NA	**0.12 JQ**	0.43 U	NA	**0.16 JQ**	**0.98**	0.4 U	0.41 U
Dibenzofuran	**0.94 JQ**	NA	1 U	0.4 U	0.41 U	0.44 U	0.4 U	NA	0.4 U	0.43 U	NA	0.39 U	**0.098 JQ**	0.4 U	0.41 U
Di-n-butyl phthalate	1.8 U	NA	1 U	0.4 U	**0.041 JQ**	0.44 U	0.4 U	NA	0.4 U	0.43 U	NA	0.39 U	0.73 U	**0.038 JB**	**0.04 JB**
Di-n-octyl phthalate	1.8 U	NA	1 U	0.4 U	0.41 U	0.44 U	0.4 U	NA	0.4 U	0.43 U	NA	0.39 U	0.73 U	0.4 U	0.41 U
Fluoranthene	**20**	NA	**440**	**0.049 JQ**	**0.32 JQ**	**0.048 JQ**	**0.079 JQ**	NA	**0.77**	**0.32 JQ**	NA	**0.93**	**7.8**	0.4 U	0.41 U
Fluorene	**1.8**	NA	1 U	0.4 U	0.41 U	0.44 U	0.4 U	NA	0.4 U	0.43 U	NA	0.39 U	**0.22 JQ**	0.4 U	0.41 U
Indeno(1,2,3-cd)pyrene	**4.8**	NA	**82**	0.4 U	**0.095 JQ**	0.44 U	0.4 U	NA	**0.34 JQ**	**0.11 JQ**	NA	**0.44**	**2.7**	0.4 U	0.41 U
Methylnaphthalene, 2-	1.8 U	NA	1 U	0.4 U	0.41 U	0.44 U	0.4 U	NA	0.4 U	0.43 U	NA	0.39 U	0.73 U	0.4 U	0.41 U
Methylphenol, 3- and/or 4-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	1.8 U	NA	1 U	0.4 U	**0.043 JQ**	0.44 U	0.4 U	NA	0.4 U	0.43 U	NA	0.39 U	0.73 U	0.4 U	0.41 U
Nitrosodiphenylamine, N-	1.8 U	NA	1 U	0.4 U	0.41 U	0.44 U	0.4 U	NA	0.4 U	0.43 U	NA	0.39 U	0.73 U	0.4 U	0.41 U
Phenanthrene	**16**	NA	**210**	0.4 U	**0.17 JQ**	0.44 U	**0.078 J**	NA	**0.39 JQ**	**0.18 JQ**	NA	**0.41**	**3.5**	0.4 U	0.41 U
Phenol	**0.88 JQ**	NA	1 U	0.4 U	0.41 U	0.44 U	0.4 U	NA	0.4 U	0.43 U	NA	0.39 U	0.73 U	0.4 U	0.41 U
Pyrene	**17**	NA	**360**	**0.046 JQ**	**0.25 JQ**	0.44 U	**0.073 J**	NA	**0.61**	**0.33 JQ**	NA	**0.85**	**7.8**	**0.041 JQ**	0.41 U
Pesticide/PCB (mg/kg)															
Chlordane, alpha-	0.0072 U	0.039 U	NA	0.002 U	0.0021 U	0.0022 U	0.002 U	NA	0.004 U	0.0044 U	NA	0.0079 U	0.0037 U	0.002 U	0.002 U
Chlordane, gamma-	0.0072 U	0.039 U	NA	0.002 U	0.0021 U	0.0022 U	0.002 U	NA	0.004 U	0.0044 U	NA	0.0079 U	0.0037 U	0.002 U	0.002 U
DDD, p,p'-	0.014 U	0.077 U	NA	0.004 U	**0.017**	0.0045 U	0.004 U	NA	0.0079 U	**0.026**	NA	0.016 U	0.0075 U	0.004 U	0.004 U
DDE, p,p'-	0.014 U	0.077 U	NA	0.004 U	**0.81 E**	0.0045 U	0.004 U	NA	**0.019**	**0.028**	NA	**0.05**	0.0075 U	0.004 U	0.004 U
DDT, p,p'-	**0.021**	0.077 U	NA	0.004 U	**0.46 E**	0.0045 U	0.004 U	NA	**0.057**	**0.083**	NA	**0.078**	0.0075 U	0.004 U	0.004 U
PCB 1242	0.14 U	0.77 U	NA	0.04 U	0.041 U	0.045 U	0.04 U	NA	0.079 U	0.089 U	NA	0.16 U	0.075 U	0.04 U	0.04 U
PCB 1248	0.14 U	0.77 U	NA	0.04 U	0.041 U	0.045 U	0.04 U	NA	0.079 U	0.089 U	NA	0.16 U	0.075 U	0.04 U	0.04 U
PCB 1254	0.14 U	0.77 U	NA	0.04 U	0.041 U	0.045 U	0.04 U	NA	0.079 U	0.089 U	NA	0.16 U	0.075 U	0.04 U	0.04 U
PCB 1260	0.14 U	0.77 U	NA	0.04 U	0.041 U	0.045 U	0.04 U	NA	0.079 U	0.089 U	NA	0.16 U	0.075 U	0.04 U	0.04 U
Dioxin (mg/kg)															
Heptachlorodibenzofuran, 1,2,3,4,6,7,8-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlorodibenzofuran, 1,2,3,4,7,8,9-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlorodibenzofurans, total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlorodibenzo-p-dioxin, 1,2,3,4,6,7,8-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlorodibenzo-p-dioxins, total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorodibenzofuran, 1,2,3,4,7,8-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorodibenzofuran, 1,2,3,6,7,8-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorodibenzofuran, 2,3,4,6,7,8-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorodibenzofurans, total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorodibenzo-p-dioxin, 1,2,3,4,7,8-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorodibenzo-p-dioxin, 1,2,3,6,7,8-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 4-1

Concentrations of Detected Analytes in Surface Soil

Samples Collected During Phase I, Phase II, and Remedial Investigations

Former Lockbourne Air Force Base, Lockbourne, Ohio

Sample ID	**LCK-SO1**	**LCK-SO2**	**LCK-SO2**	**LCK-SO3**	**LCK-SO4**	**LCK-SO5**	**LCK-SO6**	**LCK-SO6**	**LCK-SO7**	**LCK-SO8**	**LCK-SO8**	**LCK-SO9**	**LCK-SO10**	**LCK-SO11**	**LCK-SO12**
Sample Date	**5/24/1995**	**5/24/1995**	**5/24/1995**	**5/25/1995**	**5/25/1995**	**5/24/1995**	**5/23/1995**	**5/23/1995**	**5/23/1995**	**5/23/1995**	**5/23/1995**	**5/24/1995**	**5/24/1995**	**5/25/1995**	**5/25/1995**
Sample Depth (ft bgs)	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**
Investigation Phase[1]	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**PhaseI**
PARAMETER_NAME			**Resampled**					**Resampled**			**Resampled**				
Hexachlorodibenzo-p-dioxin, 1,2,3,7,8,9-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorodibenzo-p-dioxins, total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Octachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Octachlorodibenzo-p-dioxin	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorodibenzofuran, 1,2,3,7,8-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorodibenzofuran, 2,3,4,7,8-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorodibenzofurans, total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorodibenzo-p-dioxin, 1,2,3,7,8-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorodibenzo-p-dioxins, total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TCDD-TEQ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachlorodibenzofuran, 2,3,7,8-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachlorodibenzofurans, total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachlorodibenzo-p-dioxins, total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Explosives (mg/kg)															
Trinitrobenzene, 1,3,5-	0.24 U	0.24 U	NA	0.23 U	0.24 U	0.23 U	0.24 U	NA	0.24 U	0.22 U	NA	0.23 U	0.23 U	0.24 U	0.22 U
Trinitrotoluene, 2,4,6-	0.24 U	0.24 U	NA	0.23 U	0.24 U	0.23 U	0.24 U	NA	0.24 U	0.22 U	NA	0.23 U	0.23 U	0.24 U	0.22 U
Metals (mg/kg)															
Aluminum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	**1.8**	**6**	NA	**5.2**	**11**	**4**	**5.8**	NA	**5.8 JL**	**5.2**	NA	**3.4**	**5.3**	**5.1**	**4.6**
Barium	**31.8**	**54**	NA	**79.9**	**74.9**	**130**	**80.6**	NA	**89.2**	**180**	NA	**87.7**	**184**	**68**	**101**
Beryllium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	0.54 U	0.58 U	NA	0.43 U	0.44 U	0.67 U	0.42 U	NA	**0.67**	**1.1**	NA	0.6 U	0.56 U	0.43 U	**0.53**
Calcium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium, total	**2.2**	**11.1**	NA	**8.2**	**9.1**	**14**	**9.6**	NA	**10**	**11.5**	NA	**14.8**	**9.2**	**9.7**	**13.3**
Cobalt	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	**12.9**	**33.7**	NA	**26.7**	**23.2**	**14.2**	**15.5**	NA	**27.6 J**	**23.3**	NA	**41**	**23.6**	**21.3**	**15.5**
Magnesium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	0.11 U	0.12 U	NA	**0.08**	0.062 U	0.13 U	0.06 U	NA	**0.08**	0.07 U	NA	0.12 U	0.11 U	0.061 U	0.061 U
Nickel	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	0.54 U	0.58 U	NA	**0.47**	**0.42**	0.67 U	**0.22**	NA	0.14 U	0.16 U	NA	0.6 U	0.56 U	**0.49**	**0.26**
Silver	1.1 U	1.2 U	NA	**0.44**	0.44 U	1.3 U	0.42 U	NA	0.42 U	0.47 U	NA	1.2 U	1.1 U	0.43 U	0.43 U
Sodium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	**17.7**	**69.7**	NA	**81.6**	**67.7**	**73.3**	**59.4**	NA	**84.1 JL**	**70.1**	NA	**91.7**	**52.9**	**58.5**	**69.1**

TABLE 4-1
Concentrations of Detected Analytes in Surface Soil
Samples Collected During Phase I, Phase II, and Remedial Investigations
Former Lockbourne Air Force Base, Lockbourne, Ohio

Sample ID	**LCK-SO1**	**LCK-SO6**	**LCK-SO7**	**LCK-SO7**	**LCK-SO7**	**LCK-SO8**	**LCKSO-22**	**LCKSO-23**	**LCKSO-24**	**LCKSO-25**	**LCKSO-49**	**LCKSO-49**	**LCKSO-49 Dup**
Sample Date	**7/28/1997**	**7/24/1997**	**7/28/1997**	**7/28/1997**	**7/28/1997**	**7/28/1997**	**11/10/1998**	**11/10/1998**	**11/10/1998**	**11/10/1998**	**11/10/1998**	**11/10/1998**	**11/10/1998**
Sample Depth (ft bgs)	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**
Investigation Phase[1]	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**Phase II**
PARAMETER_NAME				**Duplicate**	**Duplicate**							**Duplicate**	**Duplicate**
Volatile Organic Compound (mg/kg)													
Acetone	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dichloropropene, 1,3-, trans-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene chloride	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Semi-Volatile Organic Compound (mg/kg)													
Acenaphthene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acenaphthylene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benz(a)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(a)pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(b)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(ghi)perylene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzo(k)fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzoic acid	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-ethylhexyl) phthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbazole	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chrysene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz(ah)anthracene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-butyl phthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-octyl phthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluorene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylnaphthalene, 2-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylphenol, 3- and/or 4-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrosodiphenylamine, N-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Phenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pesticide/PCB (mg/kg)													
Chlordane, alpha-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlordane, gamma-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
DDD, p,p'-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
DDE, p,p'-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
DDT, p,p'-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB 1242	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB 1248	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB 1254	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
PCB 1260	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dioxin (mg/kg)													
Heptachlorodibenzofuran, 1,2,3,4,6,7,8-	0.0000021 U	**0.0000017**	**0.0000064 J**	**0.0000089**	**0.0000068 J**	**0.0000083**	**0.0000052**	**0.0000059**	**0.0000048 J**	**0.0000069**	**0.0000101 J**	**0.000026 J**	**0.0000063 C**
Heptachlorodibenzofuran, 1,2,3,4,7,8,9-	0.0000027 U	0.0000007 U	0.0000021 U	0.0000012 U	0.0000026 U	**0.00000064 J**	0.0000006 U	**0.00000046 C**	0.0000004 U	0.0000002 U	0.0000015 U	**0.000002 J**	0.0000018 U
Heptachlorodibenzofurans, total	0.0000023 U	**0.0000033**	**0.0000088 J**	**0.0000236**	**0.0000155 J**	**0.0000178**	**0.0000111**	**0.0000133 C**	**0.0000109 C**	**0.0000173**	**0.0000211 J**	**0.0000642 J**	**0.0000125 C**
Heptachlorodibenzo-p-dioxin, 1,2,3,4,6,7,8-	**0.0000241**	**0.0000052**	**0.0000195**	**0.0000279**	**0.0000193**	**0.000034**	**0.0000304**	**0.0000499**	**0.0000168**	**0.0000185**	**0.0000345 J**	**0.000108 J**	**0.0000245 C**
Heptachlorodibenzo-p-dioxins, total	**0.000062**	**0.0000098**	**0.0000401**	**0.000062**	**0.0000407**	**0.0000676**	**0.0000724**	**0.000117**	**0.0000397**	**0.0000416**	**0.0000804 J**	**0.000211 J**	**0.0000627 C**
Hexachlorodibenzofuran, 1,2,3,4,7,8-	0.0000013 U	0.0000005 U	**0.0000039**	**0.0000062 R**	**0.0000049 R**	**0.0000033**	**0.00000095 C**	**0.0000014 J**	**0.0000017 J**	**0.0000012 J**	0.0000005 U	**0.0000055 J**	**0.0000012 J**
Hexachlorodibenzofuran, 1,2,3,6,7,8-	0.000001 U	0.0000004 U	**0.00000073 J**	**0.0000014**	0.0000011 U	**0.00000096**	**0.00000076 J**	**0.00000064 C**	**0.0000005 C**	**0.00000056 JC**	**0.0000012 J**	**0.0000034 J**	0.0000005 U
Hexachlorodibenzofuran, 2,3,4,6,7,8-	0.0000012 U	**0.00000063**	**0.0000018 R**	**0.0000013**	0.0000014 U	**0.0000019**	**0.0000014 J**	**0.0000012 J**	**0.00000092 J**	**0.00000087 J**	**0.0000019 J**	**0.0000039 J**	**0.0000013 J**
Hexachlorodibenzofurans, total	**0.0000051**	**0.0000026**	**0.0000195 J**	**0.0000228 E**	**0.0000128 J**	**0.0000157**	**0.0000153 C**	**0.0000128 C**	**0.0000082 C**	**0.0000091 C**	**0.0000205 CJ**	**0.0000657 CJ**	**0.000014 C**
Hexachlorodibenzo-p-dioxin, 1,2,3,4,7,8-	0.0000023 U	0.0000007 U	0.0000019 U	**0.00000076**	0.0000022 U	**0.0000009**	**0.00000055 C**	**0.000001 J**	0.0000004 U	**0.00000055 JC**	0.0000009 U	**0.0000025 J**	0.000001 U
Hexachlorodibenzo-p-dioxin, 1,2,3,6,7,8-	0.0000019 U	0.0000006 U	0.0000016 U	**0.0000012**	0.0000019 U	**0.0000017 J**	**0.0000015 J**	**0.0000015 C**	**0.00000091 J**	**0.0000015 J**	**0.0000013 JC**	**0.0000066 J**	0.0000009 U

TABLE 4-1

Concentrations of Detected Analytes in Surface Soil

Samples Collected During Phase I, Phase II, and Remedial Investigations

Former Lockbourne Air Force Base, Lockbourne, Ohio

Sample ID	**LCK-SO1**	**LCK-SO6**	**LCK-SO7**	**LCK-SO7**	**LCK-SO7**	**LCK-SO8**	**LCKSO-22**	**LCKSO-23**	**LCKSO-24**	**LCKSO-25**	**LCKSO-49**	**LCKSO-49**	**LCKSO-49 Dup**
Sample Date	**7/28/1997**	**7/24/1997**	**7/28/1997**	**7/28/1997**	**7/28/1997**	**7/28/1997**	**11/10/1998**	**11/10/1998**	**11/10/1998**	**11/10/1998**	**11/10/1998**	**11/10/1998**	**11/10/1998**
Sample Depth (ft bgs)	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**
Investigation Phase[1]	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**Phase II**
PARAMETER_NAME				**Duplicate**	**Duplicate**							**Duplicate**	**Duplicate**
Hexachlorodibenzo-p-dioxin, 1,2,3,7,8,9-	0.000002 U	0.0000006 U	0.0000016 U	**0.0000015 R**	0.000002 U	**0.0000017 R**	**0.0000022 J**	**0.0000025 J**	**0.0000014 J**	**0.0000018 J**	**0.000002 J**	**0.0000064 J**	0.0000011 U
Hexachlorodibenzo-p-dioxins, total	0.0000021 U	**0.0000025**	**0.0000092 J**	**0.0000115**	**0.0000065**	**0.0000137**	**0.0000175 C**	**0.0000196 C**	**0.0000101**	**0.0000313 C**	**0.0000162 CJ**	**0.0000474 CJ**	**0.0000093**
Octachlorodibenzofuran	0.0000083 U	**0.0000022 J**	**0.0000128**	**0.0000142**	**0.0000105**	**0.0000137**	**0.0000061 J**	**0.0000072 J**	**0.0000078 J**	**0.0000135**	**0.00001 J**	**0.0000365 J**	**0.0000057 JC**
Octachlorodibenzo-p-dioxin	**0.000265**	**0.0000579 J**	**0.000375**	**0.000757**	**0.000307**	**0.000464**	**0.000693**	0.000001 U	**0.000134**	**0.00012**	**0.00157**	**0.00133 J**	**0.00132**
Pentachlorodibenzofuran, 1,2,3,7,8-	0.0000009 U	0.0000005 U	0.0000009 U	**0.0000014**	0.0000012 U	**0.00000075 J**	0.0000003 U	**0.00000011 C**	**0.00000047 C**	**0.00000079 JC**	0.0000006 U	**0.0000018 J**	0.0000007 U
Pentachlorodibenzofuran, 2,3,4,7,8-	0.0000009 U	0.0000005 U	**0.0000016**	**0.000001**	**0.0000021**	**0.0000019**	**0.00000057 C**	**0.00000066 C**	**0.00000081 C**	**0.0000006 JC**	0.0000006 U	**0.0000022 J**	0.0000007 U
Pentachlorodibenzofurans, total	**0.0000076 Q**	**0.000003 EJ**	**0.0000126 J**	**0.0000275 E**	**0.00003 Q**	**0.0000142**	**0.0000214 C**	**0.0000137 C**	**0.0000081 C**	**0.0000124 C**	**0.0000212 CJ**	**0.0000553 CJ**	**0.0000181 QC**
Pentachlorodibenzo-p-dioxin, 1,2,3,7,8-	0.0000013 U	0.0000007 U	0.0000014 U	0.0000006 U	0.0000016 U	**0.00000086**	**0.00000062 C**	**0.0000011 C**	**0.00000035 C**	**0.00000071 JC**	0.0000007 U	**0.0000017 J**	0.0000008 U
Pentachlorodibenzo-p-dioxins, total	0.0000013 U	0.0000007 U	**0.0000026 J**	**0.0000016**	**0.0000026 J**	**0.0000017**	**0.0000039 C**	**0.0000045 C**	**0.0000031 C**	**0.0000255 C**	0.0000007 U	**0.0000162 CJ**	0.0000008 U
TCDD-TEQ	**2.12642E-06**	**1.95901E-06**	**3.39878E-06**	**2.96212E-06**	**8.03075E-06**	**4.94067E-06**	**3.15741E-06**	**5.39687E-06**	**1.83668E-06**	**6.11085E-06**	**2.2195E-06**	**8.36665E-06**	**1.90707E-06**
Tetrachlorodibenzofuran, 2,3,7,8-	**0.00000082**	**0.00000065**	**0.0000015 B**	**0.0000012 B**	0.000001 U	**0.0000033 B**	**0.0000009 C**	**0.00000054 J**	**0.00000098 J**	**0.0000014**	**0.00000053 J**	**0.0000014 J**	**0.00000055 J**
Tetrachlorodibenzofurans, total	**0.0000055 Q**	**0.00000065**	**0.0000102**	**0.0000081 E**	**0.0000111 Q**	**0.0000288**	**0.0000254 C**	**0.0000245 B**	**0.000023 B**	**0.0000284 C**	**0.0000145 CB**	**0.0000369 CJ**	**0.0000117 CB**
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-	0.0000006 U	**0.0000011**	0.0000009 U	0.0000005 U	**0.0000048 J**	**0.0000012 J**	**0.00000097 J**	**0.0000025 C**	0.0000003 U	**0.000004**	0.0000006 U	**0.000001 J**	0.0000007 U
Tetrachlorodibenzo-p-dioxins, total	**0.0000016 J**	**0.0000011**	**0.0000021 J**	**0.0000018 J**	**0.0000072 J**	**0.0000027 J**	**0.0000033 C**	**0.0000056 C**	**0.0000034**	**0.000026 C**	**0.0000042 J**	**0.00001 CJ**	**0.0000038**
Explosives (mg/kg)													
Trinitrobenzene, 1,3,5-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trinitrotoluene, 2,4,6-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals (mg/kg)													
Aluminum	**1800**	**8800 J**	**6700**	**7600**	**6900**	**16000**	NA	NA	NA	NA	NA	NA	NA
Antimony	66 U	7 UJ	7 U	7 U	6 U	40 U	NA	NA	NA	NA	NA	NA	NA
Arsenic	**3.89 J**	**2.92 J**	**12.9 J**	**6.77 J**	**6.36 J**	**12 J**	NA	NA	NA	NA	NA	NA	NA
Barium	**110**	**59 J**	**130**	**91**	**110**	**130**	NA	NA	NA	NA	NA	NA	NA
Beryllium	6 U	**0.79 J**	**0.839**	**0.848**	**0.787**	3 U	NA	NA	NA	NA	NA	NA	NA
Cadmium	6 U	**0.727 J**	0.59 U	0.58 U	0.56 U	3 U	NA	NA	NA	NA	NA	NA	NA
Calcium	**160000**	**74000 J**	**53000**	**40000**	**38000**	**81000**	NA	NA	NA	NA	NA	NA	NA
Chromium, total	11 U	**12 J**	**11**	**11**	**10**	**24**	NA	NA	NA	NA	NA	NA	NA
Cobalt	11 U	**8.4 J**	**6.6**	**6.8**	**9.4**	**7.8**	NA	NA	NA	NA	NA	NA	NA
Copper	22 U	23 U	**20**	**30**	**22**	**140**	NA	NA	NA	NA	NA	NA	NA
Iron	**6100**	**24000 J**	**16000**	**16000**	**16000**	**18000**	NA	NA	NA	NA	NA	NA	NA
Lead	**42.6**	**15.2 J**	**22.7**	**24.1**	**23.2**	**9340**	NA	NA	NA	NA	NA	NA	NA
Magnesium	**25000**	**22000 J**	**11000**	**9200**	**9700**	**16000**	NA	NA	NA	NA	NA	NA	NA
Manganese	**230**	**560 J**	**350**	**340**	**380**	**390**	NA	NA	NA	NA	NA	NA	NA
Mercury	0.11 U	0.12 U	0.12 U	0.12 U	0.11 U	0.13 U	NA	NA	NA	NA	NA	NA	NA
Nickel	44 U	**21 J**	**18**	**18**	**19**	26 U	NA	NA	NA	NA	NA	NA	NA
Potassium	5500 U	**2900 J**	**2500**	**2400**	**2500**	3300 U	NA	NA	NA	NA	NA	NA	NA
Selenium	0.56 U	0.58 U	0.6 U	0.59 U	0.57 U	**0.9**	NA	NA	NA	NA	NA	NA	NA
Silver	11 U	1 UJ	1 U	1 U	1 U	6 U	NA	NA	NA	NA	NA	NA	NA
Sodium	1100 U	120 U	120 U	120 U	110 U	660 U	NA	NA	NA	NA	NA	NA	NA
Thallium	6 U	0.58 U	0.59 U	0.58 U	0.56 U	3 U	NA	NA	NA	NA	NA	NA	NA
Vanadium	11 U	**24 J**	**23**	**22**	**21**	**23**	NA	NA	NA	NA	NA	NA	NA
Zinc	**55**	**62 J**	**68**	**77**	**67**	**130**	NA	NA	NA	NA	NA	NA	NA

TABLE 4-1

Concentrations of Detected Analytes in Surface Soil

Samples Collected During Phase I, Phase II, and Remedial Investigations

Former Lockbourne Air Force Base, Lockbourne, Ohio

Sample ID	**LCKSB-8**	**LCKSB-9**	**LCKSB-10**	**LCKSB-11**	**LCKSB-11**	**LCKSB-11**	**LCKSB-12**	**LCKSB-13**	**LCKSB-13**	**LCKSB-14**	**14MW1**	**LCKSO-323**	**EEGLKB-SS01**	**EEGLKB-SS01**
Sample Date	**7/17/1997**	**7/16/1997**	**7/21/1997**	**7/21/1997**	**7/21/1997**	**7/21/1997**	**7/25/1997**	**7/24/1997**	**7/24/1997**	**7/30/1997**	**11/13/1998**	**11/13/1998**	**7/29/2003**	**7/30/2003**
Sample Depth (ft bgs)	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**	**0 - 1**	**0 - 1**
Investigation Phase[1]	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**RI**	**RI**
PARAMETER_NAME					**Duplicate**	**Duplicate**			**Duplicate**					**Resampled**
Volatile Organic Compound (mg/kg)														
Acetone	0.012 U	0.012 U	0.012 UJ	0.011 U	0.012 U	0.012 U	**0.025**	0.012 UJ	0.012 U	**0.02**	NA	NA	NA	**3.2**
Dichloropropene, 1,3-, trans-	0.0061 U	0.0059 U	0.0058 U	0.0055 U	0.0058 U	0.0058 U	0.0061 U	0.006 U	0.006 U	0.0053 U	NA	NA	NA	0.0075 U
Methylene chloride	**0.0046**	0.0059 U	0.0058 U	0.0055 U	0.0058 U	**0.012 J**	0.0061 U	0.006 U	0.006 U	0.0053 U	NA	NA	NA	0.015 U
Toluene	0.0061 U	0.0059 U	0.0058 U	0.0055 U	0.0058 U	0.0058 U	0.0061 U	0.006 U	0.006 U	0.0053 U	NA	NA	NA	0.0075 U
Trichlorofluoromethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.0043 J**
Semi-Volatile Organic Compound (mg/kg)														
Acenaphthene	0.4 U	0.39 U	0.39 U	0.38 U	0.38 U	0.39 U	8.1 U	4 U	4 U	0.35 U	NA	NA	**0.021 J**	NA
Acenaphthylene	0.4 U	0.39 U	0.39 U	0.38 U	0.38 U	0.39 U	8.1 U	4 U	4 U	0.35 U	NA	NA	0.046 U	NA
Anthracene	0.4 U	0.39 U	0.39 U	0.38 U	0.38 U	0.39 U	**11**	**4.6 J**	4 U	0.35 U	NA	NA	**0.052 J**	NA
Benz(a)anthracene	0.4 U	0.39 U	0.39 U	0.38 U	0.38 U	0.39 U	**49**	**17 J**	**6.9 J**	0.35 U	NA	NA	**0.14**	NA
Benzo(a)pyrene	0.4 U	0.39 U	0.39 U	0.38 U	0.38 U	0.39 U	**44**	**17 J**	**6.6 J**	0.35 U	NA	NA	**0.15**	NA
Benzo(b)fluoranthene	0.4 U	0.39 U	0.39 U	0.38 U	0.38 U	0.39 U	**61**	**21 J**	**8.4 J**	0.35 U	NA	NA	**0.13**	NA
Benzo(ghi)perylene	0.4 U	0.39 U	0.39 U	0.38 U	0.38 U	0.39 U	**32**	**11 J**	**3.7 J**	0.35 U	NA	NA	**0.088 J**	NA
Benzo(k)fluoranthene	0.4 U	0.39 U	0.39 U	0.38 U	0.38 U	0.39 U	**20**	**10 J**	**2.7 J**	0.35 U	NA	NA	**0.15 J**	NA
Benzoic acid	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.94 U	NA
Bis(2-ethylhexyl) phthalate	0.4 U	0.39 U	0.39 U	0.38 U	0.38 U	0.39 U	**16**	4 U	4 U	0.35 U	NA	NA	0.23 U	NA
Carbazole	0.4 U	0.39 U	0.39 U	0.38 U	0.38 U	0.39 U	**4.9 J**	4 U	4 U	0.35 U	NA	NA	0.23 U	NA
Chrysene	0.4 U	0.39 U	0.39 U	0.38 U	0.38 U	0.39 U	**42**	**15 J**	**6.2 J**	0.35 U	NA	NA	**0.21 J**	NA
Dibenz(ah)anthracene	0.4 U	0.39 U	0.39 U	0.38 U	0.38 U	0.39 U	**9**	**2.4 J**	4 U	0.35 U	NA	NA	**0.028 J**	NA
Dibenzofuran	0.4 U	0.39 U	0.39 U	0.38 U	0.38 U	0.39 U	8.1 U	4 U	4 U	0.35 U	NA	NA	**0.009 J**	NA
Di-n-butyl phthalate	0.4 U	0.39 U	0.39 U	0.38 U	0.38 U	0.39 U	8.1 U	4 U	4 U	0.35 U	NA	NA	0.23 U	NA
Di-n-octyl phthalate	0.4 U	0.39 U	0.39 U	0.38 U	0.38 U	0.39 U	**15**	4 U	4 U	0.35 U	NA	NA	0.46 U	NA
Fluoranthene	0.4 U	0.39 U	0.39 U	0.38 U	0.38 U	0.39 U	**77**	**25 J**	**12 J**	0.35 U	NA	NA	**0.47 J**	NA
Fluorene	0.4 U	0.39 U	0.39 U	0.38 U	0.38 U	0.39 U	8.1 U	4 U	4 U	0.35 U	NA	NA	**0.018 J**	NA
Indeno(1,2,3-cd)pyrene	0.4 U	0.39 U	0.39 U	0.38 U	0.38 U	0.39 U	**35**	**11 J**	**4 J**	0.35 U	NA	NA	**0.07**	NA
Methylnaphthalene, 2-	0.4 U	0.39 U	0.39 U	0.38 U	0.38 U	0.39 U	8.1 U	4 U	4 U	0.35 U	NA	NA	0.046 U	NA
Methylphenol, 3- and/or 4-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.094 U	NA
Naphthalene	0.4 U	0.39 U	0.39 U	0.38 U	0.38 U	0.39 U	8.1 U	4 U	4 U	0.35 U	NA	NA	0.046 U	NA
Nitrosodiphenylamine, N-	0.4 U	0.39 U	0.39 U	0.38 U	0.38 U	0.39 U	8.1 U	4 U	4 U	0.35 U	NA	NA	0.046 U	NA
Phenanthrene	0.4 U	0.39 U	0.39 U	0.38 U	0.38 U	0.39 U	**49**	**18 J**	**7.6 J**	0.35 U	NA	NA	**0.22**	NA
Phenol	0.4 U	0.39 U	0.39 U	0.38 U	0.38 U	0.39 U	8.1 U	4 U	4 U	0.35 U	NA	NA	0.23 U	NA
Pyrene	**0.21 J**	0.39 U	0.39 U	0.38 U	0.38 U	0.39 U	**72**	**31 J**	**13 J**	0.35 U	NA	NA	**0.34**	NA
Pesticide/PCB (mg/kg)														
Chlordane, alpha-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0024 U	NA
Chlordane, gamma-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0024 U	NA
DDD, p,p'-	0.004 U	0.0039 U	0.0038 U	0.0038 U	0.0038 U	0.0039 U	0.0041 U	0.004 U	0.004 U	**0.021**	NA	NA	0.0024 U	NA
DDE, p,p'-	**0.062**	**0.012**	0.0038 U	0.0038 U	0.0038 U	0.0039 U	0.0041 U	0.004 U	0.004 U	0.0036 U	NA	NA	0.0024 U	NA
DDT, p,p'-	0.004 U	0.0039 U	0.0038 U	0.0038 U	0.0038 U	0.0039 U	0.0041 U	0.004 U	0.004 U	0.0036 U	NA	NA	0.0024 U	NA
PCB 1242	0.04 U	0.039 U	0.039 U	0.038 U	0.038 U	0.039 U	0.041 U	0.04 U	0.04 U	0.035 U	NA	NA	0.023 U	NA
PCB 1248	0.04 U	0.039 U	0.039 U	0.038 U	0.038 U	0.039 U	0.041 U	0.04 U	0.04 U	0.035 U	NA	NA	0.023 U	NA
PCB 1254	0.04 U	0.039 U	0.039 U	0.038 U	0.038 U	0.039 U	0.041 U	0.04 U	0.04 U	0.035 U	NA	NA	0.023 U	NA
PCB 1260	0.04 U	0.039 U	0.039 U	0.038 U	0.038 U	0.039 U	0.041 U	0.04 U	0.04 U	0.035 U	NA	NA	0.023 U	NA
Dioxin (mg/kg)														
Heptachlorodibenzofuran, 1,2,3,4,6,7,8-	**0.0000041**	**0.0000026**	**0.0000026 J**	**0.0000019 J**	**0.0000014 J**	**0.0000027**	**0.000028**	**0.0000145 J**	NA	**0.0000055**	**0.0000034 JB**	**0.0000032 JB**	NA	NA
Heptachlorodibenzofuran, 1,2,3,4,7,8,9-	0.0000006 U	**0.00000034 J**	0.0000005 U	0.0000018 U	0.0000005 U	0.000001 U	0.000002 U	0.0000039 UJ	NA	0.0000008 U	0.0000005 U	0.0000003 U	NA	NA
Heptachlorodibenzofurans, total	**0.000007**	**0.0000026**	**0.0000042 J**	**0.0000019 J**	**0.0000017**	**0.0000054 J**	**0.0000849**	**0.0000385 J**	NA	**0.0000128**	**0.0000071 B**	**0.0000045 B**	NA	NA
Heptachlorodibenzo-p-dioxin, 1,2,3,4,6,7,8-	**0.0000097**	**0.0000094**	**0.0000055**	**0.0000066**	**0.000004**	**0.0000064**	**0.0000902**	**0.000088 J**	NA	**0.0000221**	**0.0000261**	**0.0000755**	NA	NA
Heptachlorodibenzo-p-dioxins, total	**0.0000221**	**0.0000213**	**0.0000114**	**0.0000066**	**0.000008**	**0.0000064**	**0.000188**	**0.000175 J**	NA	**0.000055**	**0.0000539**	**0.000174**	NA	NA
Hexachlorodibenzofuran, 1,2,3,4,7,8-	**0.0000013**	**0.0000008**	**0.0000012**	0.0000012 U	**0.00000052**	0.0000006 U	**0.0000031**	**0.0000046 J**	NA	**0.0000019**	**0.00000093 JB**	**0.00000084 JB**	NA	NA
Hexachlorodibenzofuran, 1,2,3,6,7,8-	**0.00000057**	**0.00000039**	**0.00000059**	0.000001 U	0.0000003 U	0.0000005 U	**0.0000015**	**0.0000017 J**	NA	0.0000004 U	**0.00000043 JB**	**0.00000047 JB**	NA	NA
Hexachlorodibenzofuran, 2,3,4,6,7,8-	**0.0000017 B**	**0.0000012 B**	**0.000001**	0.0000012 U	**0.00000068 J**	0.0000006 U	**0.0000029 J**	**0.0000023 B**	NA	**0.0000015 B**	**0.0000004 JB**	**0.00000059 JB**	NA	NA
Hexachlorodibenzofurans, total	**0.0000116**	**0.0000099**	**0.0000049**	**0.0000018**	**0.0000037**	**0.0000025**	**0.0000303**	**0.0000254 J**	NA	**0.0000037**	**0.0000055 CB**	**0.0000047 CB**	NA	NA
Hexachlorodibenzo-p-dioxin, 1,2,3,4,7,8-	0.0000008 U	0.0000005 U	0.0000005 U	0.0000014 U	0.0000004 U	0.0000008 U	**0.0000024**	0.0000029 UJ	NA	**0.0000006 J**	**0.00000037 JC**	**0.00000062 J**	NA	NA
Hexachlorodibenzo-p-dioxin, 1,2,3,6,7,8-	**0.00000067**	**0.00000041 J**	**0.00000059 J**	0.0000012 U	0.0000003 U	0.0000007 U	**0.0000067**	**0.0000046 J**	NA	**0.00000099**	**0.0000008 JC**	**0.00000094 J**	NA	NA

TABLE 4-1

Concentrations of Detected Analytes in Surface Soil

Samples Collected During Phase I, Phase II, and Remedial Investigations

Former Lockbourne Air Force Base, Lockbourne, Ohio

Sample ID	**LCKSB-8**	**LCKSB-9**	**LCKSB-10**	**LCKSB-11**	**LCKSB-11**	**LCKSB-11**	**LCKSB-12**	**LCKSB-13**	**LCKSB-13**	**LCKSB-14**	**14MW1**	**LCKSO-323**	**EEGLKB-SS01**	**EEGLKB-SS01**
Sample Date	**7/17/1997**	**7/16/1997**	**7/21/1997**	**7/21/1997**	**7/21/1997**	**7/21/1997**	**7/25/1997**	**7/24/1997**	**7/24/1997**	**7/30/1997**	**11/13/1998**	**11/13/1998**	**7/29/2003**	**7/30/2003**
Sample Depth (ft bgs)	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**	**0 - 0.5**	**0 - 1**	**0 - 1**
Investigation Phase[1]	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**RI**	**RI**
PARAMETER_NAME					**Duplicate**	**Duplicate**			**Duplicate**					**Resampled**
Hexachlorodibenzo-p-dioxin, 1,2,3,7,8,9-	**0.000001**	**0.000001 J**	**0.00000098**	0.0000013 U	**0.00000051 J**	**0.0000012 J**	**0.0000079**	**0.000008 J**	NA	**0.0000017**	**0.0000011 J**	**0.0000017 J**	NA	NA
Hexachlorodibenzo-p-dioxins, total	**0.0000075**	**0.0000055**	**0.0000024**	0.0000013 U	**0.0000021 B**	**0.0000046 BJ**	**0.0000543**	**0.0000445 J**	NA	**0.0000104**	**0.00001 C**	**0.0000135 C**	NA	NA
Octachlorodibenzofuran	**0.0000059**	**0.0000059**	**0.0000032**	**0.0000056**	**0.0000025**	**0.0000046 J**	**0.0000654**	**0.0000342 J**	NA	**0.0000101**	**0.0000058 J**	**0.0000026 J**	NA	NA
Octachlorodibenzo-p-dioxin	**0.00021**	**0.000487**	**0.000068**	**0.000081**	**0.0000507**	**0.0000822**	**0.000961**	**0.00117 J**	NA	**0.00095**	**0.00119**	**0.00908 E**	NA	NA
Pentachlorodibenzofuran, 1,2,3,7,8-	0.0000005 U	0.0000004 U	0.0000004 U	0.000001 U	0.0000003 U	0.0000005 U	0.0000008 U	0.000001 UJ	NA	0.0000004 U	0.0000002 U	0.0000002 U	NA	NA
Pentachlorodibenzofuran, 2,3,4,7,8-	**0.00000065**	**0.00000038**	0.0000004 U	0.000001 U	0.0000003 U	0.0000005 U	0.0000008 U	0.0000009 UJ	NA	0.0000004 U	0.0000001 U	**0.00000038 JB**	NA	NA
Pentachlorodibenzofurans, total	**0.0000078 E**	**0.0000117 E**	**0.0000063**	**0.0000049 J**	**0.0000055**	**0.0000026 J**	**0.0000183**	**0.0000155 JE**	NA	**0.0000022**	**0.0000044 B**	**0.0000039 CB**	NA	NA
Pentachlorodibenzo-p-dioxin, 1,2,3,7,8-	0.0000007 U	0.0000005 U	0.0000007 U	0.0000016 U	0.0000005 U	0.0000008 U	**0.0000017**	0.0000015 UJ	NA	0.0000007 U	**0.00000025 JC**	0.0000002 U	NA	NA
Pentachlorodibenzo-p-dioxins, total	**0.0000011**	0.0000005 U	**0.00000087 J**	0.0000016 U	0.0000005 U	0.0000008 U	**0.0000033**	**0.0000032 J**	NA	**0.0000023 J**	**0.0000027 CB**	**0.0000012 CB**	NA	NA
TCDD-TEQ	**1.73409E-06**	**1.81269E-06**	**1.30162E-06**	**2.09266E-06**	**8.6732E-07**	**1.22218E-06**	**6.14964E-06**	**5.34992E-06**	NA	**3.56501E-06**	**2.03208E-06**	**2.8648E-06**	NA	NA
Tetrachlorodibenzofuran, 2,3,7,8-	0.0000009 U	0.0000007 U	**0.0000007 J**	0.0000006 U	**0.00000082**	0.0000003 U	**0.0000013 B**	**0.0000037 J**	NA	**0.0000021**	**0.00000082 JB**	**0.00000097 JB**	NA	NA
Tetrachlorodibenzofurans, total	**0.0000039 E**	**0.000003**	**0.0000029**	0.0000006 U	**0.000001**	0.0000003 U	**0.0000067**	**0.0000253 JQ**	NA	**0.0000101**	**0.0000067 CB**	**0.0000034 CB**	NA	NA
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-	0.0000005 U	**0.00000073**	0.0000004 U	0.0000009 U	0.0000003 U	0.0000005 U	0.0000006 U	0.0000009 UJ	NA	**0.0000018**	**0.00000084 J**	**0.00000025 JC**	NA	NA
Tetrachlorodibenzo-p-dioxins, total	**0.00000083 J**	**0.0000016**	**0.00000093**	0.0000009 U	**0.00000045 BJ**	**0.00000089 BJ**	**0.00000097**	**0.0000013 J**	NA	**0.0000018**	**0.0000012 CB**	**0.0000011 CB**	NA	NA
Explosives (mg/kg)														
Trinitrobenzene, 1,3,5-	0.0007 U	0.0007 U	0.0007 U	0.0007 U	0.0007 U	0.0007 U	0.0007 U	0.0007 U	0.0007 U	0.0007 U	NA	NA	NA	NA
Trinitrotoluene, 2,4,6-	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	0.0005 U	NA	NA	NA	NA
Metals (mg/kg)														
Aluminum	**9000 J**	**8200 J**	**7800 J**	**9200 J**	**10000 J**	**16000 J**	**6300**	**4900**	**6200**	**5200**	NA	NA	**3100**	NA
Antimony	7 U	7 U	6 UJ	6 U	6 U	14 U	15 U	14 UJ	14 U	12.6 U	NA	NA	35 U	NA
Arsenic	**11.6 J**	**12.3 J**	**9.13 J**	**10.8 J**	**13.8 J**	**8.85 J**	**15.4 J**	**12.3 J**	**11.5 J**	**10.1 J**	NA	NA	**18**	NA
Barium	**87 J**	**91 J**	**160 J**	**84 J**	**93 J**	**200 J**	**160**	**110**	**120**	**31**	NA	NA	**490**	NA
Beryllium	**0.775 J**	**0.708 J**	**0.661 J**	**0.703 J**	**0.805 J**	**1.3 J**	**1.94**	1 U	1 U	1 U	NA	NA	2.8 U	NA
Cadmium	0.6 U	0.59 U	0.57 U	0.57 U	0.57 U	1 U	1.2 U	1 U	1 U	1 U	NA	NA	3.5 U	NA
Calcium	**5900 J**	**15000 J**	**3200 J**	**2700 J**	**3400 J**	**5400 J**	**87000**	**110000**	**92000**	**65000**	NA	NA	**280000**	NA
Chromium, total	**12 J**	**11 J**	**10 J**	**12 J**	**15 J**	**22 J**	**13 J**	**5.6 J**	**13 J**	**8.5**	NA	NA	**5 J**	NA
Cobalt	**8.6 J**	**12 J**	**6.1 J**	**8.2 J**	**9 J**	**26 J**	**6.3 J**	**2.5 J**	**5.7 J**	**5.6**	NA	NA	**1.2 J**	NA
Copper	19 U	21 U	15 U	15 U	20 U	34 U	**36**	**22**	**24**	**18**	NA	NA	21 U	NA
Iron	**18000 J**	**18000 J**	**16000 J**	**18000 J**	**19000 J**	**33000 J**	**19000**	**14000**	**16000**	**12000**	NA	NA	**5400**	NA
Lead	**22.8 J**	**20.9 J**	**15.3 J**	**17.6 J**	**23.3 J**	**40.2 J**	**665 J**	**63.6 J**	**130 J**	**15.7**	NA	NA	**3.8 J**	NA
Magnesium	**3200 J**	**5600 J**	**1500 J**	**1800 J**	**2100 J**	**3300 J**	**12000**	**23000**	**25000**	**25000**	NA	NA	**17000**	NA
Manganese	**550 J**	**690 J**	990 UJ	**480 J**	**460 J**	**1600 J**	**250**	**300**	**290**	**210**	NA	NA	**260**	NA
Mercury	0.12 U	0.12 U	0.12 U	0.11 U	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U	0.1 U	NA	NA	0.00002 U	NA
Nickel	**18 J**	**19 J**	**13 J**	**13 J**	**16 J**	**26 J**	**22 J**	9 U	**18 J**	**20**	NA	NA	**4.7 J**	NA
Potassium	**1700 J**	**1500 J**	**1300 J**	**2000 J**	**2300 J**	**3300 J**	**3600**	**4200**	**3900**	**2500**	NA	NA	**380 J**	NA
Selenium	0.6 U	**0.27**	0.58 U	0.57 U	0.58 U	0.58 U	0.6 U	0.6 U	0.6 U	0.53 U	NA	NA	11 U	NA
Silver	1 U	1 U	1 UJ	1 U	1 U	2 U	2 U	2 UJ	2 U	2 U	NA	NA	7.1 U	NA
Sodium	120 U	120 U	110 U	110 U	110 U	230 U	**370**	**270**	**250**	210 U	NA	NA	1800 U	NA
Thallium	0.6 U	0.59 U	0.57 U	0.57 U	0.57 U	1 U	1.2 U	1 U	1 U	1 U	NA	NA	18 U	NA
Vanadium	**25 J**	**23 J**	**21 J**	**26 J**	**28 J**	**44 J**	**29**	**19**	**25**	**15**	NA	NA	**7.3**	NA
Zinc	**65 J**	**61 J**	**44 J**	**49 J**	**58 J**	**95 J**	**250**	**120**	**140**	**57**	NA	NA	**12 J**	NA

TABLE 4-1
Concentrations of Detected Analytes in Surface Soil
Samples Collected During Phase I, Phase II, and Remedial Investigations
Former Lockbourne Air Force Base, Lockbourne, Ohio

Sample ID	**EEGLKB-SS02**	**EEGLKB-SS03**	**EEGLKB-SS04**	**EEGLKB-SS05**	**EEGLKB-SS06**	**EEGLKB-SS07**	**EEGLKB-SS07**	**EEGLKB-SS08**	**EEGLKB-SS08**	**EEGLKB-SS09**	**EEGLKB-SS09**	**EEGLKB-SS10**	**EEGLKB-SS11**
Sample Date	**7/29/2003**	**7/29/2003**	**7/29/2003**	**7/29/2003**	**7/29/2003**	**7/29/2003**	**7/30/2003**	**7/28/2003**	**7/28/2003**	**7/29/2003**	**7/29/2003**	**7/29/2003**	**7/29/2003**
Sample Depth (ft bgs)	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**
Investigation Phase[1]	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**
PARAMETER_NAME							**Resampled**		**Duplicate**		**Duplicate**		
Volatile Organic Compound (mg/kg)													
Acetone	**0.07**	**0.75**	0.029 U	**0.58**	**4.6**	NA	0.026 U	**0.17 J**	**0.83**	**0.58 J**	**0.19**	0.025 U	**6.8**
Dichloropropene, 1,3-, trans-	0.0083 U	0.0082 U	0.0056 U	0.0051 U	0.0055 U	NA	0.0066 U	0.0054 U	0.0065 U	0.0054 U	0.0051 U	0.0063 U	0.0057 U
Methylene chloride	0.017 U	0.016 U	0.011 U	0.01 U	0.011 U	NA	0.013 U	0.011 U	0.013 U	0.011 UJ	0.01 U	0.013 U	0.011 U
Toluene	0.0083 U	0.0082 U	0.0056 U	0.0051 U	0.0055 U	NA	**0.0016 J**	0.0054 U	0.0065 U	**0.0015 B**	**0.0012 J**	**0.0014 J**	0.0057 U
Trichlorofluoromethane	0.0083 U	**0.0082**	**0.0035 J**	0.0051 U	**0.0015 J**	NA	**0.005 J**	0.0054 U	0.0065 U	**0.0047 B**	**0.0034 J**	**0.0035 J**	**0.0031 J**
Semi-Volatile Organic Compound (mg/kg)													
Acenaphthene	**0.21**	**0.022 J**	**0.066 J**	**54**	**85**	**0.27**	NA	**23**	**16**	**3.2**	**1.4**	**0.18 J**	**0.36**
Acenaphthylene	0.19 U	0.047 U	0.2 U	**0.7**	**0.66**	**0.36**	NA	**1.9**	**1.5**	**0.26**	**0.08 J**	0.19 U	**0.078 J**
Anthracene	**0.36 J**	**0.071 J**	**0.15 J**	**160 J**	**130 J**	**0.79 J**	NA	**67 J**	**48 J**	**7.1 J**	**4.2 J**	**0.82 J**	**1.6 J**
Benz(a)anthracene	**0.97**	**0.24**	**1.5**	**450**	**310**	**4.5**	NA	**200**	**160**	**22**	**14**	**4.9**	**4.6**
Benzo(a)pyrene	**0.71**	**0.22**	**1.6**	**380**	**290**	**5.2**	NA	**180 J**	**130 J**	**18 J**	**13**	**5.7**	**4.2**
Benzo(b)fluoranthene	**0.83**	**0.18**	**1.5**	**340**	**220**	**5.1**	NA	**140 J**	**110**	**18 J**	**14**	**4.5**	**4.6**
Benzo(ghi)perylene	**0.24 J**	**0.12 J**	**0.78**	**110 J**	**110 J**	**2.7 J**	NA	**46 J**	**49 J**	**6.9 J**	**6.2 J**	**2.8 J**	**2.3 J**
Benzo(k)fluoranthene	**0.6 J**	**0.21 J**	**1.7**	**340 J**	**250 J**	**5.3 J**	NA	**150 J**	**100 J**	**12 J**	**9.4 J**	**6.1 J**	**4.5 J**
Benzoic acid	**4.8**	0.95 U	4.1 U	3.8 U	3.9 U	4.1 U	NA	19 R	19 U	4.1 U	4 U	3.9 U	4 U
Bis(2-ethylhexyl) phthalate	0.99 U	0.24 U	1 U	0.95 U	0.96 U	1 U	NA	4.7 U	4.7 U	1 U	1 U	0.98 U	1 U
Carbazole	0.99 U	0.24 U	1 U	**70 J**	**88**	**0.36 J**	NA	**17 J**	**8.8**	**3.7 J**	**1.9 J**	**0.33 J**	**1 J**
Chrysene	**1.1 J**	**0.28 J**	**1.8**	**470 J**	**370 J**	**4.7 J**	NA	**180 J**	**130**	**18 J**	**12 J**	**4.5 J**	**4.8 J**
Dibenz(ah)anthracene	0.19 U	**0.047**	**0.38**	**71**	**57**	**1.3**	NA	**28**	**22**	**4**	**3.3**	**1**	**0.97**
Dibenzofuran	**0.87**	**0.014 J**	0.41 U	**25**	**42**	**1**	NA	**18**	**11**	**2.6**	**0.88**	**0.12 J**	**0.38 J**
Di-n-butyl phthalate	0.99 U	0.24 U	1 U	0.95 U	0.96 U	1 U	NA	4.7 U	4.7 U	1 U	1 U	0.98 U	1 U
Di-n-octyl phthalate	1.9 U	0.47 U	2 U	1.9 U	1.9 U	2 U	NA	9.2 U	9.2 U	2 U	2 U	1.9 U	2 U
Fluoranthene	**1.8 J**	**0.58 J**	**3.2**	**1100 J**	**950 J**	**7.1 J**	NA	**490 J**	**330 J**	**51 J**	**29 J**	**7.4 J**	**11 J**
Fluorene	0.19 U	**0.015 J**	0.2 U	**54**	**67**	**0.31**	NA	**32**	**19**	**4.1**	**1.5**	**0.16 J**	**0.42**
Indeno(1,2,3-cd)pyrene	**0.14 J**	**0.1**	**0.82**	**130**	**120**	**2.6**	NA	**50**	**54**	**7.5**	**7.1**	**2.9**	**2.2**
Methylnaphthalene, 2-	**3.3**	0.047 U	0.2 U	**3.4**	**14**	**4.4**	NA	**3.7**	**1.8**	**0.62**	**0.23**	**0.084 J**	**0.13 J**
Methylphenol, 3- and/or 4-	0.4 U	0.095 U	0.41 U	**0.25 J**	**0.21 J**	0.41 U	NA	1.9 U	1.9 U	0.41 UJ	0.4 U	0.39 U	0.4 U
Naphthalene	**1.4**	0.047 U	0.2 U	**1.9**	**13**	**2.2**	NA	**0.68 J**	**0.34 J**	**0.14 J**	**0.081 J**	0.19 U	**0.19 J**
Nitrosodiphenylamine, N-	0.19 U	0.047 U	0.2 U	0.19 U	0.19 U	0.2 U	NA	0.92 U	0.92 U	0.2 U	0.2 U	0.19 U	0.2 U
Phenanthrene	**4.9**	**0.19**	**0.74**	**480**	**600**	**6.5**	NA	**230**	**170**	**31**	**14**	**2.5**	**6.3**
Phenol	0.99 U	0.24 U	1 U	**0.054 J**	**0.068 J**	1 U	NA	4.7 U	4.7 U	1 U	1 U	0.98 U	1 U
Pyrene	**1.9**	**0.41**	**2.5**	**870**	**720**	**7.5**	NA	**300 J**	**230 J**	**38 J**	**21**	**7.2**	**8.9**
Pesticide/PCB (mg/kg)													
Chlordane, alpha-	0.21 U	0.0024 U	0.21 U	0.19 U	0.2 U	0.21 U	NA	0.19 U	0.4 U	0.2 U	0.2 U	0.2 U	0.2 U
Chlordane, gamma-	0.21 U	0.0024 U	0.21 U	**0.44 J**	0.2 U	0.21 U	NA	**0.29 J**	0.4 U	0.2 U	0.2 U	0.2 U	0.2 U
DDD, p,p'-	0.21 U	0.0024 U	0.21 U	0.19 U	0.2 U	0.21 U	NA	0.19 U	0.4 U	0.2 U	0.2 U	0.2 U	**0.36 J**
DDE, p,p'-	0.21 U	0.0024 U	0.21 U	0.19 U	0.2 U	0.21 U	NA	0.19 U	0.4 U	0.2 U	0.2 U	0.2 U	**0.2 J**
DDT, p,p'-	0.21 U	0.0024 U	0.21 U	0.19 U	0.2 U	0.21 U	NA	0.19 U	0.4 U	0.2 U	0.2 U	0.2 U	**0.42**
PCB 1242	0.02 U	0.024 U	0.021 U	**0.23**	**0.13**	0.021 U	NA	0.37 U	0.38 U	0.02 U	0.02 U	2 U	0.02 U
PCB 1248	0.02 U	0.024 U	0.021 U	0.019 U	0.019 U	0.021 U	NA	0.37 U	0.38 U	0.02 U	0.02 U	**16**	0.02 U
PCB 1254	0.02 U	**0.1**	0.021 U	**0.058**	**0.092**	0.021 U	NA	0.37 U	0.38 U	**0.065**	0.02 U	2 U	0.02 U
PCB 1260	0.02 U	0.024 U	0.021 U	0.019 U	0.019 U	0.021 U	NA	0.37 U	0.38 U	0.02 U	0.02 U	2 U	0.02 U
Dioxin (mg/kg)													
Heptachlorodibenzofuran, 1,2,3,4,6,7,8-	**0.0000033 J**	NA	NA	NA	NA	NA	NA	**0.000017 J**	**0.0000091**	NA	NA	NA	NA
Heptachlorodibenzofuran, 1,2,3,4,7,8,9-	0.00000073 U	NA	NA	NA	NA	NA	NA	0.0000018 U	0.0000018 U	NA	NA	NA	NA
Heptachlorodibenzofurans, total	**0.0000089**	NA	NA	NA	NA	NA	NA	**0.000057**	**0.000036**	NA	NA	NA	NA
Heptachlorodibenzo-p-dioxin, 1,2,3,4,6,7,8-	**0.000013**	NA	NA	NA	NA	NA	NA	**0.000084**	**0.00004**	NA	NA	NA	NA
Heptachlorodibenzo-p-dioxins, total	**0.000026**	NA	NA	NA	NA	NA	NA	**0.00015**	**0.000073**	NA	NA	NA	NA
Hexachlorodibenzofuran, 1,2,3,4,7,8-	0.0000006 U	NA	NA	NA	NA	NA	NA	0.0000037 U	0.0000022 U	NA	NA	NA	NA
Hexachlorodibenzofuran, 1,2,3,6,7,8-	0.00000041 U	NA	NA	NA	NA	NA	NA	0.0000011 U	0.00000057 U	NA	NA	NA	NA
Hexachlorodibenzofuran, 2,3,4,6,7,8-	0.00000056 U	NA	NA	NA	NA	NA	NA	0.00000098 U	0.00000042 U	NA	NA	NA	NA
Hexachlorodibenzofurans, total	0.0000018 U	NA	NA	NA	NA	NA	NA	**0.000015**	**0.000013**	NA	NA	NA	NA
Hexachlorodibenzo-p-dioxin, 1,2,3,4,7,8-	0.00000045 U	NA	NA	NA	NA	NA	NA	0.00000084 U	0.00000028 U	NA	NA	NA	NA
Hexachlorodibenzo-p-dioxin, 1,2,3,6,7,8-	0.00000094 U	NA	NA	NA	NA	NA	NA	0.0000035 U	0.0000016 U	NA	NA	NA	NA

TABLE 4-1
Concentrations of Detected Analytes in Surface Soil
Samples Collected During Phase I, Phase II, and Remedial Investigations
Former Lockbourne Air Force Base, Lockbourne, Ohio

Sample ID	**EEGLKB-SS02**	**EEGLKB-SS03**	**EEGLKB-SS04**	**EEGLKB-SS05**	**EEGLKB-SS06**	**EEGLKB-SS07**	**EEGLKB-SS07**	**EEGLKB-SS08**	**EEGLKB-SS08**	**EEGLKB-SS09**	**EEGLKB-SS09**	**EEGLKB-SS10**	**EEGLKB-SS11**
Sample Date	**7/29/2003**	**7/29/2003**	**7/29/2003**	**7/29/2003**	**7/29/2003**	**7/29/2003**	**7/30/2003**	**7/28/2003**	**7/28/2003**	**7/29/2003**	**7/29/2003**	**7/29/2003**	**7/29/2003**
Sample Depth (ft bgs)	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**
Investigation Phase[1]	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**
PARAMETER_NAME							**Resampled**		**Duplicate**		**Duplicate**		
Hexachlorodibenzo-p-dioxin, 1,2,3,7,8,9-	0.000001 U	NA	NA	NA	NA	NA	NA	0.0000031 U	0.0000017 U	NA	NA	NA	NA
Hexachlorodibenzo-p-dioxins, total	0.0000022 U	NA	NA	NA	NA	NA	NA	0.000007 U	**0.0000048**	NA	NA	NA	NA
Octachlorodibenzofuran	**0.00001 J**	NA	NA	NA	NA	NA	NA	0.000024 U	**0.000011 J**	NA	NA	NA	NA
Octachlorodibenzo-p-dioxin	**0.00026 J**	NA	NA	NA	NA	NA	NA	**0.0014**	**0.0008**	NA	NA	NA	NA
Pentachlorodibenzofuran, 1,2,3,7,8-	0.00000032 U	NA	NA	NA	NA	NA	NA	0.00000018 U	0.00000012 U	NA	NA	NA	NA
Pentachlorodibenzofuran, 2,3,4,7,8-	0.0000005 U	NA	NA	NA	NA	NA	NA	0.00000043 U	0.00000043 U	NA	NA	NA	NA
Pentachlorodibenzofurans, total	0.0000014 U	NA	NA	NA	NA	NA	NA	0.0000041 U	**0.0000098**	NA	NA	NA	NA
Pentachlorodibenzo-p-dioxin, 1,2,3,7,8-	0.00000047 U	NA	NA	NA	NA	NA	NA	0.00000041 U	0.00000062 U	NA	NA	NA	NA
Pentachlorodibenzo-p-dioxins, total	0.00000047 U	NA	NA	NA	NA	NA	NA	0.0000017 U	0.00000062 U	NA	NA	NA	NA
TCDD-TEQ	**9.1165E-07**	NA	NA	NA	NA	NA	NA	**2.3362E-06**	**1.6311E-06**	NA	NA	NA	NA
Tetrachlorodibenzofuran, 2,3,7,8-	0.00000075 U	NA	NA	NA	NA	NA	NA	0.00000059 U	0.00000046 U	NA	NA	NA	NA
Tetrachlorodibenzofurans, total	0.00000075 U	NA	NA	NA	NA	NA	NA	0.0000017 U	**0.0000055**	NA	NA	NA	NA
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-	0.00000018 U	NA	NA	NA	NA	NA	NA	0.0000003 U	0.00000052 U	NA	NA	NA	NA
Tetrachlorodibenzo-p-dioxins, total	0.00000029 U	NA	NA	NA	NA	NA	NA	0.0000004 U	0.00000052 U	NA	NA	NA	NA
Explosives (mg/kg)													
Trinitrobenzene, 1,3,5-	**1.6**	NA	NA	NA	NA	NA	NA	2.5 U	2.5 U	NA	NA	NA	NA
Trinitrotoluene, 2,4,6-	0.25 U	NA	NA	NA	NA	NA	NA	2.5 U	**5.3**	NA	NA	NA	NA
Metals (mg/kg)													
Aluminum	**2700**	**7600**	**9100**	**3900**	**3200**	**2100**	NA	**2100 J**	**2300**	**9500 J**	**9900**	**5400**	**8100**
Antimony	5.9 U	35 U	6.1 U	5.3 U	5.5 U	5.7 U	NA	5.2 UJ	5.4 U	5.7 UJ	5.7 U	**1.4 J**	**1.3 J**
Arsenic	**11**	**21**	**14**	**12**	**11**	**13**	NA	**4.6 J**	**5.9**	**13**	**12**	**9.8**	**12**
Barium	**100**	**370**	**100**	**76**	**58**	**33**	NA	**170 J**	**96**	**93 J**	**120**	**98**	**110**
Beryllium	**1.1**	2.8 U	**0.67**	**0.95**	**0.84**	**0.41 J**	NA	**0.72**	**0.74**	**0.52**	**0.53**	**1.3**	**1.2**
Cadmium	0.59 U	3.5 U	**0.39 J**	**0.58**	**0.5 J**	**0.18 J**	NA	**0.17 J**	**0.19 J**	**0.3 J**	**0.44 J**	**1.1**	**2.6**
Calcium	**810**	**250000**	**45000**	**94000**	**130000**	**77000**	NA	**140000 J**	**160000**	**21000 J**	**41000**	**83000**	**43000**
Chromium, total	**12**	**8.3**	**15**	**12**	**11**	**7.1**	NA	**6.4**	**6.8**	**14 J**	**15**	**14**	**18**
Cobalt	**5.1**	**3.8 J**	**7.8**	**4.2**	**3.5**	**2.3**	NA	**2.1**	**2.8**	**8.3 J**	**9.1**	**5**	**7.3**
Copper	**13**	**9.6 J**	**24**	**16**	**13**	**7.8**	NA	**9.7 J**	**12**	**22**	**24**	**26**	**55**
Iron	**21000**	**12000**	**25000**	**18000**	**13000**	**11000**	NA	**9000 J**	**11000**	**23000 J**	**22000**	**17000**	**25000**
Lead	**14**	**9.2 J**	**25**	**34**	**28**	**17**	NA	**9.3**	**12**	**20 J**	**28**	**55**	**150**
Magnesium	**290**	**18000**	**14000**	**17000**	**37000**	**23000**	NA	**14000**	**18000**	**7100 J**	**9500**	**24000**	**11000**
Manganese	**620**	**300**	**310**	**210**	**210**	**150**	NA	**100 J**	**130**	**380 J**	**380**	**240**	**290**
Mercury	**0.09**	**0.0099**	**0.021**	**0.023**	**0.017**	**0.034**	NA	**0.013 J**	**0.012**	**0.04**	**0.043**	**0.16**	**0.21**
Nickel	**6.2**	**11**	**26**	**12**	**12**	**7.4**	NA	**8.4**	**9.7**	**23 J**	**23**	**14**	**21**
Potassium	**520**	**880**	**1500**	**800**	**800**	**700**	NA	**710 J**	**780**	**1200 J**	**1400**	**1200**	**1400**
Selenium	**3.5**	10 U	**0.6 J**	**1.1 J**	**1.5 J**	**2**	NA	**0.9 J**	**0.9 J**	1.7 U	**0.5 J**	**0.7 J**	**0.7 J**
Silver	1.2 U	6.9 U	1.2 U	1.1 U	1.1 U	1.1 U	NA	1 U	1.1 U	1.1 UJ	1.1 U	**0.4 J**	**1.4**
Sodium	**220 J**	1800 U	**140 J**	**220 J**	**240 J**	**140 J**	NA	**190 J**	**220 J**	**110 J**	300 U	**110 J**	**270 J**
Thallium	**2.8 J**	17 U	**1.9 J**	**2 J**	**1.6 J**	**1.3 J**	NA	**1 J**	**1.4 J**	**1.8 J**	**1.7 J**	**1.7 J**	**2.2 J**
Vanadium	**24**	**14**	**26**	**17**	**17**	**12**	NA	**14**	**14**	**25 J**	**28**	**24**	**28**
Zinc	**18**	**27 J**	**88**	**87**	**48**	**21**	NA	**14 J**	**17**	**71 J**	**71**	**85**	**240**

TABLE 4-1

Concentrations of Detected Analytes in Surface Soil

Samples Collected During Phase I, Phase II, and Remedial Investigations

Former Lockbourne Air Force Base, Lockbourne, Ohio

Sample ID	**EEGLKB-SS12**	**EEGLKB-SS13**	**EEGLKB-SS14**	**EEGLKB-SS15**	**EEGLKB-SS16**	**EEGLKB-SS17**	**EEGLKB-SS18**	**EEGLKB-SS19**	**EEGLKB-SS20**	**EEGLKB-SS20**	**EEGLKB-SS21**	**EEGLKB-SS22**	**EEGLKB-SS23**	**EEGLKB-SS24**
Sample Date	**7/29/2003**	**7/29/2003**	**7/29/2003**	**7/29/2003**	**7/28/2003**	**7/28/2003**	**7/28/2003**	**7/28/2003**	**7/28/2003**	**7/28/2003**	**7/28/2003**	**7/28/2003**	**7/28/2003**	**7/28/2003**
Sample Depth (ft bgs)	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**
Investigation Phase[1]	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**
PARAMETER_NAME										**Duplicate**				
Volatile Organic Compound (mg/kg)														
Acetone	**0.067**	0.027 U	**0.27 J**	0.021 U	**0.077 J**	**4.4**	**34**	0.02 U	**3.2 J**	**2.4**	**1.2**	**40**	**0.13**	**0.018 J**
Dichloropropene, 1,3-, trans-	0.0051 U	0.0068 U	0.0053 U	0.0051 U	0.005 U	0.0054 U	0.006 U	0.005 U	0.005 R	0.0052 U	0.0063 U	0.0072 U	0.0062 U	0.0068 U
Methylene chloride	0.01 U	0.014 U	0.011 U	0.01 U	0.0099 U	0.011 U	0.012 U	0.01 U	0.01 R	0.01 U	0.013 U	0.014 U	0.012 U	0.014 U
Toluene	0.0051 U	0.0068 U	**0.0013 J**	0.0051 U	0.005 U	0.0054 U	0.006 U	0.005 U	0.005 R	0.0052 U	0.0063 U	0.0072 U	0.0062 U	0.0068 U
Trichlorofluoromethane	**0.0013 J**	**0.0015 J**	**0.0021 J**	**0.00091 J**	**0.0028 J**	0.0054 U	0.006 U	**0.0043 J**	0.0028 R	0.0052 U	0.0063 U	**0.0049 J**	0.0062 U	**0.0053 J**
Semi-Volatile Organic Compound (mg/kg)														
Acenaphthene	**0.019 J**	0.043 U	0.038 U	0.039 U	**23**	0.041 U	0.043 U	0.04 U	0.039 UJ	0.039 U	**0.014 J**	**0.013 J**	0.044 U	**0.016 J**
Acenaphthylene	**0.013 J**	0.043 U	0.038 U	0.039 U	**1.2**	0.041 U	0.043 U	0.04 U	0.039 UJ	0.039 U	0.042 U	0.044 U	0.044 U	0.045 U
Anthracene	**0.079 J**	**0.029 J**	**0.021 J**	0.039 U	**43 J**	0.041 U	0.043 U	0.04 U	0.039 UJ	0.039 U	**0.045 J**	**0.033 J**	0.044 U	**0.038 J**
Benz(a)anthracene	**0.48**	**0.11**	**0.05**	0.039 U	**200**	0.041 U	**0.088**	**0.016 J**	**0.012 J**	**0.019 J**	**0.17**	**0.13**	0.044 U	**0.28**
Benzo(a)pyrene	**0.47**	**0.12**	**0.044**	0.039 U	**160 J**	0.041 U	**0.096 J**	**0.016 J**	**0.012 J**	**0.023 J**	**0.17 J**	**0.13 J**	0.044 U	**0.32 J**
Benzo(b)fluoranthene	**0.51**	**0.15**	**0.052**	**0.012 J**	**140**	**0.021 J**	**0.12**	**0.038 J**	**0.03 J**	**0.038 J**	**0.16**	**0.14**	**0.022 J**	**0.34**
Benzo(ghi)perylene	**0.16 J**	**0.051 J**	**0.031 J**	0.039 U	**43 J**	0.041 U	**0.081 J**	**0.022 J**	**0.024 J**	**0.023 J**	**0.11 J**	**0.063 J**	**0.016 J**	**0.15 J**
Benzo(k)fluoranthene	**0.56 J**	**0.14 J**	**0.051 J**	**0.016 J**	**150 J**	**0.023 J**	**0.1 J**	**0.028 J**	**0.023 J**	**0.032 J**	**0.18 J**	**0.14 J**	**0.022 J**	**0.32 J**
Benzoic acid	**0.62 J**	0.88 U	0.77 U	0.78 U	18 U	0.82 U	0.86 U	0.82 U	0.8 R	0.79 U	**1.1**	0.89 U	0.89 U	**0.81 J**
Bis(2-ethylhexyl) phthalate	**0.54**	0.22 U	**0.11 J**	0.19 U	4.4 U	0.21 U	0.22 U	0.2 U	0.2 UJ	0.2 U	0.21 U	0.22 U	0.22 U	0.23 U
Carbazole	**0.06 J**	0.22 U	0.19 U	0.19 U	**14**	0.21 U	0.22 U	0.2 U	0.2 UJ	0.2 U	0.21 U	0.22 U	0.22 U	0.23 U
Chrysene	**0.48 J**	**0.16 J**	**0.073 J**	**0.018 J**	**190**	**0.025 J**	**0.13**	**0.038 J**	**0.035 J**	**0.05**	**0.22**	**0.18**	**0.027 J**	**0.35**
Dibenz(ah)anthracene	**0.048**	0.043 U	0.038 U	0.039 U	**27**	0.041 U	**0.019 J**	0.04 U	0.039 UJ	0.039 U	**0.044**	**0.013 J**	0.044 U	**0.054**
Dibenzofuran	**0.034 J**	0.088 U	0.077 U	0.078 U	**17**	0.082 U	0.086 U	0.082 U	0.08 UJ	0.079 U	**0.07 J**	**0.053 J**	0.089 U	0.092 U
Di-n-butyl phthalate	0.19 U	0.22 U	0.19 U	0.19 U	4.4 U	0.21 U	0.22 U	0.2 U	0.2 UJ	0.2 U	0.21 U	0.22 U	0.22 U	0.23 U
Di-n-octyl phthalate	0.37 U	0.43 U	0.38 U	0.39 U	8.8 U	0.41 U	0.43 U	0.4 U	0.39 UJ	0.39 U	0.42 U	0.44 U	0.44 U	0.45 U
Fluoranthene	**1.1 J**	**0.32 J**	**0.13 J**	**0.025 J**	**390 J**	**0.044 J**	**0.25 J**	**0.063 J**	**0.07 J**	**0.062 J**	**0.29**	**0.24 J**	**0.054 J**	**0.66 J**
Fluorene	**0.024 J**	0.043 U	0.038 U	0.039 U	**21**	0.041 U	**0.0043 J**	0.04 U	0.039 UJ	0.039 U	0.042 U	0.044 U	0.044 U	0.045 U
Indeno(1,2,3-cd)pyrene	**0.16**	**0.035 J**	**0.013 J**	0.039 U	**49**	0.041 U	**0.057**	0.04 U	0.039 UJ	0.039 U	**0.081**	**0.044**	0.044 U	**0.15**
Methylnaphthalene, 2-	**0.078**	**0.028 J**	**0.034 J**	0.039 U	**5.2**	0.041 U	0.043 U	0.04 U	0.039 UJ	0.039 U	**0.28**	**0.15**	0.044 U	0.045 U
Methylphenol, 3- and/or 4-	0.074 U	0.088 U	0.077 U	0.078 U	1.8 U	0.082 U	0.086 U	0.082 U	0.08 UJ	0.079 U	0.086 U	0.089 U	0.089 U	0.092 U
Naphthalene	**0.045**	0.043 U	**0.02 J**	0.039 U	**1.6**	0.041 U	0.043 U	0.04 U	0.039 UJ	**0.017 J**	**0.12**	**0.057**	0.044 U	0.045 U
Nitrosodiphenylamine, N-	0.037 U	0.043 U	0.038 U	0.039 U	0.88 U	0.041 U	0.043 U	0.04 U	**0.026 J**	0.039 U	0.042 U	0.044 U	0.044 U	0.045 U
Phenanthrene	**0.53**	**0.16**	**0.11**	0.039 U	**200**	0.041 U	**0.086**	**0.026 J**	**0.025 J**	**0.031 J**	**0.35**	**0.36**	**0.021 J**	**0.18**
Phenol	0.19 U	0.22 U	0.19 U	0.19 U	4.4 U	0.21 U	0.22 U	0.2 U	0.2 UJ	0.2 U	0.21 U	0.22 U	0.22 U	0.23 U
Pyrene	**0.71**	**0.24**	**0.12**	**0.02 J**	**300 J**	0.041 U	**0.21 J**	0.04 U	0.039 UJ	0.039 U	**0.27 J**	**0.22 J**	0.044 U	**0.49 J**
Pesticide/PCB (mg/kg)														
Chlordane, alpha-	**0.16 J**	0.22 U	0.002 U	0.002 U	0.19 U	0.0021 U	0.0022 U	0.0021 U	0.01 U	0.01 U	0.011 U	0.012 U	0.0023 U	0.012 U
Chlordane, gamma-	**0.16 J**	0.22 U	0.002 U	0.002 U	0.19 U	0.0021 U	0.0022 U	0.0021 U	0.01 U	0.01 U	0.011 U	0.012 U	0.0023 U	0.012 U
DDD, p,p'-	0.19 U	0.22 U	**0.039 J**	0.002 U	0.19 U	0.0021 U	0.0022 U	0.0021 U	0.01 U	0.01 U	0.011 U	0.012 U	0.0023 U	0.012 U
DDE, p,p'-	0.19 U	0.22 U	**0.19 J**	0.002 U	0.19 U	0.0021 U	0.0022 U	**0.0072 J**	**0.042 J**	**0.024 J**	**0.17 J**	0.012 U	0.0023 U	0.012 U
DDT, p,p'-	**0.29**	0.22 U	**0.27**	0.002 U	0.19 U	**0.0066 J**	0.0022 U	**0.012 J**	**0.076 J**	**0.058 J**	**0.12 J**	0.012 U	0.0023 U	0.012 U
PCB 1242	0.019 U	0.022 U	0.019 U	0.02 U	0.36 U	0.02 U	0.043 U	0.02 U	0.02 U	0.02 U	0.022 U	0.022 U	0.022 U	0.022 U
PCB 1248	0.019 U	0.022 U	0.019 U	0.02 U	0.36 U	0.02 U	0.043 U	0.02 U	0.02 U	0.02 U	0.022 U	0.022 U	0.022 U	0.022 U
PCB 1254	0.019 U	0.022 U	0.019 U	0.02 U	0.36 U	0.02 U	0.043 U	0.02 U	0.02 U	0.02 U	0.022 U	0.022 U	0.022 U	0.022 U
PCB 1260	0.019 U	0.022 U	0.019 U	0.02 U	0.36 U	0.02 U	**0.26**	**0.0094 J**	0.02 U	0.02 U	0.022 U	0.022 U	0.022 U	**0.0097 J**
Dioxin (mg/kg)														
Heptachlorodibenzofuran, 1,2,3,4,6,7,8-	NA	NA	NA	NA	**0.000034 J**	NA	NA	NA	0.0000022 U	0.0000021 U	NA	NA	NA	NA
Heptachlorodibenzofuran, 1,2,3,4,7,8,9-	NA	NA	NA	NA	0.0000038 U	NA	NA	NA	0.00000048 U	0.0000014 U	NA	NA	NA	NA
Heptachlorodibenzofurans, total	NA	NA	NA	NA	**0.00017**	NA	NA	NA	0.0000022 U	0.0000021 U	NA	NA	NA	NA
Heptachlorodibenzo-p-dioxin, 1,2,3,4,6,7,8-	NA	NA	NA	NA	**0.00077**	NA	NA	NA	**0.000005 J**	**0.0000072**	NA	NA	NA	NA
Heptachlorodibenzo-p-dioxins, total	NA	NA	NA	NA	**0.0015**	NA	NA	NA	**0.000011**	**0.000015**	NA	NA	NA	NA
Hexachlorodibenzofuran, 1,2,3,4,7,8-	NA	NA	NA	NA	0.0000026 U	NA	NA	NA	0.00000031 U	0.0000011 U	NA	NA	NA	NA
Hexachlorodibenzofuran, 1,2,3,6,7,8-	NA	NA	NA	NA	0.00000059 U	NA	NA	NA	0.00000045 U	0.0000011 U	NA	NA	NA	NA
Hexachlorodibenzofuran, 2,3,4,6,7,8-	NA	NA	NA	NA	0.0000003 U	NA	NA	NA	0.00000043 U	0.0000012 U	NA	NA	NA	NA
Hexachlorodibenzofurans, total	NA	NA	NA	NA	0.000015 U	NA	NA	NA	0.0000028 U	0.0000013 U	NA	NA	NA	NA
Hexachlorodibenzo-p-dioxin, 1,2,3,4,7,8-	NA	NA	NA	NA	0.0000017 U	NA	NA	NA	0.00000043 U	0.0000012 U	NA	NA	NA	NA
Hexachlorodibenzo-p-dioxin, 1,2,3,6,7,8-	NA	NA	NA	NA	0.0000077 U	NA	NA	NA	0.00000042 U	0.0000012 U	NA	NA	NA	NA

TABLE 4-1

Concentrations of Detected Analytes in Surface Soil

Samples Collected During Phase I, Phase II, and Remedial Investigations

Former Lockbourne Air Force Base, Lockbourne, Ohio

Sample ID	**EEGLKB-SS12**	**EEGLKB-SS13**	**EEGLKB-SS14**	**EEGLKB-SS15**	**EEGLKB-SS16**	**EEGLKB-SS17**	**EEGLKB-SS18**	**EEGLKB-SS19**	**EEGLKB-SS20**	**EEGLKB-SS20**	**EEGLKB-SS21**	**EEGLKB-SS22**	**EEGLKB-SS23**	**EEGLKB-SS24**
Sample Date	**7/29/2003**	**7/29/2003**	**7/29/2003**	**7/29/2003**	**7/28/2003**	**7/28/2003**	**7/28/2003**	**7/28/2003**	**7/28/2003**	**7/28/2003**	**7/28/2003**	**7/28/2003**	**7/28/2003**	**7/28/2003**
Sample Depth (ft bgs)	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**	**0 - 1**
Investigation Phase[1]	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**
PARAMETER_NAME										**Duplicate**				
Hexachlorodibenzo-p-dioxin, 1,2,3,7,8,9-	NA	NA	NA	NA	0.0000051 U	NA	NA	NA	0.00000041 U	0.0000011 U	NA	NA	NA	NA
Hexachlorodibenzo-p-dioxins, total	NA	NA	NA	NA	**0.000052**	NA	NA	NA	0.0000013 U	0.0000018 U	NA	NA	NA	NA
Octachlorodibenzofuran	NA	NA	NA	NA	**0.00031**	NA	NA	NA	0.0000014 U	0.0000019 U	NA	NA	NA	NA
Octachlorodibenzo-p-dioxin	NA	NA	NA	NA	**0.016**	NA	NA	NA	**0.00042**	**0.00019**	NA	NA	NA	NA
Pentachlorodibenzofuran, 1,2,3,7,8-	NA	NA	NA	NA	0.00000064 U	NA	NA	NA	0.00000045 U	0.0000007 U	NA	NA	NA	NA
Pentachlorodibenzofuran, 2,3,4,7,8-	NA	NA	NA	NA	0.0000005 U	NA	NA	NA	0.00000045 U	0.00000069 U	NA	NA	NA	NA
Pentachlorodibenzofurans, total	NA	NA	NA	NA	0.0000016 U	NA	NA	NA	**0.0000034**	0.0000018 U	NA	NA	NA	NA
Pentachlorodibenzo-p-dioxin, 1,2,3,7,8-	NA	NA	NA	NA	0.0000013 U	NA	NA	NA	0.00000069 U	0.0000011 U	NA	NA	NA	NA
Pentachlorodibenzo-p-dioxins, total	NA	NA	NA	NA	0.0000034 U	NA	NA	NA	0.0000012 U	0.0000011 U	NA	NA	NA	NA
TCDD-TEQ	NA	NA	NA	NA	**1.19615E-05**	NA	NA	NA	**4.62672E-06**	**4.2846E-06**	NA	NA	NA	NA
Tetrachlorodibenzofuran, 2,3,7,8-	NA	NA	NA	NA	0.0000015 U	NA	NA	NA	0.00000027 U	0.00000052 U	NA	NA	NA	NA
Tetrachlorodibenzofurans, total	NA	NA	NA	NA	0.0000015 U	NA	NA	NA	**0.00000082**	**0.0000015**	NA	NA	NA	NA
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-	NA	NA	NA	NA	0.000001 U	NA	NA	NA	**0.0000039**	**0.000003**	NA	NA	NA	NA
Tetrachlorodibenzo-p-dioxins, total	NA	NA	NA	NA	0.000001 U	NA	NA	NA	**0.0000039**	**0.000003**	NA	NA	NA	NA
Explosives (mg/kg)														
Trinitrobenzene, 1,3,5-	NA	NA	NA	NA	2.5 U	NA	NA	NA	0.25 U	0.25 U	NA	NA	NA	NA
Trinitrotoluene, 2,4,6-	NA	NA	NA	NA	**4.2**	NA	NA	NA	0.25 U	0.25 U	NA	NA	NA	NA
Metals (mg/kg)														
Aluminum	**5200**	**6000**	**7500**	**13000**	**2900**	**9500**	**9600**	**9500**	**7500 J**	**6000**	**6000**	**8700**	**11000**	**16000**
Antimony	5.4 U	6.3 U	5.5 U	5.8 U	26 U	5.9 U	6.1 U	5.8 U	5.4 UJ	5.7 U	5.9 U	6.4 U	6.1 U	6.5 U
Arsenic	**11**	**13**	**8.4**	**18**	11 U	**12**	**12**	**13**	**14 J**	**12**	**16**	**12**	**11**	**15**
Barium	**95**	**59**	**120**	**77**	**130**	**86**	**61**	**82**	**82 J**	**67**	**65**	**84**	**120**	**130**
Beryllium	**0.46**	**2.4**	**0.64**	**0.53**	2.1 U	**0.37 J**	**0.42 J**	**0.5**	**0.41 J**	**0.32 J**	**2.4**	**1.2**	**0.52**	**0.75**
Cadmium	**0.43 J**	**0.47 J**	**0.42 J**	0.58 U	2.6 U	0.59 U	**0.17 J**	**0.4 J**	**0.27 J**	**0.22 J**	0.59 U	**0.14 J**	0.61 U	**0.22 J**
Calcium	**89000**	**13000**	**3200**	**1800**	**220000**	**2000**	**43000**	**16000**	**36000 J**	**74000**	**4200**	**24000**	**3100**	**7700**
Chromium, total	**13**	**11**	**8**	**16**	**13**	**12**	**13**	**13**	**12**	**11**	**8.5**	**12**	**13**	**18**
Cobalt	**5.8**	**7.7**	**8.6**	**11**	**3.5 J**	**8.7**	**5.8**	**6.8**	**10**	**6.6**	**5.7**	**5**	**6.5**	**5.8**
Copper	**22**	**25**	**19**	**29**	**8 J**	**20**	**22**	**20**	**23 J**	**19**	**23**	**21**	**17**	**25**
Iron	**17000**	**26000**	**20000**	**31000**	**7000**	**20000**	**20000**	**20000**	**20000 J**	**17000**	**27000**	**20000**	**22000**	**29000**
Lead	**64**	**37**	**20**	**16**	**40**	**95**	**16**	**19**	**19**	**13**	**21**	**17**	**17**	**21**
Magnesium	**23000**	**3900**	**1700**	**1900**	**39000**	**1800**	**11000**	**6900**	**13000**	**32000**	**770**	**7600**	**2000**	**3700**
Manganese	**320**	**180**	**630**	**390**	**280**	**560**	**260**	**430**	**330 J**	**290**	**0.007**	**210**	**670**	**290**
Mercury	**0.044**	**0.13**	**0.11**	**0.033**	**0.012**	**0.047**	**0.043**	**0.034**	**0.018 J**	**0.033**	**0.036**	**0.049**	**0.034**	**0.057**
Nickel	**19**	**19**	**16**	**28**	**10**	**18**	**21**	**19**	**25**	**21**	**13**	**15**	**14**	**21**
Potassium	**1500**	**1700**	**900**	**1800**	**600**	**1000**	**1600**	**1200**	**1700 J**	**1600**	**600**	**1300**	**1000**	**1200**
Selenium	**0.8 J**	**0.8 J**	**0.7 J**	**0.6 J**	7.9 U	1.8 U	1.8 U	1.7 U	1.6 U	1.7 U	**0.6 J**	**0.6 J**	1.8 U	2 U
Silver	1.1 U	**0.51 J**	**190**	1.2 U	5.3 U	1.2 U	1.2 U	1.2 U	1.1 U	1.1 U	**0.64 J**	1.3 U	1.2 U	1.3 U
Sodium	**160 J**	330 U	290 U	300 U	1400 U	**110 J**	**170 J**	**120 J**	**160 J**	**210 J**	**150 J**	**160 J**	320 U	**160 J**
Thallium	**1.5 J**	**2.1 J**	**2.2 J**	**2.5 J**	13 U	**1.9 J**	**1.8 J**	**2.1 J**	**2.1 J**	**1.5 J**	**2.2 J**	**2.2 J**	**2.2 J**	**2.1 J**
Vanadium	**26**	**28**	**19**	**33**	**12**	**24**	**26**	**25**	**20**	**19**	**22**	**25**	**28**	**36**
Zinc	**83**	**62**	**69**	**110**	**31**	**73**	**67**	**67**	**76 J**	**63**	**48**	**59**	**56**	**80**

TABLE 4-1
Concentrations of Detected Analytes in Surface Soil
Samples Collected During Phase I, Phase II, and Remedial Investigations
Former Lockbourne Air Force Base, Lockbourne, Ohio

Notes:

1. Investigation phase indicates in which phase the samples were collected
   - Phase I - Samples collected during Phase I Site Investigation (LAW, 1995).
   - Phase II - Samples collected during Phase II Site Investigation (Program Management Company, 2000)
   - RI - Samples collected as part of the Remedial Investigation field investigation conducted by Ellis Environmental.
2. TCDD-TEQ is a calculated number used for risk assessment purposes

Legend:

NA - not analyzed
Bold - Indicates analyte detected
A - Concentration exceeds the instrument calibration range
a - Concentration is below the reporting limit
B - Organics: The constituent was detected in associated field or laboratory blank samples
Inorganics: Reported value is less than the contract required detection limit but above the instrument detection limit
C - Confirmed by gas chromatography / mass spectrometry (GC/MS)
CON - Confirmation analysis for dioxins / furans
D or I - The original sample was diluted and re-analyzed because detected concentrations were outside the instrument detection range
E - Organics:The reported concentration exceeds the calibration range of the GC/MS instrument
Inorganics:The value is estimated due to matrix interferences
H - Possibly biased high based upon QC data (Phase I SI)
Alternate peak selection upon analytical review (RI)
J - While the identity of the constituent is positive, the reported concentration is estimated
L - Possibly biased low or a false negative based upon QC data
M - Result was manually integrated
N - Spiked sample recovery not within control limits
PR - Value is underestimated due to the presence of poorly resolved GC peaks
Q - Quantitative interference in sample (Phase II SI)
Detected below the practical quantitation limit (Phase I SI)
R - Data rejected based upon QC data
U - The constituent was not detected above RLs
* - Batch QC exceeds the upper or lower control limits

TABLE 4-2

RI Surface Soil Locations and Rationale

Former Lockbourne Air Force Base, Lockbourne, Ohio

Sample ID	Northing Y	Easting X	Reason For Sample Location
EEGLKB-SS01	659605.48	1838360.97	Lime sludge area
EEGLKB-SS02	659898.27	1838487.33	Burn area
EEGLKB-SS03	659492.46	1838695.95	Stressed vegetation area
EEGLKB-SS04	659461.11	1838890.88	Stressed vegetation area
EEGLKB-SS05	659520.90	1839070.67	Stressed vegetation area
EEGLKB-SS06	659702.99	1839079.40	Stressed vegetation, burn area
EEGLKB-SS07	659936.39	1838947.94	Stressed vegetation, burn area
EEGLKB-SS08	659580.90	1839211.44	Stressed vegetation, burn area
EEGLKB-SS09	659398.77	1839210.52	Stressed vegetation area
EEGLKB-SS10	658893.85	1839012.85	Stressed vegetation area
EEGLKB-SS11	658761.84	1839105.82	Stressed vegetation area
EEGLKB-SS12	658417.22	1839221.12	Stressed vegetation area
EEGLKB-SS13	658152.28	1839586.56	Landfill debris
EEGLKB-SS14	658961.38	1839660.91	Measured distance from transmitter building parking lot corner
EEGLKB-SS15	659384.72	1839983.01	Stressed vegetation area
EEGLKB-SS16	658776.45	1840214.05	Stressed vegetation area
EEGLKB-SS17	658543.10	1840337.73	Stressed vegetation area
EEGLKB-SS18	657915.45	1840396.99	Landfill debris
EEGLKB-SS19	658218.09	1840578.01	Suspected area from previous investigation
EEGLKB-SS20	660168.16	1841134.09	Burn area
EEGLKB-SS21	659736.69	1840413.99	Suspected area from previous investigation
EEGLKB-SS22	660091.89	1840205.09	Suspected area from previous investigation
EEGLKB-SS23	660277.54	1839511.52	Suspected area from previous investigation
EEGLKB-SS24	659984.75	1839385.18	Stressed vegetation area

TABLE 4-3

Concentrations of Detected Analytes in Subsurface Soil

Samples Collected During Phase I, Phase II, and Remedial Investigations

Former Lockbourne Air Force Base, Lockbourne, Ohic

Sample ID	**LCKSO-1**	**LCKSO-2**	**LCKSO-3**	**LCKSO-3**	**LCKSO-4**	**LCKSO-4**	**LCKSO-5**	**LCKSO-6**	**LCKSO-6**	**LCKSO-7**	**LCKSO-7**	**LCKSO-8**
Sample Date	**5/24/1995**	**5/24/1995**	**5/25/1995**	**5/25/1995**	**5/24/1995**	**5/25/1995**	**5/24/1995**	**5/23/1995**	**5/23/1995**	**5/23/1995**	**5/23/1995**	**5/23/1995**
Sample Depth (ft BGS)	**2 - 3**	**2 - 3**	**2 - 3**	**2 - 3**	**2 - 3**	**2 - 3**	**2 - 3**	**2 - 3**	**2 - 3**	**2 - 3**	**2 - 3**	**2 - 3**
Investigation Phase[1]	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**
Volatile Organic Compounds (mg/kg)				**Duplicate**		**Resampled**			**Resampled**		**Resampled**	
Acetone	0.012 U	0.012 U	NA	**0.016 JB**	NA	**0.013 JB**	**0.017 JB**	NA	**0.18**	NA	0.014 U	NA
Dichloroethenes, 1,2-, total	0.006 U	0.006 U	NA	0.006 U	NA	0.006 U	0.007 U	NA	0.044 U	NA	0.007 U	NA
Dichloropropene, 1,3-, trans-	0.006 U	0.006 U	0.007 U	0.006 U	NA	0.006 U	**0.005 JQ**	NA	0.044 U	NA	0.007 U	NA
Ethylbenzene	0.006 U	0.006 U	0.007 U	0.006 U	NA	0.006 U	0.007 U	NA	**0.026 JH**	NA	0.007 U	NA
Methyl ethyl ketone	0.012 U	0.012 U	0.014 U	0.013 U	NA	0.013 U	0.014 U	NA	0.088 U	NA	0.014 U	NA
Methylene chloride	**0.016 JB**	**0.023 JB**	NA	**0.012**	NA	**0.019 JB**	**0.005 JB**	NA	**0.16**	NA	**0.037 JB**	NA
Toluene	0.006 U	0.006 U	0.007 U	0.006 U	NA	0.006 U	0.007 U	NA	**0.014 JH**	NA	**0.005 JH**	NA
Trichloroethene	0.006 U	0.006 U	0.007 U	0.006 U	NA	0.006 U	0.007 U	NA	0.044 U	NA	0.007 U	NA
Trichlorofluoromethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl chloride	0.012 U	0.012 U	0.014 U	0.013 U	NA	0.013 U	0.014 U	NA	0.088 U	NA	0.014 U	NA
Xylenes, total	0.006 U	0.006 U	0.007 U	0.006 U	NA	0.006 U	0.007 U	NA	**0.033 JH**	NA	0.007 U	NA
Semi-Volatile Organic Compound (mg/kg)												
Acenaphthene	**0.13 JQ**	0.38 U	0.44 U	0.44 U	NA	0.41 U	0.42 U	3.5 U	NA	0.43 U	NA	**0.082 JQ**
Anthracene	**0.43**	0.38 U	0.44 U	0.44 U	NA	0.41 U	0.42 U	3.5 U	NA	0.43 U	NA	**0.1 JQ**
Benz(a)anthracene	**0.94**	**0.14 JQ**	0.44 U	0.44 U	NA	0.41 U	0.42 U	3.5 U	NA	**0.11 JQ**	NA	**0.33 JQ**
Benzo(a)pyrene	**0.95**	**0.13 JQ**	0.44 U	0.44 U	NA	0.41 U	0.42 U	3.5 U	NA	**0.11 JQ**	NA	**0.26 JQ**
Benzo(b)fluoranthene	**0.85**	**0.13 JQ**	0.44 U	0.44 U	NA	0.41 U	0.42 U	3.5 U	NA	**0.092 JQ**	NA	**0.25 JQ**
Benzo(ghi)perylene	**0.45**	**0.066 JQ**	0.44 U	0.44 U	NA	0.41 U	0.42 U	3.5 U	NA	**0.076 JQ**	NA	**0.18 JQ**
Benzo(k)fluoranthene	**1.1**	**0.14 JQ**	0.44 U	0.44 U	NA	0.41 U	0.42 U	3.5 U	NA	**0.1 JQ**	NA	**0.27 JQ**
Bis(2-ethylhexyl) phthalate	0.4 U	0.38 U	0.44 U	0.44 U	NA	0.41 U	0.42 U	**3 JQ**	NA	0.43 U	NA	**1.4**
Butylbenzyl phthalate	0.4 U	0.38 U	0.44 U	0.44 U	NA	0.41 U	0.42 U	**0.73 JQ**	NA	0.43 U	NA	0.44 U
Carbazole	**0.3 JQ**	0.38 U	0.44 U	0.44 U	NA	0.41 U	0.42 U	3.5 U	NA	0.43 U	NA	**0.076 JQ**
Chrysene	**0.94**	**0.14 JQ**	0.44 U	0.44 U	NA	0.41 U	0.42 U	3.5 U	NA	**0.12 JQ**	NA	**0.38 JQ**
Dibenz(ah)anthracene	**0.19 JQ**	0.38 U	0.44 U	0.44 U	NA	0.41 U	0.42 U	3.5 U	NA	0.43 U	NA	0.44 U
Dibenzofuran	**0.072 JQ**	0.38 U	0.44 U	0.44 U	NA	0.41 U	0.42 U	3.5 U	NA	0.43 U	NA	0.44 U
Diethyl phthalate	0.4 U	0.38 U	0.44 U	0.44 U	NA	0.41 U	0.42 U	**1.3 JQ**	NA	0.43 U	NA	0.44 U
Di-n-butyl phthalate	0.4 U	0.38 U	**0.051 JB**	**0.056 JB**	NA	**0.049 JB**	0.42 U	**2.6 JQ**	NA	0.43 U	NA	0.44 U
Fluoranthene	**2.1**	**0.28 JQ**	0.44 U	0.44 U	NA	0.41 U	0.42 U	3.5 U	NA	**0.21 JQ**	NA	**0.89**
Fluorene	**0.16 JQ**	0.38 U	0.44 U	0.44 U	NA	0.41 U	0.42 U	3.5 U	NA	0.43 U	NA	**0.071 JQ**
Indeno(1,2,3-cd)pyrene	**0.48**	**0.068 JQ**	0.44 U	0.44 U	NA	0.41 U	0.42 U	3.5 U	NA	**0.066 JQ**	NA	**0.17 JQ**
Methylnaphthalene, 2-	0.4 U	0.38 U	0.44 U	0.44 U	NA	0.41 U	0.42 U	**0.86**	NA	0.43 U	NA	0.44 U
Naphthalene	0.4 U	0.38 U	0.44 U	0.44 U	NA	0.41 U	0.42 U	**2 JQ**	NA	0.43 U	NA	0.44 U
Phenanthrene	**1.7**	**0.086 JQ**	0.44 U	0.44 U	NA	0.41 U	0.42 U	**0.35 JQ**	NA	**0.12 JQ**	NA	**0.58**
Pyrene	**1.8**	**0.25 JQ**	0.44 U	0.44 U	NA	0.41 U	0.42 U	3.5 U	NA	**0.19 JQ**	NA	**0.81**
Trichlorobenzene, 1,2,4-	0.4 U	0.38 U	0.44 U	0.44 U	NA	0.41 U	0.42 U	**2.1**	NA	0.43 U	NA	0.44 U
Pesticides/PCBs (mg/kg)												
Chlordane, alpha-	0.002 U	0.0019 U	0.0022 U	0.0022 U	NA	0.002 U	0.0021 U	0.012 U	NA	0.0022 U	NA	0.002 U
DDD, p,p'-	0.004 U	0.0039 U	0.0044 U	0.0043 U	NA	0.004 U	0.0043 U	0.023 U	NA	0.0044 U	NA	**0.029 J**
DDE, p,p'-	0.004 U	0.0039 U	0.0044 U	0.0043 U	NA	0.004 U	0.0043 U	0.023 U	NA	0.0044 U	NA	**0**
DDT, p,p'-	0.004 U	0.0039 U	0.0044 U	0.0043 U	NA	0.004 U	0.0043 U	0.023 U	NA	**0.011**	NA	0.018 U
PCB 1254	0.04 U	0.039 U	0.044 U	0.043 U	NA	0.04 U	0.043 U	0.23 U	NA	0.044 U	NA	**0.81 J**

TABLE 4-3
Concentrations of Detected Analytes in Subsurface Soil
Samples Collected During Phase I, Phase II, and Remedial Investigations
Former Lockbourne Air Force Base, Lockbourne, Ohic

Sample ID	**LCKSO-1**	**LCKSO-2**	**LCKSO-3**	**LCKSO-3**	**LCKSO-4**	**LCKSO-4**	**LCKSO-5**	**LCKSO-6**	**LCKSO-6**	**LCKSO-7**	**LCKSO-7**	**LCKSO-8**
Sample Date	**5/24/1995**	**5/24/1995**	**5/25/1995**	**5/25/1995**	**5/24/1995**	**5/25/1995**	**5/24/1995**	**5/23/1995**	**5/23/1995**	**5/23/1995**	**5/23/1995**	**5/23/1995**
Sample Depth (ft BGS)	**2 - 3**	**2 - 3**	**2 - 3**	**2 - 3**	**2 - 3**	**2 - 3**	**2 - 3**	**2 - 3**	**2 - 3**	**2 - 3**	**2 - 3**	**2 - 3**
Investigation Phase[1]	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**
Dioxins/Furans (mg/kg)												
Heptachlorodibenzofuran, 1,2,3,4,6,7,8-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlorodibenzofuran, 1,2,3,4,7,8,9-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlorodibenzofurans, total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlorodibenzo-p-dioxin, 1,2,3,4,6,7,8-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlorodibenzo-p-dioxins, total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorodibenzofuran, 1,2,3,4,7,8-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorodibenzofuran, 1,2,3,6,7,8-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorodibenzofuran, 1,2,3,7,8,9-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorodibenzofuran, 2,3,4,6,7,8-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorodibenzofurans, total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorodibenzo-p-dioxin, 1,2,3,4,7,8-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorodibenzo-p-dioxin, 1,2,3,6,7,8-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorodibenzo-p-dioxin, 1,2,3,7,8,9-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorodibenzo-p-dioxins, total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Octachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Octachlorodibenzo-p-dioxin	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorodibenzofuran, 1,2,3,7,8-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorodibenzofuran, 2,3,4,7,8-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorodibenzofurans, total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorodibenzo-p-dioxin, 1,2,3,7,8-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorodibenzo-p-dioxins, total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TCDD-TEQ	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachlorodibenzofuran, 2,3,7,8-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachlorodibenzofurans, total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachlorodibenzo-p-dioxins, total	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals (mg/kg)												
Aluminum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	**5.9**	**9.8**	**25.1**	**17.2**	**12.5**	NA	**5.1**	**5.1**	NA	**10.8**	NA	**11.9**
Barium	**61.9**	**67.2**	**66.6**	**66.9**	**60.8**	NA	**139**	**39.1**	NA	**136**	NA	**51.4**
Beryllium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	0.59 U	0.58 U	0.46 U	**0.67**	0.43 U	NA	**0.65**	**4**	NA	0.46 U	NA	0.47 U
Calcium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium, total	**7.2**	**11.7**	**12.9**	**12.1**	**10.8**	NA	**17.6**	**35.5**	NA	**6.4**	NA	**11.3**
Cobalt	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	**15.9**	**10.8**	**15**	**23.5**	**13**	NA	**24.7**	**54.6**	NA	**10.3**	NA	**25.9**
Magnesium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	0.12 U	0.12 U	0.066 U	0.066 U	0.061 U	NA	0.13 U	**0.79**	NA	0.07 U	NA	0.07 U
Nickel	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	0.59 U	0.58 U	**0.54**	**0.41**	**0.27**	NA	0.64 U	0.21 U	NA	**0.63**	NA	**0.62**
Sodium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	**41.4**	**72.1**	**95.1**	**86.9**	**71.7**	NA	**125**	**1650**	NA	**136**	NA	**60.3**

TABLE 4-3
Concentrations of Detected Analytes in Subsurface Soil
Samples Collected During Phase I, Phase II, and Remedial Investigations
Former Lockbourne Air Force Base, Lockbourne, Ohio

Sample ID	**LCKSO-8**	**LCKSO-8**	**LCKSO-8**	**LCKSO-9**	**LCK-SO10**	**LCKSO-11**	**LCK-SO12**	**LCKSO-12**	**LCK-SO12**	**LCKSO-1**	**LCKSO-6**	**LCKSO-7**
Sample Date	**5/23/1995**	**5/23/1995**	**5/23/1995**	**5/24/1995**	**5/24/1995**	**5/25/1995**	**5/25/1995**	**5/25/1995**	**5/25/1995**	**7/28/1997**	**7/24/1997**	**7/28/1997**
Sample Depth (ft BGS)	**2 - 3**	**2 - 3**	**2 - 3**	**2 - 3**	**2 - 3**	**2 - 3**	**2 - 3**	**2 - 3**	**2 - 3**	**2 - 3**	**2 - 3**	**2 - 3**
Investigation Phase[1]	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase II**	**Phase II**	**Phase II**
Volatile Organic Compounds (mg/kg)	**Resampled**	**Duplicate**	**Duplicate-Resampled**					**Resampled**	**Duplicate**			
Acetone	**0.025**	NA	0.012 U	0.012 U	0.012 U	**0.024 JB**	0.013 U	NA	**0.011 JB**	NA	NA	NA
Dichloroethenes, 1,2-, total	0.006 U	NA	0.006 U	0.006 U	0.006 U	0.006 U	0.006 U	NA	0.006 U	NA	NA	NA
Dichloropropene, 1,3-, trans-	0.006 U	NA	0.006 U	0.006 U	0.006 U	0.006 U	0.006 U	NA	0.006 U	NA	NA	NA
Ethylbenzene	NA	NA	0.006 U	0.006 U	0.006 U	0.006 U	0.006 U	NA	0.006 U	NA	NA	NA
Methyl ethyl ketone	0.013 U	NA	0.012 U	0.012 U	0.012 U	0.013 U	0.013 U	NA	0.013 U	NA	NA	NA
Methylene chloride	**0.021 JB**	NA	**0.018 JB**	**0.003 JB**	**0.007 JB**	**0.019 JB**	**0.021 JB**	NA	**0.014 JB**	NA	NA	NA
Toluene	NA	NA	0.006 U	0.006 U	**0.003 JQ**	0.006 U	0.006 U	NA	**0.002 JQ**	NA	NA	NA
Trichloroethene	0.006 U	NA	0.006 U	0.006 U	0.006 U	0.006 U	0.006 U	NA	0.006 U	NA	NA	NA
Trichlorofluoromethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl chloride	0.013 U	NA	0.012 U	0.012 U	0.012 U	0.013 U	0.013 U	NA	0.013 U	NA	NA	NA
Xylenes, total	NA	NA	0.006 U	0.006 U	0.006 U	0.006 U	0.006 U	NA	0.006 U	NA	NA	NA
Semi-Volatile Organic Compound (mg/kg)												
Acenaphthene	NA	0.39 U	NA	**0.11 JQ**	0.4 U	0.41 U	NA	0.42 U	0.44 U	NA	NA	NA
Anthracene	NA	0.39 U	NA	**0.39**	**0.056 JQ**	0.41 U	NA	0.42 U	0.44 U	NA	NA	NA
Benz(a)anthracene	NA	0.39 U	NA	**1.7**	**0.13 JQ**	0.41 U	NA	0.42 U	0.44 U	NA	NA	NA
Benzo(a)pyrene	NA	0.39 U	NA	**1.9**	**0.14 JQ**	0.41 U	NA	0.42 U	0.44 U	NA	NA	NA
Benzo(b)fluoranthene	NA	0.39 U	NA	**1.8**	**0.11 JQ**	0.41 U	NA	0.42 U	0.44 U	NA	NA	NA
Benzo(ghi)perylene	NA	0.39 U	NA	**1.2**	0.4 U	0.41 U	NA	0.42 U	0.44 U	NA	NA	NA
Benzo(k)fluoranthene	NA	0.39 U	NA	**1.8**	**0.11 JQ**	0.41 U	NA	0.42 U	0.44 U	NA	NA	NA
Bis(2-ethylhexyl) phthalate	NA	**0.45**	NA	**0.047 JQ**	0.4 U	0.41 U	NA	0.42 U	0.44 U	NA	NA	NA
Butylbenzyl phthalate	NA	0.39 U	NA	0.39 U	0.4 U	0.41 U	NA	0.42 U	0.44 U	NA	NA	NA
Carbazole	NA	0.39 U	NA	**0.23 JQ**	0.4 U	0.41 U	NA	0.42 U	0.44 U	NA	NA	NA
Chrysene	NA	**0.04 JQ**	NA	**2.1**	**0.17 JQ**	0.41 U	NA	0.42 U	0.44 U	NA	NA	NA
Dibenz(ah)anthracene	NA	0.39 U	NA	**0.42**	0.4 U	0.41 U	NA	0.42 U	0.44 U	NA	NA	NA
Dibenzofuran	NA	0.39 U	NA	**0.085 JQ**	0.4 U	0.41 U	NA	0.42 U	0.44 U	NA	NA	NA
Diethyl phthalate	NA	0.39 U	NA	0.39 U	0.4 U	0.41 U	NA	0.42 U	0.44 U	NA	NA	NA
Di-n-butyl phthalate	NA	0.39 U	NA	0.39 U	0.4 U	**0.079 JB**	NA	**0.15 JB**	**0.049 JB**	NA	NA	NA
Fluoranthene	NA	**0.14 JQ**	NA	**3.4**	**0.28 JQ**	0.41 U	NA	0.42 U	0.44 U	NA	NA	NA
Fluorene	NA	0.39 U	NA	**0.15 JQ**	0.4 U	0.41 U	NA	0.42 U	0.44 U	NA	NA	NA
Indeno(1,2,3-cd)pyrene	NA	0.39 U	NA	**1.2**	0.4 U	0.41 U	NA	0.42 U	0.44 U	NA	NA	NA
Methylnaphthalene, 2-	NA	0.39 U	NA	0.39 U	0.4 U	0.41 U	NA	0.42 U	0.44 U	NA	NA	NA
Naphthalene	NA	0.39 U	NA	0.39 U	0.4 U	0.41 U	NA	0.42 U	0.44 U	NA	NA	NA
Phenanthrene	NA	**0.11 J**	NA	**2**	**0.25 JQ**	0.41 U	NA	0.42 U	0.44 U	NA	NA	NA
Pyrene	NA	**0.12 J**	NA	**3.1**	**0.31 JQ**	0.41 U	NA	0.42 U	0.44 U	NA	NA	NA
Trichlorobenzene, 1,2,4-	NA	0.39 U	NA	0.39 U	0.4 U	0.41 U	NA	0.42 U	0.44 U	NA	NA	NA
Pesticides/PCBs (mg/kg)												
Chlordane, alpha-	NA	0.002 U	NA	0.0039 U	0.0041 U	0.0021 U	0.002 U	NA	0.0022 U	NA	NA	NA
DDD, p,p'-	NA	**0.0059 J**	NA	**0.013**	0.0082 U	0.0042 U	0.004 U	NA	0.0045 U	NA	NA	NA
DDE, p,p'-	NA	0.004 U	NA	**0.023**	0.0082 U	0.0042 U	0.004 U	NA	0.0045 U	NA	NA	NA
DDT, p,p'-	NA	0.004 U	NA	**0.015**	0.0082 U	0.0042 U	0.004 U	NA	0.0045 U	NA	NA	NA
PCB 1254	NA	0.04 U	NA	0.079 U	0.082 U	0.042 U	0.04 U	NA	0.045 U	NA	NA	NA

TABLE 4-3
Concentrations of Detected Analytes in Subsurface Soil
Samples Collected During Phase I, Phase II, and Remedial Investigations
Former Lockbourne Air Force Base, Lockbourne, Ohic

Sample ID	**LCKSO-8**	**LCKSO-8**	**LCKSO-8**	**LCKSO-9**	**LCK-SO10**	**LCKSO-11**	**LCK-SO12**	**LCKSO-12**	**LCK-SO12**	**LCKSO-1**	**LCKSO-6**	**LCKSO-7**
Sample Date	**5/23/1995**	**5/23/1995**	**5/23/1995**	**5/24/1995**	**5/24/1995**	**5/25/1995**	**5/25/1995**	**5/25/1995**	**5/25/1995**	**7/28/1997**	**7/24/1997**	**7/28/1997**
Sample Depth (ft BGS)	**2 - 3**	**2 - 3**	**2 - 3**	**2 - 3**	**2 - 3**	**2 - 3**	**2 - 3**	**2 - 3**	**2 - 3**	**2 - 3**	**2 - 3**	**2 - 3**
Investigation Phase[1]	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase II**	**Phase II**	**Phase II**
Dioxins/Furans (mg/kg)												
Heptachlorodibenzofuran, 1,2,3,4,6,7,8-	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.0000037 J**	**0.0000494**	**0.000317**
Heptachlorodibenzofuran, 1,2,3,4,7,8,9-	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0000011 U	**0.0000044**	**0.0000152**
Heptachlorodibenzofurans, total	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.0000148 J**	**0.000211 E**	**0.00135**
Heptachlorodibenzo-p-dioxin, 1,2,3,4,6,7,8-	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.000065**	**0.000385**	**0.00124**
Heptachlorodibenzo-p-dioxins, total	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.000163**	**0.000808**	**0.0021**
Hexachlorodibenzofuran, 1,2,3,4,7,8-	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.0000019 EJ**	**0.0000026 PR**	**0.0000253 J**
Hexachlorodibenzofuran, 1,2,3,6,7,8-	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0000005 U	**0.0000008**	**0.0000077**
Hexachlorodibenzofuran, 1,2,3,7,8,9-	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0000007 U	**0.0000011**	**0.0000025**
Hexachlorodibenzofuran, 2,3,4,6,7,8-	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.00000092 PR**	**0.0000031 BPR**	**0.0000105 PR**
Hexachlorodibenzofurans, total	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.000008 E**	**0.0000783**	**0.000319**
Hexachlorodibenzo-p-dioxin, 1,2,3,4,7,8-	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.000001**	0.0000021 U	**0.000036**
Hexachlorodibenzo-p-dioxin, 1,2,3,6,7,8-	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.0000017**	**0.0000242**	**0.000118**
Hexachlorodibenzo-p-dioxin, 1,2,3,7,8,9-	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.0000023 PR**	**0.0000057 PR**	**0.0000646 PR**
Hexachlorodibenzo-p-dioxins, total	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.0000217**	**0.00011**	**0.000553**
Octachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.000011**	**0.000145**	**0.00131**
Octachlorodibenzo-p-dioxin	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.00341**	**0.00634**	**0.01079**
Pentachlorodibenzofuran, 1,2,3,7,8-	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0000004 U	0.0000009 U	**0.0000076**
Pentachlorodibenzofuran, 2,3,4,7,8-	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0000004 U	**0.0000014**	**0.0000078**
Pentachlorodibenzofurans, total	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.0000046 E**	**0.00001 E**	**0.000111**
Pentachlorodibenzo-p-dioxin, 1,2,3,7,8-	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0000007 U	**0.00000048 J**	**0.0000158**
Pentachlorodibenzo-p-dioxins, total	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.0000012 J**	**0.0000113 J**	**0.0000698**
TCDD-TEQ	NA	NA	NA	NA	NA	NA	NA	NA	NA	**2.6746E-06**	**1.4954E-05**	**6.6022E-05**
Tetrachlorodibenzofuran, 2,3,7,8-	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.00000088 B**	**0.0000163**	**0.0000055**
Tetrachlorodibenzofurans, total	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.000004 BE**	**0.0000259**	**0.0000957 Q**
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0000005 U	**0.0000019**	**0.000002**
Tetrachlorodibenzo-p-dioxins, total	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.0000011 J**	**0.0000078**	**0.0000486**
Metals (mg/kg)												
Aluminum	NA	NA	NA	NA	NA	NA	NA	NA	NA	**8200**	**26000**	**11000**
Arsenic	NA	**9.2**	NA	**6.7**	**6.4**	**1.8**	**4.6**	NA	**6.7**	**10.2 J**	**14.6 J**	**7.29 J**
Barium	NA	**58.4**	NA	**131**	**51.5**	**105**	**69.5**	NA	**149**	**88**	**130**	**56**
Beryllium	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.728**	1.4 U	**3.32**
Cadmium	NA	0.42 U	NA	**6.3**	0.61 U	0.45 U	0.44 U	NA	0.47 U	0.59 U	1.4 U	0.56 U
Calcium	NA	NA	NA	NA	NA	NA	NA	NA	NA	**2400**	**33000**	**4300**
Chromium, total	NA	**11.8**	NA	**16.5**	**12.1**	**15.9**	**10.2**	NA	**17**	**11**	**19 J**	**8.1**
Cobalt	NA	NA	NA	NA	NA	NA	NA	NA	NA	**12**	**7.7 J**	**3.9**
Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA	**15**	**51**	**18**
Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA	**17000**	**38000**	**11000**
Lead	NA	**26**	NA	**34.3**	**16.7**	**13.3**	**10.3**	NA	**28.6**	**22.5**	**29.4 J**	**8.29**
Magnesium	NA	NA	NA	NA	NA	NA	NA	NA	NA	**1400**	**14000**	**660**
Manganese	NA	NA	NA	NA	NA	NA	NA	NA	NA	**900**	**480**	**74**
Mercury	NA	**0.26**	NA	0.12 U	0.12 U	0.064 U	0.062 U	NA	0.067 U	0.12 U	0.14 U	0.11 U
Nickel	NA	NA	NA	NA	NA	NA	NA	NA	NA	**14**	**32 J**	**10**
Potassium	NA	NA	NA	NA	NA	NA	NA	NA	NA	**2000**	**2600**	**1200**
Selenium	NA	**0.31**	NA	0.59 U	0.61 U	0.15 U	0.15 U	NA	0.16 U	0.59 U	0.7 U	**1.5**
Sodium	NA	NA	NA	NA	NA	NA	NA	NA	NA	120 U	**980**	110 U
Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.59 U	1.4 U	0.56 U
Vanadium	NA	NA	NA	NA	NA	NA	NA	NA	NA	**25**	**28**	**31**
Zinc	NA	**101**	NA	**98.6**	**61.7**	**68.3**	**70.4**	NA	**86.7**	**53**	**630**	**100**

TABLE 4-3
Concentrations of Detected Analytes in Subsurface Soil
Samples Collected During Phase I, Phase II, and Remedial Investigations
Former Lockbourne Air Force Base, Lockbourne, Ohio

Sample ID	**LCKSO-8**	**LCKSB-8**	**LCKSB-9**	**LCKSB-10**	**LCKSB-11**	**LCKSB-12**	**LCKSB-13**	**LCKSB-14**	**LCKMW-15**	**LCKMW-15**	**LCKMW-16**	**LCKMW-16**
Sample Date	**7/28/1997**	**7/17/1997**	**7/16/1997**	**7/21/1997**	**7/21/1997**	**7/25/1997**	**7/24/1997**	**7/30/1997**	**8/5/2003**	**8/5/2003**	**8/6/2003**	**8/6/2003**
Sample Depth (ft BGS)	**2 - 3**	**2 - 4**	**2 - 4**	**2 - 4**	**2 - 4**	**8 - 10**	**8 - 10**	**2 - 4**	**4 - 6**	**4 - 6**	**8 - 10**	**8 - 10**
Investigation Phase^1	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**RI**	**RI**	**RI**	**RI**
Volatile Organic Compounds (mg/kg)		**Resampled**								**Resampled**		**Resampled**
Acetone	NA	0.012 U	0.012 U	0.012 U	0.011 U	**11 EJ**	**1.7**	0.01 U	NA	**0.047**	NA	0.021 U
Dichloroethenes, 1,2-, total	NA	0.0061 U	0.0061 U	0.0058 U	0.0057 U	**0.014**	0.031 U	0.0052 U	NA	NA	NA	NA
Dichloropropene, 1,3-, trans-	NA	0.0061 U	0.0061 U	0.0058 U	0.0057 U	0.0061 U	0.031 U	0.0052 U	NA	0.005 U	NA	0.0052 U
Ethylbenzene	NA	0.0061 U	0.0061 U	0.0058 U	0.0057 U	0.0061 U	0.031 U	0.0052 U	NA	0.005 U	NA	0.0052 U
Methyl ethyl ketone	NA	0.012 U	0.012 U	0.012 U	0.011 U	**0.007 J**	0.062 U	0.01 U	NA	0.02 U	NA	0.021 U
Methylene chloride	NA	**0.0084**	**0.012**	**0.01**	**0.0072**	0.0061 U	0.031 U	0.0052 U	NA	0.01 U	NA	0.01 U
Toluene	NA	0.0061 U	0.0061 U	0.0058 U	0.0057 U	0.0061 U	0.031 U	0.0052 U	NA	0.005 U	NA	0.0052 U
Trichloroethene	NA	0.0061 U	0.0061 U	0.0058 U	0.0057 U	**0.017**	0.031 U	0.0052 U	NA	0.005 U	NA	0.0052 U
Trichlorofluoromethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.005 U	NA	**0.0013 J**
Vinyl chloride	NA	0.0061 U	0.0061 U	0.0058 U	0.0057 U	**0.0098**	0.031 U	0.0052 U	NA	0.005 U	NA	0.0052 U
Xylenes, total	NA	0.0061 U	0.0061 U	0.0058 U	0.0057 U	0.0061 U	0.031 U	0.0052 U	NA	NA	NA	NA
Semi-Volatile Organic Compound (mg/kg)												
Acenaphthene	NA	0.41 U	0.41 U	0.38 U	0.38 U	1.6 U	21 U	0.35 U	0.037 U	NA	0.039 U	NA
Anthracene	NA	0.41 U	0.41 U	0.38 U	0.38 U	**1.1 J**	21 U	0.35 U	0.037 U	NA	0.039 U	NA
Benz(a)anthracene	NA	0.41 U	0.41 U	0.38 U	0.38 U	**3.9**	21 U	0.35 U	0.037 U	NA	0.039 U	NA
Benzo(a)pyrene	NA	0.41 U	0.41 U	0.38 U	0.38 U	**1.2 J**	21 U	0.35 U	0.037 U	NA	**0.056**	NA
Benzo(b)fluoranthene	NA	0.41 U	0.41 U	0.38 U	0.38 U	**4.6**	21 U	0.35 U	0.037 U	NA	**0.092**	NA
Benzo(ghi)perylene	NA	0.41 U	0.41 U	0.38 U	0.38 U	1.6 U	21 U	0.35 U	0.037 U	NA	**0.051 J**	NA
Benzo(k)fluoranthene	NA	0.41 U	0.41 U	0.38 U	0.38 U	**1.4 J**	21 U	0.35 U	0.037 U	NA	**0.081 J**	NA
Bis(2-ethylhexyl) phthalate	NA	0.41 U	0.41 U	0.38 U	0.38 U	1.6 U	21 U	0.35 U	0.19 U	NA	0.2 U	NA
Butylbenzyl phthalate	NA	0.41 U	0.41 U	0.38 U	0.38 U	1.6 U	21 U	0.35 U	0.075 U	NA	0.079 U	NA
Carbazole	NA	0.41 U	0.41 U	0.38 U	0.38 U	1.6 U	21 U	0.35 U	0.19 U	NA	0.2 U	NA
Chrysene	NA	0.41 U	0.41 U	0.38 U	0.38 U	**3.5**	21 U	0.35 U	0.037 U	NA	**0.11 J**	NA
Dibenz(ah)anthracene	NA	0.41 U	0.41 U	0.38 U	0.38 U	1.6 U	21 U	0.35 U	0.037 U	NA	0.039 U	NA
Dibenzofuran	NA	0.41 U	0.41 U	0.38 U	0.38 U	1.6 U	21 U	0.35 U	0.075 U	NA	0.079 U	NA
Diethyl phthalate	NA	0.41 U	0.41 U	0.38 U	0.38 U	1.6 U	21 U	0.35 U	0.075 U	NA	0.079 U	NA
Di-n-butyl phthalate	NA	0.41 U	0.41 U	0.38 U	0.38 U	1.6 U	21 U	0.35 U	0.19 U	NA	0.2 U	NA
Fluoranthene	NA	0.41 U	0.41 U	0.38 U	0.38 U	**9.5**	**10 J**	0.35 U	0.037 U	NA	**0.15 J**	NA
Fluorene	NA	0.41 U	0.41 U	0.38 U	0.38 U	1.6 U	21 U	0.35 U	0.037 U	NA	0.039 U	NA
Indeno(1,2,3-cd)pyrene	NA	0.41 U	0.41 U	0.38 U	0.38 U	**1.2 J**	21 U	0.35 U	0.037 U	NA	0.039 U	NA
Methylnaphthalene, 2-	NA	0.41 U	0.41 U	0.38 U	0.38 U	1.6 U	21 U	0.35 U	0.037 U	NA	0.039 U	NA
Naphthalene	NA	0.41 U	0.41 U	0.38 U	0.38 U	1.6 U	21 U	0.35 U	0.037 U	NA	0.039 U	NA
Phenanthrene	NA	0.41 U	0.41 U	0.38 U	0.38 U	**6.2**	21 U	0.35 U	0.037 U	NA	**0.068**	NA
Pyrene	NA	0.41 U	0.41 U	0.38 U	0.38 U	**3.7**	21 U	0.35 U	0.037 U	NA	**0.12**	NA
Trichlorobenzene, 1,2,4-	NA	0.41 U	0.41 U	0.38 U	0.38 U	1.6 U	21 U	0.35 U	0.19 U	NA	0.2 U	NA
Pesticides/PCBs (mg/kg)												
Chlordane, alpha-	NA	NA	NA	NA	NA	NA	NA	NA	0.0019 U	NA	0.002 U	NA
DDD, p,p'-	NA	0.0041 U	0.0041 U	0.0038 U	0.0038 U	0.0041 U	0.0041 U	0.0034 U	0.0019 U	NA	**0.014**	NA
DDE, p,p'-	NA	0.0041 U	0.0041 U	0.0038 U	0.0038 U	0.0041 U	0.0041 U	0.0034 U	0.0019 U	NA	**0.0058**	NA
DDT, p,p'-	NA	0.0041 U	0.0041 U	0.0038 U	0.0038 U	0.0041 U	0.0041 U	0.0034 U	0.0019 U	NA	**0.014**	NA
PCB 1254	NA	0.041 U	0.041 U	0.038 U	0.038 U	0.041 U	0.041 U	0.035 U	0.019 U	NA	0.02 U	NA

TABLE 4-3

Concentrations of Detected Analytes in Subsurface Soil

Samples Collected During Phase I, Phase II, and Remedial Investigations

Former Lockbourne Air Force Base, Lockbourne, Ohio

Sample ID	**LCKSO-8**	**LCKSB-8**	**LCKSB-9**	**LCKSB-10**	**LCKSB-11**	**LCKSB-12**	**LCKSB-13**	**LCKSB-14**	**LCKMW-15**	**LCKMW-15**	**LCKMW-16**	**LCKMW-16**
Sample Date	**7/28/1997**	**7/17/1997**	**7/16/1997**	**7/21/1997**	**7/21/1997**	**7/25/1997**	**7/24/1997**	**7/30/1997**	**8/5/2003**	**8/5/2003**	**8/6/2003**	**8/6/2003**
Sample Depth (ft BGS)	**2 - 3**	**2 - 4**	**2 - 4**	**2 - 4**	**2 - 4**	**8 - 10**	**8 - 10**	**2 - 4**	**4 - 6**	**4 - 6**	**8 - 10**	**8 - 10**
Investigation Phase[1]	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**RI**	**RI**	**RI**	**RI**
Dioxins/Furans (mg/kg)												
Heptachlorodibenzofuran, 1,2,3,4,6,7,8-	**0.0000262**	0.0000003 U	**0.00000046 J**	**0.000002**	0.0000006 U	**0.0000052 J**	**0.0000317**	0.0000005 U	NA	NA	NA	NA
Heptachlorodibenzofuran, 1,2,3,4,7,8,9-	**0.0000031 J**	0.0000004 U	0.0000004 U	0.0000005 U	0.0000008 U	0.0000027 U	**0.000002**	0.0000007 U	NA	NA	NA	NA
Heptachlorodibenzofurans, total	**0.000109**	0.0000004 U	**0.00000046 J**	**0.000002**	0.0000007 U	**0.000009**	**0.000075**	0.0000006 U	NA	NA	NA	NA
Heptachlorodibenzo-p-dioxin, 1,2,3,4,6,7,8-	**0.00019**	**0.00000051 B**	**0.00000021 B**	**0.000005**	**0.00000047 J**	**0.0000621**	**0.000178**	**0.0000841**	NA	NA	NA	NA
Heptachlorodibenzo-p-dioxins, total	**0.000349**	**0.0000011 BJ**	**0.00000051 B**	**0.0000106**	**0.000001 J**	**0.000121**	**0.000357**	**0.000261**	NA	NA	NA	NA
Hexachlorodibenzofuran, 1,2,3,4,7,8-	**0.000005 EJ**	0.0000003 U	0.0000004 U	0.0000005 U	0.0000005 U	0.0000016 U	**0.0000084 EJ**	0.0000004 U	NA	NA	NA	NA
Hexachlorodibenzofuran, 1,2,3,6,7,8-	**0.00000099 J**	0.0000002 U	0.0000003 U	0.0000004 U	0.0000004 U	0.0000012 U	**0.0000025**	0.0000004 U	NA	NA	NA	NA
Hexachlorodibenzofuran, 1,2,3,7,8,9-	0.0000013 U	0.0000003 U	0.0000004 U	0.0000005 U	0.0000006 U	0.0000017 U	0.0000012 U	0.0000005 U	NA	NA	NA	NA
Hexachlorodibenzofuran, 2,3,4,6,7,8-	**0.00000087**	**0.0000004 B**	**0.00000045 B**	0.0000004 U	0.0000005 U	0.0000015 U	**0.0000047 PR**	**0.00000054 B**	NA	NA	NA	NA
Hexachlorodibenzofurans, total	**0.0000217 E**	**0.0000004 B**	**0.00000045 B**	**0.0000024 J**	0.0000005 U	**0.000008**	**0.0000356 E**	**0.00000054 B**	NA	NA	NA	NA
Hexachlorodibenzo-p-dioxin, 1,2,3,4,7,8-	0.0000017 U	0.0000005 U	0.0000004 U	0.0000005 U	0.0000006 U	0.000003 U	**0.000003**	0.0000005 U	NA	NA	NA	NA
Hexachlorodibenzo-p-dioxin, 1,2,3,6,7,8-	**0.0000118**	0.0000004 U	0.0000003 U	**0.00000056**	0.0000005 U	0.0000025 U	**0.0000074**	0.0000004 U	NA	NA	NA	NA
Hexachlorodibenzo-p-dioxin, 1,2,3,7,8,9-	**0.0000051 PR**	**0.00000023 J**	**0.00000036**	0.0000004 U	0.0000005 U	0.0000026 U	**0.0000074 PR**	**0.00000067 J**	NA	NA	NA	NA
Hexachlorodibenzo-p-dioxins, total	**0.0000641**	**0.000001**	**0.00000036**	**0.0000031 B**	**0.0000023 BJ**	**0.0000158**	**0.0000623**	**0.000004 B**	NA	NA	NA	NA
Octachlorodibenzofuran	**0.000089**	0.0000005 U	**0.0000025**	**0.0000031**	0.0000005 U	**0.0000162**	**0.0000346**	0.0000008 U	NA	NA	NA	NA
Octachlorodibenzo-p-dioxin	**0.00214**	**0.000009 B**	**0.0000063 B**	**0.0000563**	**0.0000025 B**	**0.000482**	**0.00161**	**0.00943**	NA	NA	NA	NA
Pentachlorodibenzofuran, 1,2,3,7,8-	0.0000006 U	0.0000004 U	0.0000004 U	0.0000004 U	0.0000005 U	0.0000013 U	**0.0000017**	0.0000004 U	NA	NA	NA	NA
Pentachlorodibenzofuran, 2,3,4,7,8-	0.0000006 U	0.0000004 U	0.0000004 U	0.0000004 U	0.0000005 U	0.0000013 U	**0.0000029 J**	0.0000004 U	NA	NA	NA	NA
Pentachlorodibenzofurans, total	**0.0000051 E**	0.0000004 U	0.0000004 U	**0.0000022**	0.0000005 U	**0.0000101**	**0.0000535**	0.0000004 U	NA	NA	NA	NA
Pentachlorodibenzo-p-dioxin, 1,2,3,7,8-	0.0000011 U	0.0000004 U	0.0000005 U	0.0000008 U	0.0000008 U	0.000002 U	**0.0000017**	0.0000006 U	NA	NA	NA	NA
Pentachlorodibenzo-p-dioxins, total	**0.0000018 J**	0.0000004 U	0.0000005 U	0.0000008 U	0.0000008 U	**0.000002 J**	**0.0000088**	0.0000006 U	NA	NA	NA	NA
TCDD-TEQ	**6.1869E-06**	**6.2753E-07**	**1.3856E-06**	**1.1054E-06**	**2.7495E-06**	**3.5638E-06**	**1.0086E-05**	**2.721E-06**	NA	NA	NA	NA
Tetrachlorodibenzofuran, 2,3,7,8-	**0.0000023 B**	0.0000002 U	0.0000003 U	**0.00000076**	0.0000004 U	0.0000033 U	**0.0000031 B**	**0.0000014 J**	NA	NA	NA	NA
Tetrachlorodibenzofurans, total	**0.0000044**	0.0000002 U	0.0000003 U	**0.00000076**	0.0000004 U	**0.0000036 B**	**0.0000418**	0.0000002 U	NA	NA	NA	NA
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-	0.0000006 U	0.0000003 U	**0.00000083**	0.0000005 U	**0.000002 J**	0.0000012 U	**0.00000086**	0.0000003 U	NA	NA	NA	NA
Tetrachlorodibenzo-p-dioxins, total	**0.0000015**	0.0000003 U	**0.00000083**	**0.0000014 BJ**	**0.000002 J**	**0.0000022 J**	**0.0000121**	0.0000003 U	NA	NA	NA	NA
Metals (mg/kg)												
Aluminum	**6600**	**15000**	**10000**	**6900 J**	**5600**	**4200 J**	**4900 J**	**5000**	**5900**	NA	**7500**	NA
Arsenic	**12.5 J**	**23.9 J**	**25.8 J**	**10.4 J**	**15.7 J**	**13.5 J**	**20.4 J**	**5.8 J**	**13**	NA	**8.6**	NA
Barium	**210**	**79**	**71**	**56 J**	**40**	**53 J**	**70 J**	**65**	**53**	NA	**52**	NA
Beryllium	1.7 U	1 U	1.2 U	0.57 U	1 U	**3.15 J**	**4.43 J**	0.51 U	**0.33 J**	NA	**0.53**	NA
Cadmium	1.7 U	1 U	1.2 U	0.57 U	1 U	0.61 U	**1.07 J**	0.51 U	**0.3 J**	NA	**0.67**	NA
Calcium	**140000**	**2300**	**2500**	**52000 J**	**100000**	**19000 J**	**8700 J**	**1700**	**48000**	NA	**95000**	NA
Chromium, total	**14**	**19 J**	**15 J**	**8.8 J**	**9.3 J**	**10 J**	**13 J**	**7.8**	**5.9**	NA	**6.3**	NA
Cobalt	**5.7**	**12 J**	**17 J**	**7.7 J**	**7.8 J**	**5.2 J**	**6.6 J**	**4**	**7.1**	NA	**6.8**	NA
Copper	**30**	**40**	**41**	18 U	**22**	18 U	**47**	**9**	**23**	NA	**22**	NA
Iron	**17000**	**40000**	**34000**	**16000 J**	**19000**	**11000 J**	**17000 J**	**8400**	**21000**	NA	**16000**	NA
Lead	**38.2**	**16.7 J**	**19.6 J**	**10.8 J**	**9.69 J**	**40.5 J**	**89.2 J**	**8.17**	**8.8**	NA	**18**	NA
Magnesium	**13000**	**3000**	**2500**	**22000 J**	**48000**	**4800 J**	**2300 J**	**980**	**19000**	NA	**23000**	NA
Manganese	**310**	**520**	**760**	**370 J**	**410**	**79 J**	**85 J**	**310**	**420**	NA	**270**	NA
Mercury	0.33 U	0.12 U	0.12 U	0.12 U	0.11 U	0.12 U	**0.3**	0.1 U	**0.013**	NA	**0.024**	NA
Nickel	**16**	**45 J**	**41 J**	**19 J**	**30 J**	**14 J**	**22 J**	**9.3**	**27**	NA	**21**	NA
Potassium	**3300**	**3600**	**2700**	**1700 J**	**2200 J**	**700**	**660**	**1000**	**1700**	NA	**1600**	NA
Selenium	1.7 U	0.6 U	0.62 U	0.58 U	0.58 U	0.6 U	**0.63**	0.52 U	**0.5 J**	NA	**1.9**	NA
Sodium	350 U	240 U	250 U	110 U	230 U	120 U	**1300**	104 U	270 U	NA	310 U	NA
Thallium	1.7 U	1 U	1.2 U	0.57 U	1 U	0.61 U	0.62 U	0.51 U	**2 J**	NA	**1.4 J**	NA
Vanadium	**20**	**38**	**26**	**17 J**	**16**	**25 J**	**25 J**	**13**	**16**	NA	**21**	NA
Zinc	**110**	**100**	**94**	**45 J**	**57**	**47 J**	**1100 J**	**33**	**79**	NA	**75**	NA

TABLE 4-3
Concentrations of Detected Analytes in Subsurface Soil
Samples Collected During Phase I, Phase II, and Remedial Investigations
Former Lockbourne Air Force Base, Lockbourne, Ohio

Notes:

1. Investigation phase indicates in which phase the samples were collected.
    - Phase I - Samples collected during Phase I Site Investigation (LAW, 1995).
    - Phase II - Samples collected during Phase II Site Investigation (Program Management Company, 2000)
    - RI - Samples collected as part of the Remedial Investigation field investigation conducted by Ellis Environmental.
2. TCDD-TEQ is a calculated number used for risk assessment purposes

Legend:

NA - not analyzed
Bold - Indicates analyte detected
A - Concentration exceeds the instrument calibration range
a - Concentration is below the reporting limit
B - Organics: The constituent was detected in associated field or laboratory blank samples
Inorganics: Reported value is less than the contract required detection limit but above the instrument detection limit
C - Confirmed by gas chromatography / mass spectrometry (GC/MS)
CON - Confirmation analysis for dioxins / furans
D or I - The original sample was diluted and re-analyzed because detected concentrations were outside the instrument detection range
DUP - Duplicate
E - Organics:The reported concentration exceeds the calibration range of the GC/MS instrument
Inorganics:The value is estimated due to matrix interferences
H - Possibly biased high based upon QC data (Phase I SI)
Alternate peak selection upon analytical review (RI)
J - While the identity of the constituent is positive, the reported concentration is estimated
L - Possibly biased low or a false negative based upon QC data
M - Result was manually integrated
N - Spiked sample recovery not within control limits
PR - Value is underestimated due to the presence of poorly resolved GC peaks
Q - Quantitative interference in sample (Phase II SI)
Detected below the practical quantitation limit (Phase I SI)
R - Data rejected based upon QC data
RE - Reanalyzed
U - The constituent was not detected above RLs
* - Batch QC exceeds the upper or lower control limits

TABLE 4-4

Concentrations of Detected Analytes in Surface Water

Samples Collected During Phase I, Phase II, and Remedial Investigations

Former Lockbourne Air Force Base, Lockbourne, Ohic

Location	**West Ditch**	**West Ditch**	**West Ditch**	**West Ditch**	**Background**	**East Ditch**	**Background**	**West Ditch**	**West Ditch**	**West Ditch**	**West Ditch**	**West Ditch**	**West Ditch**	**West Ditch**	**West Ditch**
Sample ID	**LCK-SW1**	**LCK-SW2**	**LCK-SW2-RE**	**LCK-SW3**	**LCKSW-1**	**LCKSW-2**	**LCKSW-3**	**LCKSW-4**	**LCKSW-5**	**LCKSW-5 Dup**	**LCKSW-5 Dup**	**EEGLKB-SW01**	**EEGLKB-SW02**	**EEGLKB-SW02**	**EEGLKB-SW03**
Sample Date	**5/26/1995**	**5/26/1995**	**5/26/1995**	**5/26/1995**	**8/25/1997**	**8/25/1997**	**8/25/1997**	**8/25/1997**	**8/25/1997**	**8/25/1997**	**8/25/1997**	**7/30/2003**	**7/31/2003**	**7/31/2003**	**7/31/2003**
Phase	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**RI**	**RI**	**RI**	**RI**
PARAMETER_NAME			**Resampled**							**Duplicate**	**Duplicate**			**Duplicate**	
Volatile Organic Compounds (mg/L)															
Acetone	**0.009 JB**	0.01 U	NA	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 UJ	0.01 U	0.01 U	NA	NA	NA	NA
Carbon disulfide	0.005 U	0.005 U	NA	0.005 U	0.001 U	0.001 U	**0.0016**	0.001 U	0.001 U	0.001 U	0.001 U	NA	NA	NA	NA
Dichloroethenes, 1,2-, total	0.005 U	0.005 U	NA	0.005 U	**0.0013**	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	NA	NA	NA	NA
Methylene chloride	**0.022**	**0.004 JB**	NA	**0.007 JB**	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	NA	NA	NA	NA
Semi-Volatile Organic Compounds (mg/L)															
Benzoic acid	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02 U	**0.02 J**	0.02 U	0.022 R
Bis(2-ethylhexyl) phthalate	0.01 U	NA	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.0051 U	0.0052 U	**0.028 ***	0.0054 U
Diethyl phthalate	**0.004 JQ**	NA	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.002 U	0.0021 U	0.002 U	0.0022 U
Di-n-butyl phthalate	**0.002 JQ**	NA	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.0051 U	0.0052 U	0.0051 U	0.0054 U
Dioxin (mg/L)															
Heptachlorodibenzo-p-dioxin, 1,2,3,4,6,7,8-	NA	NA	NA	NA	7.2E-09 U	NA	**0.000000004 J**	NA	5.8E-09 U	**3.8E-09 J**	**3.7E-09 J**	1.6E-09 U	NA	NA	NA
Heptachlorodibenzo-p-dioxins, total	NA	NA	NA	NA	7.2E-09 U	NA	**0.000000004 J**	NA	5.8E-09 U	**3.8E-09 J**	**0.000000003**	1.6E-09 U	NA	NA	NA
Hexachlorodibenzofuran, 1,2,3,4,7,8-	NA	NA	NA	NA	0.000000004 U	NA	3.3E-09 U	NA	2.8E-09 U	**3.1E-09 J**	1.7E-09 U	7.8E-10 U	NA	NA	NA
Hexachlorodibenzofuran, 2,3,4,6,7,8-	NA	NA	NA	NA	3.9E-09 U	NA	**4.9E-09**	NA	2.8E-09 U	**4.5E-09 J**	**3.8E-09**	8.1E-10 U	NA	NA	NA
Hexachlorodibenzofurans, total	NA	NA	NA	NA	3.7E-09 U	NA	**4.9E-09**	NA	2.7E-09 U	**4.5E-09 J**	**3.8E-09**	0.000000001 U	NA	NA	NA
Hexachlorodibenzo-p-dioxins, total	NA	NA	NA	NA	0.000000007 U	NA	4.9E-09 U	NA	**1.03E-08 J**	**7.2E-09 J**	**7.4E-09**	0.000000001 U	NA	NA	NA
Octachlorodibenzofuran	NA	NA	NA	NA	**1.25E-08 J**	NA	0.000000011 U	NA	8.7E-09 U	7.6E-09 U	4.6E-09 U	2.1E-09 U	NA	NA	NA
Octachlorodibenzo-p-dioxin	NA	NA	NA	NA	**0.000000038 J**	NA	**6.82E-08**	NA	**0.000000042 J**	**5.02E-08 J**	**4.14E-08**	5.9E-09 U	NA	NA	NA
TCDD-TEQ	NA	NA	NA	NA	**6.35005E-09**	NA	**7.21887E-09**	NA	**5.44214E-09**	**5.0264E-09**	**4.14837E-09**	**1.07035E-09**	NA	NA	NA
Tetrachlorodibenzofuran, 2,3,7,8-	NA	NA	NA	NA	**5.8E-09 B**	NA	2.6E-09 U	NA	0.000000002 U	1.7E-09 U	**0.000000007 B**	3.8E-10 U	NA	NA	NA
Tetrachlorodibenzofurans, total	NA	NA	NA	NA	**9.2E-09 BJ**	NA	2.6E-09 U	NA	0.000000002 U	1.7E-09 U	**0.000000007 B**	3.8E-10 U	NA	NA	NA
Metals (mg/L)															
Aluminum	NA	NA	NA	NA	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	**0.17 J**	**0.18 J**	**0.074 J**	**0.071 J**	**0.066 J**	**0.16 J**
Arsenic	**0.005**	0.0018 U	NA	0.0018 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.02 U	0.02 U	0.02 U	0.02 U
Arsenic, dissolved	NA	NA	NA	NA	0.005 U	**0.023 J**	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	NA	NA	NA	NA
Barium	**0.0678**	**0.0541**	NA	**0.0582**	**0.07 J**	**0.08 J**	**0.08 J**	**0.08 J**	**0.08 J**	**0.08 J**	**0.08 J**	**0.068**	**0.078**	**0.074**	**0.081**
Barium, dissolved	NA	NA	NA	NA	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	**0.08**	NA	NA	NA	NA
Calcium	NA	NA	NA	NA	**110 J**	**110 J**	**95 J**	**90 J**	**96 J**	**96 J**	**98 J**	**83**	**93**	**87**	**95**
Calcium, dissolved	NA	NA	NA	NA	**110**	**110**	**97**	**92**	**95**	**95**	**96**	NA	NA	NA	NA
Copper	NA	NA	NA	NA	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	**0.0036 J**	**0.0026 J**	**0.0029 J**	**0.0032 J**
Iron	NA	NA	NA	NA	**0.64 J**	**0.42 J**	**0.29 J**	**0.43 J**	**0.48 J**	**0.71 J**	**0.78 J**	0.35 U	**0.47**	**0.28**	**0.42**
Lead	**0.0523**	**0.0016**	NA	**0.0083 J**	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	0.0075 U	0.0075 U	0.0075 U	0.0075 U
Magnesium	NA	NA	NA	NA	**33 J**	**34 J**	**30 J**	**28 J**	**31 J**	**31 J**	**32 J**	**24**	**27**	**25**	**27**
Magnesium, dissolved	NA	NA	NA	NA	**33**	**34**	**31**	**29**	**31**	**30**	**31**	NA	NA	NA	NA
Manganese	NA	NA	NA	NA	**0.09 J**	**0.03 J**	**0.04 J**	**0.05 J**	**0.03 J**	**0.04 J**	**0.04 J**	**0.028**	**0.024**	**0.022**	**0.063**
Manganese, dissolved	NA	NA	NA	NA	**0.09**	**0.03**	**0.04**	**0.05**	**0.02**	**0.02**	**0.02**	NA	NA	NA	NA
Potassium	NA	NA	NA	NA	5 U	**5.4**	**6.2**	**7.7**	**8.9**	**9.7**	**11**	**4.8**	**5.9**	**5.5**	**5.9**
Potassium, dissolved	NA	NA	NA	NA	5 U	5 U	**5.6**	**7.7**	**7.1**	**7.3**	**7.6**	NA	NA	NA	NA
Selenium	**0.0015**	**0.0012**	NA	0.0012 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 UJ	0.005 U	0.005 U	0.015 U	0.015 U	0.015 U	0.015 U
Sodium	NA	NA	NA	NA	**9.3**	**6.5**	**4**	**6.2**	**6.9**	**7.1**	**7.1**	**6.9**	**9.2**	**8.6**	**9.3**
Sodium, dissolved	NA	NA	NA	NA	**9.3**	**6.6**	**4.2**	**6.4**	**6.8**	**6.9**	**7.1**	NA	NA	NA	NA
Thallium	NA	NA	NA	NA	0.005 U	**0.007**	**0.006**	**0.006**	**0.006**	**0.006**	**0.007**	0.025 U	0.025 U	0.025 U	0.025 U
Thallium, dissolved	NA	NA	NA	NA	0.005 U	**0.008**	**0.005**	**0.005**	**0.006**	0.005 U	0.005 U	NA	NA	NA	NA
Zinc	**0.0919**	**0.0141**	NA	**0.0131**	**0.02 J**	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	**0.024 J**	**0.078**	**0.015 J**	**0.036 J**
Zinc, dissolved	NA	NA	NA	NA	**0.02**	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	NA	NA	NA	NA

TABLE 4-4
Concentrations of Detected Analytes in Surface Water
Samples Collected During Phase I, Phase II, and Remedial Investigations
Former Lockbourne Air Force Base, Lockbourne, Ohio

Notes:

1. Investigation phase indicates in which phase the samples were collected
   - Phase I - Samples collected during Phase I Site Investigation (LAW, 1995).
   - Phase II - Samples collected during Phase II Site Investigation (Program Management Company, 2000)
   - RI - Samples collected as part of the Remedial Investigation field investigation conducted by Ellis Environmental.
2. TCDD-TEQ is a calculated number used for risk assessment purposes

Legend:

NA - not analyzed
Bold - Indicates analyte detected
A - Concentration exceeds the instrument calibration range
a - Concentration is below the reporting limit
B - Organics: The constituent was detected in associated field or laboratory blank samples
Inorganics: Reported value is less than the contract required detection limit but above the instrument detection limit
C - Confirmed by gas chromatography / mass spectrometry (GC/MS)
CON - Confirmation analysis for dioxins / furans
D or I - The original sample was diluted and re-analyzed because detected concentrations were outside the instrument detection range
DUP - Duplicate
E - Organics:The reported concentration exceeds the calibration range of the GC/MS instrument
Inorganics:The value is estimated due to matrix interferences
H - Possibly biased high based upon QC data (Phase I SI)
Alternate peak selection upon analytical review (RI)
J - While the identity of the constituent is positive, the reported concentration is estimated
L - Possibly biased low or a false negative based upon QC data
M - Result was manually integrated
N - Spiked sample recovery not within control limits
PR - Value is underestimated due to the presence of poorly resolved GC peaks
Q - Quantitative interference in sample (Phase II SI)
Detected below the practical quantitation limit (Phase I SI)
R - Data rejected based upon QC data
RE - Reanalyzed
U - The constituent was not detected above MDLs
* - Batch QC exceeds the upper or lower control limits

TABLE 4-5

Concentrations of Detected Analytes in Sediment

Samples Collected During Phase I, Phase II, and Remedial Investigations

Former Lockbourne Air Force Base, Lockbourne, Ohio

Location	**West Ditch**	**West Ditch**	**West Ditch**	**West Ditch**	**West Ditch**	**West Ditch**	**West Ditch**	**Background**	**East Ditch**	**Background**	**West Ditch**	**West Ditch**
Sample ID	**LCK-SE1**	**LCK-SE1-RE**	**LCK-SE2**	**LCK-SE2-RE**	**LCK-SE3**	**LCK-SE3 Dup 1**	**LCK-SE3**	**LCKSD-1**	**LCKSD-2**	**LCKSD-3**	**LCKSD-4**	**LCKSD-5**
Sample Date	**5/26/1995**	**5/26/1995**	**5/26/1995**	**5/26/1995**	**5/26/1995**	**5/26/1995**	**5/26/1995**	**8/25/1997**	**8/25/1997**	**8/25/1997**	**8/25/1997**	**8/25/1997**
Phase	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**Phase II**
PARAMETER_NAME		**Resampled**		**Resampled**		**Resampled**	**Duplicate**					
Volatile Organic Compounds (VOCs) (mg/kg)												
Acetone	NA	**0.019 JB**	NA	**0.004 JB**	NA	**0.033 JB**	**0.005 JB**	**0.012 J**	**0.028**	**0.031**	**0.14**	0.012 U
Carbon disulfide	NA	0.006 U	NA	0.006 U	NA	0.006 U	0.006 U	0.0096 U	**0.0059 J**	**0.0066 J**	0.011 U	0.0059 U
Chloroethane	NA	0.011 U	NA	0.012 U	NA	0.012 U	0.012 U	0.0096 U	0.0062 U	0.0069 U	0.011 U	0.0059 U
Methyl ethyl ketone	NA	0.011 U	NA	0.012 U	NA	0.012 U	0.012 U	0.019 U	**0.0096 J**	**0.012 J**	**0.036**	0.012 U
Methylene chloride	NA	**0.024**	NA	**0.063 JB**	NA	**0.026 JB**	**0.027 JB**	0.0096 U	0.0062 U	0.0069 U	0.011 U	0.0059 U
Toluene	NA	0.006 U	NA	**0.002 JQ**	NA	0.006 U	0.006 U	0.0096 U	0.0062 U	0.0069 U	0.011 U	0.0059 U
Trichlorofluoromethane	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Semi-Volatile Organic Compounds (SVOCs) (mg/kg)												
Acenaphthene	0.4 U	NA	0.39 U	NA	0.4 U	NA	0.39 U	0.64 U	0.41 U	0.46 U	0.73 U	0.39 U
Anthracene	0.4 U	NA	0.39 U	NA	0.4 U	NA	0.39 U	0.64 U	0.41 U	0.46 U	0.73 U	0.39 U
Benz(a)anthracene	**0.063 JQ**	NA	0.39 U	NA	0.4 U	NA	0.39 U	**0.53 J**	0.41 U	0.46 U	0.73 U	0.39 U
Benzo(a)pyrene	**0.17 JQ**	NA	0.39 U	NA	0.4 U	NA	0.39 U	**0.55 J**	0.41 U	0.46 U	0.73 U	0.39 U
Benzo(b)fluoranthene	**0.26 JQ**	NA	0.39 U	NA	0.4 U	NA	0.39 U	**0.77**	0.41 U	**0.36 J**	**0.47 J**	0.39 U
Benzo(ghi)perylene	**0.16 JQ**	NA	0.39 U	NA	0.4 U	NA	0.39 U	0.64 U	0.41 U	0.46 U	0.73 U	0.39 U
Benzo(k)fluoranthene	**0.2 JQ**	NA	0.39 U	NA	0.4 U	NA	0.39 U	0.64 U	0.41 U	0.46 U	0.73 U	0.39 U
Bis(2-ethylhexyl) phthalate	**0.1 JQ**	NA	0.39 U	NA	**0.04 JQ**	NA	0.39 U	0.64 U	0.41 U	0.46 U	0.73 U	0.39 U
Chrysene	**0.2 JQ**	NA	0.39 U	NA	0.4 U	NA	0.39 U	**0.56 J**	0.41 U	**0.29 J**	**0.37 J**	0.39 U
Dibenzofuran	0.4 U	NA	0.39 U	NA	0.4 U	NA	0.39 U	0.64 U	0.41 U	0.46 U	0.73 U	0.39 U
Di-n-butyl phthalate	0.4 U	NA	**0.065 JB**	NA	**0.22 JB**	NA	0.39 U	0.64 U	0.41 U	0.46 U	0.73 U	0.39 U
Fluoranthene	**0.36 JQ**	NA	0.39 U	NA	**0.086 JQ**	NA	**0.062 JQ**	**1.2**	**0.23 J**	**0.53**	**0.71 J**	0.39 U
Fluorene	**0.05 JQ**	NA	0.39 U	NA	0.4 U	NA	0.39 U	0.64 U	0.41 U	0.46 U	0.73 U	0.39 U
Indeno(1,2,3-cd)pyrene	**0.14 JQ**	NA	0.39 U	NA	0.4 U	NA	0.39 U	0.64 U	0.41 U	0.46 U	0.73 U	0.39 U
Methylnaphthalene, 2-	0.4 U	NA	0.39 U	NA	0.4 U	NA	0.39 U	0.64 U	0.41 U	0.46 U	0.73 U	0.39 U
Naphthalene	0.4 U	NA	0.39 U	NA	0.4 U	NA	0.39 U	0.64 U	0.41 U	0.46 U	0.73 U	0.39 U
Phenanthrene	**0.16 JQ**	NA	0.39 U	NA	0.4 U	NA	0.39 U	**0.94**	0.41 U	**0.24 J**	0.73 U	0.39 U
Pyrene	**0.27 JQ**	NA	0.39 U	NA	**0.065 JQ**	NA	**0.049 JQ**	**1.1**	**0.22 J**	**0.42 J**	**0.63 J**	0.39 U
Pesticides/PCBs (mg/kg)												
DDD, p,p'-	**0.012**	NA	0.0038 U	NA	**0.01**	NA	**0.012**	0.0064 U	0.0041 U	0.0046 U	0.0073 U	**0.019**
DDE, p,p'-	0.0039 U	NA	0.0038 U	NA	0.0039 U	NA	0.0039 U	0.0064 U	0.0041 U	0.0046 U	0.0073 U	0.0039 U
DDT, p,p'-	0.0039 U	NA	0.0038 U	NA	**0.0063**	NA	**0.0047**	0.0064 U	0.0041 U	0.0046 U	0.0073 U	**0.0043**
PCB 1260	0.039 U	NA	0.038 U	NA	0.039 U	NA	0.039 U	0.064 U	0.041 U	0.046 U	0.073 U	0.039 U
Dioxin (mg/kg)												
Heptachlorodibenzofuran, 1,2,3,4,6,7,8-	NA	NA	NA	NA	NA	NA	NA	**0.000025**	NA	**0.0000068**	NA	**0.000001 J**
Heptachlorodibenzofuran, 1,2,3,4,7,8,9-	NA	NA	NA	NA	NA	NA	NA	**0.0000028**	NA	0.0000006 U	NA	0.0000012 U
Heptachlorodibenzofurans, total	NA	NA	NA	NA	NA	NA	NA	**0.0000659**	NA	**0.0000068 E**	NA	**0.000001**
Heptachlorodibenzo-p-dioxin, 1,2,3,4,6,7,8-	NA	NA	NA	NA	NA	NA	NA	**0.000115**	NA	**0.0000224**	NA	**0.0000034 J**
Heptachlorodibenzo-p-dioxins, total	NA	NA	NA	NA	NA	NA	NA	**0.000218**	NA	**0.0000453**	NA	**0.0000067 J**
Hexachlorodibenzofuran, 1,2,3,4,7,8-	NA	NA	NA	NA	NA	NA	NA	**0.0000048**	NA	**0.0000025**	NA	0.0000008 U
Hexachlorodibenzofuran, 1,2,3,6,7,8-	NA	NA	NA	NA	NA	NA	NA	**0.0000021**	NA	**0.00000089**	NA	0.0000006 U
Hexachlorodibenzofuran, 2,3,4,6,7,8-	NA	NA	NA	NA	NA	NA	NA	**0.0000032**	NA	**0.0000015 B**	NA	0.0000008 U

TABLE 4-5
Concentrations of Detected Analytes in Sediment
Samples Collected During Phase I, Phase II, and Remedial Investigations
Former Lockbourne Air Force Base, Lockbourne, Ohio

Location	**West Ditch**	**West Ditch**	**West Ditch**	**West Ditch**	**West Ditch**	**West Ditch**	**West Ditch**	**Background**	**East Ditch**	**Background**	**West Ditch**	**West Ditch**
Sample ID	**LCK-SE1**	**LCK-SE1-RE**	**LCK-SE2**	**LCK-SE2-RE**	**LCK-SE3**	**LCK-SE3 Dup 1**	**LCK-SE3**	**LCKSD-1**	**LCKSD-2**	**LCKSD-3**	**LCKSD-4**	**LCKSD-5**
Sample Date	**5/26/1995**	**5/26/1995**	**5/26/1995**	**5/26/1995**	**5/26/1995**	**5/26/1995**	**5/26/1995**	**8/25/1997**	**8/25/1997**	**8/25/1997**	**8/25/1997**	**8/25/1997**
Phase	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase I**	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**Phase II**
PARAMETER_NAME		**Resampled**		**Resampled**		**Resampled**	**Duplicate**					
Dioxin (mg/kg)												
Hexachlorodibenzofurans, total	NA	NA	NA	NA	NA	NA	NA	**0.0000418**	NA	**0.0000135**	NA	**0.00000089 J**
Hexachlorodibenzo-p-dioxin, 1,2,3,4,7,8-	NA	NA	NA	NA	NA	NA	NA	**0.0000033**	NA	**0.00000095**	NA	0.0000013 U
Hexachlorodibenzo-p-dioxin, 1,2,3,6,7,8-	NA	NA	NA	NA	NA	NA	NA	**0.0000061**	NA	**0.0000013**	NA	0.0000011 U
Hexachlorodibenzo-p-dioxin, 1,2,3,7,8,9-	NA	NA	NA	NA	NA	NA	NA	**0.0000056**	NA	**0.0000022**	NA	0.0000012 U
Hexachlorodibenzo-p-dioxins, total	NA	NA	NA	NA	NA	NA	NA	**0.0000449**	NA	**0.0000149**	NA	**0.0000067 J**
Octachlorodibenzofuran	NA	NA	NA	NA	NA	NA	NA	**0.0000515**	NA	**0.0000095**	NA	0.0000021 U
Octachlorodibenzo-p-dioxin	NA	NA	NA	NA	NA	NA	NA	**0.00085**	NA	**0.000179**	NA	**0.0000313**
Pentachlorodibenzofuran, 1,2,3,7,8-	NA	NA	NA	NA	NA	NA	NA	**0.0000012**	NA	**0.00000059**	NA	0.0000007 U
Pentachlorodibenzofuran, 2,3,4,7,8-	NA	NA	NA	NA	NA	NA	NA	**0.0000016**	NA	**0.00000093 B**	NA	0.0000007 U
Pentachlorodibenzofurans, total	NA	NA	NA	NA	NA	NA	NA	**0.000024**	NA	**0.0000086**	NA	**0.0000009 J**
Pentachlorodibenzo-p-dioxin, 1,2,3,7,8-	NA	NA	NA	NA	NA	NA	NA	**0.0000015**	NA	**0.00000082**	NA	0.0000013 U
Pentachlorodibenzo-p-dioxins, total	NA	NA	NA	NA	NA	NA	NA	**0.0000053**	NA	**0.0000035**	NA	**0.0000023 J**
TCDD-TEQ	NA	NA	NA	NA	NA	NA	NA	**8.25315E-06**	NA	**3.59135E-06**	NA	**3.05074E-06**
Tetrachlorodibenzofuran, 2,3,7,8-	NA	NA	NA	NA	NA	NA	NA	**0.0000013 B**	NA	**0.00000079 B**	NA	0.0000004 U
Tetrachlorodibenzofurans, total	NA	NA	NA	NA	NA	NA	NA	**0.0000141**	NA	**0.0000107**	NA	0.0000004 U
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-	NA	NA	NA	NA	NA	NA	NA	**0.0000017**	NA	**0.00000093**	NA	**0.0000018 J**
Tetrachlorodibenzo-p-dioxins, total	NA	NA	NA	NA	NA	NA	NA	**0.0000045**	NA	**0.0000026**	NA	**0.0000018 J**
Metals (mg/kg)												
Aluminum	NA	NA	NA	NA	NA	NA	NA	**8500**	**4400**	**4600**	**5700**	**3200**
Arsenic	**11.3 J**	NA	**14.1**	NA	**3**	NA	**4.2**	**42.8 J**	**10.1 J**	**6.35 J**	**16.8 J**	**9.78 J**
Barium	**12.5**	NA	**30.9**	NA	**17.2**	NA	**14.6**	89 U	24 U	52 U	29 U	29 U
Beryllium	NA	NA	NA	NA	NA	NA	NA	**2.09**	1.2 U	1.3 U	2.2 U	1.2 U
Cadmium	**0.48**	NA	**1.3**	NA	0.42 U	NA	0.42 U	**2.03**	1.2 U	**1.6**	2.2 U	1.2 U
Calcium	NA	NA	NA	NA	NA	NA	NA	**110000**	**130000**	**83000**	**160000**	**88000**
Chromium, total	**5.1**	NA	**5.7**	NA	**3.5**	NA	**4.4**	**40**	**9.6**	**10**	**12**	**6.9 J**
Cobalt	NA	NA	NA	NA	NA	NA	NA	**14**	**6.2**	**6.7**	**16**	**5.6**
Copper	NA	NA	NA	NA	NA	NA	NA	**54**	**18**	**20**	**26**	**13**
Iron	NA	NA	NA	NA	NA	NA	NA	**63000**	**18000**	**16000**	**24000**	**16000**
Lead	**15.1 JL**	NA	**11.4**	NA	**10.3**	NA	**12.8**	**114**	**12.4**	**20.2**	**16.5**	**11.3 J**
Magnesium	NA	NA	NA	NA	NA	NA	NA	**43000**	**46000**	**21000**	**44000**	**24000**
Manganese	NA	NA	NA	NA	NA	NA	NA	**360**	**380**	**380**	**420**	**300 J**
Mercury	0.06 U	NA	0.058 U	NA	0.06 U	NA	0.059 U	0.19 U	0.12 U	0.14 U	0.22 U	0.12 U
Nickel	NA	NA	NA	NA	NA	NA	NA	**47**	**19**	**20**	**36**	**16**
Potassium	NA	NA	NA	NA	NA	NA	NA	1912 U	1300 U	1381 U	2188 U	1177 U
Selenium	**0.27 JL**	NA	0.14 U	NA	0.14 U	NA	0.14 U	**4.03**	**0.704**	0.69 U	1.09 U	0.59 U
Sodium	NA	NA	NA	NA	NA	NA	NA	382 U	250 U	276 U	438 U	235 U
Thallium	NA	NA	NA	NA	NA	NA	NA	3 U	1 U	1 U	2 U	1 U
Vanadium	NA	NA	NA	NA	NA	NA	NA	**42**	**15**	**14**	**21**	**10**
Zinc	NA	NA	NA	NA	NA	NA	NA	**200**	**73**	**82**	**120**	**50 J**

TABLE 4-5

Concentrations of Detected Analytes in Sediment

Samples Collected During Phase I, Phase II, and Remedial Investigations

Former Lockbourne Air Force Base, Lockbourne, Ohio

Location	West Ditch	West Ditch	Background	Background	Background	Background	Background	West Ditch	West Ditch	West Ditch	West Ditch	West Ditch
Sample ID	LCKSD-5 Dup	LCKSD-5 Dup	LCKSD-10	LCKSD-11	LCKSD-11	LCKSD-11	LCKSD-12	EEGLKB-SD01	EEGLKB-SD02	EEGLKB-SD02	EEGLKB-SD03	EEGLKB-SD04
Sample Date	8/25/1997	8/25/1997	11/10/1998	11/10/1998	11/10/1998	11/10/1998	11/10/1998	7/30/2003	7/31/2003	7/31/2003	7/31/2003	7/31/2003
Phase	Phase II	Phase II	Phase II	Phase II	Phase II	Phase II	Phase II	RI	RI	RI	RI	RI
PARAMETER_NAME	Duplicate	Duplicate			Duplicate	Duplicate				Duplicate		
Volatile Organic Compounds (VOCs) (mg/kg)												
Acetone	**0.0099 J**	0.013 U	NA	NA	NA	NA	NA	**0.016 J**	**9.8**	0.1 U	**1.6 J**	**0.043 J**
Carbon disulfide	0.0063 U	0.0063 U	NA	NA	NA	NA	NA	0.011 U	0.097 U	0.1 U	0.0099 U	0.014 U
Chloroethane	0.0063 U	0.0063 U	NA	NA	NA	NA	NA	0.0057 U	0.097 U	0.1 U	0.0049 U	**0.0048 J**
Methyl ethyl ketone	0.013 U	0.013 U	NA	NA	NA	NA	NA	0.023 U	0.097 U	0.1 U	0.02 U	0.028 U
Methylene chloride	0.0063 U	0.0063 U	NA	NA	NA	NA	NA	0.011 U	0.097 U	0.1 U	0.0099 R	0.014 U
Toluene	0.0063 U	0.0063 U	NA	NA	NA	NA	NA	**0.002 J**	0.024 U	0.025 U	0.0049 U	**0.0024 J**
Trichlorofluoromethane	NA	NA	NA	NA	NA	NA	NA	**0.0038 J**	0.097 U	0.1 U	**0.0022 B**	**0.0035 J**
Semi-Volatile Organic Compounds (SVOCs) (mg/kg)												
Acenaphthene	0.42 U	0.42 U	NA	NA	NA	NA	NA	0.043 U	**0.038**	**0.016 J**	**0.028 J**	0.048 U
Anthracene	0.42 U	0.42 U	NA	NA	NA	NA	NA	0.043 U	**0.05 J**	**0.029 J**	**0.047 J**	0.048 U
Benz(a)anthracene	0.42 U	0.42 U	NA	NA	NA	NA	NA	0.043 U	**0.13**	**0.073**	**0.082**	**0.021 J**
Benzo(a)pyrene	0.42 U	0.42 U	NA	NA	NA	NA	NA	0.043 U	**0.1 J**	**0.051 J**	**0.072 J**	**0.029 J**
Benzo(b)fluoranthene	0.42 U	0.42 U	NA	NA	NA	NA	NA	0.043 U	**0.16**	**0.09**	**0.11 J**	**0.035 J**
Benzo(ghi)perylene	0.42 U	0.42 U	NA	NA	NA	NA	NA	0.043 U	**0.055 J**	**0.031 J**	**0.048 J**	**0.036 J**
Benzo(k)fluoranthene	0.42 U	0.42 U	NA	NA	NA	NA	NA	0.043 U	**0.13 J**	**0.076 J**	**0.091 J**	**0.053 J**
Bis(2-ethylhexyl) phthalate	0.42 U	0.42 U	NA	NA	NA	NA	NA	0.22 U	**0.15 J**	**0.15 J**	**0.13 J**	0.24 U
Chrysene	0.42 U	0.42 U	NA	NA	NA	NA	NA	**0.014 J**	**0.21 J**	**0.14 J**	**0.22 J**	**0.052 J**
Dibenzofuran	0.42 U	0.42 U	NA	NA	NA	NA	NA	0.088 U	**0.019 J**	**0.02 J**	0.079 U	0.097 U
Di-n-butyl phthalate	0.42 U	0.42 U	NA	NA	NA	NA	NA	0.22 U	0.18 U	0.2 U	0.2 U	0.24 U
Fluoranthene	0.42 U	0.42 U	NA	NA	NA	NA	NA	**0.024 J**	**0.65 J**	**0.32 J**	**0.57 J**	**0.074**
Fluorene	0.42 U	0.42 U	NA	NA	NA	NA	NA	0.043 U	**0.019 J**	**0.017 J**	0.039 U	0.048 U
Indeno(1,2,3-cd)pyrene	0.42 U	0.42 U	NA	NA	NA	NA	NA	0.043 U	**0.038**	**0.016 J**	**0.028 J**	0.048 U
Methylnaphthalene, 2-	0.42 U	0.42 U	NA	NA	NA	NA	NA	0.043 U	**0.047**	**0.029 J**	**0.048**	0.048 U
Naphthalene	0.42 U	0.42 U	NA	NA	NA	NA	NA	0.043 U	**0.032 J**	0.039 U	0.039 U	0.048 U
Phenanthrene	0.42 U	0.42 U	NA	NA	NA	NA	NA	0.043 U	**0.12**	**0.081**	**0.21**	0.048 U
Pyrene	0.42 U	0.42 U	NA	NA	NA	NA	NA	0.043 U	**0.37**	**0.24**	**0.35 J**	**0.069**
Pesticides/PCBs (mg/kg)												
DDD, p,p'-	**0.021**	**0.0082**	NA	NA	NA	NA	NA	0.011 U	**0.028**	**0.031**	**0.077**	**0.008**
DDE, p,p'-	0.0042 U	0.0042 U	NA	NA	NA	NA	NA	0.011 U	**0.0053**	**0.0068**	**0.0091 J**	0.0025 U
DDT, p,p'-	**0.0044**	0.0042 U	NA	NA	NA	NA	NA	0.011 U	**0.0064**	**0.0062**	**0.019**	**0.0067**
PCB 1260	0.042 U	0.042 U	NA	NA	NA	NA	NA	**0.023**	0.019 U	0.02 U	0.02 UJ	0.024 U
Dioxin (mg/kg)												
Heptachlorodibenzofuran, 1,2,3,4,6,7,8-	**0.00000089 J**	**0.00000084 J**	**0.000107**	**0.0000288**	**0.0000257**	**0.0000236**	0.0000003 U	0.0000017 U	NA	NA	NA	NA
Heptachlorodibenzofuran, 1,2,3,4,7,8,9-	0.0000004 U	0.0000011 U	**0.0000091**	**0.0000135 CJ**	**0.0000019 JC**	0.0000017 U	0.0000004 U	0.00000032 U	NA	NA	NA	NA
Heptachlorodibenzofurans, total	**0.000002 J**	**0.00000084 J**	**0.000216 C**	**0.000085 JC**	**0.0000594 C**	**0.0000535 J**	0.0000004 U	0.0000017 U	NA	NA	NA	NA
Heptachlorodibenzo-p-dioxin, 1,2,3,4,6,7,8-	**0.0000043**	**0.000004**	**0.000429**	**0.000131**	**0.000101**	**0.0001**	**0.0000014 J**	**0.000021**	NA	NA	NA	NA
Heptachlorodibenzo-p-dioxins, total	**0.0000087**	**0.0000076**	**0.000873**	**0.000257**	**0.000199**	**0.000207**	**0.0000032 C**	**0.000046**	NA	NA	NA	NA
Hexachlorodibenzofuran, 1,2,3,4,7,8-	0.0000003 U	0.0000007 U	**0.0000241**	**0.0000055**	**0.0000056**	**0.000005 J**	**0.00000031 BJ**	0.00000094 U	NA	NA	NA	NA
Hexachlorodibenzofuran, 1,2,3,6,7,8-	0.0000002 U	0.0000005 U	**0.0000128 C**	**0.0000034 J**	**0.0000031 J**	**0.000003 J**	0.0000002 U	0.00000049 U	NA	NA	NA	NA
Hexachlorodibenzofuran, 2,3,4,6,7,8-	**0.00000063 B**	0.0000008 U	**0.0000118**	**0.0000035 J**	**0.0000036 J**	**0.0000035 J**	0.0000002 U	0.00000049 U	NA	NA	NA	NA

TABLE 4-5

Concentrations of Detected Analytes in Sediment

Samples Collected During Phase I, Phase II, and Remedial Investigations

Former Lockbourne Air Force Base, Lockbourne, Ohio

Location	West Ditch	West Ditch	Background	Background	Background	Background	Background	West Ditch	West Ditch	West Ditch	West Ditch	West Ditch
Sample ID	LCKSD-5 Dup	LCKSD-5 Dup	LCKSD-10	LCKSD-11	LCKSD-11	LCKSD-11	LCKSD-12	EEGLKB-SD01	EEGLKB-SD02	EEGLKB-SD02	EEGLKB-SD03	EEGLKB-SD04
Sample Date	8/25/1997	8/25/1997	11/10/1998	11/10/1998	11/10/1998	11/10/1998	11/10/1998	7/30/2003	7/31/2003	7/31/2003	7/31/2003	7/31/2003
Phase	Phase II	Phase II	Phase II	Phase II	Phase II	Phase II	Phase II	RI	RI	RI	RI	RI
PARAMETER_NAME	Duplicate	Duplicate			Duplicate	Duplicate				Duplicate		
Dioxin (mg/kg)												
Hexachlorodibenzofurans, total	**0.00000092**	**0.0000009 J**	**0.000193 C**	**0.0000659 JC**	**0.000061**	**0.000055 C**	**0.00000046 CB**	0.0000015 U	NA	NA	NA	NA
Hexachlorodibenzo-p-dioxin, 1,2,3,4,7,8-	0.0000004 U	0.0000013 U	**0.0000097**	**0.0000023 J**	**0.0000021 JC**	**0.0000021 JC**	0.0000003 U	0.0000006 U	NA	NA	NA	NA
Hexachlorodibenzo-p-dioxin, 1,2,3,6,7,8-	0.0000004 U	0.0000011 U	**0.0000256**	**0.0000081 J**	**0.0000064**	**0.0000042 JC**	0.0000003 U	0.000001 U	NA	NA	NA	NA
Hexachlorodibenzo-p-dioxin, 1,2,3,7,8,9-	0.0000004 U	0.0000011 U	**0.0000276**	**0.0000059**	**0.0000067**	**0.0000056**	0.0000003 U	0.0000015 U	NA	NA	NA	NA
Hexachlorodibenzo-p-dioxins, total	**0.0000013 J**	**0.0000011**	**0.000217 C**	**0.0000561 C**	**0.0000491 C**	**0.0000426 C**	**0.00000095 C**	0.0000027 U	NA	NA	NA	NA
Octachlorodibenzofuran	**0.0000015 J**	0.0000022 U	**0.000141**	**0.0000459**	**0.0000408**	**0.0000371**	0.0000005 U	0.0000028 U	NA	NA	NA	NA
Octachlorodibenzo-p-dioxin	**0.0000341**	**0.0000274**	**0.00358**	**0.00173**	**0.00127**	**0.00175**	**0.0000327**	**0.0013**	NA	NA	NA	NA
Pentachlorodibenzofuran, 1,2,3,7,8-	0.0000003 U	0.0000008 U	**0.0000057 C**	**0.0000015 JC**	**0.0000018 J**	**0.0000012 J**	0.0000002 U	0.00000052 U	NA	NA	NA	NA
Pentachlorodibenzofuran, 2,3,4,7,8-	0.0000003 U	0.0000008 U	**0.0000099 C**	**0.0000022 J**	**0.0000021 JC**	**0.000002 JC**	0.0000002 U	0.00000051 U	NA	NA	NA	NA
Pentachlorodibenzofurans, total	**0.0000012 J**	0.0000008 U	**0.000154 C**	**0.0000632 JC**	**0.0000605 C**	**0.0000593 C**	0.0000002 U	0.0000015 U	NA	NA	NA	NA
Pentachlorodibenzo-p-dioxin, 1,2,3,7,8-	0.0000005 U	0.0000016 U	**0.0000064 C**	**0.0000018 J**	**0.0000021 J**	**0.0000015 J**	0.0000002 U	0.00000077 U	NA	NA	NA	NA
Pentachlorodibenzo-p-dioxins, total	0.0000005 U	0.0000016 U	**0.000066 C**	**0.000013 JC**	**0.0000173 C**	**0.0000162 C**	0.0000002 U	0.000001 U	NA	NA	NA	NA
TCDD-TEQ	**4.06296E-06**	**2.92175E-06**	**3.11931E-05**	**8.88559E-06**	**9.20208E-06**	**7.57321E-06**	**1.5348E-06**	**1.45674E-06**	NA	NA	NA	NA
Tetrachlorodibenzofuran, 2,3,7,8-	0.0000002 U	0.0000005 U	**0.0000043**	**0.0000014**	**0.0000014**	**0.0000012**	**0.00000053 J**	0.00000045 U	NA	NA	NA	NA
Tetrachlorodibenzofurans, total	0.0000002 U	0.0000005 U	**0.000118 C**	**0.0000427 C**	**0.0000339 CB**	**0.000036 C**	**0.0000132 B**	**0.00000074**	NA	NA	NA	NA
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-	**0.0000035 J**	**0.0000015**	**0.000002**	**0.0000011**	**0.0000015**	**0.0000011**	**0.0000012**	0.00000058 U	NA	NA	NA	NA
Tetrachlorodibenzo-p-dioxins, total	**0.0000035 J**	**0.0000015**	**0.0000317 C**	**0.0000111 JC**	**0.0000097 C**	**0.0000082 C**	**0.0000031 C**	**0.0000029**	NA	NA	NA	NA
Metals (mg/kg)												
Aluminum	**4200**	**3100**	NA	NA	NA	NA	NA	**8300**	**2700**	**2300**	**3100 J**	**12000**
Arsenic	**11.3 J**	**10.9 J**	NA	NA	NA	NA	NA	**10**	**22**	**16**	**13 J**	**18**
Barium	19 U	17 U	NA	NA	NA	NA	NA	**95**	**16**	**17**	**38 J**	**110**
Beryllium	1.2 U	1.2 U	NA	NA	NA	NA	NA	**0.43 J**	**0.22 J**	**0.16 J**	**0.24 J**	**0.56**
Cadmium	1.2 U	1.2 U	NA	NA	NA	NA	NA	**0.15 J**	**0.44 J**	**0.34 J**	**0.63**	0.67 U
Calcium	**93000**	**110000**	NA	NA	NA	NA	NA	**18000**	**110000**	**100000**	**85000 J**	**11000**
Chromium, total	**8.4**	**7**	NA	NA	NA	NA	NA	**12**	**6.4**	**5**	**6.4**	**16**
Cobalt	**6.3**	**5.1**	NA	NA	NA	NA	NA	**8**	**4.8**	**3.4**	**6.6**	**10**
Copper	**16**	**15**	NA	NA	NA	NA	NA	**20**	**17**	**10**	**23 J**	**24**
Iron	**17000**	**14000**	NA	NA	NA	NA	NA	**20000**	**21000**	**15000**	**14000 J**	**28000**
Lead	**15.6**	**12.5**	NA	NA	NA	NA	NA	**14**	**21**	**18**	**29**	**51**
Magnesium	**31000**	**40000**	NA	NA	NA	NA	NA	**6400**	**30000**	**32000**	**25000**	**6300**
Manganese	**250**	**320**	NA	NA	NA	NA	NA	**410**	**260**	**260**	**240 J**	**200**
Mercury	0.13 U	0.13 U	NA	NA	NA	NA	NA	**0.029**	**0.018**	**0.02**	**0.022**	**0.042**
Nickel	**19**	**15**	NA	NA	NA	NA	NA	**25**	**15**	**10**	**19**	**28**
Potassium	1254 U	1257 U	NA	NA	NA	NA	NA	**1600**	**1100**	**840**	**1300 J**	**2100**
Selenium	0.63 U	0.63 U	NA	NA	NA	NA	NA	1.9 U	**0.5 J**	**0.7 J**	**0.7 J**	2 U
Sodium	250 U	251 U	NA	NA	NA	NA	NA	**180 J**	**200 J**	**200 J**	**230 J**	**200 J**
Thallium	1 U	1 U	NA	NA	NA	NA	NA	**1.9 J**	**1.7 J**	**1.3 J**	**2 J**	**2 J**
Vanadium	**14**	**12**	NA	NA	NA	NA	NA	**23**	**10**	**8.5**	**13**	**29**
Zinc	**58**	**48**	NA	NA	NA	NA	NA	**72**	**58**	**48**	**90 J**	**90**

TABLE 4-5
Concentrations of Detected Analytes in Sediment
Samples Collected During Phase I, Phase II, and Remedial Investigations
Former Lockbourne Air Force Base, Lockbourne, Ohio

Notes:
1. Investigation phase indicates in which phase the samples were collected
   Phase I - Samples collected during Phase I Site Investigation (LAW, 1995).
   Phase II - Samples collected during Phase II Site Investigation (Program Management Company, 2000)
   RI - Samples collected as part of the Remedial Investigation field investigation conducted by Ellis Environmental.
2. TCDD-TEQ is a calculated number used for risk assessment purposes

Legend:
NA - not analyzed
Bold - Indicates analyte detected
A - Concentration exceeds the instrument calibration range
a - Concentration is below the reporting limit
B - Organics: The constituent was detected in associated field or laboratory blank samples
Inorganics: Reported value is less than the contract required detection limit but above the instrument detection limit
C - Confirmed by gas chromatography / mass spectrometry (GC/MS)
CON - Confirmation analysis for dioxins / furans
D or I - The original sample was diluted and re-analyzed because detected concentrations were outside the instrument detection range
DUP - Duplicate
E - Organics:The reported concentration exceeds the calibration range of the GC/MS instrument
Inorganics:The value is estimated due to matrix interferences
H - Possibly biased high based upon QC data (Phase I SI)
Alternate peak selection upon analytical review (RI)
J - While the identity of the constituent is positive, the reported concentration is estimated
L - Possibly biased low or a false negative based upon QC data
M - Result was manually integrated
N - Spiked sample recovery not within control limits
PR - Value is underestimated due to the presence of poorly resolved GC peaks
Q - Quantitative interference in sample (Phase II SI)
Detected below the practical quantitation limit (Phase I SI)
R - Data rejected based upon QC data
RE - Reanalyzed
U - The constituent was not detected above RLs
* - Batch QC exceeds the upper or lower control limits

TABLE 4-6

Concentrations of Detected Analytes in Seep Water

Samples Collected During Phase I, Phase II, and Remedial Investigations

Former Lockbourne Air Force Base, Lockbourne, Ohio

Location	**West Ditch**	**West Ditch**	**West Ditch**	**West Ditch**	**West Ditch**	**West Ditch**	**West Ditch**	**East Ditch**	**West Ditch**
Sample ID	**LCK-SW4**	**LCK-SW5**	**LCK-SW5**	**LCKSP-1**	**LCKSP-1**	**LCKSP-1**	**LCKSP-2**	**LCKSP-3**	**EEGLKB-SP01**
			DUP1		**LCKSP-6 DUP**	**LCKSP-7 DUP**			
Sample Date	**5/26/1995**	**5/26/1995**	**5/26/1995**	**8/26/1997**	**8/26/1997**	**8/26/1997**	**8/26/1997**	**8/26/1997**	**8/7/2003**
Phase	**Phase I**	**Phase I**	**Phase I**	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**Phase II**	**RI**
PARAMETER_NAME			**Duplicate**		**Duplicate**	**Duplicate**			
Volatile Organic Compounds (mg/L)									
Carbon disulfide	0.005 U	0.005 U	0.005 U	0.001 U	**0.016 J**	**0.023**	**0.002**	0.001 U	0.002 U
Dichloroethenes, 1,2-, total	0.005 U	0.005 U	0.005 U	**0.00067 J**	**0.00066 J**	**0.00062 J**	**0.00085 J**	0.001 U	NA
Methylene chloride	**0.003 JB**	**0.004 JB**	**0.002 B**	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.002 U
Trichloroethene	0.005 U	0.005 U	0.005 U	**0.00063 J**	**0.00061 J**	**0.00072 J**	0.001 U	0.001 U	0.001 U
Semi-Volatile Organic Compounds (mg/L)									
Bis(2-ethylhexyl) phthalate	**0.004 JQ**	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.012 U
Diethyl phthalate	0.01 U	**0.003 JQ**	**0.002 Q**	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.0019 U
Di-n-butyl phthalate	0.01 U	**0.002 JQ**	**0.0009 Q**	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.0048 U
Dioxins / Furans (mg/L)									
Octachlorodibenzo-p-dioxin	NA	NA	NA	NA	NA	NA	NA	NA	**0.00000014**
Metals (mg/L)									
Aluminum	NA	NA	NA	**21 J**	**2.7 J**	**1.6 J**	**21 J**	**17 J**	**62**
Arsenic	0.0018 U	**0.0023**	0.0018 U	**0.224 J**	**0.037 J**	**0.05 J**	**0.006**	**0.007**	**0.13**
Arsenic, dissolved	NA	NA	NA	**0.021 J**	0.005 U	**0.021 J**	0.005 U	0.005 U	NA
Barium	**0.0386**	**0.0785**	**0.0499**	**0.29 J**	**0.08 J**	**0.08 J**	**0.33 J**	**0.16 J**	**0.55**
Barium, dissolved	NA	NA	NA	**0.06**	**0.06**	**0.06**	**0.16**	**0.06**	NA
Beryllium	NA	NA	NA	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	**0.0056**
Cadmium	0.0035 U	0.0035 U	0.0035 U	0.005 U	0.005 U	0.005 U	0.005 U	0.005 U	**0.011**
Calcium	NA	NA	NA	**470 J**	**260 J**	**270 J**	**310 J**	**260 J**	**920**
Calcium, dissolved	NA	NA	NA	**250**	**250**	**260**	**140**	**140**	NA
Chromium, total	0.0042 U	**0.0046**	0.0042 U	**0.03 J**	0.01 U	0.01 U	**0.03 J**	**0.03 J**	**0.13**
Cobalt	NA	NA	NA	**0.02 J**	0.01 U	0.01 U	**0.02 J**	**0.02 J**	**0.086**
Copper	NA	NA	NA	**0.08 J**	0.02 U	0.02 U	**0.06 J**	**0.14 J**	**0.29**
Iron	NA	NA	NA	**130 J**	**19 J**	**23 J**	**53 J**	**56 J**	**210**
Iron, dissolved	NA	NA	NA	**10**	**10**	**11**	0.1 U	0.1 U	NA
Lead	0.0015 U	**0.0193 J**	**0.0115 J**	**0.068 J**	0.005 U	0.005 U	**0.021 J**	**0.078 J**	**0.34**
Magnesium	NA	NA	NA	**140 J**	**94 J**	**98 J**	**110 J**	**110 J**	**210**
Magnesium, dissolved	NA	NA	NA	**92**	**93**	**96**	**48**	**60**	NA
Manganese	NA	NA	NA	**1.7 J**	**0.44 J**	**0.44 J**	**0.98 J**	**0.58 J**	**2.8**
Manganese, dissolved	NA	NA	NA	**0.35**	**0.35**	**0.35**	**0.1**	**0.02**	NA
Mercury	0.0001 U	0.0001 U	0.0001 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	**0.00083**
Nickel	NA	NA	NA	**0.05 J**	0.04 U	0.04 U	**0.05 J**	**0.06 J**	**0.24**
Potassium	NA	NA	NA	**38 J**	**26 J**	**30 J**	**28 J**	**15**	**20**
Potassium, dissolved	NA	NA	NA	**27**	**28**	**31**	**19**	**11**	NA
Selenium	0.0012 U	0.0012 U	0.0012 U	0.005 UJ	0.005 U	0.005 U	0.005 U	**0.014**	**0.022**
Silver	0.0035 U	**0.0042**	0.0035 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Sodium	NA	NA	NA	**37**	**36**	**37**	**16**	**9.6**	**5.2**
Sodium, dissolved	NA	NA	NA	**36**	**36**	**38**	**15**	**8.6**	NA
Thallium	NA	NA	NA	0.005 U	0.005 U	**0.008**	**0.008**	**0.007**	**0.019 J**
Thallium, dissolved	NA	NA	NA	**0.006**	**0.006**	**0.008**	**0.013**	**0.011**	NA
Vanadium	NA	NA	NA	**0.05 J**	0.01 U	0.01 U	**0.05 J**	**0.05 J**	**0.17**
Zinc	**0.0052**	**0.0584 J**	**0.0126 J**	**0.26 J**	**0.03 J**	**0.05 J**	**0.21 J**	**0.32 J**	**1.4**

***Representatives of CH2M HILL, Ohio EPA, and USACE agreed at an onsite meeting that the seeps do not exist and will be excluded from the scope of the SI report and from further evaluation in this RI report. Previous seep sampling and analytical resulsts are presented here for reference only.**

Notes:

1. Investigation phase indicates in which phase the samples were collected
    - Phase I - Samples collected during Phase I Site Investigation (LAW, 1995).
    - Phase II - Samples collected during Phase II Site Investigation (Program Management Company, 2000)
    - RI - Samples collected as part of the Remedial Investigation field investigation conducted by Ellis Environmental.
2. TCDD-TEQ is a calculated number used for risk assessment purposes

Legend:

NA - not analyzed
Bold - Indicates analyte detected
A - Concentration exceeds the instrument calibration range
a - Concentration is below the reporting limit
B - Organics: The constituent was detected in associated field or laboratory blank samples
  Inorganics: Reported value is less than the contract required detection limit but above the instrument detection limit
C - Confirmed by gas chromatography / mass spectrometry (GC/MS)
CON - Confirmation analysis for dioxins / furans
D or I - The original sample was diluted and re-analyzed because detected concentrations were outside the instrument detection range
DUP - Duplicate
E - Organics:The reported concentration exceeds the calibration range of the GC/MS instrument
  Inorganics:The value is estimated due to matrix interferences
H - Possibly biased high based upon QC data (Phase I SI)
  Alternate peak selection upon analytical review (RI)
J - While the identity of the constituent is positive, the reported concentration is estimated
L - Possibly biased low or a false negative based upon QC data
M - Result was manually integrated
N - Spiked sample recovery not within control limits
PR - Value is underestimated due to the presence of poorly resolved GC peaks
Q - Quantitative interference in sample (Phase II SI)
  Detected below the practical quantitation limit (Phase I SI)
R - Data rejected based upon QC data
RE - Reanalyzed
U - The constituent was not detected above RLs
* - Batch QC exceeds the upper or lower control limits

TABLE 4-7

Concentrations of Detected Analytes in Groundwater

Samples Collected During Phase I, Phase II, and Remedial Investigations

Former Lockbourne Air Force Base, Lockbourne, Ohio

		IDA	**IDA**	**IDA**	**IDA**	**IDA**	**IDA**	**IDA**	**IDA**	**IDA**	**IDA**	**UWBZ**
		Background	**Background**	**Background**	**Background**	**Background**	**Background**	**Background**	**Background**	**Background**	**Background**	**Background**
		LCKMW-1[3]	**LCKMW-1**	**LCKMW-1**	**LCKMW-1**	**LCKMW-1**	**LCKMW-1**	**LCKMW-1**	**LCKMW-1**	**LCKMW-1**	**LCKMW-1**	**LCKMW-2[3]**
					DUP		**DUP**		**DUP**		**DUP**	
		6/6/1995	**9/24/1997**	**8/11/2003**	**8/11/2003**	**11/14/2003**	**11/14/2003**	**2/23/2004**	**2/23/2004**	**5/18/2004**	**5/18/2004**	**6/6/1995**
PARAMETER_NAME	**MCLs**	**Phase I**	**Phase II**	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**	**Phase I**
Volatile Organic Compounds (mg/L)												
Acetone		0.01 U	0.01 U	0.01 UJ	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Carbon disulfide		0.005 U	**0.00068** J	0.002 UJ	0.002 U	0.002 UJ	0.002 UJ	0.002 U*	0.002 U*	0.002 UJ	0.002 UJ	0.005 U
Methylene chloride		**0.006** JB	0.001 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	**0.002** JB
Toluene	1	0.005 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.005 U
Semi-Volatile Organic Compounds (mg/L)												
Acenaphthylene		0.01 U	0.01 U	0.0011 U	0.0011 U	0.00098 U	0.00099 U	0.001 U	0.001 U	0.001 U	0.00098 U	0.011 U
Benz(a)anthracene		0.01 U	0.01 U	0.00022 U	0.00022 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.011 U
Benzo(a)pyrene	0.0002	0.01 U	0.01 U	0.00022 U	0.00022 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.011 U
Benzo(b)fluoranthene		0.01 U	0.01 U	0.00022 U	0.00022 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	**0.00016** J	0.0002 U	0.011 U
Benzo(ghi)perylene		0.01 U	0.01 U	0.0011 U	0.0011 U	0.00098 U	0.00099 U	0.001 U	0.001 U	0.001 U	0.00098 U	0.011 U
Benzo(k)fluoranthene		0.01 U	0.01 U	0.00022 UJ	0.00022 U	0.0002 UJ	0.0002 UJ	0.0002 UJ	0.0002 UJ	**0.00019** J	0.0002 U	0.011 U
Chrysene		0.01 U	0.01 U	0.00055 U	0.00054 U	0.00049 U	0.0005 U	0.00051 U	0.00051 U	0.00051 U	0.00049 U	0.011 U
Dibenz(ah)anthracene		0.01 U	0.01 U	0.00022 U	0.00022 U	0.0002 U	0.0002 U	**0.00038**	0.0002 U	0.0002 U	0.0002 U	0.011 U
Indeno(1,2,3-cd)pyrene		0.01 U	0.01 U	0.00022 U	0.00022 U	0.0002 U	0.0002 U	**0.00036**	0.0002 U	0.0002 U	0.0002 U	0.011 U
Naphthalene		0.01 U	0.01 U	0.0011 U	0.0011 U	0.00098 U	0.00099 U	0.001 U	0.001 U	0.001 U	0.00098 U	0.011 U
Bis(2-ethylhexyl) phthalate	0.006	0.01 U	0.01 U	0.0055 U	0.0054 U	0.0049 U	0.005 U	0.0051 U	0.0051 U	**0.0051** J	0.0098 U	0.011 U
Butylbenzyl phthalate		0.01 U	0.01 U	0.0022 U	0.0022 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.011 U
Diethyl phthalate		0.01 U	0.01 U	0.0022 U	0.0022 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.011 U
Di-n-octyl phthalate		0.01 U	0.01 U	0.011 U	0.011 U	0.0098 U	0.0099 U	0.01 U	0.01 U	0.01 U	0.0098 U	0.011 U
Phenol		0.01 U	0.01 U	0.0055 UJ	0.0054 U	0.0049 U	0.005 U	0.0051 U	0.0051 U	0.0051 U	0.0049 U	0.011 U
Trichlorobenzene, 1,2,3-		NA	NA	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	NA
Dioxins / Furans (mg/L)												
Dioxins												
Heptachlorodibenzo-p-dioxin, 1,2,3,4,6,7,8-		NA	**2.2E-09** B	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlorodibenzo-p-dioxins, total		NA	**2.2E-09** BJ	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorodibenzo-p-dioxin, 1,2,3,4,7,8-		NA	**1.3E-09** B	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorodibenzo-p-dioxin, 1,2,3,6,7,8-		NA	1.5E-09 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorodibenzo-p-dioxin, 1,2,3,7,8,9-		NA	**0.000000002** B	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorodibenzo-p-dioxins, total		NA	**0.000000002** B	NA	NA	NA	NA	NA	NA	NA	NA	NA
Octachlorodibenzo-p-dioxin		NA	**1.48E-08** B	NA	NA	NA	NA	NA	NA	NA	NA	NA
Octachlorodibenzo-p-dioxin; Dissolved		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorodibenzo-p-dioxin, 1,2,3,7,8-		NA	1.6E-09 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorodibenzo-p-dioxins, total		NA	1.6E-09 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-		NA	1.3E-09 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachlorodibenzo-p-dioxins, total		NA	1.3E-09 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
Furans												
Heptachlorodibenzofuran, 1,2,3,4,6,7,8-		NA	**2.8E-09** B	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlorodibenzofuran, 1,2,3,4,7,8,9-		NA	1.7E-09 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
Heptachlorodibenzofurans, total		NA	**2.8E-09** B	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorodibenzofuran, 1,2,3,4,7,8-		NA	1.3E-09 U	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 4-7

Concentrations of Detected Analytes in Groundwater

Samples Collected During Phase I, Phase II, and Remedial Investigations

Former Lockbourne Air Force Base, Lockbourne, Ohio

		IDA	IDA	IDA	IDA	IDA	IDA	IDA	IDA	IDA	IDA	UWBZ
		Background	Background	Background	Background	Background	Background	Background	Background	Background	Background	Background
		LCKMW-1[3]	LCKMW-1	LCKMW-1	LCKMW-1	LCKMW-1	LCKMW-1	LCKMW-1	LCKMW-1	LCKMW-1	LCKMW-1	LCKMW-2[3]
					DUP		DUP		DUP		DUP	
		6/6/1995	9/24/1997	8/11/2003	8/11/2003	11/14/2003	11/14/2003	2/23/2004	2/23/2004	5/18/2004	5/18/2004	6/6/1995
PARAMETER_NAME	**MCLs**	**Phase I**	**Phase II**	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**	**Phase I**
Hexachlorodibenzofuran, 1,2,3,6,7,8-		NA	**1.5E-09** B	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorodibenzofuran, 1,2,3,7,8,9-		NA	1.4E-09 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorodibenzofuran, 2,3,4,6,7,8-		NA	**4.5E-09** B	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorodibenzofurans, total		NA	**1.5E-09** B	NA	NA	NA	NA	NA	NA	NA	NA	NA
Octachlorodibenzofuran		NA	**8.2E-09** B	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorodibenzofuran, 1,2,3,7,8-		NA	1.2E-09 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorodibenzofuran, 2,3,4,7,8-		NA	1.2E-09 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorodibenzofurans, total		NA	1.2E-09 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachlorodibenzofuran, 2,3,7,8-		NA	**8.4E-09** B	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachlorodibenzofurans, total		NA	**8.4E-09** B	NA	NA	NA	NA	NA	NA	NA	NA	NA
TCDD-TEQ	3E-08	NA	**3.8208E-09**	NA	NA	NA	NA	NA	NA	NA	NA	NA
TCDD-TEQ; Dissolved	3E-08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals (mg/L)												
Aluminum		NA	0.1 U	**0.065** J	**0.064** J	0.2 U	0.2 U	0.039 U	0.034 U	0.2 U	0.029 U	NA
Arsenic	0.01	**0.007**	**0.007**	**0.013** J	**0.012** J	**0.015** J	**0.014** J	**0.01** J	**0.011** J	**0.011** J	**0.012** J	**0.0029**
Arsenic, dissolved	0.01	NA	**0.006**	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium	2	**0.886**	**0.08**	**0.072**	**0.071**	**0.071**	**0.072**	**0.067**	**0.067**	**0.074**	**0.071**	**0.19**
Barium, dissolved	2	NA	**0.08**	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	0.004	NA	0.005 U	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	NA
Cadmium	0.005	0.0035 U	0.005 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.0035 U
Calcium		NA	**110**	**110** J	**110**	**110**	**110**	**110**	**110**	**110**	**110**	NA
Calcium, dissolved		NA	**100**	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium, total	0.1	**0.0042**	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.0031 U	0.0034 U	0.01 U	**0.0021** J	**0.0162**
Cobalt		NA	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.0014 U	0.0016 U	0.01 U	0.01 U	NA
Copper	1.3	NA	0.02 U	**0.0026** J	**0.0027** J	0.003 U	0.0021 U	0.01 U	0.01 U	0.002 U	0.003 U	NA
Copper, dissolved	1.3	NA	0.02 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron		**4.06**	**1.8**	**1.8**	**1.8**	**2** J	**1.9** J	**1.9** J	**2** J	**1.8**	**1.8**	**23**
Iron, dissolved		NA	**0.81**	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	0.015	**0.0032**	0.005 U	0.0075 U	0.0075 U	0.0075 U	0.0075 U	0.0075 U	0.0075 U	0.0075 U	0.0075 U	**0.0099**
Magnesium		NA	**38**	**38**	**39**	**38**	**39**	**38**	**38**	**39**	**38**	NA
Magnesium, dissolved		NA	**33**	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese		**0.0605**	**0.03**	**0.032**	**0.031**	**0.033**	**0.033**	**0.032**	**0.032**	**0.033**	**0.034**	**0.477**
Manganese, dissolved		NA	**0.03**	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	0.002	0.0001 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0001 U
Nickel		NA	0.04 U	0.01 U	0.01 U	0.01 U	0.01 U	**0.0025** J	**0.0026** J	0.01 U	0.01 U	NA
Potassium		NA	5 U	**2.5**	**2.5**	**2.7**	**2.8**	**2.6**	**2.6**	**2.6**	**2.6**	NA
Potassium, dissolved		NA	5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	0.05	0.0012 U	0.005 U	0.015 U	0.015 U	0.015 U	0.015 U	0.015 U	0.015 U	0.015 U	0.015 U	0.0012 U
Sodium		**15.8**	**14**	**15**	**16**	**16**	**17**	**17**	**16**	**17**	**17**	**9.61**
Sodium, dissolved		NA	**15**	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	0.002	NA	0.005 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	NA
Vanadium		NA	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.0029 U	0.0029 U	0.01 U	0.01 U	NA
Zinc		NA	0.02 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.023 J	NA

TABLE 4-7

Concentrations of Detected Analytes in Groundwater

Samples Collected During Phase I, Phase II, and Remedial Investigations

Former Lockbourne Air Force Base, Lockbourne, Ohio

		UWBZ	**UWBZ**	**UWBZ**	**UWBZ**	**UWBZ**	**IDA**	**IDA**	**IDA**	**IDA**	**IDA**	**IDA**
		Background	**Background**	**Background**	**Background**	**Background**	**Site**	**Site**	**Site**	**Site**	**Site**	**Site**
		LCKMW-2	**LCKMW-2**	**LCKMW-2**	**LCKMW-2**	**LCKMW-2**	**LCKMW-3**[3]	**LCKMW-3**	**LCKMW-3**	**LCKMW-3**	**LCKMW-3**	**LCKMW-3**
		9/24/1997	**8/11/2003**	**11/13/2003**	**2/23/2004**	**5/18/2004**	**6/7/1995**	**9/18/1997**	**8/13/2003**	**11/13/2003**	**2/27/2004**	**5/20/2004**
PARAMETER_NAME	**MCLs**	**Phase II**	**RI**	**RI**	**RI**	**RI**	**Phase I**	**Phase II**	**RI**	**RI**	**RI**	**RI**
Volatile Organic Compounds (mg/L)												
Acetone		0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 UJ	0.01 U	0.01 U	0.01 U	0.01 U
Carbon disulfide		0.001 U	0.002 U	0.002 UJ	0.002 U*	0.002 UJ	0.005 U	0.001 U	0.002 U	0.002 UJ	0.002 U*	0.002 U*
Methylene chloride		0.001 U	0.002 U	0.002 U	0.002 U	0.002 U	0.005 U	0.001 U	0.002 U	0.002 U	0.002 U	0.002 U
Toluene	1	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.005 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Semi-Volatile Organic Compounds (mg/L)												
Acenaphthylene		0.01 U	0.0011 U	0.001 U	0.001 U	0.00098 U	0.011 U	0.01 U	0.00099 U	0.001 U	0.001 U	0.00099 U
Benz(a)anthracene		0.01 U	0.00021 U	0.0002 U	0.0002 U	0.0002 U	0.011 U	0.01 U	0.0002 U	0.0002 U	0.00021 U	0.0002 U
Benzo(a)pyrene	0.0002	0.01 U	0.00021 U	0.0002 U	0.0002 U	0.0002 U	0.011 U	0.01 U	0.0002 U	0.0002 U	0.00021 U	0.0002 U
Benzo(b)fluoranthene		0.01 U	0.00021 U	0.0002 U	0.0002 U	**0.00017** J	0.011 U	0.01 U	0.0002 U	0.0002 U	0.00021 U	0.0002 U
Benzo(ghi)perylene		0.01 U	0.0011 U	0.001 U	0.001 U	0.00098 U	0.011 U	0.01 U	0.00099 U	0.001 U	**0.00021** J	0.00099 U
Benzo(k)fluoranthene		0.01 U	0.00021 U	0.0002 UJ	0.0002 UJ	**0.00022**	0.011 U	0.01 U	0.0002 U	0.0002 UJ	**0.00021** UJ	0.0002 U
Chrysene		0.01 U	0.00053 U	0.0005 U	0.0005 U	0.00049 U	0.011 U	0.01 U	0.0005 U	0.0005 U	0.00052 U	0.0005 U
Dibenz(ah)anthracene		0.01 U	0.00021 U	0.0002 U	0.0002 U	0.0002 U	0.011 U	0.01 U	0.0002 U	0.0002 U	**0.00021**	0.0002 U
Indeno(1,2,3-cd)pyrene		0.01 U	0.00021 U	0.0002 U	0.0002 U	0.0002 U	0.011 U	0.01 U	0.0002 U	0.0002 U	**0.0002** J	0.0002 U
Naphthalene		0.01 U	0.0011 U	0.001 U	0.001 U	0.00098 U	0.011 U	0.01 U	0.00099 U	0.001 U	0.001 U	0.00099 U
Bis(2-ethylhexyl) phthalate	0.006	0.01 U	0.0053 U	0.005 U	0.005 U	0.0098 U	0.011 U	0.01 U	0.005 U	**0.0055**	**0.017**	0.0099 U
Butylbenzyl phthalate		0.01 U	0.0021 U	0.002 U	0.002 U	0.002 U	0.011 U	0.01 U	0.002 U	0.002 U	0.0021 U	0.002 U
Diethyl phthalate		0.01 U	0.0021 U	0.002 U	0.002 U	0.002 U	0.011 U	0.01 U	0.002 U	0.002 U	0.0021 U	0.002 U
Di-n-octyl phthalate		0.01 U	0.011 U	0.01 U	0.01 U	0.0098 U	0.011 U	0.01 U	0.0099 U	0.01 U	0.01 U	0.0099 U
Phenol		0.01 U	0.0053 U	0.005 U	0.005 U	0.0049 U	0.011 U	0.01 U	0.005 U	0.005 U	0.0052 U	0.005 U
Trichlorobenzene, 1,2,3-		NA	0.001 U	0.001 U	0.001 U	**0.00064** J	NA	NA	0.001 U	0.001 U	0.001 U	0.001 U
Dioxins / Furans (mg/L)												
Dioxins												
Heptachlorodibenzo-p-dioxin, 1,2,3,4,6,7,8-		**1.03E-08** B	NA	NA	NA	NA	NA	**3.9E-09**	NA	NA	NA	NA
Heptachlorodibenzo-p-dioxins, total		**2.27E-08** B	NA	NA	NA	NA	NA	**3.9E-09**	NA	NA	NA	NA
Hexachlorodibenzo-p-dioxin, 1,2,3,4,7,8-		1.9E-09 U	NA	NA	NA	NA	NA	2.5E-09 U	NA	NA	NA	NA
Hexachlorodibenzo-p-dioxin, 1,2,3,6,7,8-		1.7E-09 U	NA	NA	NA	NA	NA	2.1E-09 U	NA	NA	NA	NA
Hexachlorodibenzo-p-dioxin, 1,2,3,7,8,9-		1.6E-09 U	NA	NA	NA	NA	NA	2.1E-09 U	NA	NA	NA	NA
Hexachlorodibenzo-p-dioxins, total		**2.5E-09** B	NA	NA	NA	NA	NA	2.2E-09 U	NA	NA	NA	NA
Octachlorodibenzo-p-dioxin		**0.00000052**	NA	NA	NA	NA	NA	**1.68E-08**	NA	NA	NA	NA
Octachlorodibenzo-p-dioxin; Dissolved		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorodibenzo-p-dioxin, 1,2,3,7,8-		**0.000000002** B	NA	NA	NA	NA	NA	2.1E-09 U	NA	NA	NA	NA
Pentachlorodibenzo-p-dioxins, total		**0.000000002** B	NA	NA	NA	NA	NA	2.1E-09 U	NA	NA	NA	NA
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-		**0.000000004** J	NA	NA	NA	NA	NA	1.8E-09 U	NA	NA	NA	NA
Tetrachlorodibenzo-p-dioxins, total		**0.000000004** J	NA	NA	NA	NA	NA	1.8E-09 U	NA	NA	NA	NA
Furans												
Heptachlorodibenzofuran, 1,2,3,4,6,7,8-		**3.2E-09** B	NA	NA	NA	NA	NA	0.000000002 U	NA	NA	NA	NA
Heptachlorodibenzofuran, 1,2,3,4,7,8,9-		0.000000002 U	NA	NA	NA	NA	NA	2.3E-09 U	NA	NA	NA	NA
Heptachlorodibenzofurans, total		**3.4E-09** B	NA	NA	NA	NA	NA	2.1E-09 U	NA	NA	NA	NA
Hexachlorodibenzofuran, 1,2,3,4,7,8-		**3.6E-09** B	NA	NA	NA	NA	NA	**2.4E-09** B	NA	NA	NA	NA

TABLE 4-7

Concentrations of Detected Analytes in Groundwater

Samples Collected During Phase I, Phase II, and Remedial Investigations

Former Lockbourne Air Force Base, Lockbourne, Ohio

		UWBZ	**UWBZ**	**UWBZ**	**UWBZ**	**UWBZ**	**IDA**	**IDA**	**IDA**	**IDA**	**IDA**	**IDA**
		Background	**Background**	**Background**	**Background**	**Background**	**Site**	**Site**	**Site**	**Site**	**Site**	**Site**
		LCKMW-2	**LCKMW-2**	**LCKMW-2**	**LCKMW-2**	**LCKMW-2**	**LCKMW-3**[3]	**LCKMW-3**	**LCKMW-3**	**LCKMW-3**	**LCKMW-3**	**LCKMW-3**
		9/24/1997	**8/11/2003**	**11/13/2003**	**2/23/2004**	**5/18/2004**	**6/7/1995**	**9/18/1997**	**8/13/2003**	**11/13/2003**	**2/27/2004**	**5/20/2004**
PARAMETER_NAME	**MCLs**	**Phase II**	**RI**	**RI**	**RI**	**RI**	**Phase I**	**Phase II**	**RI**	**RI**	**RI**	**RI**
Hexachlorodibenzofuran, 1,2,3,6,7,8-		1.2E-09 U	NA	NA	NA	NA	NA	1.6E-09 U	NA	NA	NA	NA
Hexachlorodibenzofuran, 1,2,3,7,8,9-		1.6E-09 U	NA	NA	NA	NA	NA	**3.3E-09**	NA	NA	NA	NA
Hexachlorodibenzofuran, 2,3,4,6,7,8-		**6.9E-09** B	NA	NA	NA	NA	NA	**5.1E-09** B	NA	NA	NA	NA
Hexachlorodibenzofurans, total		**1.05E-08** B	NA	NA	NA	NA	NA	**1.08E-08** B	NA	NA	NA	NA
Octachlorodibenzofuran		**6.8E-09** B	NA	NA	NA	NA	NA	**5.2E-09**	NA	NA	NA	NA
Pentachlorodibenzofuran, 1,2,3,7,8-		1.2E-09 U	NA	NA	NA	NA	NA	1.9E-09 U	NA	NA	NA	NA
Pentachlorodibenzofuran, 2,3,4,7,8-		1.2E-09 U	NA	NA	NA	NA	NA	1.9E-09 U	NA	NA	NA	NA
Pentachlorodibenzofurans, total		1.2E-09 U	NA	NA	NA	NA	NA	1.9E-09 U	NA	NA	NA	NA
Tetrachlorodibenzofuran, 2,3,7,8-		**9.4E-09** B	NA	NA	NA	NA	NA	**6.4E-09** B	NA	NA	NA	NA
Tetrachlorodibenzofurans, total		**6.6E-09** B	NA	NA	NA	NA	NA	**4.7E-09** B	NA	NA	NA	NA
TCDD-TEQ	3E-08	**8.91768E-09**	NA	NA	NA	NA	NA	**4.6702E-09**	NA	NA	NA	NA
TCDD-TEQ; Dissolved	3E-08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals (mg/L)												
Aluminum		**11**	**0.12** J	0.2 U	0.03 U	0.2 U	NA	**0.14**	**0.99**	**0.044** J	**0.11** J	0.1 U
Arsenic	0.01	**0.005**	0.02 U	0.02 U	0.02 U	0.02 U	**0.0189** JL	**0.008**	**0.015** J	**0.011** J	**0.013** J	**0.011** J
Arsenic, dissolved	0.01	0.005 U	NA	NA	NA	NA	NA	0.005 U	NA	NA	NA	NA
Barium	2	**0.18**	**0.11**	**0.11**	**0.094**	**0.1**	**0.88**	**0.57**	**0.62**	**0.59**	**0.59**	**0.59**
Barium, dissolved	2	**0.09**	NA	NA	NA	NA	NA	**0.46**	NA	NA	NA	NA
Beryllium	0.004	0.005 U	0.004 U	0.004 U	0.004 U	0.004 U	NA	0.005 U	0.004 U	0.004 U	0.004 U	0.004 U
Cadmium	0.005	0.005 U	0.002 U	0.002 U	0.002 U	0.002 U	0.0035 U	0.005 U	0.002 U	0.002 U	0.002 U	0.002 U
Calcium		**220**	**210**	**220**	**220**	**220**	NA	**82**	**99**	**86**	**89**	**84** J
Calcium, dissolved		**160**	NA	NA	NA	NA	NA	**70**	NA	NA	NA	NA
Chromium, total	0.1	**0.02**	0.01 U	0.01 U	0.0023 U	0.01 U	**0.0265**	0.01 U	**0.0064** J	0.01 U	**0.0031** J	**0.0027** J
Cobalt		**0.01**	0.01 U	0.01 U	0.0012 U	0.01 U	NA	0.01 U	**0.0024** J	0.01 U	0.01 U	0.01 U
Copper	1.3	**0.04**	**0.0025** J	0.01 U	0.01 U	0.0046 U	NA	**0.05**	**0.015**	0.01 U	0.01 U	0.01 U
Copper, dissolved	1.3	0.02 U	NA	NA	NA	NA	NA	0.02 U	NA	NA	NA	NA
Iron		**24**	**0.056** J	0.2 U	0.21 U	0.2 U	**45.8**	**1.6**	**4.5**	**1.5** J	**1.7**	**1.5**
Iron, dissolved		0.1 U	NA	NA	NA	NA	NA	**0.13**	NA	NA	NA	NA
Lead	0.015	**0.013**	0.0075 U	0.0075 U	0.0075 U	0.0075 U	**0.0348** JH	0.005 U	**0.0062** J	0.0075 U	0.0075 U	0.0075 U
Magnesium		**72**	**56**	**57**	**56**	**57**	NA	**27**	**32**	**29**	**29**	**28**
Magnesium, dissolved		**43**	NA	NA	NA	NA	NA	**28**	NA	NA	NA	NA
Manganese		**0.31**	**0.025**	**0.061**	**0.006** J	**0.013**	**1** JL	**0.03**	**0.093**	**0.027**	**0.03**	**0.029**
Manganese, dissolved		**0.1**	NA	NA	NA	NA	NA	**0.01**	NA	NA	NA	NA
Mercury	0.002	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0001 U	0.0002 U	0.0004 U	0.0002 U	0.0002 U	0.0002 U
Nickel		0.04 U	0.01 U	0.01 U	**0.0025** J	0.01 U	NA	0.04 U	**0.0052** J	0.01 U	0.01 U	0.01 U
Potassium		5 U	**0.48** J	0.48 U	0.43 U	0.34 U	NA	5 U	**2.4**	**2**	**2.1**	**1.9**
Potassium, dissolved		5 U	NA	NA	NA	NA	NA	5 U	NA	NA	NA	NA
Selenium	0.05	0.005 U	0.015 U	0.015 U	0.015 U	0.015 U	0.0012 U	0.005 UJ	**0.0056** J	0.015 U	0.015 U	0.015 U
Sodium		**3.8**	**7.4**	**8.1**	**5.1**	**5.1**	**12.3**	**10**	**13**	**13**	**13**	**13**
Sodium, dissolved		**4.3**	NA	NA	NA	NA	NA	**11**	NA	NA	NA	NA
Thallium	0.002	0.005 U	0.025 U	0.025 U	0.025 U	0.025 U	NA	0.005 U	0.025 U	0.025 U	0.025 U	0.025 U
Vanadium		**0.03**	0.01 U	0.01 U	0.0032 U	0.01 U	NA	0.01 U	**0.0037** J	0.01 U	0.01 U	0.01 U
Zinc		**0.1**	0.04 U	**0.011** J	0.04 U	0.04 U	NA	**0.03**	**0.017** J	0.04 U	0.04 U	0.04 U

TABLE 4-7

Concentrations of Detected Analytes in Groundwater

Samples Collected During Phase I, Phase II, and Remedial Investigations

Former Lockbourne Air Force Base, Lockbourne, Ohio

		UWBZ	UWBZ	UWBZ	UWBZ	UWBZ	UWBZ	IDA	IDA	IDA	IDA	IDA
		Site	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site
		LCKMW-4[2]	LCKMW-4	LCKMW-4	LCKMW-4	LCKMW-4	LCKMW-4	LCKMW-5[3]	LCKMW-5	LCKMW-5	LCKMW-5	LCKMW-5
										DUP		
		6/7/1995	9/16/1997	8/12/2003	11/12/2003	2/26/2004	5/19/2004	6/6/1995	9/16/1997	9/16/1997	8/13/2003	11/12/2003
PARAMETER_NAME	**MCLs**	**Phase I**	**Phase II**	**RI**	**RI**	**RI**	**RI**	**Phase I**	**Phase II**	**Phase II**	**RI**	**RI**
Volatile Organic Compounds (mg/L)												
Acetone		0.01 U	0.01 U	0.01 U	0.01 U	**0.0099** J	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Carbon disulfide		0.005 U	0.001 U	0.002 U	0.002 UJ	0.002 U*	0.002 U	0.005 U	0.001 U	0.001 U	0.002 U	0.002 UJ
Methylene chloride		0.005 U	0.001 U	0.002 U	0.002 U	0.002 U	0.002 U	**0.001** JB	0.001 U	0.001 U	0.002 U	0.002 U
Toluene	1	0.005 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.005 U	0.001 U	0.001 U	0.001 U	0.001 U
Semi-Volatile Organic Compounds (mg/L)												
Acenaphthylene		0.012 U	0.01 U	0.0011 U	**0.00026** J	0.0011 U	0.0011 U	0.011 U	0.01 U	0.01 U	0.001 U	0.001 U
Benz(a)anthracene		0.012 U	0.01 U	0.00022 U	0.00021 U	0.00021 U	0.00022 U	0.011 U	0.01 U	0.01 U	0.0002 U	0.0002 U
Benzo(a)pyrene	0.0002	0.012 U	0.01 U	0.00022 U	0.00021 U	**0.00022**	0.00022 U	0.011 U	0.01 U	0.01 U	0.0002 U	0.0002 U
Benzo(b)fluoranthene		0.012 U	0.01 U	0.00022 U	0.00021 U	0.00021 U	0.00022 U	0.011 U	0.01 U	0.01 U	0.0002 U	0.0002 U
Benzo(ghi)perylene		0.012 U	0.01 U	0.0011 U	0.001 U	**0.00039** J	0.0011 U	0.011 U	0.01 U	0.01 U	0.001 U	0.001 U
Benzo(k)fluoranthene		0.012 U	0.01 U	0.00022 U	0.00021 U	0.00021 UJ	0.00022 U	0.011 U	0.01 U	0.01 U	0.0002 U	0.0002 U
Chrysene		0.012 U	0.01 U	0.00055 U	0.00052 U	0.00053 U	0.00054 U	0.011 U	0.01 U	0.01 U	0.00051 U	0.0005 U
Dibenz(ah)anthracene		0.012 U	0.01 U	0.00022 U	0.00021 U	**0.00036**	0.00022 U	0.011 U	0.01 U	0.01 U	0.0002 U	0.00069 U
Indeno(1,2,3-cd)pyrene		0.012 U	0.01 U	0.00022 U	0.00021 U	**0.00035**	0.00022 U	0.011 U	0.01 U	0.01 U	0.0002 U	0.00045 U
Naphthalene		0.012 U	0.01 U	0.0011 U	0.001 U	0.0011 U	0.0011 U	0.011 U	0.01 U	0.01 U	0.001 U	0.001 U
Bis(2-ethylhexyl) phthalate	0.006	0.012 U	0.01 U	0.0055 U	0.0052 U*	0.011 U	0.011 U	0.011 U	0.01 U	0.01 U	0.0051 U	**0.0071** *
Butylbenzyl phthalate		0.012 U	0.01 U	0.0022 U	0.0021 U	0.0021 U	0.0022 U	0.011 U	0.01 U	0.01 U	0.002 U	0.002 U
Diethyl phthalate		0.012 U	0.01 U	0.0022 U	0.0021 U	0.0021 U	0.0022 U	0.011 U	0.01 U	0.01 U	0.002 U	0.002 U
Di-n-octyl phthalate		0.012 U	0.01 U	0.011 U	0.01 U	0.011 U	0.011 U	0.011 U	0.01 U	0.01 U	0.01 U	0.01 U
Phenol		0.012 U	0.01 U	0.0055 U	0.0052 U	0.0053 U	0.0054 U	0.011 U	0.01 U	0.01 U	0.0051 U	0.005 U
Trichlorobenzene, 1,2,3-		NA	NA	0.001 U	0.001 U	0.001 U	0.001 U	NA	NA	NA	0.001 U	0.001 U
Dioxins / Furans (mg/L)												
Dioxins												
Heptachlorodibenzo-p-dioxin, 1,2,3,4,6,7,8-		NA	**5.2E-09**	2.9E-09 U	NA	NA	NA	NA	2.7E-09 U	2.2E-09 U	NA	NA
Heptachlorodibenzo-p-dioxins, total		NA	**5.2E-09**	2.9E-09 U	NA	NA	NA	NA	2.7E-09 U	2.2E-09 U	NA	NA
Hexachlorodibenzo-p-dioxin, 1,2,3,4,7,8-		NA	2.5E-09 U	4.7E-09 U	NA	NA	NA	NA	3.9E-09 U	2.2E-09 U	NA	NA
Hexachlorodibenzo-p-dioxin, 1,2,3,6,7,8-		NA	2.1E-09 U	4.5E-09 U	NA	NA	NA	NA	3.3E-09 U	1.8E-09 U	NA	NA
Hexachlorodibenzo-p-dioxin, 1,2,3,7,8,9-		NA	2.2E-09 U	4.4E-09 U	NA	NA	NA	NA	3.4E-09 U	1.9E-09 U	NA	NA
Hexachlorodibenzo-p-dioxins, total		NA	2.3E-09 U	4.7E-09 U	NA	NA	NA	NA	3.5E-09 U	2E-09 U	NA	NA
Octachlorodibenzo-p-dioxin		NA	**0.00000014**	**0.000000062 J**	NA	NA	NA	NA	**2.1E-08** J	**1.47E-08** J	NA	NA
Octachlorodibenzo-p-dioxin; Dissolved		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorodibenzo-p-dioxin, 1,2,3,7,8-		NA	2.2E-09 U	4.9E-09 U	NA	NA	NA	NA	2.1E-09 U	1.9E-09 U	NA	NA
Pentachlorodibenzo-p-dioxins, total		NA	2.2E-09 U	4.9E-09 U	NA	NA	NA	NA	2.1E-09 U	1.9E-09 U	NA	NA
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-		NA	1.7E-09 U	3.8E-09 U	NA	NA	NA	NA	1.5E-09 U	1.4E-09 U	NA	NA
Tetrachlorodibenzo-p-dioxins, total		NA	1.7E-09 U	3.8E-09 U	NA	NA	NA	NA	1.5E-09 U	1.4E-09 U	NA	NA
Furans												
Heptachlorodibenzofuran, 1,2,3,4,6,7,8-		NA	0.000000002 U	2.8E-09 U	NA	NA	NA	NA	2.5E-09 U	1.7E-09 U	NA	NA
Heptachlorodibenzofuran, 1,2,3,4,7,8,9-		NA	2.6E-09 U	3.2E-09 U	NA	NA	NA	NA	3.3E-09 U	2.2E-09 U	NA	NA
Heptachlorodibenzofurans, total		NA	2.2E-09 U	3.2E-09 U	NA	NA	NA	NA	2.8E-09 U	1.9E-09 U	NA	NA
Hexachlorodibenzofuran, 1,2,3,4,7,8-		NA	1.8E-09 U	4.2E-09 U	NA	NA	NA	NA	2.2E-09 U	1.4E-09 U	NA	NA

TABLE 4-7

Concentrations of Detected Analytes in Groundwater

Samples Collected During Phase I, Phase II, and Remedial Investigations

Former Lockbourne Air Force Base, Lockbourne, Ohio

		UWBZ	**UWBZ**	**UWBZ**	**UWBZ**	**UWBZ**	**UWBZ**	**IDA**	**IDA**	**IDA**	**IDA**	**IDA**
		Site	**Site**	**Site**	**Site**	**Site**	**Site**	**Site**	**Site**	**Site**	**Site**	**Site**
		LCKMW-4^2	**LCKMW-4**	**LCKMW-4**	**LCKMW-4**	**LCKMW-4**	**LCKMW-4**	**LCKMW-5^3**	**LCKMW-5**	**LCKMW-5**	**LCKMW-5**	**LCKMW-5**
										DUP		
		6/7/1995	**9/16/1997**	**8/12/2003**	**11/12/2003**	**2/26/2004**	**5/19/2004**	**6/6/1995**	**9/16/1997**	**9/16/1997**	**8/13/2003**	**11/12/2003**
PARAMETER_NAME	**MCLs**	**Phase I**	**Phase II**	**RI**	**RI**	**RI**	**RI**	**Phase I**	**Phase II**	**Phase II**	**RI**	**RI**
Hexachlorodibenzofuran, 1,2,3,6,7,8-		NA	1.4E-09 U	0.000000004 U	NA	NA	NA	NA	1.7E-09 U	1E-09 U	NA	NA
Hexachlorodibenzofuran, 1,2,3,7,8,9-		NA	1.9E-09 U	4.8E-09 U	NA	NA	NA	NA	2.4E-09 U	1.5E-09 U	NA	NA
Hexachlorodibenzofuran, 2,3,4,6,7,8-		NA	**6.5E-09**	4.4E-09 U	NA	NA	NA	NA	2.1E-09 U	**4.4E-09** J	NA	NA
Hexachlorodibenzofurans, total		NA	**6.5E-09**	4.8E-09 U	NA	NA	NA	NA	2E-09 U	**4.4E-09** J	NA	NA
Octachlorodibenzofuran		NA	2.7E-09 U	4.7E-09 U	NA	NA	NA	NA	3E-09 U	2.7E-09 U	NA	NA
Pentachlorodibenzofuran, 1,2,3,7,8-		NA	1.8E-09 U	2.8E-09 U	NA	NA	NA	NA	1.8E-09 U	1.3E-09 U	NA	NA
Pentachlorodibenzofuran, 2,3,4,7,8-		NA	1.8E-09 U	2.8E-09 U	NA	NA	NA	NA	1.7E-09 U	1.3E-09 U	NA	NA
Pentachlorodibenzofurans, total		NA	1.8E-09 U	3.1E-09 U	NA	NA	NA	NA	1.7E-09 U	1.3E-09 U	NA	NA
Tetrachlorodibenzofuran, 2,3,7,8-		NA	**4.9E-09** B	1.7E-09 U	NA	NA	NA	NA	**7E-09** B	**3E-09** B	NA	NA
Tetrachlorodibenzofurans, total		NA	**5.8E-09** BJ	1.7E-09 U	NA	NA	NA	NA	**1.22E-08** BJ	**5.4E-09** BJ	NA	NA
TCDD-TEQ	3E-08	NA	**4.26914E-09**	**6.80594E-09**	NA	NA	NA	NA	**3.9648E-09**	**3.2696E-09**	NA	NA
TCDD-TEQ; Dissolved	3E-08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals (mg/L)												
Aluminum		NA	**8.3** J	**1.1**	0.2 U	0.11 U	0.2 U	NA	**0.27** J	**0.22** J	**0.06** J	**0.2** U
Arsenic	0.01	**0.084**	**0.05** J	**0.073**	**0.013** J	**0.028**	**0.013** J	**0.0102**	**0.017** J	**0.005**	**0.019** J	0.019 J
Arsenic, dissolved	0.01	NA	**0.008** J	NA	NA	NA	NA	NA	**0.016** J	**0.015** J	**NA**	NA
Barium	2	**0.372**	**0.17** J	**0.16**	**0.11**	**0.1**	**0.098**	**0.317**	**0.51** J	**0.51** J	**0.52**	**0.52**
Barium, dissolved	2	NA	**0.11**	**NA**	NA	NA	NA	NA	**0.47**	**0.48**	**NA**	NA
Beryllium	0.004	NA	0.005 U	**0.00019** J	0.004 U	0.004 U	0.004 U	NA	0.005 U	0.005 U	0.004 U	0.004 U
Cadmium	0.005	**0.0063**	0.005 U	0.002 U	0.002 U	0.002 U	0.002 U	0.0035 U	0.005 U	0.005 U	0.002 U	0.002 U
Calcium		NA	**210**	**170**	**160**	**150**	**150**	NA	**95**	**95**	**95**	**97**
Calcium, dissolved		NA	**140**	NA	NA	NA	NA	NA	**89**	**90**	NA	NA
Chromium, total	0.1	**0.0627**	**0.02** J	0.01 U	0.01 U	0.01 U	0.01 U	**0.0042**	0.01 U	0.01 U	0.01 U	0.01 U
Cobalt		NA	**0.01**	0.01 U	0.01 U	0.01 U	0.01 U	NA	0.01 U	0.01 U	0.01 U	0.01 U
Copper	1.3	NA	**0.03**	**0.0051** J	0.01 U	0.002 U	0.0031 U	NA	0.02 U	0.02 U	**0.0026** J	0.01 U
Copper, dissolved	1.3	NA	0.02 U	NA	NA	NA	NA	NA	0.02 U	0.02 U	NA	NA
Iron		**143**	**27** J	**22**	**5.2** J	**7.5**	**5.9**	**2.69**	**1.9** J	**1.8** J	**1.7**	**1.8** J
Iron, dissolved		NA	**1.5**	NA	NA	NA	NA	NA	**1.2**	**1.1**	NA	NA
Lead	0.015	**0.124**	**0.011**	**0.0048** J	0.0075 U	0.0075 U	0.0075 U	**0.0152**	0.005 U	0.005 U	0.0075 U	**0.038** J
Magnesium		NA	**64**	**54**	**53**	**49**	**51**	NA	**31**	**31**	**32**	**33**
Magnesium, dissolved		NA	**48**	NA	NA	NA	NA	NA	**30**	**31**	NA	NA
Manganese		**2.47**	**0.36** J	**0.038**	**0.035**	**0.026**	**0.029**	**0.0655**	**0.06** J	**0.06** J	**0.045**	**0.046**
Manganese, dissolved		NA	**0.03**	NA	NA	NA	NA	NA	**0.05**	**0.04**	NA	NA
Mercury	0.002	0.0001 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.000055 U	0.0001 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Nickel		NA	0.04 U	0.01 U	0.01 U	0.01 U	0.01 U	NA	0.04 U	0.04 U	0.01 U	0.01 U
Potassium		NA	5 U	**2.5**	**2.2**	**2**	**2.1**	NA	5 U	5 U	**1.6**	**1.6**
Potassium, dissolved		NA	5 U	NA	NA	NA	NA	NA	5 U	5 U	NA	NA
Selenium	0.05	0.0012 U	0.005 U	0.015 U	0.015 U	0.015 UJ	0.015 U	0.0012 U	0.005 U	0.005 U	0.015 U	0.015 U
Sodium		**59.1**	**44**	**48**	**49**	**43**	**47**	**5.55** JB	**7.7**	**7.6**	**8.4**	**8.8**
Sodium, dissolved		NA	**52**	NA	NA	NA	NA	NA	**7.2**	**7.4**	NA	NA
Thallium	0.002	NA	0.005 U	0.025 U	0.025 U	0.025 U	0.025 U	NA	0.005 U	0.005 U	0.025 U	0.025 U
Vanadium		NA	**0.02** J	0.01 U	0.01 U	0.01 U	0.01 U	NA	0.01 U	0.01 U	0.01 U	0.01 U
Zinc		NA	**0.07** J	**0.011** J	0.04 U	0.04 U	0.04 U	NA	0.02 U	0.02 U	0.04 U	**0.015** J

TABLE 4-7

Concentrations of Detected Analytes in Groundwater

Samples Collected During Phase I, Phase II, and Remedial Investigations

Former Lockbourne Air Force Base, Lockbourne, Ohio

		IDA	IDA	UWBZ	UWBZ	UWBZ	UWBZ	UWBZ	UWBZ	UWBZ	UWBZ	UWBZ
		Site	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site
		LCKMW-5	LCKMW-5	LCKMW-6^2	LCKMW-6^2	LCKMW-6	LCKMW-6	LCKMW-6	LCKMW-6	LCKMW-6	LCKMW-7^3	LCKMW-7
					DUP							
		2/25/2004	5/20/2004	6/5/1995	6/5/1995	9/19/1997	8/13/2003	11/12/2003	2/25/2004	5/20/2004	6/7/1995	9/19/1997
PARAMETER_NAME	**MCLs**	RI	RI	Phase I	Phase I	Phase II	RI	RI	RI	RI	Phase I	Phase II
Volatile Organic Compounds (mg/L)												
Acetone		0.01 U	**0.01**	0.01 U	0.01 U	0.01 U	0.01 U	**0.008** J	0.01 U	0.01 U	0.01 U	0.01 U
Carbon disulfide		0.002 U*	**0.002**	0.005 U	0.005 U	0.001 U	0.002 U	0.002 UJ	0.002 U*	0.002 U*	0.005 U	0.001 U
Methylene chloride		0.002 U	**0.002**	**0.001** JB	**0.006** JB	0.001 U	0.002 U	0.002 U	0.002 U	0.002 U	0.005 U	0.001 U
Toluene	1	0.001 U	0.001 U	0.005 U	0.005 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.005 U	0.001 U
Semi-Volatile Organic Compounds (mg/L)												
Acenaphthylene		0.00099 U	0.00099 U	0.01 U	0.011 U	0.01 U	0.001 U	**0.00017** J	0.00097 U	0.001 U	0.01 U	0.01 U
Benz(a)anthracene		0.0002 U	0.0002 U	0.01 U	0.011 U	0.01 U	0.0002 U	0.00022 U	0.00019 U	0.0002 U	0.01 U	0.01 U
Benzo(a)pyrene	0.0002	0.0002 U	0.0002 U	0.01 U	0.011 U	0.01 U	0.0002 U	0.00022 U	0.00019 U	0.0002 U	0.01 U	0.01 U
Benzo(b)fluoranthene		0.0002 U	0.0002 U	0.01 U	0.011 U	0.01 U	0.0002 U	0.00022 U	0.00019 U	0.0002 U	0.01 U	0.01 U
Benzo(ghi)perylene		0.00099 U	0.00099 U	0.01 U	0.011 U	0.01 U	0.001 U	0.0011 U	0.00097 U	0.001 U	0.01 U	0.01 U
Benzo(k)fluoranthene		0.0002 UJ	0.0002 U	0.01 U	0.011 U	0.01 U	0.0002 U	0.00022 U	0.00019 UJ	0.0002 U	0.01 U	0.01 U
Chrysene		0.0005 U	0.0005 U	0.01 U	0.011 U	0.01 U	0.00051 U	0.00054 U	0.00049 U	0.0005 U	0.01 U	0.01 U
Dibenz(ah)anthracene		0.0002 U	0.0002 U	0.01 U	0.011 U	0.01 U	0.0002 U	**0.00069**	0.00019 U	0.0002 U	0.01 U	0.01 U
Indeno(1,2,3-cd)pyrene		0.0002 U	0.0002 U	0.01 U	0.011 U	0.01 U	0.0002 U	**0.00044**	0.00019 U	0.0002 U	0.01 U	0.01 U
Naphthalene		0.00099 U	**0.00056**	0.01 U	0.011 U	0.01 U	0.001 U	0.0011 U	**0.00016** J	0.001 U	0.01 U	0.01 U
Bis(2-ethylhexyl) phthalate	0.006	0.0099 U	0.0099 U	**0.003** JB	**0.002** JB	0.01 U	0.0051 U	0.0054 U*	0.0097 U	0.01 U	0.01 U	0.01 U
Butylbenzyl phthalate		0.002 U	0.002 U	0.01 U	**0.002** JL	0.01 U	0.002 U	0.0022 U	0.0019 U	0.002 U	0.01 U	0.01 U
Diethyl phthalate		0.002 U	0.002 U	**0.002** JB	**0.004** JB	0.01 U	0.002 U	0.0022 U	0.0019 U	0.002 U	0.01 U	0.01 U
Di-n-octyl phthalate		0.0099 U	0.0099 U	**0.001** JB	**0.002** JB	0.01 U	0.01 U	0.011 U	0.0097 U	0.01 U	0.01 U	0.01 U
Phenol		0.005 U	0.005 U	**0.002** JB	**0.003** JB	0.01 U	0.0051 U	0.0054 U	0.0049 U	0.005 U	0.01 U	0.01 U
Trichlorobenzene, 1,2,3-		0.001 U	0.001 U	NA	NA	NA	0.001 U	0.001 U	0.001 U	0.001 U	NA	NA
Dioxins / Furans (mg/L)												
Dioxins												
Heptachlorodibenzo-p-dioxin, 1,2,3,4,6,7,8-		NA	NA	NA	NA	5.4E-09 U	NA	NA	NA	NA	NA	1.05E-08 U
Heptachlorodibenzo-p-dioxins, total		NA	NA	NA	NA	5.4E-09 U	NA	NA	NA	NA	NA	1.05E-08 U
Hexachlorodibenzo-p-dioxin, 1,2,3,4,7,8-		NA	NA	NA	NA	5E-09 U	NA	NA	NA	NA	NA	8.3E-09 U
Hexachlorodibenzo-p-dioxin, 1,2,3,6,7,8-		NA	NA	NA	NA	3.9E-09 U	NA	NA	NA	NA	NA	6.6E-09 U
Hexachlorodibenzo-p-dioxin, 1,2,3,7,8,9-		NA	NA	NA	NA	4.5E-09 U	NA	NA	NA	NA	NA	7.5E-09 U
Hexachlorodibenzo-p-dioxins, total		NA	NA	NA	NA	4.4E-09 U	NA	NA	NA	NA	NA	7.4E-09 U
Octachlorodibenzo-p-dioxin		NA	NA	NA	NA	**6.89E-08**	NA	NA	NA	NA	NA	**3.26E-08**
Octachlorodibenzo-p-dioxin; Dissolved		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorodibenzo-p-dioxin, 1,2,3,7,8-		NA	NA	NA	NA	3.6E-09 U	NA	NA	NA	NA	NA	5.4E-09 U
Pentachlorodibenzo-p-dioxins, total		NA	NA	NA	NA	3.6E-09 U	NA	NA	NA	NA	NA	5.4E-09 U
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-		NA	NA	NA	NA	**1.6E-09** J	NA	NA	NA	NA	NA	3.3E-09 U
Tetrachlorodibenzo-p-dioxins, total		NA	NA	NA	NA	**1.6E-09** J	NA	NA	NA	NA	NA	3.3E-09 U
Furans												
Heptachlorodibenzofuran, 1,2,3,4,6,7,8-		NA	NA	NA	NA	4E-09 U	NA	NA	NA	NA	NA	7.5E-09 U
Heptachlorodibenzofuran, 1,2,3,4,7,8,9-		NA	NA	NA	NA	5.5E-09 U	NA	NA	NA	NA	NA	1.04E-08 U
Heptachlorodibenzofurans, total		NA	NA	NA	NA	4.6E-09 U	NA	NA	NA	NA	NA	8.7E-09 U
Hexachlorodibenzofuran, 1,2,3,4,7,8-		NA	NA	NA	NA	3.3E-09 U	NA	NA	NA	NA	NA	5E-09 U

TABLE 4-7

Concentrations of Detected Analytes in Groundwater

Samples Collected During Phase I, Phase II, and Remedial Investigations

Former Lockbourne Air Force Base, Lockbourne, Ohio

		IDA	**IDA**	**UWBZ**	**UWBZ**	**UWBZ**	**UWBZ**	**UWBZ**	**UWBZ**	**UWBZ**	**UWBZ**	**UWBZ**
		Site	**Site**	**Site**	**Site**	**Site**	**Site**	**Site**	**Site**	**Site**	**Site**	**Site**
		LCKMW-5	**LCKMW-5**	**LCKMW-6^2**	**LCKMW-6^2**	**LCKMW-6**	**LCKMW-6**	**LCKMW-6**	**LCKMW-6**	**LCKMW-6**	**LCKMW-7^3**	**LCKMW-7**
					DUP							
		2/25/2004	**5/20/2004**	**6/5/1995**	**6/5/1995**	**9/19/1997**	**8/13/2003**	**11/12/2003**	**2/25/2004**	**5/20/2004**	**6/7/1995**	**9/19/1997**
PARAMETER_NAME	**MCLs**	**RI**	**RI**	**Phase I**	**Phase I**	**Phase II**	**RI**	**RI**	**RI**	**RI**	**Phase I**	**Phase II**
Hexachlorodibenzofuran, 1,2,3,6,7,8-		NA	NA	NA	NA	2.4E-09 U	NA	NA	NA	NA	NA	3.8E-09 U
Hexachlorodibenzofuran, 1,2,3,7,8,9-		NA	NA	NA	NA	4E-09 U	NA	NA	NA	NA	NA	6.2E-09 U
Hexachlorodibenzofuran, 2,3,4,6,7,8-		NA	NA	NA	NA	**3.2E-09** J	NA	NA	NA	NA	NA	**8.6E-09**
Hexachlorodibenzofurans, total		NA	NA	NA	NA	**3.2E-09** J	NA	NA	NA	NA	NA	**8.6E-09**
Octachlorodibenzofuran		NA	NA	NA	NA	6.5E-09 U	NA	NA	NA	NA	NA	1.2E-08 U
Pentachlorodibenzofuran, 1,2,3,7,8-		NA	NA	NA	NA	2.8E-09 U	NA	NA	NA	NA	NA	4.1E-09 U
Pentachlorodibenzofuran, 2,3,4,7,8-		NA	NA	NA	NA	2.8E-09 U	NA	NA	NA	NA	NA	4.1E-09 U
Pentachlorodibenzofurans, total		NA	NA	NA	NA	2.8E-09 U	NA	NA	NA	NA	NA	4.1E-09 U
Tetrachlorodibenzofuran, 2,3,7,8-		NA	NA	NA	NA	**5.3E-09**	NA	NA	NA	NA	NA	**9.8E-09**
Tetrachlorodibenzofurans, total		NA	NA	NA	NA	**1.06E-08**	NA	NA	NA	NA	NA	**9.8E-09**
TCDD-TEQ	3E-08	NA	NA	NA	NA	**6.2567E-09**	NA	NA	NA	NA	NA	**9.3334E-09**
TCDD-TEQ; Dissolved	3E-08	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals (mg/L)												
Aluminum		0.2 U	0.028 U	NA	NA	**11**	**0.078** J	**0.031** J	**0.069** J	0.067 U	NA	0.1 U
Arsenic	0.01	**0.02** J	**0.016** J	**0.0104** JL	0.0058 JL	0.005 U	0.02 U	0.02 U	0.02 U	0.02 U	**0.0035** JB	0.005 U
Arsenic, dissolved	0.01	NA	NA	NA	NA	0.005 U	NA	NA	NA	NA	NA	0.005 U
Barium	2	**0.52**	**0.51**	**0.442**	**0.393**	**0.24**	**0.16**	**0.19**	**0.16**	**0.19**	**0.256**	**0.27**
Barium, dissolved	2	NA	NA	NA	NA	**0.17**	NA	NA	NA	NA	NA	**0.19**
Beryllium	0.004	0.004 U	0.004 U	NA	NA	0.005 U	0.004 U	0.004 U	0.004 U	0.004 U	NA	0.005 U
Cadmium	0.005	0.002 U	0.002 U	0.0035 U	0.0035 U	0.005 U	0.002 U	0.002 U	0.002 U	0.002 U	0.0035 U	0.005 U
Calcium		**98**	**93** J	NA	NA	**320**	**180**	**200**	**190**	**180** J	NA	**80**
Calcium, dissolved		NA	NA	NA	NA	**170**	NA	NA	NA	NA	NA	**70**
Chromium, total	0.1	0.01 U	0.01 U	**0.0384**	**0.0238**	**0.02**	0.01 U	0.01 U	**0.0034** J	**0.0028** J	0.0042 U	0.01 U
Cobalt		0.01 U	0.01 U	NA	NA	**0.02**	0.01 U	0.01 U	0.01 U	0.01 U	NA	0.01 U
Copper	1.3	0.0022 U	0.01 U	NA	NA	**0.06**	**0.0038** J	0.01 U	0.0048 U	**0.0081** J	NA	**0.02**
Copper, dissolved	1.3	NA	NA	NA	NA	0.02 U	NA	NA	NA	NA	NA	0.02 U
Iron		**1.7**	**1.7**	**109**	**72.5**	**44**	0.2 U	**0.086** J	**0.44**	**0.11** J	**4.53**	**1**
Iron, dissolved		NA	NA	NA	NA	0.1 U	NA	NA	NA	NA	NA	**0.12**
Lead	0.015	0.0075 U	0.0075 U	**0.0835** J	0.0544 J	**0.033**	0.0075 U	0.0075 U	0.0075 U	0.0075 U	**0.0151**	0.005 U
Magnesium		**33**	**31**	NA	NA	**140**	**81**	**89**	**81**	**74**	NA	**24**
Magnesium, dissolved		NA	NA	NA	NA	**75**		NA	NA	NA	NA	**22**
Manganese		**0.046**	**0.045**	**2.94**	**2.48**	**1.2**	**0.0059** J	**0.017**	**0.019**	**0.019**	**0.168**	**0.2**
Manganese, dissolved		NA	NA	NA	NA	**0.25**	NA	NA	NA	NA	NA	**0.04**
Mercury	0.002	0.0002 U	0.0002 U	**0.00045** J	0.00014 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0001 U	0.0002 U
Nickel		0.01 U	0.01 U	NA	NA	**0.06**	**0.0035** J	**0.0068** J	**0.0061** J	**0.0049** J	NA	0.04 U
Potassium		**1.4**	**1.5**	NA	NA	**12**	**7.6**	**9.6**	**5.4**	**10**	NA	5 U
Potassium, dissolved		NA	NA	NA	NA	**8.5**		NA	NA	NA	NA	5 U
Selenium	0.05	0.015 U	0.015 U	0.0012 U	0.0012 U	0.005 U	0.015 U	0.015 U	0.015 U	0.015 U	0.0012 U	0.005 U
Sodium		**8.9**	**8.6**	**16.6**	**17.3**	**16**	**14**	**19**	**11**	**12**	**9.76**	**11**
Sodium, dissolved		NA	NA	NA	NA	**16**	NA	NA	NA	NA	NA	**13**
Thallium	0.002	0.025 U	0.025 U	NA	NA	0.005 U	0.025 U	0.025 U	0.025 U	0.025 U	NA	0.005 U
Vanadium		0.01 U	0.01 U	NA	NA	**0.04**	0.01 U	0.01 U	0.01 U	0.01 U	NA	0.01 U
Zinc		0.04 U	0.04 U	NA	NA	**0.18**	0.04 U	0.04 U	0.04 U	0.04 U	NA	**0.04**

TABLE 4-7

Concentrations of Detected Analytes in Groundwater

Samples Collected During Phase I, Phase II, and Remedial Investigations

Former Lockbourne Air Force Base, Lockbourne, Ohio

		UWBZ	**UWBZ**	**UWBZ**	**UWBZ**	**UWBZ**	**UWBZ**	**UWBZ**	**IDA**	**IDA**	**IDA**	**IDA**
		Site	**Site**	**Site**	**Site**	**Site**	**Site**	**Site**	**Background**	**Background**	**Background**	**Background**
		LCKMW-7	**LCKMW-7**	**LCKMW-7**	**LCKMW-7**	**LCKMW-7**	**LCKMW-7**	**LCKMW-7**	**LCKMW-8**	**LCKMW-8**	**LCKMW-8**	**LCKMW-8**
			DUP				**DUP**					
		11/11/1998	**11/11/1998**	**8/13/2003**	**11/13/2003**	**2/24/2004**	**2/24/2004**	**5/20/2004**	**9/23/1997**	**8/11/2003**	**11/13/2003**	**2/26/2004**
PARAMETER_NAME	**MCLs**	**Phase II**	**Phase II**	**RI**	**RI**	**RI**	**RI**	**RI**	**Phase II**	**RI**	**RI**	**RI**
Volatile Organic Compounds (mg/L)												
Acetone		NA	NA	0.01 U	0.01 U	0.01 U	0.01 U	**0.015**	0.01 U	0.01 U	0.01 U	0.01 U
Carbon disulfide		NA	NA	0.002 U	0.002 UJ	0.002 U*	0.002 U*	0.002 U*	**0.0048**	0.002 U	0.002 UJ	0.002 U*
Methylene chloride		NA	NA	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.001 U	0.002 U	0.002 U	0.002 U
Toluene	1	NA	NA	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Semi-Volatile Organic Compounds (mg/L)												
Acenaphthylene		NA	NA	0.001 U	0.00098 U	0.001 U	0.001 U	0.00098 U	0.01 U	0.0011 U	0.001 U	0.001 U
Benz(a)anthracene		NA	NA	0.0002 U	0.0002 U	0.0002 U	**0.00015** J	0.0002 U	0.01 U	0.00022 U	0.0002 U	0.00021 U
Benzo(a)pyrene	0.0002	NA	NA	0.0002 U	0.0002 U	0.0002 U	**0.00031**	0.0002 U	0.01 U	0.00022 U	0.0002 U	0.00021 U
Benzo(b)fluoranthene		NA	NA	0.0002 U	0.0002 U	0.0002 U	**0.00032** H	0.0002 U	0.01 U	0.00022 U	0.0002 U	0.00021 U
Benzo(ghi)perylene		NA	NA	0.001 U	0.00098 U	0.001 U	0.001 U	0.00098 U	0.01 U	0.0011 U	0.001 U	**0.00026** J
Benzo(k)fluoranthene		NA	NA	0.0002 U	0.0002 UJ	0.0002 UJ	0.00029 UJ	0.0002 U	0.01 U	0.00022 U	0.0002 UJ	0.00021 UJ
Chrysene		NA	NA	0.00051 U	0.00049 U	0.00051 U	0.00051 U	0.00049 U	0.01 U	0.00054 U	0.0005 U	0.00052 U
Dibenz(ah)anthracene		NA	NA	0.0002 U	0.0002 U	0.0002 U	**0.0003**	0.0002 U	0.01 U	0.00022 U	0.0002 U	**0.00028**
Indeno(1,2,3-cd)pyrene		NA	NA	0.0002 U	0.0002 U	0.0002 U	**0.00032**	0.0002 U	0.01 U	0.00022 U	0.0002 U	**0.00025**
Naphthalene		NA	NA	0.001 U	0.00098 U	0.001 U	0.001 U	0.00098 U	0.01 U	0.0011 U	0.001 U	0.001 U
Bis(2-ethylhexyl) phthalate	0.006	NA	NA	0.0051 U	0.0049 U	0.02 U	0.028 U	0.0098 U	0.01 U	0.0054 U	0.005 U	0.01 U
Butylbenzyl phthalate		NA	NA	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.01 U	0.0022 U	0.002 U	0.0021 U
Diethyl phthalate		NA	NA	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.01 U	0.0022 U	0.002 U	0.0021 U
Di-n-octyl phthalate		NA	NA	0.01 U	0.0098 U	0.01 U	0.01 U	0.0098 U	0.01 U	0.011 U	0.01 U	0.01 U
Phenol		NA	NA	0.0051 U	0.0049 U	0.0051 U	0.0051 U	0.0049 U	0.01 U	0.0054 U	0.005 U	0.0052 U
Trichlorobenzene, 1,2,3-		NA	NA	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	NA	0.001 U	0.001 U	0.001 U
Dioxins / Furans (mg/L)												
Dioxins												
Heptachlorodibenzo-p-dioxin, 1,2,3,4,6,7,8-		4.8E-09 U	4.8E-09 U	7.4E-09 U	NA	NA	NA	NA	**3.4E-09** B	NA	NA	NA
Heptachlorodibenzo-p-dioxins, total		4.8E-09 U	4.8E-09 U	7.4E-09 U	NA	NA	NA	NA	**3.4E-09** BJ	NA	NA	NA
Hexachlorodibenzo-p-dioxin, 1,2,3,4,7,8-		3.4E-09 U	3.4E-09 U	4.2E-09 U	NA	NA	NA	NA	1.9E-09 U	NA	NA	NA
Hexachlorodibenzo-p-dioxin, 1,2,3,6,7,8-		3.2E-09 U	3.1E-09 U	4E-09 U	NA	NA	NA	NA	**2.4E-09** B	NA	NA	NA
Hexachlorodibenzo-p-dioxin, 1,2,3,7,8,9-		3.6E-09 U	3.5E-09 U	3.9E-09 U	NA	NA	NA	NA	**3.2E-09** B	NA	NA	NA
Hexachlorodibenzo-p-dioxins, total		3.4E-09 U	3.3E-09 U	4.2E-09 U	NA	NA	NA	NA	**3.2E-09** B	NA	NA	NA
Octachlorodibenzo-p-dioxin		7.5E-09 U	9.4E-09 U	4.1E-08 U	NA	NA	NA	NA	**1.71E-08** B	NA	NA	NA
Octachlorodibenzo-p-dioxin; Dissolved		4.5E-09 U	7.5E-09 U	5.5E-09 U	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorodibenzo-p-dioxin, 1,2,3,7,8-		3.9E-09 U	4.4E-09 U	5.5E-09 U	NA	NA	NA	NA	1.6E-09 U	NA	NA	NA
Pentachlorodibenzo-p-dioxins, total		3.9E-09 U	4.4E-09 U	5.5E-09 U	NA	NA	NA	NA	1.6E-09 U	NA	NA	NA
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-		3.1E-09 U	3.5E-09 U	4.9E-09 U	NA	NA	NA	NA	1.2E-09 U	NA	NA	NA
Tetrachlorodibenzo-p-dioxins, total		3.1E-09 U	3.5E-09 U	4.9E-09 U	NA	NA	NA	NA	1.2E-09 U	NA	NA	NA
Furans												
Heptachlorodibenzofuran, 1,2,3,4,6,7,8-		3.4E-09 U	3.4E-09 U	6.8E-09 U	NA	NA	NA	NA	1.2E-09 U	NA	NA	NA
Heptachlorodibenzofuran, 1,2,3,4,7,8,9-		5.1E-09 U	5.2E-09 U	3.1E-09 U	NA	NA	NA	NA	**3E-09** B	NA	NA	NA
Heptachlorodibenzofurans, total		4.1E-09 U	4.1E-09 U	6.8E-09 U	NA	NA	NA	NA	**3E-09** BJ	NA	NA	NA
Hexachlorodibenzofuran, 1,2,3,4,7,8-		**4.1E-09** J	2.5E-09 U	4.2E-09 U	NA	NA	NA	NA	**3.2E-09** B	NA	NA	NA

TABLE 4-7
Concentrations of Detected Analytes in Groundwater
Samples Collected During Phase I, Phase II, and Remedial Investigations
Former Lockbourne Air Force Base, Lockbourne, Ohio

		UWBZ	**UWBZ**	**UWBZ**	**UWBZ**	**UWBZ**	**UWBZ**	**UWBZ**	**IDA**	**IDA**	**IDA**	**IDA**
		Site	**Site**	**Site**	**Site**	**Site**	**Site**	**Site**	**Background**	**Background**	**Background**	**Background**
		LCKMW-7	**LCKMW-7**	**LCKMW-7**	**LCKMW-7**	**LCKMW-7**	**LCKMW-7**	**LCKMW-7**	**LCKMW-8**	**LCKMW-8**	**LCKMW-8**	**LCKMW-8**
			DUP				**DUP**					
		11/11/1998	**11/11/1998**	**8/13/2003**	**11/13/2003**	**2/24/2004**	**2/24/2004**	**5/20/2004**	**9/23/1997**	**8/11/2003**	**11/13/2003**	**2/26/2004**
PARAMETER_NAME	**MCLs**	**Phase II**	**Phase II**	**RI**	**RI**	**RI**	**RI**	**RI**	**Phase II**	**RI**	**RI**	**RI**
Hexachlorodibenzofuran, 1,2,3,6,7,8-		**3.2E-09** J	2.3E-09 U	4E-09 U	NA	NA	NA	NA	1.1E-09 U	NA	NA	NA
Hexachlorodibenzofuran, 1,2,3,7,8,9-		3E-09 U	3E-09 U	4.8E-09 U	NA	NA	NA	NA	**3E-09** B	NA	NA	NA
Hexachlorodibenzofuran, 2,3,4,6,7,8-		2.6E-09 U	2.5E-09 U	4.4E-09 U	NA	NA	NA	NA	**6.1E-09** B	NA	NA	NA
Hexachlorodibenzofurans, total		**7.3E-09** J	2.6E-09 U	4.8E-09 U	NA	NA	NA	NA	**6.1E-09** B	NA	NA	NA
Octachlorodibenzofuran		6E-09 U	7.6E-09 U	6E-09 U	NA	NA	NA	NA	**9.8E-09** B	NA	NA	NA
Pentachlorodibenzofuran, 1,2,3,7,8-		2.8E-09 U	3E-09 U	3.8E-09 U	NA	NA	NA	NA	**2.1E-09** B	NA	NA	NA
Pentachlorodibenzofuran, 2,3,4,7,8-		2.7E-09 U	2.9E-09 U	3.7E-09 U	NA	NA	NA	NA	**2.6E-09** B	NA	NA	NA
Pentachlorodibenzofurans, total		2.8E-09 U	2.9E-09 U	5E-09 U	NA	NA	NA	NA	**2.6E-09** B	NA	NA	NA
Tetrachlorodibenzofuran, 2,3,7,8-		2.7E-09 U	2.7E-09 U	2.7E-09 U	NA	NA	NA	NA	**3.6E-09** B	NA	NA	NA
Tetrachlorodibenzofurans, total		2.7E-09 U	2.7E-09 U	2.7E-09 U	NA	NA	NA	NA	**3.6E-09** B	NA	NA	NA
TCDD-TEQ	3E-08	**5.9672E-09**	**5.9439E-09**	**7.9189E-09**	NA	NA	NA	NA	**5.1777E-09**	NA	NA	NA
TCDD-TEQ; Dissolved	3E-08	**3.2184E-09**	**5.8896E-09**	**2.2794E-09**	NA	NA	NA	NA	NA	NA	NA	NA
Metals (mg/L)												
Aluminum		NA	NA	**0.078** J	0.2 U	**0.031** J	**0.035** J	0.06 U	**0.12**	**0.07** J	0.2 U	0.2 U
Arsenic	0.01	NA	NA	**0.0092** J	**0.0078** J	**0.0097** J	**0.01** J	**0.0093** J	**0.014**	**0.02**	**0.021**	**0.015** J
Arsenic, dissolved	0.01	NA	NA	NA	NA	NA	NA	NA	0.005 U	NA	NA	NA
Barium	2	NA	NA	**0.44**	**0.46**	**0.42**	**0.42**	**0.45**	**0.46**	**0.53**	**0.52**	**0.5**
Barium, dissolved	2	NA	NA	NA	NA	NA	NA	NA	**0.13**	NA	NA	NA
Beryllium	0.004	NA	NA	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.005 U	0.004 U	0.004 U	0.004 U
Cadmium	0.005	NA	NA	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.005 U	0.002 U	0.002 U	0.002 U
Calcium		NA	NA	**84**	**88**	**86**	**85**	**82** J	**84**	**89**	**93**	**90**
Calcium, dissolved		NA	NA	NA	NA	NA	NA	NA	**13**	NA	NA	NA
Chromium, total	0.1	NA	NA	0.01 U	0.01 U	0.003 U	0.003 U	0.01 U	0.01 U	0.01 U	0.01 U	**0.0015** J
Cobalt		NA	NA	0.01 U	0.01 U	0.0018 U	0.002 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Copper	1.3	NA	NA	**0.0028** J	0.01 U	0.01 U	0.01 U	0.01 U	**0.06**	**0.0026** J	0.01 U	0.01 U
Copper, dissolved	1.3	NA	NA	NA	NA	NA	NA	NA	0.02 U	NA	NA	NA
Iron		NA	NA	**1.2**	**1.3** J	**1.5** J	**1.5** J	**1.4**	**1.7**	**2**	**1.6** J	**1.5**
Iron, dissolved		NA	NA	NA	NA	NA	NA	NA	0.1 U	NA	NA	NA
Lead	0.015	NA	NA	0.0075 U	0.0075 U	0.0075 U	0.0075 U	0.0075 U	0.005 U	0.0075 U	0.0075 U	0.003 U
Magnesium		NA	NA	**25**	**27**	**26**	**25**	**25**	**29**	**30**	**32**	**30**
Magnesium, dissolved		NA	NA	NA	NA	NA	NA	NA	**17**	NA	NA	NA
Manganese		NA	NA	**0.079**	**0.081**	**0.098**	**0.098**	**0.12**	**0.04**	**0.017**	**0.017**	**0.017**
Manganese, dissolved		NA	NA	NA	NA	NA	NA	NA	0.01 U	NA	NA	NA
Mercury	0.002	NA	NA	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Nickel		NA	NA	0.01 U	0.01 U	0.0024 U	0.0024 U	0.01 U	0.04 U	0.01 U	0.01 U	0.01 U
Potassium		NA	NA	**1.3**	**1.3**	**1.3**	**1.3**	**1.2**	5 U	**1.8**	**1.6**	**1.6**
Potassium, dissolved		NA	NA	NA	NA	NA	NA	NA	**37**	NA	NA	NA
Selenium	0.05	NA	NA	0.015 U	0.015 U	0.015 U	0.015 U	0.015 U	0.005 U	0.015 U	0.015 U	0.015 U
Sodium		NA	NA	**6.2**	**6.1**	**5.9**	**5.8**	**5.6**	**8.9**	**10**	**10**	**9.7**
Sodium, dissolved		NA	NA	NA	NA	NA	NA	NA	**20**	NA	NA	NA
Thallium	0.002	NA	NA	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.005 U	0.025 U	0.025 U	0.025 U
Vanadium		NA	NA	0.01 U	0.01 U	0.0028 U	0.0028 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Zinc		NA	NA	0.04 U	**0.013** J	0.04 U	0.04 U	0.04 U	0.02 U	0.04 U	0.04 U	0.04 U

TABLE 4-7

Concentrations of Detected Analytes in Groundwater

Samples Collected During Phase I, Phase II, and Remedial Investigations

Former Lockbourne Air Force Base, Lockbourne, Ohio

		IDA	UWBZ	UWBZ	UWBZ	UWBZ	UWBZ	IDA	IDA	IDA	IDA	IDA
		Background	Background	Background	Background	Background	Background	Site	Site	Site	Site	Site
		LCKMW-8	LCKMW-9	LCKMW-9	LCKMW-9	LCKMW-9	LCKMW-9	LCKMW-10	LCKMW-10	LCKMW-10	LCKMW-10	LCKMW-10
		5/18/2004	9/23/1997	8/11/2003	11/13/2003	2/26/2004	5/18/2004	9/22/1997	11/12/1998	8/14/2003	11/11/2003	2/24/2004
PARAMETER_NAME	**MCLs**	RI	Phase II		RI	RI	RI	Phase II	Phase II	RI	RI	RI
Volatile Organic Compounds (mg/L)												
Acetone		**0.015** J	0.01 U	0.01 U	0.01 U	**0.039** J	**0.14** J	0.01 U	NA	0.01 U	0.01 U	0.01 U
Carbon disulfide		0.002 UJ	0.001 U	0.002 U	0.002 UJ	0.002 U*	0.002 UJ	**0.0032**	NA	0.002 U	0.002 UJ	0.002 U*
Methylene chloride		0.002 U	0.001 U	0.002 U	0.002 U	0.002 U	0.002 U	0.001 U	NA	0.002 U	0.002 U	0.002 U
Toluene	1	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	**0.0011**	NA	0.001 U	0.001 U	0.001 U
Semi-Volatile Organic Compounds (mg/L)												
Acenaphthylene		0.00099 U	0.01 U	0.001 U	0.001 U	0.00099 U	0.00098 U	0.01 U	NA	0.00098 U	0.001 U	0.001 U
Benz(a)anthracene		0.0002 U	0.01 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.01 U	NA	0.0002 U	0.0002 U	**0.00028**
Benzo(a)pyrene	0.0002	0.0002 U	0.01 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.01 U	NA	0.0002 U	0.0002 U	**0.00079**
Benzo(b)fluoranthene		0.0002 U	0.01 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.01 U	NA	0.0002 U	0.0002 U	**0.00075** H
Benzo(ghi)perylene		0.00099 U	0.01 U	0.001 U	0.001 U	0.00099 U	0.00098 U	0.01 U	NA	0.00098 U	0.001 U	0.001 U
Benzo(k)fluoranthene		0.0002 U	0.01 U	0.0002 U	0.0002 UJ	0.0002 UJ	0.0002 U	0.01 U	NA	0.0002 U	0.0002 U	0.00075 UJ
Chrysene		0.0005 U	0.01 U	0.0005 U	0.0005 U	0.0005 U	0.00049 U	0.01 U	NA	0.00049 U	0.0005 U	0.00052 U
Dibenz(ah)anthracene		0.0002 U	0.01 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.01 U	NA	0.0002 U	0.0002 U	**0.001**
Indeno(1,2,3-cd)pyrene		0.0002 U	0.01 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.01 U	NA	0.0002 U	0.0002 U	**0.00091**
Naphthalene		0.00099 U	0.01 U	0.001 U	0.001 U	0.00099 U	0.00098 U	0.01 U	NA	0.00098 U	0.001 U	0.001 U
Bis(2-ethylhexyl) phthalate	0.006	0.0099 U	0.01 U	0.005 U	0.005 U	**0.0054** J	0.0098 U	0.01 U	NA	0.0049 U	0.005 U	0.046 U
Butylbenzyl phthalate		0.002 U	0.01 U	0.002 U	0.002 U	0.002 U	0.002 U	0.01 U	NA	0.002 U	0.002 U	0.0021 U
Diethyl phthalate		0.002 U	0.01 U	0.002 U	0.002 U	0.002 U	0.002 U	0.01 U	NA	0.002 U	0.002 U	0.0021 U
Di-n-octyl phthalate		0.0099 U	0.01 U	0.01 U	0.01 U	0.0099 U	0.0098 U	0.01 U	NA	0.0098 U	0.01 U	0.01 U
Phenol		0.005 U	0.01 U	0.005 U	0.005 U	0.005 U	0.0049 U	0.01 U	NA	0.0049 U	0.005 U	0.0052 U
Trichlorobenzene, 1,2,3-		0.001 U		0.001 U	0.001 U	0.001 U	0.001 U	NA	NA	0.001 U	0.001 U	0.001 U
Dioxins / Furans (mg/L)												
Dioxins												
Heptachlorodibenzo-p-dioxin, 1,2,3,4,6,7,8-		NA	**6E-09** B	NA	NA	NA	NA	3.6E-09 U	1.8E-09 U	NA	NA	NA
Heptachlorodibenzo-p-dioxins, total		NA	**5.2E-09** B	NA	NA	NA	NA	3.6E-09 U	1.8E-09 U	NA	NA	NA
Hexachlorodibenzo-p-dioxin, 1,2,3,4,7,8-		NA	2.1E-09 U	NA	NA	NA	NA	3.9E-09 U	1E-09 U	NA	NA	NA
Hexachlorodibenzo-p-dioxin, 1,2,3,6,7,8-		NA	1.9E-09 U	NA	NA	NA	NA	3.3E-09 U	9E-10 U	NA	NA	NA
Hexachlorodibenzo-p-dioxin, 1,2,3,7,8,9-		NA	1.9E-09 U	NA	NA	NA	NA	3.2E-09 U	1.1E-09 U	NA	NA	NA
Hexachlorodibenzo-p-dioxins, total		NA	**1.16E-08** BJ	NA	NA	NA	NA	3.4E-09 U	1E-09 U	NA	NA	NA
Octachlorodibenzo-p-dioxin		NA	**8.36E-08** B	NA	NA	NA	NA	**1.11E-08** J	**6.2E-09** JC	NA	NA	NA
Octachlorodibenzo-p-dioxin; Dissolved		NA	NA	NA	NA	NA	NA	NA	4.1E-09 U	NA	NA	NA
Pentachlorodibenzo-p-dioxin, 1,2,3,7,8-		NA	1.7E-09 U	NA	NA	NA	NA	2.9E-09 U	8E-10 U	NA	NA	NA
Pentachlorodibenzo-p-dioxins, total		NA	1.7E-09 U	NA	NA	NA	NA	2.9E-09 U	8E-10 U	NA	NA	NA
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-		NA	1.4E-09 U	NA	NA	NA	NA	2.5E-09 U	1E-09 U	NA	NA	NA
Tetrachlorodibenzo-p-dioxins, total		NA	1.4E-09 U	NA	NA	NA	NA	2.5E-09 U	1E-09 U	NA	NA	NA
Furans												
Heptachlorodibenzofuran, 1,2,3,4,6,7,8-		NA	**3.8E-09** B	NA	NA	NA	NA	2.9E-09 U	1.2E-09 U	NA	NA	NA
Heptachlorodibenzofuran, 1,2,3,4,7,8,9-		NA	2.2E-09 U	NA	NA	NA	NA	3.3E-09 U	1.9E-09 U	NA	NA	NA
Heptachlorodibenzofurans, total		NA	**6E-09** BJ	NA	NA	NA	NA	3.1E-09 U	1.5E-09 U	NA	NA	NA
Hexachlorodibenzofuran, 1,2,3,4,7,8-		NA	1.5E-09 U	NA	NA	NA	NA	2.8E-09 U	8E-10 U	NA	NA	NA

TABLE 4-7

Concentrations of Detected Analytes in Groundwater

Samples Collected During Phase I, Phase II, and Remedial Investigations

Former Lockbourne Air Force Base, Lockbourne, Ohio

		IDA	**UWBZ**	**UWBZ**	**UWBZ**	**UWBZ**	**UWBZ**	**IDA**	**IDA**	**IDA**	**IDA**	**IDA**
		Background	**Background**	**Background**	**Background**	**Background**	**Background**	**Site**	**Site**	**Site**	**Site**	**Site**
		LCKMW-8	**LCKMW-9**	**LCKMW-9**	**LCKMW-9**	**LCKMW-9**	**LCKMW-9**	**LCKMW-10**	**LCKMW-10**	**LCKMW-10**	**LCKMW-10**	**LCKMW-10**
		5/18/2004	**9/23/1997**	**8/11/2003**	**11/13/2003**	**2/26/2004**	**5/18/2004**	**9/22/1997**	**11/12/1998**	**8/14/2003**	**11/11/2003**	**2/24/2004**
PARAMETER_NAME	**MCLs**	**RI**	**Phase II**		**RI**	**RI**	**RI**	**Phase II**	**Phase II**	**RI**	**RI**	**RI**
Hexachlorodibenzofuran, 1,2,3,6,7,8-		NA	1.2E-09 U	NA	NA	NA	NA	2.3E-09 U	7E-10 U	NA	NA	NA
Hexachlorodibenzofuran, 1,2,3,7,8,9-		NA	1.7E-09 U	NA	NA	NA	NA	2.9E-09 U	9E-10 U	NA	NA	NA
Hexachlorodibenzofuran, 2,3,4,6,7,8-		NA	**6.1E-09** B	NA	NA	NA	NA	**4.2E-09** B	8E-10 U	NA	NA	NA
Hexachlorodibenzofurans, total		NA	**6.1E-09** B	NA	NA	NA	NA	**4.2E-09** B	8E-10 U	NA	NA	NA
Octachlorodibenzofuran		NA	**1.11E-08** B	NA	NA	NA	NA	3.1E-09 U	3.8E-09 U	NA	NA	NA
Pentachlorodibenzofuran, 1,2,3,7,8-		NA	1.3E-09 U	NA	NA	NA	NA	2.3E-09 U	7E-10 U	NA	NA	NA
Pentachlorodibenzofuran, 2,3,4,7,8-		NA	1.3E-09 U	NA	NA	NA	NA	2.3E-09 U	7E-10 U	NA	NA	NA
Pentachlorodibenzofurans, total		NA	1.3E-09 U	NA	NA	NA	NA	2.3E-09 U	7E-10 U	NA	NA	NA
Tetrachlorodibenzofuran, 2,3,7,8-		NA	**4.5E-09** B	NA	NA	NA	NA	2.1E-09 U	7E-10 U	NA	NA	NA
Tetrachlorodibenzofurans, total		NA	**5.8E-09** B	NA	NA	NA	NA	2.1E-09 U	7E-10 U	NA	NA	NA
TCDD-TEQ	3E-08	NA	**3.601E-09**	NA	NA	NA	NA	**4.8278E-09**	**1.4628E-09**	NA	NA	NA
TCDD-TEQ; Dissolved	3E-08	NA	NA	NA	NA	NA	NA	NA	**2.0418E-09**	NA	NA	NA
Metals (mg/L)												
Aluminum		0.23 U	**22**	**0.14** J	**0.12** J	0.2 U	0.047 U	**0.11**	NA	**0.23**	**0.044** J	**0.086** J
Arsenic	0.01	**0.022**	**0.006**	0.02 U	0.02 U	0.02 U	0.02 U	0.005 U	NA	**0.0066** J	**0.0065** J	**0.009** J
Arsenic, dissolved	0.01	NA	0.005 U	NA	NA	NA	NA	0.005 U	NA	NA	NA	NA
Barium	2	**0.51**	**0.24**	**0.048**	**0.039**	**0.032**	**0.04**	**0.42**	NA	**0.38**	**0.41**	**0.39**
Barium, dissolved	2	NA	**0.1**	NA	NA	NA	NA	**0.34**	NA	NA	NA	NA
Beryllium	0.004	0.004 U	0.005 U	0.004 U	0.004 U	0.004 U	0.004 U	0.005 U	NA	0.004 U	0.004 U	0.004 U
Cadmium	0.005	0.002 U	0.005 U	0.002 U	0.002 U	0.002 U	0.002 U	0.005 U	NA	0.002 U	0.002 U	0.002 U
Calcium		**95**	**230**	**89**	**93**	**90**	**99**	**79**	NA	**90**	**87**	**85**
Calcium, dissolved		NA	**99**	NA	NA	NA	NA	**72**	NA	NA	NA	NA
Chromium, total	0.1	**0.0039** J	**0.04**	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	NA	**0.0036** J	0.01 U	0.0046 U
Cobalt		0.01 U	**0.03**	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	NA	**0.0022** J	**0.0029** J	0.0059 U
Copper	1.3	0.0029 U	**0.09**	**0.004** J	**0.023**	0.0024 U	0.0038 U	0.02 U	NA	0.01 U	0.01 U	**0.0016** J
Copper, dissolved	1.3	NA	0.02 U	NA	NA	NA	NA	0.02 U	NA	NA	NA	NA
Iron		**2.2**	**49**	**0.19** J	**0.15** J	0.2 U	0.057 U	**3**	NA	**4.1**	**2.9** J	**2.9** J
Iron, dissolved		NA	0.1 U	NA	NA	NA	NA	**0.39**	NA	NA	NA	NA
Lead	0.015	0.0075 U	**0.027**	0.0075 U	0.0054 U	0.0036 U	0.0075 U	0.005 U	NA	0.0075 U	0.0075 U	0.0075 U
Magnesium		**32**	**78**	**25**	**28**	**28**	**30**	**26**	NA	**27**	**28**	**27**
Magnesium, dissolved		NA	**28**	NA	NA	NA	NA	**26**	NA	NA	NA	NA
Manganese		**0.027**	**1.3**	**0.08**	**0.028**	0.0041 U	**0.12**	**0.22**	NA	**0.12**	**0.13**	**0.12**
Manganese, dissolved		NA	**0.3**	NA	NA	NA	NA	**0.19**	NA	NA	NA	NA
Mercury	0.002	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	NA	0.0002 U	0.0002 U	0.0002 U
Nickel		0.01 U	**0.08**	0.01 U	0.01 U	0.01 U	0.01 U	0.04 U	NA	0.01 U	0.01 U	0.0032 U
Potassium		**1.8**	**7.8**	**0.48** J	0.41 U	0.28 U	0.33 U	5 U	NA	**1.3**	**1.3**	**1.4**
Potassium, dissolved		NA	5 U	NA	NA	NA	NA	**5.6**	NA	NA	NA	NA
Selenium	0.05	0.015 U	0.005 U	0.015 U	0.015 U	0.015 U	0.015 U	0.005 U	NA	0.015 U	0.015 U	0.015 U
Sodium		**11**	**6.3**	**4.6**	**3.7**	**2.7**	**2.6**	**8.1**	NA	**9.8**	**8.6**	**8.8**
Sodium, dissolved		NA	**4.1**	NA	NA	NA	NA	**8.8**	NA	NA	NA	NA
Thallium	0.002	0.025 U	0.005 U	0.025 U	0.025 U	0.025 U	0.025 U	0.005 U	NA	0.025 U	0.025 U	0.025 U
Vanadium		0.01 U	**0.06**	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	NA	0.01 U	0.01 U	0.003 U
Zinc		0.04 U	**0.19**	0.04 U	**0.012** J	0.04 U	0.04 U	0.02 U	NA	**0.013** J	0.04 U	0.04 U

TABLE 4-7

Concentrations of Detected Analytes in Groundwater

Samples Collected During Phase I, Phase II, and Remedial Investigations

Former Lockbourne Air Force Base, Lockbourne, Ohio

		IDA	**UWBZ**	**UWBZ**	**UWBZ**	**UWBZ**	**UWBZ**	**UWBZ**	**IDA**	**IDA**	**IDA**	**IDA**
		Site	**Site**	**Site**	**Site**	**Site**	**Site**	**Site**	**Site**	**Site**	**Site**	**Site**
		LCKMW-10	**LCKMW-11**	**LCKMW-11**	**MW-11**	**LCKMW-11**	**LCKMW-11**	**LCKMW-11**	**LCKMW-12A[4]**	**LCKMW-12A[5]**	**LCKMW-12A[6]**	**LCKMW-12A[7]**
										DUP		
		5/19/2004	**9/22/1997**	**11/12/1998**	**8/14/2003**	**11/11/2003**	**2/24/2004**	**5/19/2004**	**9/17/1997**	**9/17/1997**	**11/12/1998**	**8/14/2003**
PARAMETER_NAME	**MCLs**	**RI**	**Phase II**	**Phase II**	**RI**	**RI**	**RI**	**RI**	**Phase II**	**Phase II**	**Phase II**	**RI**
Volatile Organic Compounds (mg/L)												
Acetone		0.01 U	0.01 U	NA	0.01 U	0.01 U	0.013 U	0.01 U	0.01 U	0.01 U	NA	**0.0024** J
Carbon disulfide		0.002 U	0.001 U	NA	0.002 U	0.002 UJ	0.002 U*	0.002 U	**0.0013**	**0.0012**	NA	0.002 U
Methylene chloride		0.002 U	0.001 U	NA	0.002 U	0.002 U	0.002 U	0.002 U	0.001 U	0.001 U	NA	0.002 U
Toluene	1	0.001 U	0.001 U	NA	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	NA	0.001 U
Semi-Volatile Organic Compounds (mg/L)												
Acenaphthylene		0.00099 U	0.01 U	NA	0.00095 U	0.001 U	0.0011 U	0.00099 U	0.01 U	0.01 U	NA	0.001 U
Benz(a)anthracene		0.0002 U	0.01 U	NA	0.00019 U	0.0002 U	**0.00015** J	0.0002 U	0.01 U	0.01 U	NA	0.0002 U
Benzo(a)pyrene	0.0002	0.0002 U	0.01 U	NA	0.00019 U	0.0002 U	**0.00063**	0.0002 U	0.01 U	0.01 U	NA	0.0002 U
Benzo(b)fluoranthene		0.0002 U	0.01 U	NA	0.00019 U	0.0002 U	**0.00046** H	0.0002 U	0.01 U	0.01 U	NA	0.0002 U
Benzo(ghi)perylene		**0.00024** J	0.01 U	NA	0.00095 U	0.001 U	0.0011 U	0.00099 U	0.01 U	0.01 U	NA	0.001 U
Benzo(k)fluoranthene		0.0002 U	0.01 U	NA	0.00019 U	0.0002 U	0.00059 UJ	0.0002 U	0.01 U	0.01 U	NA	0.0002 U
Chrysene		0.0005 U	0.01 U	NA	0.00048 U	0.0005 U	0.00053 U	0.0005 U	0.01 U	0.01 U	NA	0.0005 U
Dibenz(ah)anthracene		0.0002 U	0.01 U	NA	0.00019 U	0.0002 U	**0.001**	0.0002 U	0.01 U	0.01 U	NA	0.0002 U
Indeno(1,2,3-cd)pyrene		0.0002 U	0.01 U	NA	0.00019 U	0.0002 U	**0.001**	0.0002 U	0.01 U	0.01 U	NA	0.0002 U
Naphthalene		0.00099 U	0.01 U	NA	0.00095 U	0.001 U	0.0011 U	**0.00029** J	0.01 U	0.01 U	NA	0.001 U
Bis(2-ethylhexyl) phthalate	0.006	0.0099 U	0.01 U	NA	0.0048 U	0.005 U	0.011 U	0.0099 U	0.01 U	0.01 U	NA	0.005 U
Butylbenzyl phthalate		0.002 U	0.01 U	NA	0.0019 U	0.002 U	0.0021 U	0.002 U	0.01 U	0.01 U	NA	0.002 U
Diethyl phthalate		0.002 U	0.01 U	NA	0.0019 U	0.002 U	0.0021 U	0.002 U	0.01 U	0.01 U	NA	0.002 U
Di-n-octyl phthalate		0.0099 U	0.01 U	NA	0.0095 U	0.01 U	0.011 U	0.0099 U	0.01 U	0.01 U	NA	0.01 U
Phenol		0.005 U	0.01 U	NA	0.0048 U	0.005 U	0.0053 U	0.005 U	0.01 U	0.01 U	NA	0.005 U
Trichlorobenzene, 1,2,3-		0.001 U	NA	NA	0.001 U	0.001 U	0.001 U	0.001 U	NA	NA	NA	0.001 U
Dioxins / Furans (mg/L)												
Dioxins												
Heptachlorodibenzo-p-dioxin, 1,2,3,4,6,7,8-		NA	**1.78E-08**	1.8E-09 U	NA	NA	NA	NA	0.000000004 U	**7.3E-09** J	2.3E-09 U	NA
Heptachlorodibenzo-p-dioxins, total		NA	**2.44E-08**	1.8E-09 U	NA	NA	NA	NA	0.000000004 U	**1.34E-08** BJ	2.3E-09 U	NA
Hexachlorodibenzo-p-dioxin, 1,2,3,4,7,8-		NA	**9.4E-09**	1E-09 U	NA	NA	NA	NA	3.6E-09 U	3.8E-09 U	1.3E-09 U	NA
Hexachlorodibenzo-p-dioxin, 1,2,3,6,7,8-		NA	**9.7E-09**	9E-10 U	NA	NA	NA	NA	3.3E-09 U	3.2E-09 U	1.3E-09 U	NA
Hexachlorodibenzo-p-dioxin, 1,2,3,7,8,9-		NA	**1.96E-08**	1E-09 U	NA	NA	NA	NA	3.2E-09 U	3.2E-09 U	1.3E-09 U	NA
Hexachlorodibenzo-p-dioxins, total		NA	**3.87E-08**	1E-09 U	NA	NA	NA	NA	3.4E-09 U	3.4E-09 U	1.3E-09 U	NA
Octachlorodibenzo-p-dioxin		NA	**1.21E-07**	4.6E-09 U	NA	NA	NA	NA	**2.96E-08** J	**8.55E-08** J	5.7E-09 U	NA
Octachlorodibenzo-p-dioxin; Dissolved		NA		3.2E-09 U	NA	NA	NA	NA	NA	NA	**0.000000006** JC	NA
Pentachlorodibenzo-p-dioxin, 1,2,3,7,8-		NA	**1.21E-08**	8E-10 U	NA	NA	NA	NA	2.7E-09 U	0.000000003 U	1.2E-09 U	NA
Pentachlorodibenzo-p-dioxins, total		NA	**1.21E-08**	8E-10 U	NA	NA	NA	NA	2.7E-09 U	0.000000003 U	1.2E-09 U	NA
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-		NA	**8.5E-09**	1E-09 U	NA	NA	NA	NA	2.2E-09 U	2.4E-09 U	1.6E-09 U	NA
Tetrachlorodibenzo-p-dioxins, total		NA	**8.5E-09**	**1.1E-09** C	NA	NA	NA	NA	2.2E-09 U	2.4E-09 U	1.6E-09 U	NA
Furans												
Heptachlorodibenzofuran, 1,2,3,4,6,7,8-		NA	**9.7E-09** J	1.1E-09 U	NA	NA	NA	NA	2.5E-09 U	**4.1E-09** J	1.6E-09 U	NA
Heptachlorodibenzofuran, 1,2,3,4,7,8,9-		NA	**1.83E-08**	1.8E-09 U	NA	NA	NA	NA	3.9E-09 U	3.6E-09 U	2.6E-09 U	NA
Heptachlorodibenzofurans, total		NA	**1.83E-08**	1.4E-09 U	NA	NA	NA	NA	0.000000003 U	**4.1E-09** J	0.000000002 U	NA
Hexachlorodibenzofuran, 1,2,3,4,7,8-		NA	**1.05E-08** B	8E-10 U	NA	NA	NA	NA	**4.5E-09** B	**3.8E-09** B	0.000000001 U	NA

TABLE 4-7

Concentrations of Detected Analytes in Groundwater

Samples Collected During Phase I, Phase II, and Remedial Investigations

Former Lockbourne Air Force Base, Lockbourne, Ohio

		IDA	UWBZ	UWBZ	UWBZ	UWBZ	UWBZ	UWBZ	IDA	IDA	IDA	IDA
		Site	Site	Site	Site	Site	Site	Site	Site	Site	Site	Site
		LCKMW-10	LCKMW-11	LCKMW-11	MW-11	LCKMW-11	LCKMW-11	LCKMW-11	LCKMW-12A^4	LCKMW-12A^5	LCKMW-12A^6	LCKMW-12A^7
										DUP		
		5/19/2004	9/22/1997	11/12/1998	8/14/2003	11/11/2003	2/24/2004	5/19/2004	9/17/1997	9/17/1997	11/12/1998	8/14/2003
PARAMETER_NAME	**MCLs**	**RI**	**Phase II**	**Phase II**	**RI**	**RI**	**RI**	**RI**	**Phase II**	**Phase II**	**Phase II**	**RI**
Hexachlorodibenzofuran, 1,2,3,6,7,8-		NA	**8.8E-09**	6E-10 U	NA	NA	NA	NA	**2.4E-09** J	2.3E-09 U	0.000000001 U	NA
Hexachlorodibenzofuran, 1,2,3,7,8,9-		NA	**2.12E-08**	9E-10 U	NA	NA	NA	NA	**4.4E-09** J	2.9E-09 U	1.2E-09 U	NA
Hexachlorodibenzofuran, 2,3,4,6,7,8-		NA	**1.05E-08** B	7E-10 U	NA	NA	NA	NA	**4.7E-09** B	**7.6E-09** B	0.000000001 U	NA
Hexachlorodibenzofurans, total		NA	**5.1E-08**	7E-10 U	NA	NA	NA	NA	**6.9E-09** BJ	**1.14E-08** BJ	0.000000001 U	NA
Octachlorodibenzofuran		NA	**2.85E-08**	3.7E-09 U	NA	NA	NA	NA	4.4E-09 U	0.000000004 U	4.6E-09 U	NA
Pentachlorodibenzofuran, 1,2,3,7,8-		NA	**1.23E-08**	7E-10 U	NA	NA	NA	NA	2.2E-09 U	2.5E-09 U	1.1E-09 U	NA
Pentachlorodibenzofuran, 2,3,4,7,8-		NA	**6.2E-09** J	7E-10 U	NA	NA	NA	NA	2.2E-09 U	2.5E-09 U	1.1E-09 U	NA
Pentachlorodibenzofurans, total		NA	**1.23E-08**	7E-10 U	NA	NA	NA	NA	**1.36E-08** J	2.5E-09 U	1.1E-09 U	NA
Tetrachlorodibenzofuran, 2,3,7,8-		NA	**5.7E-09** B	8E-10 U	NA	NA	NA	NA	**4.46E-08** J	**5.5E-09** B	1.2E-09 U	NA
Tetrachlorodibenzofurans, total		NA	**5.7E-09** BJ	8E-10 U	NA	NA	NA	NA	**8.89E-08** J	**1.02E-08** BJ	1.2E-09 U	NA
TCDD-TEQ	3E-08	NA	**3.4328E-08**	**1.4514E-09**	NA	NA	NA	NA	**9.67518E-09**	**5.98825E-09**	**2.08552E-09**	NA
TCDD-TEQ; Dissolved	3E-08	NA	NA	**1.9153E-09**	NA	NA	NA	NA	NA	NA	**1.86421E-09**	NA
Metals (mg/L)												
Aluminum		0.026 U	**23**	NA	**0.03** J	0.2 U	0.2 U	0.2 U	**2.1** J	**7.7** J	NA	**0.53**
Arsenic	0.01	**0.0063** J	**0.012**	NA	0.02 U	0.02 U	0.02 U	0.02 U	**0.017** J	**0.009** J	NA	**0.009** J
Arsenic, dissolved	0.01	NA	0.005 U	NA	NA	NA	NA	NA	0.005 U	**0.005** U	NA	**NA**
Barium	2	**0.41**	**0.25**	NA	**0.061**	**0.077**	**0.057**	**0.067**	**0.09** J	**0.13** J	NA	**0.086**
Barium, dissolved	2	NA	**0.08**	NA	NA	NA	NA	NA	**0.07**	**0.07**	NA	NA
Beryllium	0.004	0.004 U	0.005 U	NA	0.004 U	0.004 U	0.004 U	0.004 U	0.005 U	0.005 U	NA	0.004 U
Cadmium	0.005	0.002 U	0.005 U	NA	0.002 U	0.002 U	0.002 U	0.002 U	0.005 U	0.005 U	NA	0.002 U
Calcium		**84**	**250**	NA	**99**	**100**	**99**	**96**	**150**	**170**	NA	**180**
Calcium, dissolved		NA	**110**	NA	NA	NA	NA	NA	**140**	**140**	NA	NA
Chromium, total	0.1	0.01 U	**0.03**	NA	0.01 U	0.01 U	0.0033 U	0.01 U	0.01 U	**0.02** J	NA	**0.018**
Cobalt		**0.0029** J	**0.03**	NA	**0.0011** J	**0.0011** J	0.0032 U	0.01 U	0.01 U	0.01 U	NA	**0.0026** J
Copper	1.3	0.0022 U	**0.08**	NA	0.01 U	0.01 U	0.01 U	0.0024 U	0.02 U	0.02 U	NA	**0.0041** J
Copper, dissolved	1.3	NA	0.02 U	NA	NA	NA	NA	NA	0.02 U	0.02 U	NA	NA
Iron		**2.4**	**72**	NA	**0.5**	**0.48** J	**0.48**	**0.43**	**7.6** J	**18** J	NA	**4.7**
Iron, dissolved		NA	0.1 U	NA	NA	NA	NA	NA	**2.6**	**2.7**	NA	NA
Lead	0.015	0.0075 U	**0.043**	NA	**0.0032** J	0.0075 U	0.0075 U	0.0075 U	0.005 U	**0.006**	NA	**0.004** J
Magnesium		**28**	**93**	NA	**29**	**30**	**29**	**29**	**56**	**60**	NA	**62**
Magnesium, dissolved		NA	**33**	NA	NA	NA	NA	NA	**53**	**54**	NA	NA
Manganese		**0.13**	**1.4**	NA	**0.28**	**0.6**	**0.35**	**0.48**	**0.43** J	**0.58** J	NA	**0.41**
Manganese, dissolved		NA	**0.23**	NA	NA	NA	NA	NA	**0.34**	**0.36**	NA	NA
Mercury	0.002	0.000065 U	0.0002 U	NA	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	NA	0.0002 U
Nickel		0.01 U	**0.09**	NA	0.01 U	**0.0027** J	0.0044 U	**0.0023** J	0.04 U	0.04 U	NA	**0.012**
Potassium		**1.3**	**7.6**	NA	**0.47** J	0.34 U	0.44 U	**0.4** J	5 U	5 U	NA	**2.6**
Potassium, dissolved		NA	5 U	NA	NA	NA	NA	NA	5 U	5 U	NA	NA
Selenium	0.05	0.015 U	0.005 U	NA	0.015 U	0.015 U	0.015 U	0.015 U	**0.005**	0.005 U	NA	0.015 U
Sodium		**8.8**	**11**	NA	**5.8**	**4.1**	**5.2**	**5.7**	**5.6**	**5.2**	NA	**9.5**
Sodium, dissolved		NA	**10**	NA	NA	NA	NA	NA	**5.8**	**5.8**	NA	NA
Thallium	0.002	0.025 U	0.005 U	NA	0.025 U	0.025 U	0.025 U	0.025 U	0.005 U	0.005 U	NA	0.025 U
Vanadium		0.01 U	**0.06**	NA	0.01 U	0.01 U	0.0033 U	0.01 U	0.01 U	**0.02** J	NA	0.01 U
Zinc		0.04 U	**0.23**	NA	**0.012** J	0.04 U	0.04 U	0.04 U	**0.03** J	**0.05** J	NA	**0.017** J

TABLE 4-7

Concentrations of Detected Analytes in Groundwater

Samples Collected During Phase I, Phase II, and Remedial Investigations

Former Lockbourne Air Force Base, Lockbourne, Ohio

		IDA	IDA	IDA	UWBZ	UWBZ	UWBZ	UWBZ	UWBZ	UWBZ	UWBZ	UWBZ
		Site	Site	Site	Site	Site	Site	Site	Site	Site	Site	Background
		LCKMW-12A[8]	LCKMW-12A[9]	LCKMW-12A[10]	LCKMW-13	LCKMW-13	LCKMW-13	LCKMW-13	LCKMW-13	LCKMW-13	LCKMW-13	14MW1
						DUP						
		11/11/2003	2/25/2004	5/17/2004	9/17/1997	9/17/1997	11/12/1998	8/14/2003	11/11/2003	2/25/2004	5/17/2004	11/13/1998
PARAMETER_NAME	**MCLs**	RI	RI	RI	Phase II	Phase II	Phase II	RI	RI	RI	RI	Phase II
Volatile Organic Compounds (mg/L)												
Acetone		0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	NA	**0.0018** J	0.01 U	**0.04** J	**0.019**	NA
Carbon disulfide		0.002 UJ	0.002 U*	0.002 U	0.001 U	0.001 U	NA	0.002 U	0.002 UJ	0.002 U*	0.002 U	NA
Methylene chloride		0.002 U	0.002 U	0.002 U	0.001 U	0.001 U	NA	0.002 U	0.002 U	0.002 U	0.002 U	NA
Toluene	1	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	NA	0.001 U	0.001 U	0.001 U	0.001 U	NA
Semi-Volatile Organic Compounds (mg/L)												
Acenaphthylene		0.0012 U	0.00096 U	NA	0.01 U	0.01 U	NA	0.001 U	0.001 U	0.00096 U	NA	NA
Benz(a)anthracene		0.00025 U	0.00019 U	NA	0.01 U	0.01 U	NA	**0.00015** J	0.0002 U	0.00019 U	NA	NA
Benzo(a)pyrene	0.0002	0.00025 U	0.00019 U	NA	0.01 U	0.01 U	NA	**0.00022**	0.0002 U	**0.00011** J	NA	NA
Benzo(b)fluoranthene		0.00025 U	0.00019 U	NA	0.01 U	0.01 U	NA	**0.00018** J	0.0002 U	**0.000098** J	NA	NA
Benzo(ghi)perylene		0.0012 U	0.00096 U	NA	0.01 U	0.01 U	NA	**0.00031** J	0.001 U	**0.00053** J	NA	NA
Benzo(k)fluoranthene		0.00025 U	0.00019 UJ	NA	0.01 U	0.01 U	NA	**0.00022**	0.0002 U	**0.000097** J	NA	NA
Chrysene		0.00062 U	0.00048 U	NA	0.01 U	0.01 U	NA	**0.00017** J	0.0005 U	0.00048 U	NA	NA
Dibenz(ah)anthracene		0.00025 U	0.00019 U	NA	0.01 U	0.01 U	NA	**0.00026**	0.0002 U	**0.00047**	NA	NA
Indeno(1,2,3-cd)pyrene		0.00025 U	0.00019 U	NA	0.01 U	0.01 U	NA	**0.00017** J	0.0002 U	**0.00049**	NA	NA
Naphthalene		0.0012 U	0.00096 U	NA	0.01 U	0.01 U	NA	0.001 U	0.001 U	0.00096 U	NA	NA
Bis(2-ethylhexyl) phthalate	0.006	0.0062 U	0.0096 U	NA	0.01 U	0.01 U	NA	0.0051 U	0.005 U	0.0096 U	NA	NA
Butylbenzyl phthalate		0.0025 U	0.0019 U	NA	0.01 U	0.01 U	NA	0.002 U	0.002 U	0.0019 U	NA	NA
Diethyl phthalate		0.0025 U	0.0019 U	NA	0.01 U	0.01 U	NA	0.002 U	0.002 U	0.0019 U	NA	NA
Di-n-octyl phthalate		0.012 U	0.0096 U	NA	0.01 U	0.01 U	NA	0.01 U	0.01 U	0.0096 U	NA	NA
Phenol		0.0062 U	0.0048 U	NA	0.01 U	0.01 U	NA	0.0051 U	0.005 U	0.0048 U	NA	NA
Trichlorobenzene, 1,2,3-		0.001 U	0.001 U	0.001 U	NA	NA	NA	0.001 U	0.001 U	0.001 U	0.001 U	NA
Dioxins / Furans (mg/L)												
Dioxins												
Heptachlorodibenzo-p-dioxin, 1,2,3,4,6,7,8-		NA	NA	NA	**2.55E-08** J	**6.43E-08**	1.3E-09 U	6.4E-09 U	NA	NA	NA	6.8E-09 U
Heptachlorodibenzo-p-dioxins, total		NA	NA	NA	**3.27E-08**	**1.12E-07**	1.3E-09 U	6.4E-09 U	NA	NA	NA	6.8E-09 U
Hexachlorodibenzo-p-dioxin, 1,2,3,4,7,8-		NA	NA	NA	9E-09 U	3.4E-09 U	6E-10 U	3.6E-09 U	NA	NA	NA	2.6E-09 U
Hexachlorodibenzo-p-dioxin, 1,2,3,6,7,8-		NA	NA	NA	8.2E-09 U	**5.5E-09**	6E-10 U	3.5E-09 U	NA	NA	NA	2.6E-09 U
Hexachlorodibenzo-p-dioxin, 1,2,3,7,8,9-		NA	NA	NA	7.9E-09 U	**4.6E-09**	6E-10 U	4.4E-09 U	NA	NA	NA	2.7E-09 U
Hexachlorodibenzo-p-dioxins, total		NA	NA	NA	8.3E-09 U	**2.7E-08**	6E-10 U	4.4E-09 U	NA	NA	NA	2.7E-09 U
Octachlorodibenzo-p-dioxin		NA	NA	NA	**2.53E-07**	**0.00000054**	**7.4E-09** JC	2.6E-08 U	NA	NA	NA	1.57E-08 U
Octachlorodibenzo-p-dioxin; Dissolved		NA	NA	NA	NA	NA	**5.7E-09** J	6.3E-09 U	NA	NA	NA	8.1E-09 U
Pentachlorodibenzo-p-dioxin, 1,2,3,7,8-		NA	NA	NA	6.5E-09 U	2.5E-09 U	6E-10 U	4E-09 U	NA	NA	NA	4.7E-09 U
Pentachlorodibenzo-p-dioxins, total		NA	NA	NA	6.5E-09 U	**3.1E-09** J	6E-10 U	4E-09 U	NA	NA	NA	4.7E-09 U
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-		NA	NA	NA	3.6E-09 U	2E-09 U	8E-10 U	2.7E-09 U	NA	NA	NA	3.4E-09 U
Tetrachlorodibenzo-p-dioxins, total		NA	NA	NA	3.6E-09 U	2E-09 U	8E-10 U	2.7E-09 U	NA	NA	NA	3.4E-09 U
Furans												
Heptachlorodibenzofuran, 1,2,3,4,6,7,8-		NA	NA	NA	**7.3E-09**	**1.65E-08**	8E-10 U	7.4E-09 U	NA	NA	NA	0.000000004 U
Heptachlorodibenzofuran, 1,2,3,4,7,8,9-		NA	NA	NA	1.07E-08 U	2.9E-09 U	1.2E-09 U	5.4E-09 U	NA	NA	NA	5.6E-09 U
Heptachlorodibenzofurans, total		NA	NA	NA	**2.02E-08**	**3.83E-08**	1E-09 U	7.4E-09 U	NA	NA	NA	4.6E-09 U
Hexachlorodibenzofuran, 1,2,3,4,7,8-		NA	NA	NA	6.1E-09 U	**4E-09** B	5E-10 U	4E-09 U	NA	NA	NA	1.8E-09 U

TABLE 4-7

Concentrations of Detected Analytes in Groundwater

Samples Collected During Phase I, Phase II, and Remedial Investigations

Former Lockbourne Air Force Base, Lockbourne, Ohio

		IDA	IDA	IDA	UWBZ	UWBZ	UWBZ	UWBZ	UWBZ	UWBZ	UWBZ	UWBZ
		Site	Site	Site	Site	Site	Site	Site	Site	Site	Site	Background
		LCKMW-12A[8]	LCKMW-12A[9]	LCKMW-12A[10]	LCKMW-13	LCKMW-13	LCKMW-13	LCKMW-13	LCKMW-13	LCKMW-13	LCKMW-13	14MW1
						DUP						
		11/11/2003	2/25/2004	5/17/2004	9/17/1997	9/17/1997	11/12/1998	8/14/2003	11/11/2003	2/25/2004	5/17/2004	11/13/1998
PARAMETER_NAME	**MCLs**	RI	RI	RI	Phase II	Phase II	Phase II	RI	RI	RI	RI	Phase II
Hexachlorodibenzofuran, 1,2,3,6,7,8-		NA	NA	NA	4.9E-09 U	1.8E-09 U	4E-10 U	3.6E-09 U	NA	NA	NA	1.7E-09 U
Hexachlorodibenzofuran, 1,2,3,7,8,9-		NA	NA	NA	6.7E-09 U	2.4E-09 U	6E-10 U	5.4E-09 U	NA	NA	NA	0.000000002 U
Hexachlorodibenzofuran, 2,3,4,6,7,8-		NA	NA	NA	6E-09 U	**6E-09** B	5E-10 U	5.4E-09 U	NA	NA	NA	1.8E-09 U
Hexachlorodibenzofurans, total		NA	NA	NA	5.8E-09 U	**1.42E-08** B	5E-10 U	5.4E-09 U	NA	NA	NA	1.8E-09 U
Octachlorodibenzofuran		NA	NA	NA	1.97E-08 U	**3.04E-08**	2.2E-09 U	9.8E-09 U	NA	NA	NA	1.23E-08 U
Pentachlorodibenzofuran, 1,2,3,7,8-		NA	NA	NA	4.2E-09 U	2E-09 U	5E-10 U	2.6E-09 U	NA	NA	NA	2.8E-09 U
Pentachlorodibenzofuran, 2,3,4,7,8-		NA	NA	NA	4.1E-09 U	2E-09 U	6E-10 U	3.3E-09 U	NA	NA	NA	2.8E-09 U
Pentachlorodibenzofurans, total		NA	NA	NA	4.1E-09 U	**4.2E-09**	5E-10 U	3.3E-09 U	NA	NA	NA	2.8E-09 U
Tetrachlorodibenzofuran, 2,3,7,8-		NA	NA	NA	**1.52E-08** B	**2.96E-08** B	6E-10 U	1.6E-09 U	NA	NA	NA	2.6E-09 U
Tetrachlorodibenzofurans, total		NA	NA	NA	**2.73E-08** B	**7.22E-08**	6E-10 U	1.6E-09 U	NA	NA	NA	2.6E-09 U
TCDD-TEQ	3E-08	NA	NA	NA	**1.0548E-08**	**9.0295E-09**	**1.0999E-09**	**5.9128E-09**	NA	NA	NA	**5.7934E-09**
TCDD-TEQ; Dissolved	3E-08	NA	NA	NA	NA	NA	**1.4962E-09**	**2.2295E-09**	NA	NA	NA	**3.36073E-09**
Metals (mg/L)												
Aluminum		**0.047** J	0.2 U	0.055 U	**13** J	**7.1** J	NA	**0.11** J	**0.035** J	0.2 U	0.054 U	NA
Arsenic	0.01	**0.0092** J	**0.01** J	**0.0079** J	**0.013** J	**0.007** J	NA	0.02 U	0.02 U	0.02 U	0.02 U	NA
Arsenic, dissolved	0.01	NA	NA	NA	0.005 U	0.005 U	NA	NA	NA	NA	NA	NA
Barium	2	**0.053**	**0.052**	**0.058**	**0.21** J	**0.16** J	NA	**0.14**	**0.16**	**0.088**	**0.099**	NA
Barium, dissolved	2	NA	NA	NA	**0.1**	**0.1**	NA	NA	NA	NA	NA	NA
Beryllium	0.004	0.004 U	0.004 U	0.004 U	0.005 U	0.005 U	NA	0.004 U	0.004 U	0.004 U	0.004 U	NA
Cadmium	0.005	0.002 U	0.002 U	0.002 U	0.005 U	0.005 U	NA	0.002 U	0.002 U	0.002 U	0.002 U	NA
Calcium		**180**	**180**	**180**	**280**	**250**	NA	**270**	**230**	**390**	**350**	NA
Calcium, dissolved		NA	NA	NA	**220**	**210**	NA	NA	NA	NA	NA	NA
Chromium, total	0.1	0.0026 U	**0.0061** J	**0.0034** J	**0.03** J	**0.02** J	NA	**0.0026** J	**0.015**	0.01 U	**0.015**	NA
Cobalt		0.01 U	0.01 U	**0.0012** J	**0.02**	0.01 U	NA	0.01 U	0.01 U	0.01 U	**0.0025** J	NA
Copper	1.3	0.01 U	0.0017 U	0.01 U	**0.04**	0.02 U	NA	**0.0029** J	**0.019**	0.0029 U	0.0083 U	NA
Copper, dissolved	1.3	NA	NA	NA	0.02 U	0.02 U	NA	NA	NA	NA	NA	NA
Iron		**3.3** J	**3.3**	**3.4**	**38** J	**24** J	NA	**15**	**4.8** J	**2**	**20**	NA
Iron, dissolved		NA	NA	NA	**8.4**	**7.9**	NA	NA	NA	NA	NA	NA
Lead	0.015	0.0075 U	0.0075 U	0.0075 U	**0.022**	**0.008**	NA	**0.0036** J	**0.0076**	0.0075 U	0.0075 U	NA
Magnesium		**64**	**64**	**65**	**130**	**120**	NA	**110**	**110**	**140**	**150**	NA
Magnesium, dissolved		NA	NA	NA	**100**	**100**	NA	NA	NA	NA	NA	NA
Manganese		**0.19**	**0.15**	**0.22**	**0.84** J	**0.58** J	NA	**0.48**	**0.44**	**0.71**	**0.7**	NA
Manganese, dissolved		NA	NA	NA	**0.38**	**0.33**	NA	NA	NA	NA	NA	NA
Mercury	0.002	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	NA	0.0002 U	0.0002 U	0.0002 U	**0.000067** J	NA
Nickel		0.01 U	**0.004** J	**0.0022** J	0.04 U	0.04 U	NA	0.01 U	**0.014**	**0.0027** J	**0.014**	NA
Potassium		**1.9**	**1.6**	**2.2**	**26**	**26**	NA	**27**	**24**	**29**	**28**	NA
Potassium, dissolved		NA	NA	NA	**21**	**20**	NA	NA	NA	NA	NA	NA
Selenium	0.05	0.015 U	0.015 U	0.015 U	0.005 U	0.005 U	NA	0.015 U	0.015 U	0.015 U	**0.0051** J	NA
Sodium		**8**	**7.6**	**8.7**	**51**	**51**	NA	**61**	**61**	**55**	**50**	NA
Sodium, dissolved		NA	NA	NA	**50**	**50**	NA	NA	NA	NA	NA	NA
Thallium	0.002	0.025 U	0.025 U	0.025 U	0.005 U	0.005 U	NA	0.025 U	0.025 U	0.025 U	0.025 U	NA
Vanadium		0.01 U	0.01 U	0.01 U	**0.03** J	**0.02** J	NA	0.01 U	0.01 U	0.01 U	0.01 U	NA
Zinc		0.04 U	0.04 U	**0.012** J	**0.13** J	**0.07** J	NA	**0.017** J	0.025 U	0.04 U	**0.045**	NA

TABLE 4-7

Concentrations of Detected Analytes in Groundwater

Samples Collected During Phase I, Phase II, and Remedial Investigations

Former Lockbourne Air Force Base, Lockbourne, Ohio

		IDA	**IDA**	**IDA**	**IDA**	**IDA**	**UWBZ**	**UWBZ**	**UWBZ**	**UWBZ**	**UWBZ**	**UWBZ**
							Site	**Site**	**Site**	**Site**	**Site**	**Site**
		LCKMW-14	**LCKMW-14**	**LCKMW-14**	**LCKMW-14**	**LCKMW-14**	**LCKMW-15**	**LCKMW-15**	**LCKMW-15**	**LCKMW-15**	**LCKMW-15**	**LCKMW-15**
							DUP		**DUP**			**DUP**
		9/16/1997	**8/14/2003**	**11/12/2003**	**2/26/2004**	**5/19/2004**	**8/12/2003**	**11/10/2003**	**11/10/2003**	**2/24/2004**	**5/18/2004**	**5/18/2004**
PARAMETER_NAME	**MCLs**	**Phase II**	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**
Volatile Organic Compounds (mg/L)												
Acetone		0.01 UJ	**0.0016** J	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	**0.013**	0.01 UJ	0.01 U	0.01 U
Carbon disulfide		0.001 U	0.002 U	0.002 UJ	0.002 U*	0.002 U	0.002 U	0.002 UJ	0.002 UJ	0.002 U*	0.002 UJ	0.002 UJ
Methylene chloride		0.001 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Toluene	1	0.001 U	0.001 U	**0.0011**	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Semi-Volatile Organic Compounds (mg/L)												
Acenaphthylene		0.01 U	0.0011 U	**0.00022** J	0.0011 U	0.00099 U	0.00099 U	0.001 U	0.001 U	0.0011 U	0.001 U	0.001 U
Benz(a)anthracene		0.01 U	0.00022 U	0.00019 U	0.00022 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.00023 U	0.00021 U	0.00021 U
Benzo(a)pyrene	0.0002	0.01 U	0.00022 U	0.00019 U	**0.00016** J	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.00023 U	0.00021 U	0.00021 U
Benzo(b)fluoranthene		0.01 U	0.00022 U	0.00019 U	**0.00012** J	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.00023 U	0.00021 U	0.00021 U
Benzo(ghi)perylene		0.01 U	0.0011 U	0.00097 U	**0.00041** J	0.00099 U	0.00099 U	0.001 U	0.001 U	0.0011 U	0.001 U	0.001 U
Benzo(k)fluoranthene		0.01 U	0.00022 U	0.00019 U	**0.00014** J	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.00023 UJ	0.00021 U	0.00021 U
Chrysene		0.01 U	0.00054 U	0.00049 U	0.00054 U	0.0005 U	0.0005 U	0.00051 U	0.00051 U	0.00057 U	0.00052 U	0.00052 U
Dibenz(ah)anthracene		0.01 U	0.00022 U	0.00019 U	**0.0004**	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.00023 U	0.00021 U	0.00021 U
Indeno(1,2,3-cd)pyrene		0.01 U	0.00022 U	0.00019 U	**0.00036**	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.00023 U	0.00021 U	0.00021 U
Naphthalene		0.01 U	0.0011 U	0.00097 U	0.0011 U	0.00099 U	0.00099 U	0.001 U	0.001 U	0.0011 U	0.001 U	0.001 U
Bis(2-ethylhexyl) phthalate	0.006	0.01 U	0.0054 U	0.0049 U*	0.011 U	0.0099 U	0.005 U	0.0051 U	**0.01**	0.067 U	0.01 U	**0.018**
Butylbenzyl phthalate		0.01 U	0.0022 U	0.0019 U	0.0022 U	0.002 U	0.002 U	0.002 U	0.002 U	0.0023 U	0.0021 U	0.0021 U
Diethyl phthalate		0.01 U	0.0022 U	0.0019 U	0.0022 U	0.002 U	0.002 U	0.002 U	0.002 U	0.0023 U	0.0021 U	0.0021 U
Di-n-octyl phthalate		0.01 U	0.011 U	0.0097 U	0.011 U	0.0099 U	0.0099 U	0.01 U	0.01 U	0.011 U	0.01 U	0.01 U
Phenol		0.01 U	0.0054 U	0.0049 U	0.0054 U	0.005 U	0.005 U	0.0051 U	0.0051 U	0.0057 U	0.0052 U	0.0052 U
Trichlorobenzene, 1,2,3-		NA	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Dioxins / Furans (mg/L)												
Dioxins												
Heptachlorodibenzo-p-dioxin, 1,2,3,4,6,7,8-		2.6E-09 U	NA	NA	NA	NA	4.1E-09 U	NA	NA	NA	NA	NA
Heptachlorodibenzo-p-dioxins, total		2.6E-09 U	NA	NA	NA	NA	4.1E-09 U	NA	NA	NA	NA	NA
Hexachlorodibenzo-p-dioxin, 1,2,3,4,7,8-		2.7E-09 U	NA	NA	NA	NA	4.6E-09 U	NA	NA	NA	NA	NA
Hexachlorodibenzo-p-dioxin, 1,2,3,6,7,8-		2.3E-09 U	NA	NA	NA	NA	4.4E-09 U	NA	NA	NA	NA	NA
Hexachlorodibenzo-p-dioxin, 1,2,3,7,8,9-		2.3E-09 U	NA	NA	NA	NA	4.2E-09 U	NA	NA	NA	NA	NA
Hexachlorodibenzo-p-dioxins, total		2.4E-09 U	NA	NA	NA	NA	4.6E-09 U	NA	NA	NA	NA	NA
Octachlorodibenzo-p-dioxin		**1.49E-08** J	NA	NA	NA	NA	6E-09 U	NA	NA	NA	NA	NA
Octachlorodibenzo-p-dioxin; Dissolved		NA	NA	NA	NA	NA	5.3E-09 U	NA	NA	NA	NA	NA
Pentachlorodibenzo-p-dioxin, 1,2,3,7,8-		2.2E-09 U	NA	NA	NA	NA	5.3E-09 U	NA	NA	NA	NA	NA
Pentachlorodibenzo-p-dioxins, total		2.2E-09 U	NA	NA	NA	NA	5.3E-09 U	NA	NA	NA	NA	NA
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-		1.7E-09 U	NA	NA	NA	NA	3.3E-09 U	NA	NA	NA	NA	NA
Tetrachlorodibenzo-p-dioxins, total		1.7E-09 U	NA	NA	NA	NA	3.3E-09 U	NA	NA	NA	NA	NA
Furans												
Heptachlorodibenzofuran, 1,2,3,4,6,7,8-		2.1E-09 U	NA	NA	NA	NA	3.2E-09 U	NA	NA	NA	NA	NA
Heptachlorodibenzofuran, 1,2,3,4,7,8,9-		2.7E-09 U	NA	NA	NA	NA	3.7E-09 U	NA	NA	NA	NA	NA
Heptachlorodibenzofurans, total		2.4E-09 U	NA	NA	NA	NA	3.7E-09 U	NA	NA	NA	NA	NA
Hexachlorodibenzofuran, 1,2,3,4,7,8-		1.9E-09 U	NA	NA	NA	NA	4E-09 U	NA	NA	NA	NA	NA

TABLE 4-7

Concentrations of Detected Analytes in Groundwater

Samples Collected During Phase I, Phase II, and Remedial Investigations

Former Lockbourne Air Force Base, Lockbourne, Ohio

		IDA	**IDA**	**IDA**	**IDA**	**IDA**	**UWBZ**	**UWBZ**	**UWBZ**	**UWBZ**	**UWBZ**	**UWBZ**
							Site	**Site**	**Site**	**Site**	**Site**	**Site**
		LCKMW-14	**LCKMW-14**	**LCKMW-14**	**LCKMW-14**	**LCKMW-14**	**LCKMW-15**	**LCKMW-15**	**LCKMW-15**	**LCKMW-15**	**LCKMW-15**	**LCKMW-15**
							DUP		**DUP**			**DUP**
		9/16/1997	**8/14/2003**	**11/12/2003**	**2/26/2004**	**5/19/2004**	**8/12/2003**	**11/10/2003**	**11/10/2003**	**2/24/2004**	**5/18/2004**	**5/18/2004**
PARAMETER_NAME	**MCLs**	**Phase II**	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**	**RI**
Hexachlorodibenzofuran, 1,2,3,6,7,8-		1.5E-09 U	NA	NA	NA	NA	3.8E-09 U	NA	NA	NA	NA	NA
Hexachlorodibenzofuran, 1,2,3,7,8,9-		2.1E-09 U	NA	NA	NA	NA	4.6E-09 U	NA	NA	NA	NA	NA
Hexachlorodibenzofuran, 2,3,4,6,7,8-		**5.3E-09**	NA	NA	NA	NA	4.3E-09 U	NA	NA	NA	NA	NA
Hexachlorodibenzofurans, total		**5.3E-09**	NA	NA	NA	NA	4.6E-09 U	NA	NA	NA	NA	NA
Octachlorodibenzofuran		3.2E-09 U	NA	NA	NA	NA	5.5E-09 U	NA	NA	NA	NA	NA
Pentachlorodibenzofuran, 1,2,3,7,8-		1.8E-09 U	NA	NA	NA	NA	3.2E-09 U	NA	NA	NA	NA	NA
Pentachlorodibenzofuran, 2,3,4,7,8-		1.8E-09 U	NA	NA	NA	NA	3.1E-09 U	NA	NA	NA	NA	NA
Pentachlorodibenzofurans, total		1.8E-09 U	NA	NA	NA	NA	4.1E-09 U	NA	NA	NA	NA	NA
Tetrachlorodibenzofuran, 2,3,7,8-		4.5E-09 B	NA	NA	NA	NA	1.8E-09 U	NA	NA	NA	NA	NA
Tetrachlorodibenzofurans, total		7.8E-09 BJ	NA	NA	NA	NA	1.8E-09 U	NA	NA	NA	NA	NA
TCDD-TEQ	3E-08	**4.1037E-09**	NA	NA	NA	NA	**6.7956E-09**	NA	NA	NA	NA	NA
TCDD-TEQ; Dissolved	3E-08	NA	NA	NA	NA	NA	**1.3423E-09**	NA	NA	NA	NA	NA
Metals (mg/L)												
Aluminum		**0.1** J	**0.58**	**0.06** J	0.055 U	0.04 U	**0.99**	0.11 U	0.2 U	**0.031** J	0.2 U	0.028 U
Arsenic	0.01	**0.007** J	**0.012** J	**0.014** J	**0.01** J	**0.013** J	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Arsenic, dissolved	0.01	**0.008** J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium	2	**0.3** J	**0.32**	**0.32**	**0.31**	**0.31**	**0.16**	**0.13**	**0.13**	**0.089**	**0.084**	**0.085**
Barium, dissolved	2	**0.28**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	0.004	0.005 U	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U
Cadmium	0.005	0.005 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U
Calcium		**81**	**90**	**85**	**80**	**86**	**140**	**120**	**120**	**100**	**96**	**99**
Calcium, dissolved		**78**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium, total	0.1	0.01 U	**0.013**	**0.0018** J	**0.0027** J	0.01 U	**0.002** J	0.01 U	0.01 U	0.0021 U	0.01 U	**0.0016** J
Cobalt		0.01 U	**0.0011** J	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Copper	1.3	**0.03**	**0.017**	**0.0051** J	0.01 U	0.0028 U	**0.0068** J	**0.005** J	0.01 U	0.01 U	0.0026 U	0.0028 U
Copper, dissolved	1.3	0.02 U	NA	NA	NA	NA	NA	NA	NA	NA	**NA**	NA
Iron		**1.4** J	**3.1**	**1.4** J	**1.3**	**1.3**	**3.1**	**0.33** J	0.2 U	0.19 U	0.2 U	0.2 U
Iron, dissolved		**0.87**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	0.015	0.005 U	**0.0053** J	0.0075 U	0.003 U	0.0075 U	**0.0036** J	0.0075 U	0.0075 U	0.0075 U	0.0075 U	0.0075 U
Magnesium		**28**	**30**	**29**	**27**	**29**	**42**	**34**	**33**	**28**	**27**	**28**
Magnesium, dissolved		**27**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese		**0.19** J	**0.098**	**0.057**	**0.054**	**0.055**	**0.13**	**0.059**	**0.039**	0.0034 U	0.0015 U	0.0015 U
Manganese, dissolved		**0.16**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	0.002	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.000094 U	0.0002 U	**0.000052** J	0.0002 U	0.0002 U	0.0002 U	0.0002 U
Nickel		0.04 U	**0.0086** J	0.01 U	0.01 U	0.01 U	**0.0043** J	0.01 U	0.01 U	0.01 U	**0.0021** J	0.01 U
Potassium		5 U	**2.3**	**2.1**	**2.1**	**2.2**	**2.4**	**1.7**	**1.7**	**1.1**	**1**	**1.2**
Potassium, dissolved		5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	0.05	0.005 U	0.015 U	0.015 U	0.015 U	0.015 U	0.015 U	0.015 U	0.015 U	0.015 U	0.015 U	0.015 U
Sodium		**13**	**13**	**14**	**13**	**14**	**31**	**26**	**26**	**6**	**5.6**	**6**
Sodium, dissolved		**12**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	0.002	0.005 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U	0.025 U
Vanadium		0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	**0.0029** J	0.01 U	0.01 U	0.0025 U	0.01 U	0.01 U
Zinc		0.02 U	**0.02** J	**0.013** J	0.04 U	0.04 U	**0.01** J	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U

TABLE 4-7

Concentrations of Detected Analytes in Groundwater

Samples Collected During Phase I, Phase II, and Remedial Investigations

Former Lockbourne Air Force Base, Lockbourne, Ohio

		UWBZ	**UWBZ**	**UWBZ**	**UWBZ**	**UWBZ**	**UWBZ**	**UWBZ**	**UWBZ**	**UWBZ**	**UWBZ**	**UWBZ**	**UWBZ**
		Site	**Site**	**Site**	**Site**	**Site**	**Site**	**Site**	**Site**	**Site**	**Site**	**Site**	**Site**
		LCKMW-15	**LCKMW-16**	**LCKMW-16**	**LCKMW-16**	**LCKMW-16**	**RB25-MW7**	**RB25-MW7**	**RB25-MW7**	**RB25-MW7**	**RB25-MW7**	**RB25MW-9**	**RB25MW-9**
													DUP
		8/12/2003	**11/14/2003**	**2/27/2004**	**5/19/2004**	**8/12/2003**	**9/18/1997**	**8/11/2003**	**11/12/2003**	**2/27/2004**	**5/20/2004**	**9/17/1997**	**9/17/1997**
PARAMETER_NAME	**MCLs**	**RI**	**RI**	**RI**	**RI**	**RI**	**Phase II**	**RI**	**RI**	**RI**	**RI**	**Phase II**	**Phase II**
Volatile Organic Compounds (mg/L)													
Acetone		0.01 UJ	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U
Carbon disulfide		0.002 UJ	0.002 UJ	0.002 U*	0.002 U	0.002 U	0.001 U	0.002 U	0.002 UJ	0.002 U*	0.002 U*	0.001 U	0.001 U
Methylene chloride		0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.001 U	0.002 U	0.002 U	0.002 U	0.002 U	0.001 U	0.001 U
Toluene	1	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Semi-Volatile Organic Compounds (mg/L)													
Acenaphthylene		0.00099 U	0.00098 U	0.0011 U	0.001 U	0.001 U	0.01 U	0.001 U	**0.00015** J	0.001 U	0.00096 U	0.01 U	NA
Benz(a)anthracene		0.0002 U	0.0002 U	0.00021 U	0.0002 U	0.0002 U	0.01 U	0.0002 U	0.0002 U	0.0002 U	0.00019 U	0.01 U	NA
Benzo(a)pyrene	0.0002	0.0002 U	0.0002 U	0.00021 U	0.0002 U	0.0002 U	0.01 U	0.0002 U	0.0002 U	**0.00015** J	0.00019 U	0.01 U	NA
Benzo(b)fluoranthene		0.0002 U	0.0002 U	0.00021 U	0.0002 U	0.0002 U	0.01 U	0.0002 U	0.0002 U	0.0002 U	0.00019 U	0.01 U	NA
Benzo(ghi)perylene		0.00099 U	0.00098 U	0.0011 U	0.001 U	0.001 U	0.01 U	0.001 U	0.001 U	**0.0004** J	0.00096 U	0.01 U	NA
Benzo(k)fluoranthene		0.0002 U	0.0002 UJ	0.00021 UJ	0.0002 U	0.0002 U	0.01 U	0.0002 U	0.0002 U	0.0002 UJ	0.00019 U	0.01 U	NA
Chrysene		0.0005 U	0.00049 U	0.00053 U	0.0005 U	0.0005 U	0.01 U	0.0005 U	0.00051 U	0.0005 U	0.00048 U	0.01 U	NA
Dibenz(ah)anthracene		0.0002 U	0.0002 U	0.00021 U	0.0002 U	0.0002 U	0.01 U	0.0002 U	0.0002 U	**0.00034**	0.00019 U	0.01 U	NA
Indeno(1,2,3-cd)pyrene		0.0002 U	0.0002 U	0.00021 U	0.0002 U	0.0002 U	0.01 U	0.0002 U	**0.00041**	**0.00037**	0.00019 U	0.01 U	NA
Naphthalene		0.00099 U	0.00098 U	0.0011 U	0.001 U	0.001 U	0.01 U	0.001 U	0.001 U	0.001 U	0.00096 U	0.01 U	NA
Bis(2-ethylhexyl) phthalate	0.006	0.005 U	0.0049 U	0.011 U	0.01 U	0.005 U	0.01 U	0.005 U	0.0051 U*	0.01 U	0.0096 U	0.01 U	NA
Butylbenzyl phthalate		0.002 U	0.002 U	0.0021 U	0.002 U	0.002 U	0.01 U	0.002 U	0.002 U	0.002 U	0.0019 U	0.01 U	NA
Diethyl phthalate		0.002 U	0.002 U	0.0021 U	0.002 U	0.002 U	0.01 U	0.002 U	0.002 U	0.002 U	0.0019 U	0.01 U	NA
Di-n-octyl phthalate		0.0099 U	0.0098 U	0.011 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	0.0096 U	0.01 U	NA
Phenol		0.005 U	0.0049 U	0.0053 U	0.005 U	0.005 U	0.01 U	0.005 U	0.0051 U	0.005 U	0.0048 U	0.01 U	NA
Trichlorobenzene, 1,2,3-		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U		0.001 U	0.001 U	0.001 U	0.001 U		NA
Dioxins / Furans (mg/L)													
Dioxins													
Heptachlorodibenzo-p-dioxin, 1,2,3,4,6,7,8-		9.1E-09 U	NA	NA	NA	3.2E-09 U	4.3E-09 U	NA	NA	NA	NA	**3.2E-09**	NA
Heptachlorodibenzo-p-dioxins, total		9.1E-09 U	NA	NA	NA	3.2E-09 U	4.3E-09 U	NA	NA	NA	NA	**3.2E-09**	NA
Hexachlorodibenzo-p-dioxin, 1,2,3,4,7,8-		3.4E-09 U	NA	NA	NA	3.2E-09 U	4.4E-09 U	NA	NA	NA	NA	3.2E-09 U	NA
Hexachlorodibenzo-p-dioxin, 1,2,3,6,7,8-		3.3E-09 U	NA	NA	NA	3.1E-09 U	3.7E-09 U	NA	NA	NA	NA	2.9E-09 U	NA
Hexachlorodibenzo-p-dioxin, 1,2,3,7,8,9-		3.7E-09 U	NA	NA	NA	3E-09 U	3.7E-09 U	NA	NA	NA	NA	2.8E-09 U	NA
Hexachlorodibenzo-p-dioxins, total		7.2E-09 U	NA	NA	NA	3.2E-09 U	**4.1E-09** B	NA	NA	NA	NA	**2.9E-09** BJ	NA
Octachlorodibenzo-p-dioxin		0.000000033 U	NA	NA	NA	6.1E-09 U	**1.47E-08**	NA	NA	NA	NA	**8.43E-08**	NA
Octachlorodibenzo-p-dioxin; Dissolved		7.9E-09 U	NA	NA	NA	4.9E-09 U	NA	NA	NA	NA	NA	NA	NA
Pentachlorodibenzo-p-dioxin, 1,2,3,7,8-		4.2E-09 U	NA	NA	NA	4.1E-09 U	3.2E-09 U	NA	NA	NA	NA	2.5E-09 U	NA
Pentachlorodibenzo-p-dioxins, total		4.2E-09 U	NA	NA	NA	4.1E-09 U	3.2E-09 U	NA	NA	NA	NA	2.5E-09 U	NA
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-		**0.000000045**	NA	NA	NA	**6.4E-09** J	2.9E-09 U	NA	NA	NA	NA	1.9E-09 U	NA
Tetrachlorodibenzo-p-dioxins, total		**0.000000045**	NA	NA	NA	**6.4E-09**	2.9E-09 U	NA	NA	NA	NA	1.9E-09 U	NA
Furans													
Heptachlorodibenzofuran, 1,2,3,4,6,7,8-		2.2E-09 U	NA	NA	NA	2.1E-09 U	3.4E-09 U	NA	NA	NA	NA	2.1E-09 U	NA
Heptachlorodibenzofuran, 1,2,3,4,7,8,9-		2.6E-09 U	NA	NA	NA	2.4E-09 U	3.8E-09 U	NA	NA	NA	NA	3.3E-09 U	NA
Heptachlorodibenzofurans, total		2.6E-09 U	NA	NA	NA	2.4E-09 U	3.6E-09 U	NA	NA	NA	NA	2.6E-09 U	NA
Hexachlorodibenzofuran, 1,2,3,4,7,8-		3.9E-09 U	NA	NA	NA	2.7E-09 U	3.2E-09 U	NA	NA	NA	NA	2.6E-09 U	NA

TABLE 4-7

Concentrations of Detected Analytes in Groundwater

Samples Collected During Phase I, Phase II, and Remedial Investigations

Former Lockbourne Air Force Base, Lockbourne, Ohio

		UWBZ	**UWBZ**	**UWBZ**	**UWBZ**	**UWBZ**	**UWBZ**	**UWBZ**	**UWBZ**	**UWBZ**	**UWBZ**	**UWBZ**	**UWBZ**
		Site	**Site**	**Site**	**Site**	**Site**	**Site**	**Site**	**Site**	**Site**	**Site**	**Site**	**Site**
		LCKMW-15	**LCKMW-16**	**LCKMW-16**	**LCKMW-16**	**LCKMW-16**	**RB25-MW7**	**RB25-MW7**	**RB25-MW7**	**RB25-MW7**	**RB25-MW7**	**RB25MW-9**	**RB25MW-9**
													DUP
		8/12/2003	**11/14/2003**	**2/27/2004**	**5/19/2004**	**8/12/2003**	**9/18/1997**	**8/11/2003**	**11/12/2003**	**2/27/2004**	**5/20/2004**	**9/17/1997**	**9/17/1997**
PARAMETER_NAME	**MCLs**	**RI**	**RI**	**RI**	**RI**	**RI**	**Phase II**	**RI**	**RI**	**RI**	**RI**	**Phase II**	**Phase II**
Hexachlorodibenzofuran, 1,2,3,6,7,8-		3.7E-09 U	NA	NA	NA	2.6E-09 U	2.5E-09 U	NA	NA	NA	NA	2.1E-09 U	NA
Hexachlorodibenzofuran, 1,2,3,7,8,9-		4.5E-09 U	NA	NA	NA	3.1E-09 U	3.2E-09 U	NA	NA	NA	NA	2.8E-09 U	NA
Hexachlorodibenzofuran, 2,3,4,6,7,8-		4.1E-09 U	NA	NA	NA	2.9E-09 U	**4.5E-09** B	NA	NA	NA	NA	**3.2E-09** B	NA
Hexachlorodibenzofurans, total		4.5E-09 U	NA	NA	NA	3.1E-09 U	**4.5E-09** BJ	NA	NA	NA	NA	**3.2E-09** BJ	NA
Octachlorodibenzofuran		3.7E-09 U	NA	NA	NA	4.7E-09 U	4E-09 U	NA	NA	NA	NA	3.5E-09 U	NA
Pentachlorodibenzofuran, 1,2,3,7,8-		2.5E-09 U	NA	NA	NA	2.2E-09 U	2.8E-09 U	NA	NA	NA	NA	2E-09 U	NA
Pentachlorodibenzofuran, 2,3,4,7,8-		2.5E-09 U	NA	NA	NA	2.2E-09 U	2.9E-09 U	NA	NA	NA	NA	1.9E-09 U	NA
Pentachlorodibenzofurans, total		7.3E-09 U	NA	NA	NA	3.1E-09 U	2.9E-09 U	NA	NA	NA	NA	1.9E-09 U	NA
Tetrachlorodibenzofuran, 2,3,7,8-		0.000000002 U	NA	NA	NA	1.5E-09 U	**7.6E-09** B	NA	NA	NA	NA	**8.7E-09** B	NA
Tetrachlorodibenzofurans, total		2.3E-09 U	NA	NA	NA	1.5E-09 U	**1.4E-08**	NA	NA	NA	NA	**1.36E-08** B	NA
TCDD-TEQ	3E-08	**4.92888E-08**	NA	NA	NA	**1.0199E-08**	**6.1492E-09**	NA	NA	NA	NA	**4.8026E-09**	NA
TCDD-TEQ; Dissolved	3E-08	**1.3627E-09**	NA	NA	NA	**1.265E-09**	NA	NA	NA	NA	NA	NA	NA
Metals (mg/L)													
Aluminum		**0.15** J	**0.69**	**0.059** J	0.14 U	**0.44**	**3**	**0.083** J	0.2 U	0.2 U	0.2 U	**46** J	NA
Arsenic	0.01	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	**0.006**	0.02 U	0.02 U	0.02 U	0.02 U	**0.039** J	NA
Arsenic, dissolved	0.01	NA	NA	NA	NA	NA	0.005 U	NA	NA	NA	NA	0.005 U	NA
Barium	2	**0.13**	**0.057**	**0.033**	**0.036**	**0.054**	**0.32**	**0.29**	**0.27**	**0.23**	**0.28**	**0.33** J	NA
Barium, dissolved	2	NA	NA	NA	NA	NA	**0.29**	NA	NA	NA	NA	**0.08**	NA
Beryllium	0.004	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	0.005 U	0.004 U	0.004 U	0.004 U	0.004 U	0.005 U	NA
Cadmium	0.005	0.002 U	0.002 U	0.002 U	0.002 U	0.002 U	0.005 U	0.002 U	0.002 U	0.002 U	0.002 U	0.005 U	NA
Calcium		**130** J	**200**	**160**	**180**	**190**	**140**	**160**	**150**	**140**	**160** J	**230**	NA
Calcium, dissolved		NA	NA	NA	NA	NA	**120**	NA	NA	NA	NA	**100**	NA
Chromium, total	0.1	0.01 U	**0.0018** J	0.01 U	0.01 U	0.01 U	**0.01**	0.01 U	0.01 U	0.01 U	0.01 U	**0.1** J	NA
Cobalt		0.01 U	0.003 U	**0.0016** J	**0.0013** J	**0.0014** J	0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	**0.04**	NA
Copper	1.3	**0.0054** J	0.0034 U	**0.0018** J	0.0037 U	**0.0036** J	**0.08**	**0.17**	**0.053**	**0.0074** J	**0.009** J	**0.09**	NA
Copper, dissolved	1.3	NA	NA	NA	NA	NA	**0.02**	NA	NA	NA	NA	0.02 U	NA
Iron		**0.16** J	**2.9** J	**1.1**	**1.3**	**1.6**	**15**	**0.17** J	0.2 U	0.13 U	0.2 U	**120** J	NA
Iron, dissolved		NA	NA	NA	NA	NA	**0.22**	NA	NA	NA	NA	0.1 U	NA
Lead	0.015	0.0075 U	0.0075 U	0.0075 U	0.0075 U	**0.003** J	**0.01**	**0.0096**	0.0067 U	0.0075 U	0.0075 U	**0.054**	NA
Magnesium		**37**	**53**	**70**	**72**	**53**	**81**	**83**	**86**	**85**	**91**	**91**	NA
Magnesium, dissolved		NA	NA	NA	NA	NA	**75**	NA	NA	NA	NA	**32**	NA
Manganese		**0.03**	**0.12**	**0.044**	**0.047**	**0.093**	**0.34**	**0.14**	**0.094**	**0.11**	**0.12**	**1.8** J	NA
Manganese, dissolved		NA	NA	NA	NA	NA	**0.1**	NA	NA	NA	NA	**0.23**	NA
Mercury	0.002	0.0002 U	0.0002 U	0.0002 U	0.00011 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	NA
Nickel		0.01 U	0.0072 U	**0.0058** J	**0.0056** J	**0.0048** J	0.04 U	0.01 U	0.01 U	0.01 U	0.01 U	**0.11**	NA
Potassium		**1.7**	**1.3**	0.55 U	**0.53** J	**1.1**	**39**	**37**	**35**	**30**	**34**	**13**	NA
Potassium, dissolved		NA	NA	NA	NA	NA	**38**	NA	NA	NA	NA	5 U	NA
Selenium	0.05	0.015 U	0.015 U	0.015 U	0.015 U	0.015 U	0.005 U	0.015 U	0.015 U	0.015 U	0.015 U	**0.007**	NA
Sodium		**26**	**9.9**	**8.7**	**8.3**	**8.3**	**25**	**25**	**25**	**19**	**22**	**3**	NA
Sodium, dissolved		NA	NA	NA	NA	NA	**25**	NA	NA	NA	NA	**1.9**	NA
Thallium	0.002	0.025 U	0.025 U	0.025 U	0.025 U	**0.0087** J	0.005 U	0.025 U	0.025 U	0.025 U	0.025 U	0.005 U	NA
Vanadium		0.01 U	0.01 U	0.01 U	0.01 U	0.01 U	**0.01**	0.01 U	0.01 U	0.01 U	0.01 U	**0.11** J	NA
Zinc		0.04 U	**0.013** J	0.04 U	0.04 U	0.04 U	**0.05**	**0.012** J	0.04 U	0.04 U	0.04 U	**0.28** J	NA

TABLE 4-7
Concentrations of Detected Analytes in Groundwater
Samples Collected During Phase I, Phase II, and Remedial Investigations
Former Lockbourne Air Force Base, Lockbourne, Ohio

Notes:
1. Investigation phase indicates in which phase the samples were collected
   Phase I - Samples collected during Phase I Site Investigation (LAW, 1995).
   Phase II - Samples collected during Phase II Site Investigation (Program Management Company, 2000)
   RI - Samples collected as part of the Remedial Investigation field investigation conducted by Ellis Environmental.
2. The designation LCK-GW1 and LCKMW-1 are both samples from the same well. The term GW was used in the Phase I assessment. The MW was used in all subsequent assessments.
3. LCKMW-12 was never completed. LCKMW-12A was located adjacent to LCKMW-12 and sampled during the Phase II and the RI.
4. TCDD-TEQ is a calculated number used for risk assessment purposes

Legend:
NA - not analyzed
Bold - Indicates analyte detected
A - Concentration exceeds the instrument calibration range
a - Concentration is below the reporting limit
B - Organics: The constituent was detected in associated field or laboratory blank samples
  Inorganics: Reported value is less than the contract required detection limit but above the instrument detection limit
C - Confirmed by gas chromatography / mass spectrometry (GC/MS)
CON - Confirmation analysis for dioxins / furans
D or I - The original sample was diluted and re-analyzed because detected concentrations were outside the instrument detection range
DUP - Duplicate
E - Organics:The reported concentration exceeds the calibration range of the GC/MS instrument
  Inorganics:The value is estimated due to matrix interferences
H - Possibly biased high based upon QC data (Phase I SI)
  Alternate peak selection upon analytical review (RI)
J - While the identity of the constituent is positive, the reported concentration is estimated
L - Possibly biased low or a false negative based upon QC data
M - Result was manually integrated
N - Spiked sample recovery not within control limits
PR - Value is underestimated due to the presence of poorly resolved GC peaks
Q - Quantitative interference in sample (Phase II SI)
  Detected below the practical quantitation limit (Phase I SI)
R - Data rejected based upon QC data
RE - Reanalyzed
U - The constituent was not detected above RLs
* - Batch QC exceeds the upper or lower control limits

TABLE 5-1
Physical-Chemical Properties of the Organic Constituents
Former Lockbourne Air Force Base, Lockbourne, Ohio

Organic Constituent	MW (g/mol)	S (mg/L @ 25 ºC)	H (atm-m^3/mol)	Koc (L/kg)
Dioxans/Furans				
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-	322	1.90E-05 [e]	3.98E-05 [f]	2.45E+07 [e]
Pentachlorodibenzo-p-dioxin, 1,2,3,7,8-	356	1.18E-04 [e]	2.54E-06 [e]	
Hexachlorodibenzo-p-dioxin, 1,2,3,4,7,8-	391	4.42E-06 [e]	4.46E-05 [e]	
Heptachlorodibenzo-p-dioxin, 1,2,3,4,6,7,8-	425	2.40E-06 [e]	2.18E-05 [e]	
Octachlorodibenzo-p-dioxin	460	2.27E-09 [e]	6.74E-06 [e]	7.94E+07 [d]
Tetrachlorodibenzofuran, 2,3,7,8-	306	4.20E-04 [j]	1.48E-05 [j]	4.07E+05 [i]
Pentachlorodibenzofuran, 1,2,3,7,8-	340		2.63E-05 [j]	
Pentachlorodibenzofuran, 2,3,4,7,8-	340	2.40E-04 [j]	2.63E-05 [j]	
Hexachlorodibenzofuran, 1,2,3,4,7,8-	375	8.00E-06 [j]	2.78E-05 [j]	
Hexachlorodibenzofuran, 1,2,3,6,7,8-	375	1.80E-05 [j]	2.78E-05 [j]	
Hexachlorodibenzofuran, 1,2,3,7,8,9-	375		2.78E-05 [j]	
Hexachlorodibenzofuran, 2,3,4,6,7,8-	375		2.78E-05 [j]	
Heptachlorodibenzofuran, 1,2,3,4,6,7,8-	409	1.40E-05 [j]	4.10E-06 [j]	
Heptachlorodibenzofuran, 1,2,3,4,7,8,9-	409		4.10E-06 [j]	
Octachlorodibenzofuran	444	1.20E-06 [j]	1.70E-06 [j]	1.58E+08 [j]
Polycyclic Aromatic Hydrocarbons (PAHs)				
Benz(a)anthracene	228	9.40E-03 [a]	3.34E-06 [a]	3.58E+05 [a]
Benzo(a)pyrene	252	1.62E-03 [a]	1.13E-06 [a]	9.69E+05 [a]
Benzo(b)fluoranthene	252	1.50E-03 [a]	1.11E-04 [a]	1.23E+06 [a]
Benzo(ghi)perylene	276	2.30E-04 [b]	1.40E-07 [b]	3.08E+06 [j]
Benzo(k)fluoranthene	252	8.00E-04 [a]	8.29E-07 [a]	1.23E+06 [a]
Chrysene	228	1.60E-03 [a]	9.46E-05 [a]	3.98E+05 [a]
Dibenz(ah)anthracene	278	2.49E-03 [a]	1.47E-08 [a]	1.79E+06 [a]
Fluoranthene	202	2.06E-01 [a]	1.61E-05 [a]	4.91E+04 [a]
Indeno(1,2,3-cd)pyrene	276	2.20E-05 [a]	1.60E-06 [a]	3.47E+06 [a]
Pyrene	202	1.35E-01 [a]	1.10E-05 [a]	6.80E+04 [a]
Methylnaphthalene, 2-	142	2.46E+01 [b]	5.17E-04 [b]	2.45E+03 [g]
Polychlorinated Biphenyls (PCBs)				
PCB 1242	267	3.40E-01 [c]	5.20E-04 [c]	1.23E+04 [h]
PCB 1248	300	5.40E-02 [c]	2.80E-03 [c]	4.37E+05 [h]
PCB 1254	328	1.20E-02 [c]	2.00E-03 [c]	4.07E+05 [h]
PCB 1260	376	2.70E-03 [c]	4.61E-03 [c]	2.63E+06 [h]
Volatile Organics				
Acetone	58	1.00E+06 [a]	3.88E-05 [a]	5.75E-01 [a]
Carbon Disulfide	76	1.19E+03 [a]	3.03E-02 [a]	9.25E+01 [j]
Chloroethane	65	6.00E+03 [k]	1.11E-02 [l]	3.70E+01 [m]
Dichloropropene, 1,3-	111	2.80E+03 [a]	1.77E-02 [a]	9.25E+01 [a]
Methyl ethyl ketone	72	2.20E+05 [b]	5.60E-05 [b]	1.93E+00 [j]
Methylene chloride	85	1.30E+04 [a]	2.19E-03 [a]	1.00E+01 [a]
Trichloroethane, 1,1,2-	133	4.42E+03 [a]	9.12E-04 [a]	7.50E+01 [a]
Trichloroethene	131	1.10E+03 [a]	1.03E-02 [a]	9.43E+01 [a]
Trichlorofluoromethane	137	4.34E+04 [b]	9.10E-04 [b]	9.25E+01 [j]
Toluene	92	5.26E+02 [a]	6.64E-03 [a]	1.40E+02 [a]
Vinyl Chloride	63	2.76E+03 [a]	2.70E-02 [a]	2.98E+01 [j]
Xylene	106	1.10E+02 [b]	6.60E-03 [b]	1.40E+03 [j]
Misc. Semivolatile Organics				
Acenaphthene	154	4.24E+00 [a]	1.55E-04 [a]	4.89E+03 [a]
Acenapthylene	152	1.60E+01 [b]	1.10E-04 [b]	1.07E+04 [j]
Anthracene	178	4.34E-02 [a]	6.50E-05 [a]	2.35E+04 [a]
Benzoic Acid	123	3.50E+03 [a]	1.54E-06 [a]	1.84E+00 [j]

TABLE 5-1
Physical-Chemical Properties of the Organic Constituents
Former Lockbourne Air Force Base, Lockbourne, Ohio

Organic Constituent	MW (g/mol)	S (mg/L @ 25 ºC)	H (atm-m^3/mol)	Koc (L/kg)
Bis(2-ethylhexyl) phthalate	391	3.40E-01 [a]	1.02E-07 [a]	1.11E+05 [a]
Butylbenzyl phthalate	312	2.69E+00 [a]	1.26E-06 [a]	4.73E+04 [j]
Carbazole	167	7.48E+00 [a]	1.53E-08 [a]	3.38E+03 [j]
Di-n-butyl phthalate	278	1.12E+01 [a]	9.38E-10 [a]	1.57E+03 [a]
Di-n-octyl-phthalate	390	2.00E-02 [b]	6.7-05 [b]	3.38E+03 [j]
Dibenzofuran	168	3.10E+00 [b]	1.30E-05 [b]	1.07E+04 [j]
Diethyl phthalate	168	1.08E+03 [a]	4.50E-07 [a]	8.20E-01 [a]
Fluorene	166	1.98E+00 [a]	6.63E-05 [a]	7.71E+03 [a]
Naphthalene	128	3.10E-01 [a]	4.83E-04 [a]	1.19E+03 [a]
Phenanthrene	178	1.10E+00 [b]	2.80E-05 [b]	2.65E+04 [j]
Phenol	94	8.28E+04 [a]	3.97E-07 [a]	2.85E+01 [j]
Pesticides				
DDD, p,p'-	320	9.00E-02 [a]	4.00E-06 [a]	4.58E+04 [a]
DDE, p,p'-	318	1.20E-01 [a]	2.10E-05 [a]	8.64E+04 [a]
DDT, p,p'-	354	2.50E-02 [a]	8.10E-06 [a]	6.78E+05 [a]

Key:
S = Water solubility
H = Henry's Law constant
K_{oc} = Organic carbon partition coefficient

Notes:
a = USEPA 1996: Soil Screening Guidance: Technnical Background Document; EPA/540/R-95/128; NTIS No. PB96-963502; Office of Emergency and Remedial Response, Washington, DC.
b = USEPA 1996: Superfund Chemical Data Matrix; Office of Emergency and Remedial Response, Washington, DC.
c = ATSDR 2000: Toxicological Profile for Polychlorinated Biphenyls (PCBs); Prepared by Syracuse Research Corp. for U.S. Public Health Service, Atlanta, GA.
d = Hazardous Substances Data Bank, 2004.
e = ATSDR 1998: Toxicological Profile for Chlorinated Dibenzo-p-dioxins; Prepared by Research Triangle Institute for U.S. Public Health Service, Atlanta, GA.
f = USEPA 1994: CHEMDAT8; EPA-453/C-94-080B; Office of Air Quality Planning and Standards, Research Triangle Park, NC.
g = ATSDR 1995: Toxicological Profile for Naphthalene, 1-Methylnaphthalene, and 2-Methylnaphthalene; Prepared by Sciences International, Inc. for U.S. Public Health Service, Atlanta, GA.
h = Pennsylvania Dept. of Environmental Resources (PADER) 1993: User's Manual for Criteria Estimation (CREST) Modeling System, Interim; Scientific Services Section, Division of Remediation, Bureau of Waste Management, Pittsburgh, PA.
i = values were calculated using the following formula:
. log Koc = 0.00028+(0.983 x log Kow)
j = ATSDR 1994: Toxicological Profile for Chlorodibenzofurans; Prepared by Syracuse Research Corp. for U.S. Public Health Service, Atlanta, GA.
k = http://en.wikipedia.org/wiki/Chloroethane
l = http://www.atsdr.cdc.gov/toxprofiles/tp105.pdf
m = http://www.dec.ny.gov/regulations/36324.html

TABLE 5-2

Physical-Chemical Properties of the Inorganic Constituents

Former Lockbourne Air Force Base, Lockbourne, Ohio

Inorganic COPC	**Atomic Weight (g/mol)**	**Water Solubility (a) (mg/L @ 25 °C)**	**K_d (b) (L/kg)**	**Boiling Point (a) (degC)**	**Melting Point (a) (degC)**
Arsenic	75	neg	200	615 c	817 d
Aluminum	27	neg	1,500	2,327	660,727
Barium	137	neg	60	1,897	1,287
Calcium	40	neg	4	1,484	1,900
Chromium	52	neg	856	2,642	1,800
Cobalt	59	neg	45	2,927	1,495
Copper	64	neg	35	2,570	1,080
Iron	56	neg	25	3,000	1,540
Lead	207	neg	900	1,740	328
Magnesium	24	neg	5	1,100	651
Manganese	55	neg	65	2,061	1,246
Mercury	201	neg	10	357	-39
Nickel	59	neg	150	2,730	1,455
Potassium	39	neg	6	759	64
Selenium	80	neg	300	685	221
Sodium	23	neg	100	881	98
Thallium	204	neg	1,500	1,473	304
Vanadium	51	neg	1,000	3,407	1,910
Zinc	65	neg	40	907	420

Key:

K_d = Soil-water distribution coefficient.

na = Not located in available literature.

neg = Negligible for elemental metal. Solubility is dependent on the speciation reactions in water.

Notes:

a = Unless otherwise specified, all values from National Library of Medicine (NLM) 2004: Hazardous Substances Data Bank (HSDB), Toxicology Data Network (TOXNET), National Institutes of Health, Dept. of Health and Human Services, Bethesda, MD; Revised March 4, 2004.

b = All values are rough estimates and are not meant to be used as exact measurements of coefficient values (Baes, C.F. III, R.D. Sharp, A.L. Sjoreen, and R.W. Shor, 1984: A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture ; ORNL-5786, Sept. 1984; Prepared for U.S. Dept. of Energy by Health and Safety Research Division, Oak Ridge National Laboratory, Oak Ridge, TN.

c = Arsenic sublimes without melting (NLM HSDB 2004).

d = Arsenic melts @ 36 atmospheres (NLM HSDB 2004).

TABLE 6-1

Summary of Data Used in Baseline Human Health Risk Assessment

Former Lockbourne Air Force Base, Lockbourne, Ohio

Medium / Phase	***Sample Location***	**SampleID**	**Date of Sampling**	**Parameters**
Surface Soil - AOC 1				
1	LCK-SO10A	LCK-SO10A	24-May-95	EXPLO, HERB, METALS, PEST/PCB, SVOC, VOC
1	LCK-SO12A	LCK-SO12A	25-May-95	EXPLO, HERB, METALS, PEST/PCB, SVOC, VOC
1	LCK-SO1A	LCK-SO1A	24-May-95	EXPLO, HERB, METALS, PEST/PCB, SVOC, VOC
1	LCK-SO2A	LCK-SO2A	24-May-95	EXPLO, HERB, METALS, PEST/PCB, VOC
1	LCK-SO2A	LCK-SO2A-RE *	24-May-95	SVOC
1	LCK-SO6A	LCK-SO6A-RE *	23-May-95	VOC
1	LCK-SO6A	LCK-SO6A	23-May-95	EXPLO, HERB, METALS, PEST/PCB, SVOC
1	LCK-SO7A	LCK-SO7A	23-May-95	EXPLO, HERB, METALS, PEST/PCB, SVOC, VOC
1	LCK-SO8A	LCK-SO8A	23-May-95	EXPLO, HERB, METALS, PEST/PCB, SVOC
1	LCK-SO8A	LCK-SO8A-RE *	23-May-95	VOC
1	LCK-SO9A	LCK-SO9A	24-May-95	EXPLO, HERB, METALS, PEST/PCB, SVOC, VOC
2	LCKSB-12	LCKSB-12 0-0.5'	25-Jul-97	EXPLO, DIOXIN, METALS, PEST/PCB, SVOC, VOC
2	LCKSB-13	LCKSB-13 0-0.5'	24-Jul-97	EXPLO, DIOXIN, METALS, PEST/PCB, SVOC, VOC
2	LCKSB-13	LCKSB-16 0-0.5' **	24-Jul-97	METALS, PEST/PCB
2	LCKSB-14	LCKSB-14 0-0.5'	30-Jul-97	EXPLO, DIOXIN, METALS, PEST/PCB, SVOC, VOC
2	LCKSO-1	LCKSO-1 0-1'	28-Jul-97	DIOXIN, METALS
2	LCKSO-6	LCKSO-6 0-1'	24-Jul-97	DIOXIN, METALS
2	LCKSO-7	LCKSO-7 0-1'	28-Jul-97	DIOXIN, METALS
2	LCKSO-7	LCKSO-11 0-1' **	28-Jul-97	DIOXIN, METALS
2	LCKSO-7	LCKSO-9 0-1' **	28-Jul-97	DIOXIN, METALS
2	LCKSO-8	LCKSO-8 0-1'	28-Jul-97	DIOXIN, METALS
3	EEGLKB-SS01	EEGLKB-SS01	29-Jul-03	EXPLO, METALS, PEST/PCB, SVOC
3	EEGLKB-SS01	EEGLKB-SS01	30-Jul-03	SVOC, VOC
3	EEGLKB-SS02	EEGLKB-SS02	29-Jul-03	EXPLO, DIOXIN, METALS, PEST/PCB, SVOC, VOC
3	EEGLKB-SS03	EEGLKB-SS03	29-Jul-03	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	EEGLKB-SS04	EEGLKB-SS04	29-Jul-03	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	EEGLKB-SS05	EEGLKB-SS05	29-Jul-03	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	EEGLKB-SS06	EEGLKB-SS06	29-Jul-03	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	EEGLKB-SS07	EEGLKB-SS07	30-Jul-03	SVOC, VOC
3	EEGLKB-SS07	EEGLKB-SS07	29-Jul-03	EXPLO, METALS, PEST/PCB, SVOC
3	EEGLKB-SS08	EEGLKB-SS08	28-Jul-03	EXPLO, DIOXIN, METALS, PEST/PCB, SVOC, VOC
3	EEGLKB-SS08	EEGLKB-SS08 Dup02 **	28-Jul-03	EXPLO, DIOXIN, METALS, PEST/PCB, SVOC, VOC
3	EEGLKB-SS09	EEGLKB-SS09	29-Jul-03	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	EEGLKB-SS09	EEGLKB-SS09 Dup03 **	29-Jul-03	METALS, SVOC, VOC
3	EEGLKB-SS10	EEGLKB-SS10	29-Jul-03	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	EEGLKB-SS11	EEGLKB-SS11	29-Jul-03	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	EEGLKB-SS12	EEGLKB-SS12	29-Jul-03	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	EEGLKB-SS13	EEGLKB-SS13	29-Jul-03	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	EEGLKB-SS14	EEGLKB-SS14	29-Jul-03	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	EEGLKB-SS15	EEGLKB-SS15	29-Jul-03	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	EEGLKB-SS16	EEGLKB-SS16	28-Jul-03	EXPLO, DIOXIN, METALS, PEST/PCB, SVOC, VOC
3	EEGLKB-SS17	EEGLKB-SS17	28-Jul-03	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	EEGLKB-SS18	EEGLKB-SS18	28-Jul-03	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	EEGLKB-SS19	EEGLKB-SS19	28-Jul-03	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	EEGLKB-SS24	EEGLKB-SS24	28-Jul-03	EXPLO, METALS, PEST/PCB, SVOC, VOC
Subsurface Soil - AOC 1				
1	LCK-SO10B	LCK-SO10B	24-May-95	EXPLO, HERB, METALS, PEST/PCB, SVOC, VOC
1	LCK-SO12B	LCK-SO12B	25-May-95	EXPLO, HERB, METALS, PEST/PCB, VOC
1	LCK-SO12B	LCK-SO12B-RE *	25-May-95	SVOC
1	LCK-SO12B	LCK-SODUP3 **	25-May-95	METALS, SVOC, VOC
1	LCK-SO1B	LCK-SO1B	24-May-95	EXPLO, HERB, METALS, PEST/PCB, SVOC, VOC
1	LCK-SO2B	LCK-SO2B	24-May-95	EXPLO, HERB, METALS, PEST/PCB, SVOC, VOC
1	LCK-SO6B	LCK-SO6B	23-May-95	EXPLO, HERB, METALS, PEST/PCB, SVOC
1	LCK-SO6B	LCK-SO6B-RE *	23-May-95	VOC
1	LCK-SO7B	LCK-SO7B-RE *	23-May-95	VOC
1	LCK-SO7B	LCK-SO7B	23-May-95	EXPLO, HERB, METALS, PEST/PCB, SVOC
1	LCK-SO8B	LCK-SO8B	23-May-95	EXPLO, HERB, METALS, PEST/PCB, SVOC
1	LCK-SO8B	LCK-SO8B-RE *	23-May-95	VOC
1	LCK-SO8B	LCK-SODUP2 **	23-May-95	METALS, PEST/PCB, SVOC
1	LCK-SO8B	LCK-SODUP2-RE **	23-May-95	VOC
1	LCK-SO9B	LCK-SO9B	24-May-95	EXPLO, HERB, METALS, PEST/PCB, SVOC, VOC

TABLE 6-1

Summary of Data Used in Baseline Human Health Risk Assessment

Former Lockbourne Air Force Base, Lockbourne, Ohio

Medium / Phase	*Sample Location*	SampleID	Date of Sampling	Parameters
2	LCKSB-12	LCKSB-12 8-10'	25-Jul-97	EXPLO, DIOXIN, METALS, PEST/PCB, SVOC, VOC
2	LCKSB-13	LCKSB-13 8-10'	24-Jul-97	EXPLO, DIOXIN, METALS, PEST/PCB, SVOC, VOC
2	LCKSB-14	LCKSB-14 2-4'	30-Jul-97	EXPLO, DIOXIN, METALS, PEST/PCB, SVOC, VOC
2	LCKSO-1	LCKSO-1 2-3'	28-Jul-97	DIOXIN, METALS
2	LCKSO-6	LCKSO-6 2-3'	24-Jul-97	DIOXIN, METALS
2	LCKSO-7	LCKSO-7 2-3'	28-Jul-97	DIOXIN, METALS
2	LCKSO-8	LCKSO-8 2-3'	28-Jul-97	DIOXIN, METALS
3	LCKMW-15	LCKMW-15-4-6	05-Aug-03	SVOC, VOC
3	LCKMW-15	LCKMW-15	05-Aug-03	EXPLO, METALS, PEST/PCB, SVOC
3	LCKMW-16	LCKMW-16	06-Aug-03	EXPLO, METALS, PEST/PCB, SVOC
3	LCKMW-16	LCKMW-16-8-10	06-Aug-03	SVOC, VOC
Surface Soil - AOC 2				
1	LCK-SO11A	LCK-SO11A	25-May-95	EXPLO, HERB, METALS, PEST/PCB, SVOC, VOC
1	LCK-SO3A	LCK-SO3A	25-May-95	EXPLO, HERB, METALS, PEST/PCB, SVOC, VOC
1	LCK-SO4A	LCK-SO4A	25-May-95	EXPLO, HERB, METALS, PEST/PCB, SVOC, VOC
1	LCK-SO5A	LCK-SO5A	24-May-95	EXPLO, HERB, METALS, PEST/PCB, SVOC, VOC
2	LCKSB-10	LCKSB-10 0-0.5'	21-Jul-97	EXPLO, DIOXIN, METALS, PEST/PCB, SVOC, VOC
2	LCKSB-11	LCKSB-11 0-0.5'	21-Jul-97	EXPLO, DIOXIN, METALS, PEST/PCB, SVOC, VOC
2	LCKSB-11	LCKSB-15 0-0.5' **	21-Jul-97	DIOXIN, METALS
2	LCKSB-11	LCKSB-18 0-0.5' **	21-Jul-97	DIOXIN, METALS
3	EEGLKB-SS20	EEGLKB-SS20	28-Jul-03	EXPLO, DIOXIN, METALS, PEST/PCB, SVOC, VOC
3	EEGLKB-SS20	EEGLKB-SS20 Dup01 **	28-Jul-03	EXPLO, DIOXIN, METALS, PEST/PCB, SVOC, VOC
3	EEGLKB-SS21	EEGLKB-SS21	28-Jul-03	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	EEGLKB-SS22	EEGLKB-SS22	28-Jul-03	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	EEGLKB-SS23	EEGLKB-SS23	28-Jul-03	EXPLO, METALS, PEST/PCB, SVOC, VOC
Subsurface Soil - AOC 2				
1	LCK-SO11B	LCK-SO11B	25-May-95	EXPLO, HERB, METALS, PEST/PCB, SVOC, VOC
1	LCK-SO3B	LCK-SO3B	25-May-95	HERB, METALS, PEST/PCB, SVOC
1	LCK-SO3B	LCK-SODUP1 **	25-May-95	EXPLO, METALS, PEST/PCB, SVOC, VOC
1	LCK-SO4B	LCK-SO4B	25-May-95	EXPLO, HERB, PEST/PCB, SVOC, VOC
1	LCK-SO4B	LCK-SO4B	24-May-95	METALS
1	LCK-SO5B	LCK-SO5B	24-May-95	EXPLO, HERB, METALS, PEST/PCB, SVOC, VOC
2	LCKSB-10	LCKSB-10 2-4'	21-Jul-97	EXPLO, DIOXIN, METALS, PEST/PCB, SVOC, VOC
2	LCKSB-11	LCKSB-11 2-4'	21-Jul-97	EXPLO, DIOXIN, METALS, PEST/PCB, SVOC, VOC
Sediment - East Ditch				
2	LCKSD-2	LCKSD-2	25-Aug-97	EXPLO, METALS, PEST/PCB, SVOC, VOC
Sediment - West Ditch				
1	LCK-SE1	LCK-SE1	26-May-95	EXPLO, HERB, METALS, PEST/PCB, SVOC
1	LCK-SE1	LCK-SE1-RE *	26-May-95	EXPLO, DIOXIN, HERB, METALS, PEST/PCB, SVOC, VOC
1	LCK-SE2	LCK-SE2-RE *	26-May-95	VOC
1	LCK-SE2	LCK-SE2	26-May-95	EXPLO, HERB, METALS, PEST/PCB, SVOC
1	LCK-SE3	LCK-SE3	26-May-95	EXPLO, HERB, METALS, PEST/PCB, SVOC, VOC
1	LCK-SE3	LCK-SEDUP1 **	26-May-95	METALS, PEST/PCB, SVOC
1	LCK-SE3	LCK-SEDUP1-RE **	26-May-95	VOC
2	LCKSD-4	LCKSD-4	25-Aug-97	EXPLO, METALS, PEST/PCB, SVOC, VOC
2	LCKSD-5	LCKSD-5	25-Aug-97	EXPLO, DIOXIN, METALS, PEST/PCB, SVOC, VOC
2	LCKSD-5	LCKSD-6 **	25-Aug-97	DIOXIN, METALS, PEST/PCB, VOC
2	LCKSD-5	LCKSD-8 **	25-Aug-97	METALS
3	EEGLKB-SD01	EEGLKB-SD01	30-Jul-03	EXPLO, DIOXIN, METALS, PEST/PCB, SVOC, VOC
3	EEGLKB-SD02	EEGLKB-SD02	31-Jul-03	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	EEGLKB-SD02	EEGLKB-SD02 Dup04 **	31-Jul-03	METALS, PEST/PCB, SVOC
3	EEGLKB-SD03	EEGLKB-SD03	31-Jul-03	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	EEGLKB-SD04	EEGLKB-SD04	31-Jul-03	EXPLO, METALS, PEST/PCB, SVOC, VOC
Surface Water - East Ditch				
2	LCKSW-2	LCKSW-2	25-Aug-97	EXPLO, METALS, PEST/PCB, SVOC, VOC
Surface Water - West Ditch				
1	LCK-SW1	LCK-SW1	26-May-95	EXPLO, HERB, METALS, PEST/PCB, SVOC, VOC
1	LCK-SW2	LCK-SW2	26-May-95	EXPLO, HERB, METALS, PEST/PCB, VOC
1	LCK-SW2	LCK-SW2-RE *	26-May-95	SVOC
1	LCK-SW3	LCK-SW3	26-May-95	EXPLO, HERB, METALS, PEST/PCB, SVOC, VOC
2	LCKSW-4	LCKSW-4	25-Aug-97	EXPLO, METALS, PEST/PCB, SVOC, VOC
2	LCKSW-5	LCKSW-5	25-Aug-97	EXPLO, DIOXIN, METALS, PEST/PCB, SVOC, VOC

TABLE 6-1
Summary of Data Used in Baseline Human Health Risk Assessment
Former Lockbourne Air Force Base, Lockbourne, Ohio

Medium / Phase	*Sample Location*	SampleID	Date of Sampling	Parameters
2	LCKSW-5	LCKSW-6 **	25-Aug-97	DIOXIN, METALS
2	LCKSW-5	LCKSW-7 **	25-Aug-97	DIOXIN, METALS
3	EEGLKB-SW01	EEGLKB-SW01	30-Jul-03	EXPLO, DIOXIN, METALS, PEST/PCB, SVOC
3	EEGLKB-SW02	EEGLKB-SW02	31-Jul-03	EXPLO, METALS, SVOC
3	EEGLKB-SW02	EEGLKB-SW02 Dup04 **	31-Jul-03	EXPLO, METALS, PEST/PCB, SVOC
3	EEGLKB-SW03	EEGLKB-SW03	31-Jul-03	DIOXIN, METALS, PEST/PCB, SVOC
Groundwater - Off-Landfill (IDA)				
1	LCK-GW7	LCK-GW7	07-Jun-95	EXPLO, HERB, METALS, PEST/PCB, SVOC, VOC
2	LCKMW-7	LCKMW-7	19-Sep-97	EXPLO, DIOXIN, METALS, PEST/PCB, SVOC, VOC
2	LCKMW-7	LCKMW-7	11-Nov-98	DIOXIN
2	LCKMW-7	LCKMW-30 **	11-Nov-98	DIOXIN
3	LCKMW-7	LCKMW-7	13-Aug-03	EXPLO, DIOXIN, METALS, PEST/PCB, SVOC, VOC
3	LCKMW-7	LCKMW7	13-Nov-03	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	LCKMW-7	LCKMW-7	24-Feb-04	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	LCKMW-7	LCKMW-7Dup **	24-Feb-04	METALS, SVOC
3	LCKMW-7	LCKMW-7	20-May-04	EXPLO, METALS, PEST/PCB, SVOC, VOC
Groundwater - AOC 1 (UWBZ)				
1	LCK-GW6	LCK-GW6	05-Jun-95	EXPLO, HERB, METALS, PEST/PCB, SVOC, VOC
1	LCK-GW6	LCK-DUP1 **	05-Jun-95	METALS, PEST/PCB, SVOC, VOC
1	LCK-GW4	LCK-GW4	07-Jun-95	EXPLO, HERB, METALS, PEST/PCB, SVOC, VOC
2	LCKMW-4	LCKMW-4	16-Sep-97	EXPLO, DIOXIN, METALS, PEST/PCB, SVOC, VOC
2	LCKMW-13	LCKMW-13	17-Sep-97	EXPLO, DIOXIN, METALS, PEST/PCB, SVOC, VOC
2	LCKMW-13	LCKMW-17 **	17-Sep-97	DIOXIN
2	RB25MW-9	RB25MW-9	17-Sep-97	EXPLO, DIOXIN, METALS, PEST/PCB, SVOC
2	RB25MW-9	LCKMW-20 **	17-Sep-97	VOC
2	RB25MW-7	RB25MW-7	18-Sep-97	EXPLO, DIOXIN, METALS, PEST/PCB, SVOC, VOC
2	LCKMW-6	LCKMW-6	19-Sep-97	EXPLO, DIOXIN, METALS, PEST/PCB, SVOC, VOC
2	LCKMW-13	LCKMW-13	12-Nov-98	DIOXIN
3	RB25-MW7	RB25-MW7	11-Aug-03	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	LCKMW-15	LCKMW-15	12-Aug-03	DIOXIN, METALS, PEST/PCB, SVOC, VOC
3	LCKMW-15	LCKMW-15 Dup02 **	12-Aug-03	EXPLO, DIOXIN, METALS, SVOC, VOC
3	LCKMW-16	LCKMW-16	12-Aug-03	EXPLO, DIOXIN, METALS, PEST/PCB, SVOC, VOC
3	LCKMW-4	LCKMW-4	12-Aug-03	EXPLO, DIOXIN, METALS, PEST/PCB, SVOC, VOC
3	LCKMW-6	LCKMW-6	13-Aug-03	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	LCKMW-13	LCKMW-13	14-Aug-03	EXPLO, DIOXIN, METALS, PEST/PCB, SVOC, VOC
3	LCKMW-15	LCKMW-15	10-Nov-03	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	LCKMW-15Dup	LCKMW-15Dup **	10-Nov-03	PEST/PCB, SVOC, VOC
3	LCKMW-13	LCKMW13	11-Nov-03	METALS, PEST/PCB, SVOC, VOC
3	LCKMW4	LCKMW4	12-Nov-03	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	LCKMW-6	LCKMW6	12-Nov-03	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	RB25-MW7	MWRB25MW7	12-Nov-03	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	LCKMW-16	LCKMW16	14-Nov-03	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	LCKMW-15	LCKMW-15	24-Feb-04	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	LCKMW-13	LCKMW-13	25-Feb-04	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	LCKMW-6	LCKMW-6	25-Feb-04	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	LCKMW-4	LCKMW-4	26-Feb-04	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	LCKMW-16	LCKMW16	27-Feb-04	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	RB25-MW7	RB25-MW7	27-Feb-04	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	LCKMW-13	LCKMW13	17-May-04	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	LCKMW-15	LCKMW-15	18-May-04	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	LCKMW-15Dup	LCKMW-15Dup **	18-May-04	METALS, VOC
3	LCKMW-16	LCKMW-16	19-May-04	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	LCKMW-4	LCKMW-4	19-May-04	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	LCKMW-6	LCKMW-6	20-May-04	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	RB25-MW7	RB25-MW7	20-May-04	EXPLO, METALS, PEST/PCB, SVOC, VOC
Groundwater - AOC 1 (IDA)				
1	LCK-GW5	LCK-GW5	06-Jun-95	EXPLO, HERB, METALS, PEST/PCB, SVOC, VOC
1	LCK-GW3	LCK-GW3	07-Jun-95	EXPLO, HERB, METALS, PEST/PCB, SVOC, VOC
2	LCKMW-14	LCKMW-14	16-Sep-97	EXPLO, DIOXIN, METALS, PEST/PCB, SVOC, VOC
2	LCKMW-5	LCKMW-5	16-Sep-97	DIOXIN, METALS
2	LCKMW-5	LCKMW-15 **	16-Sep-97	EXPLO, DIOXIN, METALS, PEST/PCB, SVOC, VOC
2	LCKMW-12A	LCKMW-12A	17-Sep-97	EXPLO, DIOXIN, METALS, PEST/PCB, SVOC, VOC

TABLE 6-1
Summary of Data Used in Baseline Human Health Risk Assessment
Former Lockbourne Air Force Base, Lockbourne, Ohio

Medium / Phase	***Sample Location***	**SampleID**	**Date of Sampling**	**Parameters**
2	LCKMW-12A	LCKMW-16 **	17-Sep-97	DIOXIN, METALS
2	LCKMW-3	LCKMW-3	18-Sep-97	EXPLO, DIOXIN, METALS, PEST/PCB, SVOC, VOC
2	LCKMW-12A	LCKMW-12A	12-Nov-98	DIOXIN
3	LCKMW-3	LCKMW-3	13-Aug-03	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	LCKMW-5	LCKMW-5	13-Aug-03	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	LCKMW-12A	LCKMW-12A	14-Aug-03	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	LCKMW-14	LCKMW-14	14-Aug-03	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	LCKMW-12A	LCKMW12A	11-Nov-03	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	LCKMW-14	LCKMW14	12-Nov-03	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	LCKMW-5	LCKMW5	12-Nov-03	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	LCKMW-3	LCKMW3	13-Nov-03	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	LCKMW-12A	LCKMW-12A	25-Feb-04	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	LCKMW-5	LCKMW-5	25-Feb-04	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	LCKMW-14	LCKMW-14	26-Feb-04	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	LCKMW-3	LCKMW3	27-Feb-04	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	LCKMW-12A	LCKMW12A	17-May-04	METALS, PEST/PCB, SVOC, VOC
3	LCKMW-14	LCKMW-14	19-May-04	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	LCKMW-3	LCKMW-3	20-May-04	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	LCKMW-5	LCKMW-5	20-May-04	EXPLO, METALS, PEST/PCB, SVOC, VOC
Groundwater - AOC 2 (UWBZ)				
2	LCKMW-11	LCKMW-11	22-Sep-97	EXPLO, DIOXIN, METALS, PEST/PCB, SVOC, VOC
2	LCKMW-11	LCKMW-11	12-Nov-98	DIOXIN
3	LCKMW-11	LCKMW-11	14-Aug-03	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	LCKMW-11	LCKMW11	11-Nov-03	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	LCKMW-11	LCKMW-11	24-Feb-04	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	LCKMW-11	LCKMW-11	19-May-04	EXPLO, METALS, PEST/PCB, SVOC, VOC
Groundwater - AOC 2 (IDA)				
2	LCKMW-10	LCKMW-10	22-Sep-97	EXPLO, DIOXIN, METALS, PEST/PCB, SVOC, VOC
2	LCKMW-10	LCKMW-10	12-Nov-98	DIOXIN
3	LCKMW-10	LCKMW-10	14-Aug-03	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	LCKMW-10	LCKMW10	11-Nov-03	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	LCKMW-10	LCKMW-10	24-Feb-04	EXPLO, METALS, PEST/PCB, SVOC, VOC
3	LCKMW-10	LCKMW-10	19-May-04	EXPLO, METALS, PEST/PCB, SVOC, VOC

Notes:
* - reanalyzed sample
** - Duplicate sample
HERB - Herbicides
EXPLO - Explosives
Pest/PCBs - Pesticides/Polychlorinated Biphenyls
SVOCs - Semivolatile Organic Compounds
VOCs - Volatile Organic Compounds

TABLE 6-2

Conceptual Site Model - Potentially Complete Human Health Exposure Pathways Evaluated in the Human Health Risk Assessment

Former Lockbourne Air Force Base, Lockbourne, Ohio

Potentially Exposed Populations	Contaminated Media	Exposure Route (Human Health)	Rationale
Current/Future Industrial Land Use			
Maintenance Worker	Surface Soil (AOC 1 and AOC 2)	Ingestion, dermal contact, and inhalation	Maintenance worker could contact soil while at the site.
Trespassers/Visitors - Youth	Surface Soil (AOC 1 and AOC 2)	Ingestion, dermal contact, and inhalation	Trespassers/Visitors could contact soil while at the site.
Off-Site Industrial Worker	Surface Soil (AOC 1 and AOC 2)	Inhalation	Off-Site Industrial could inhale particulates/volatile emissions that are dispersed off-site.
Trespassers/Visitors - Youth	Sediment (East Ditch and West Ditch)	Ingestion and dermal contact	The East and West Ditches could be used for wading by trespasser/visitors
Trespassers/Visitors - Youth	Surface Water (East Ditch and West Ditch)	Ingestion and dermal contact	The East and West Ditches could be used for wading by trespasser/visitors
Future Industrial Land Use			
On-Site Facility Worker	Surface Soil (AOC 2)	Ingestion, dermal contact, and inhalation	If AOC 2 is developed for future industrial use, on-site facility workers could contact soil.
On-Site Facility Worker	Indoor Air (Vapor Intrusion from AOC 2 - Total Soil)	Inhalation	If AOC 2 is developed for future industrial use, on-site facility workers could inhale volatiles in indoor air.
Construction Worker	Total Soil (AOC 1 and AOC 2)	Ingestion, dermal contact, and inhalation	Construction worker could contact soil while performing construction/piping/excavation activities.
Construction Worker	Groundwater - UWBZ (AOC 1 and AOC 2)	Dermal contact and inhalation	Construction worker may contact and/or inhale vapors from groundwater during excavation activities.
Construction Worker	Sediment (East Ditch and West Ditch)	Ingestion and dermal contact	Construction workers may contact media in the ditches during construction/piping/excavation activities.
Construction Worker	Surface Water (East Ditch and West Ditch)	Ingestion and dermal contact	Construction workers may contact media in the ditches during construction/piping/excavation activities.
Off-Site Residents - Adults and Children	Groundwater - UWBZ and IDA (Off-Landfill Well and AOC 1 wells)	Ingestion, dermal contact, and inhalation	Groundwater is not currently used at the site as a water supply and the site will not be developed for residential use; however, the residential scenario (including inhalation of volatiles while showering) is evaluated for off-site residents downgradient of the site that may use private drinking wells.

TABLE 6-3
Calculation of Soil Gas Screening Levels for Vapor Intrusion Screening (Industrial Scenario)
Former Lockbourne Air Force Base, Lockbourne, Ohio

CAS #	**Volatile Organic Compounds**	**RSL Industrial Air[1] µg/m^3**		**Infinite Source Indoor Attenuation Coefficient[2] (unitless)**	**Soil Gas Screening Level[3] µg/m^3**
83-32-9	Acenaphthene	NA		0.1	NA
67-64-1	Acetone	1.40E+05	n	0.1	1.40E+06
132-64-9	Dibenzofuran	NA		0.1	NA
10061-02-6	Dichloropropene, 1,3-, trans-	3.10E+00	c*	0.1	3.10E+01
75-09-2	Methylene chloride	2.60E+01	c	0.1	2.60E+02
91-57-6	Methylnaphthalene, 2-	NA		0.1	NA
91-20-3	Naphthalene	3.60E-01	c*	0.1	3.60E+00
129-00-0	Pyrene	NA		0.1	NA
75-69-4	Trichlorofluoromethane	3.10E+03	n	0.1	3.10E+04

[1] Industrial air Regional Screening Levels (RSLs), at a HI=1 or Risk = 1E-06 (USEPA, 2008).
RSL for 1,3-dichloropropene used as a surrogate for tran-1,2-dichloropropene.
c = Carcinogenic
n = Noncarcinogenic
c* (where: n RSL < 100X c RSL)

[2] Attenuation factor for shallow soil gas (< 6 feet) recommended in Draft Vapor Intrusion Guidance (USEPA, 2002).

[3] Soil gas screening levels are based on the industrial air RSLs, at a HI=0.1 or Risk = 1E-06, adjusted using USEPA's (2002) soil gas-to-indoor air attenuation factor (1E-01).

TABLE 6-4

Calculation of Target Groundwater Concentrations for Vapor Intrusion Screening[1]

Former Lockbourne Air Force Base, Lockbourne, Ohio

Constituent	**Unit Risk Factor (URF)** $(ug/m^3)^{-1}$	**Reference Concentration (RfC)** mg/m^3	**Target Indoor Air Concentration, carcinogen (C_{Cancer})** ug/m^3	**Target Indoor Air Concentration, non-carcinogen ($C_{non\text{-}Cancer}$)** ug/m^3	**Target Indoor Air Concentration ($C_{target,ia}$)** ug/m^3	**Henry's Law Constant** Dimensionless	**Target Groundwater Concentration (C_{gw})** ug/L
Acetone		3.10E+01	NA	3.10E+03	3.10E+03	1.59E-03	1.95E+06
Carbon disulfide		7.00E-01	NA	7.00E+01	7.00E+01	1.24E+00	5.65E+01
Methylene chloride	4.70E-07	1.10E+00	5.18E+00	1.10E+02	5.18E+00	8.98E-02	5.77E+01
Naphthalene	3.40E-05	3.00E-03	7.16E-02	3.00E-01	7.16E-02	1.98E-02	3.61E+00
Toluene		5.00E+00	N/A	5.00E+02	5.00E+02	2.72E-01	1.84E+03

Notes:

[1] Due to change in toxicity value(s), the vapor intrusion screening level [i.e., target groundwater concentration from Table 2c, Subsurface Vapor Intrusion Guidance (EPA, 2002)] for this constituent was updated using the methodology presented in Appendix D.

URF and RfCs obtained from EPA's Integrated Risk Information System (IRIS) Database. [Online at http://www.epa.gov/iris/index.html], EPA's HEAST, or EPA's PPRTV.

Henry's Law Constants (dimensionless) were obtained from Appendix D, USEPA 2002.

Variables	**Units**	**Value**
C_{Cancer} = Target indoor air conc., cancer	ug/m^3	Solved by Eq. 1
$C_{non\text{-}Cancer}$ = Target indoor air conc., non-cancer	ug/m^3	Solved by Eq. 2
$C_{target,ia}$ = Target indoor air conc., minimum	ug/m^3	Solved by Eq. 3
C_{gw} = Target groundwater conc.	ug/L	Solved by Eq. 4
TCR = Target Cancer Risk	unitless	1.00E-06
THQ = Target Hazard Quotient	unitless	0.1
URF = Unit Risk Factor	$(ug/m^3)^{-1}$	Chemical-specific
RfC = Reference Concentration	mg/m^3	Chemical-specific
ATc = Averaging Time, carcinogens	days	25,550
EF = Exposure Frequency	days/year	350
ED = Exposure Duration	years	30
CF = Conversion Factor	ug/mg	1000
H = Dimensionless Henry's Law Constant	unitless	Chemical-specific
alpha (α) = Attenuation Factor	unitless	0.001

Equation 1:	C_{cancer} =	[(TCR x ATc)/(EF x ED x URF)]
Equation 2:	$C_{non\text{-}cancer}$ =	(THQ x RfC x CF)
Equation 3:	$C_{target,ia}$ =	Minimum(C_{cancer}, $C_{non\text{-}cancer}$)
Equation 4:	Cgw =	$C_{target,ia} \times 10^{-3}\ m^3/L * 1/H * 1/\alpha$

TABLE 6-5

Summary of Chemicals of Potential Concern for the HHRA

Former Lockbourne Air Force Base, Lockbourne, Ohio

COPC	Surface Soil		Subsurface Soil		Indoor Air	Groundwater				Sediment		Surface Water	
	AOC 1	AOC 2	AOC 1	AOC 2	AOC 2 (Total Soil)	Off-Landfill -	AOC 1 - UWBZ	AOC 1 - IDA	AOC 2 - UWBZ	East Ditch	West Ditch	East Ditch	West Ditch
Aluminum			X				X	X	X		X		
Arsenic				X			X		X		X		X
Barium													
Benz(a)anthracene	X	X	X	X		X	X		X				
Benzo(a)pyrene	X	X	X	X		X	X	X	X		X		
Benzo(b)fluoranthene	X	X	X	X		X	X	X	X		X		
Benzo(k)fluoranthene	X		X										
Bis(2-ethylhexyl) phthalate							X	X					X
Cadmium							X						
Carbazole	O		O										
Chromium, total							X	X					
Chrysene	X		X										
Cobalt		X		X			X	X	X		X		
Copper							X						
Dibenz(ah)anthracene	X	X	X	X		X	X	X	X				
Dibenzofuran	X		X										
trans-1,3-Dichloropropene					X								
Fluoranthene	X		X										
Indeno(1,2,3-cd)pyrene	X		X			X	X	X	X				
Iron						X	X	X	X		X		
Lead	X		X			X	X	X	X				X
Manganese		X		X		X	X	X	X	X	X		
Mercury			X				X						
Methylene chloride					X		X						X
Naphthalene	X		X		X		X	X					
Nickel							X		X				
PCB 1242	X		X										
PCB 1248	X		X										
PCB 1254			X										
PCB 1260	X		X										
Pyrene	X		X										
Silver	X		X										
TCDD-TEQ	X	X	X	X		X	X	X	X				X
Thallium	X	X	X	X			X				X	X	X
Vanadium							X		X				
Zinc													

Key:

AOC 1 = Area of Concern 1; AOC 2 = Area of Concern 2; HHRA = Human Health Risk Assessment; IDA = Intermediate depth aquifer; RSL = Regional Screening Level; UWBZ = Upper water-bearing zone

X = This constituent is included as a COPC and evaluated further in the HHRA because the maximum detected concentration exceeded a risk-based screening level and backgrou concentration, if available.

O = No RSL was available for this constituent; therefore it was considered a COPC and evaluated further in the HHRA.

TABLE 6-6

Soil to Indoor Air Parameters Used in the Johnson and Ettinger Model, Industrial Scenario

Former Lockbourne Air Force Base, Lockbourne, Ohio

Symbol	Parameter	Description	Selected Value	Units	Sources
T_S	Average Soil/Groundwater Temperature		13.7	°C	Assumed soil temperature equal to groundwater temperature. Site-specific average from AOC 2 UWBZ; 4 quarterly
L_F	Depth Below Grade to Bottom of Enclosed Space Floor	This is the depth from soil surface to the bottom of the floor in contact with soil	15	cm	Default value in User's Guide for slab-on-grade construction. Represents 6 inch thick concrete slab. (USEAP, 2004). Ohio EPA default.
L_T	Depth Below Grade to Top of Contamination		30.5	cm	Surface soil depth at 0 -1 ft. The majority of constituents were detected in surface soil.
h_A	Thickness of Soil Stratum A		30.5	cm	Soil stratum is modeled as a single soil type.
h_B	Thickness of Soil Stratum B		NA	cm	Not Used
h_C	Thickness of Soil Stratum C		NA	cm	Not Used
	Soil Stratum Directly Above Water Table		A	unitless	Consistent with the deepest stratum with a specified thickness (h_A).
	SCS Soil Type Above Water Table		S	unitless	Ohio EPA default, sand
	Soil Stratum A SCS Soil Type	Used to estimate soil vapor permeability	S	unitless	Ohio EPA default, sand
k_v	User-defined Soil Vapor Permeability	A parameter associated with convective transport of vapors within the zone of influence of a building. It is related to the size and shape of connected soil pores	NA	cm^2	Not Used
r_b^A	Stratum A Soil Dry Bulk Density		1.66	g/cm^3	Model default value.
n^A	Stratum A Total Soil Porosity	Used with water-filled porosity to calculate air-filled porosity (see below)	0.375	unitless	Model default value.

TABLE 6-6

Soil to Indoor Air Parameters Used in the Johnson and Ettinger Model, Industrial Scenario

Former Lockbourne Air Force Base, Lockbourne, Ohio

Symbol	Parameter	Description	Selected Value	Units	Sources
q_w^A	Stratum A Soil Water-filled porosity	Used with total porosity to calculate air-filled porosity (see below)	0.054	cm^3/cm^3	Model default value.
r_b^B	Stratum B Soil Dry Bulk Density		NA	g/cm^3	Not Used
$n^{\mathbf{B}}$	Stratum B Total Soil Porosity	Used with water-filled porosity to calculate air-filled porosity (see below)	NA	unitless	Not Used
q_w^B	Stratum B Soil Water-filled porosity	Used with total porosity to calculate air-filled porosity (see below)	NA	cm^3/cm^3	Not Used
r_b^C	Stratum C Soil Dry Bulk Density		NA	g/cm^3	Not Used
n^C	Stratum C Total Soil Porosity	Used with water-filled porosity to calculate air-filled porosity (see below)	NA	unitless	Not Used
$q_{w\backslash}^C$	Stratum C Soil Water-filled porosity	Used with total porosity to calculate air-filled porosity (see below)	NA	cm^3/cm^3	Not Used
L_{crack}	Enclosed Space Floor Thickness		10	cm	Ohio EPA default
D_P	Soil-Building Pressure Differential		40	$g/cm\text{-}s^2$	Ohio EPA default
L_B	Enclosed Space Floor Length		2200	cm	Median warehouse/storage building size for the U.S. (based on Table B-2, DOE, 2003) is 5,200 square feet.
W_B	Enclosed Space Floor Width		2200	cm	same as L_B
H_B	Enclosed Space Height		304.8	cm	Ohio EPA default; typical average ceiling

TABLE 6-6

Soil to Indoor Air Parameters Used in the Johnson and Ettinger Model, Industrial Scenario

Former Lockbourne Air Force Base, Lockbourne, Ohio

Symbol	Parameter	Description	Selected Value	Units	Sources
w	Floor-Wall Seam Crack Width	Represents a gap assumed to exist at the junction between the floor and the foundation perimeter. This gap is due to building design or concrete shrinkage. It represents the only route for soil gas intrusion into a building	0.1	cm	Ohio EPA mimimum value
ER	Indoor air exchange rate	Building ventilation rate, expressed in units of air changes per hour (ACH)	1	(1/h)	Ohio EPA value for commercial/industrial land use
Qsoil	Average vapror flow rate into building		calculated	(L/m)	calculated by model
AT_C	Averaging Time for Carcinogens		70	yrs	default (USEAP, 2004)
AT_{NC}	Averaging Time for Noncarcinogens		25	yrs	EPA, 1991
ED	Exposure Duration		25	yrs	EPA, 1991
EF	Exposure Frequency		250	days/yr	EPA, 1991
TR	Target Risk for Carcinogens	Used to calculate risk-based groundwater concentration	1×10^{-6}	unitless	not used (model used to calculate indoor air concentrations)
THQ	Target Hazard Quotient for Noncarcinogens	Used to calculate risk-based groundwater concentration	1	days/yr	not used (model used to calculate indoor air concentrations)

ASHRAE. 2001. Standard 62-2001, Ventilation for Acceptable Indoor Air Quality

DOE, 2003. Commercial Building Energy Consumption Survey (CBECS). Energy Information Administration.

USEPA, 1991. U.S. Environmental Protection Agency. Risk Assessment Guidance for Superfund, Human Health Evaluation Manual, Part B, Development of Risk-

USEPA, 2004. User's Guide for Evaluating Subsurface Vapor Intrusion Into Buildings. Office of Emergency and Remedial Response. February 2004.

TABLE 6-7

Summary of RME Cancer Risks and Hazard Indices

Former Lockbourne Air Force Base, Lockbourne, Ohio

Receptor	Media	Exposure Route	Cancer Risk	COPCs with Cancer Risks >10^{-4}	COPCs with Cancer Risks >10^{-5} and <10^{-4}	COPCs with Cancer Risks >10^{-6} and <10^{-5}	Hazard Index	COPCs with HI > 1
Current/Future Maintenance Worker Adult	Surface Soil (AOC 1)	Ingestion	1.0E-04		Benzo(a)pyrene	Benz(a)anthracene, Benzo(b)fluoranthene, Dibenz(a,h)anthracene, Indeno(1,2,3-cd)pyrene, PCB-1248	0.012	
		Dermal Contact	8.6E-05		Benzo(a)pyrene	Benz(a)anthracene, Benzo(b)fluoranthene, Dibenz(a,h)anthracene, Indeno(1,2,3-cd)pyrene, PCB-1248	0.0042	
		Inhalation	3.4E-08				0.00069	
		Total	**1.9E-04**	**Benzo(a)pyrene**	**Benz(a)anthracene, Benzo(b)fluorathene**	**Benzo(k)fluoranthene, Dibenz(a,h)anthracene, Indeno(1,2,3-cd)pyrene, PCB-1248**	**0.017**	
	Surface Soil (AOC 2)	Ingestion	1.2E-07				0.016	
		Dermal Contact	8.1E-08				0.00039	
		Inhalation	5.0E-09				0.0017	
		Total	**2.0E-07**				**0.018**	
Current/Future Trespasser/Visitor Youth	Surface Soil (AOC 1)	Ingestion	6.9E-05		Benzo(a)pyrene	Benz(a)anthracene, Benzo(b)fluoranthene, Dibenz(a,h)anthracene, Indeno(1,2,3-cd)pyrene, PCB-1248	0.021	
		Dermal Contact	3.7E-05		Benzo(a)pyrene	Benz(a)anthracene, Benzo(b)fluoranthene, Dibenz(a,h)anthracene	0.0045	
		Inhalation	6.9E-09				0.00036	
		Total	**1.1E-04**		**Benzo(a)pyrene**	**Benz(a)anthracene, Benzo(b)fluoranthene, Dibenz(a,h)anthracene, Indeno(1,2,3-cd)pyrene, PCB-1248**	**0.025**	
	Surface Soil (AOC 2)	Ingestion	8.0E-08				0.028	
		Dermal Contact	3.4E-08				0.00041	
		Inhalation	1.0E-09				0.00087	
		Total	**1.2E-07**				**0.029**	
	Sediment (East Ditch)	Ingestion	0.0E+00				0.00064	
		Dermal Contact	0.0E+00				0.000080	
		Inhalation	NA				NA	
		Total	**0.0E+00**				**0.00072**	
	Surface Water (East Ditch)	Ingestion	0.0E+00				0.013	
		Dermal Contact	0.0E+00				0.0013	
		Inhalation	NA				NA	
		Total	**0.0E+00**				**0.014**	
	Sediment (West Ditch)	Ingestion	2.6E-06			Arsenic	0.041	
		Dermal Contact	4.5E-07				0.0022	
		Inhalation	NA				NA	
		Total	**3.1E-06**			**Arsenic**	**0.043**	
	Surface Water (West Ditch)	Ingestion	1.5E-07				0.015	
		Dermal Contact	2.6E-06			TCDD-TEQ	0.14	
		Inhalation	NA				NA	
		Total	**2.7E-06**			**TCDD-TEQ**	**0.15**	
		Receptor Total (1)	**1.1E-04**		**Benzo(a)pyrene**	**Benz(a)anthracene, Benzo(b)fluoranthene, Dibenz(a,h)anthracene, Indeno(1,2,3-cd)pyrene, PCB-1248, Arsenic, TCDD-TEQ**	**0.22**	
Current/Future Off-Site Industrial Worker Adult	Surface Soil (AOC 1)	Ingestion	NA				NA	
		Dermal Contact	NA				NA	
		Inhalation	2.4E-07				0.0049	
		Total	**2.4E-07**				**0.0049**	
	Surface Soil (AOC 2)	Ingestion	NA				NA	
		Dermal Contact	NA				NA	
		Inhalation	3.6E-08				0.012	
		Total	**3.6E-08**				**0.012**	
Future Facility Worker Adult	Surface Soil (AOC 2)	Ingestion	8.3E-07				0.016	
		Dermal Contact	5.8E-07				0.0028	
		Inhalation	3.6E-08				0.012	
		Total	**1.4E-06**				**0.031**	
	Total Soil (2) (AOC 2)	Inhalation (Indoor Air)	7.2E-06			trans-1,3-dichloropropene, methylene chloride, naphthalene	0.21	
		Total	**7.2E-06**			trans-1,3-dichloropropene, methylene chloride, naphthalene	**0.21**	
		Receptor Total (1)	**8.6E-06**			**trans-1,3-dichloropropene, methylene chloride, naphthalene**	**0.24**	

TABLE 6-7

Summary of RME Cancer Risks and Hazard Indices

Former Lockbourne Air Force Base, Lockbourne, Ohio

Receptor	Media	Exposure Route	Cancer Risk	COPCs with Cancer Risks $>10^{-4}$	COPCs with Cancer Risks $>10^{-5}$ and $<10^{-4}$	COPCs with Cancer Risks $>10^{-6}$ and $<10^{-5}$	Hazard Index	COPCs with HI > 1
Future Construction Worker Adult	Total Soil (2) (AOC 1)	Ingestion	7.4E-05		Benzo(a)pyrene	Benz(a)anthracene, Benzo(b)fluoranthene, Dibenz(a,h)anthracene, Indeno(1,2,3-cd)pyrene, PCB-1248	0.33	
		Dermal Contact	2.9E-05		Benzo(a)pyrene	Benz(a)anthracene, Benzo(b)fluoranthene, Dibenz(a,h)anthracene	0.057	
		Inhalation	7.2E-09				0.0046	
		Total	**1.0E-04**		**Benzo(a)pyrene, Dibenz(a,h)anthracene**	**Benz(a)anthracene, Benzo(b)fluoranthene, Indeno(1,2,3-cd)pyrene, PCB-1248**	**0.39**	
	Groundwater (AOC 1 - UWBZ)	Ingestion	NA				NA	
		Dermal Contact	1.4E-05			Benzo(a)pyrene, Dibenz(a,h)anthracene, TCDD-TEQ	2.5	TCDD-TEQ
		Inhalation	4.0E-10				0.00016	
		Total	**1.4E-05**			**Benzo(a)pyrene, Dibenz(a,h)anthracene, TCDD-TEQ**	**2.5**	**TCDD-TEQ**
	Total Soil (2) (AOC 2)	Ingestion	1.0E-06				0.30	
		Dermal Contact	1.2E-07				0.016	
		Inhalation	1.7E-09				0.0091	
		Total	**1.1E-06**			**Arsenic**	**0.33**	
	Groundwater (AOC 2 - UWBZ)	Ingestion	NA				NA	
		Dermal Contact	3.0E-05		Dibenz(a,h)anthracene	Benz(a)pyrene, Indeno(1,2,3-cd)pyrene, TCDD-TEQ	3.1	TCDD-TEQ
		Inhalation	--				--	--
		Total	**3.0E-05**		**Dibenz(a,h)anthracene**	**Benz(a)pyrene, Indeno(1,2,3-cd)pyrene, TCDD-TEQ**	**3.1**	**TCDD-TEQ**
	Sediment (East Ditch)	Ingestion	0.0E+00				0.00035	
		Dermal Contact	0.0E+00				0.000053	
		Inhalation	NA				NA	
		Total	**0.0E+00**				**0.00040**	
	Surface Water (East Ditch)	Ingestion	0.0E+00				0.0084	
		Dermal Contact	0.0E+00				0.0022	
		Inhalation	NA				NA	
		Total	**0.0E+00**				**0.011**	
	Sediment (West Ditch)	Ingestion	4.8E-08				0.018	
		Dermal Contact	1.0E-08				0.0014	
		Inhalation	NA				NA	
		Total	**5.8E-08**				**0.019**	
	Surface Water (West Ditch)	Ingestion	9.8E-09				0.010	
		Dermal Contact	3.2E-07				0.17	
		Inhalation	NA				NA	
		Total	**3.3E-07**				**0.18**	
		Receptor Total (1)	**1.3E-04**		**Benzo(a)pryene, Dibenz(a,h)anthracene**	**Arsenic, Benzo(b)fluoranthene, Indeno(1,2,3-cd)pyrene, PCB 1248, TCDD-TEQ**	**3.7**	**TCDD-TEQ**
Future Off-Site Resident Adult	Groundwater (Off-Site - IDA)	Ingestion	NA				0.61	
		Dermal Contact	NA				5.1	TCDD-TEQ
		Inhalation	NA				--	
		Total	**NA**				**5.7**	**TCDD-TEQ**
	Groundwater (AOC 1 - UWBZ)	Ingestion	NA				12	Arsenic, Iron, Manganese, Thallium
		Dermal Contact	NA				15	TCDD-TEQ
		Inhalation	NA				0.47	
		Total	**NA**				**28**	**Arsenic, Iron, Manganese, Thallium, TCDD-TEQ**
	Groundwater (AOC 1 - IDA)	Ingestion	NA				1.9	
		Dermal Contact	NA				4.3	TCDD-TEQ
		Inhalation	NA				1.5	Naphthalene
		Total	**NA**				**7.7**	**TCDD-TEQ, Naphthalene**
Future Off-Site Resident Child	Groundwater (Off-Site - IDA)	Ingestion	NA				1.4	
		Dermal Contact	NA				12	TCDD-TEQ
		Inhalation	NA				--	
		Total	**NA**				**13**	**TCDD-TEQ**
	Groundwater (AOC 1 - UWBZ)	Ingestion	NA				28	Arsenic, Cobalt, Iron, Manganese, TCDD-TEQ, Thallium
		Dermal Contact	NA				34	TCDD-TEQ
		Inhalation	NA				0.83	
		Total	**NA**				**63**	**Arsenic, Cobalt, Iron, Manganese, TCDD-TEQ, Thallium**
	Groundwater (AOC 1 - IDA)	Ingestion	NA				4.4	Iron, Manganese
		Dermal Contact	NA				9.8	TCDD-TEQ
		Inhalation	NA				2.6	Naphthalene
		Total	**NA**				**17**	**Iron, Managanese, TCDD-TEQ, Naphthalene**

TABLE 6-7
Summary of RME Cancer Risks and Hazard Indices
Former Lockbourne Air Force Base, Lockbourne, Ohio

Receptor	Media	Exposure Route	Cancer Risk	COPCs with Cancer Risks >10^{-4}	COPCs with Cancer Risks >10^{-5} and <10^{-4}	COPCs with Cancer Risks >10^{-6} and <10^{-5}	Hazard Index	COPCs with HI > 1
Future Off-Site Resident Child/Adult	Groundwater (Off-Site - IDA)	Ingestion	3.7E-04	Benzo(a)pyrene, Dibenz(a,h)anthracene	Benzo(b)fluoranthene, Indeno(1,2,3-cd)pyrene, TCDD-TEQ	Benz(a)anthracene	NA	
		Dermal Contact	7.3E-03	Benzo(a)pyrene, Benzo(b)fluoranthene, Dibenz(a,h)anthracene, Indeno(1,2,3-cd)pyrene, TCDD-TEQ	Benz(a)anthracene		NA	
		Inhalation	--				NA	
		Total	**7.6E-03**	**Benzo(a)pyrene, Benzo(b)fluoranthene, Dibenz(a,h)anthracene, Indeno(1,2,3-cd)pyrene, TCDD-TEQ**	**Benzo(a)anthracene**		**NA**	
	Groundwater (AOC 1 - UWBZ)	Ingestion	9.6E-04	Arsenic, Benzo(a)pyrene, Dibenz(a,h)anthracene	Indeno(1,2,3-cd)pyrene, TCDD-TEQ	Benzo(a)anthracene, Benzo(b)fluoranthene, Bis(2-ethylhexyl) phthalate	NA	
		Dermal Contact	8.2E-03	Benzo(a)pyrene, Benzo(b)fluoranthene, Dibenz(a,h)anthracene, Indeno(1,2,3-cd)pyrene, TCDD-TEQ	Arsenic, Benz(a)anthracene	Bis(2-ethylhexyl) phthalate	NA	
		Inhalation	3.2E-05		Methylene chloride, Naphthalene		NA	
		Total	**9.2E-03**	**Arsenic, Benzo(a)pyrene, Benzo(b)fluoranthene, Dibenz(a,h)anthracene, Indeno(1,2,3-cd)pyrene, TCDD-TEQ**	**Benz(a)anthracene, Methylene chloride, Naphthalene**	**Bis(2-ethylhexyl) phthalate**	NA	
	Groundwater (AOC 1 - IDA)	Ingestion	3.3E-04	Dibenz(a,h)anthracene	Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, TCDD-TEQ	Benzo(b)fluoranthene, Bis(2-ethylhexyl) phthalate	NA	
		Dermal Contact	7.2E-03	Benzo(a)pyrene, Benzo(b)fluoranthene, Dibenz(a,h)anthracene, Indeno(1,2,3-cd)pyrene, TCDD-TEQ		Bis(2-ethylhexyl) phthalate	NA	
		Inhalation	7.5E-05		Naphthalene		NA	
		Total	**7.6E-03**	**Benzo(a)pyrene, Benzo(b)fluoranthene, Dibenz(a,h)anthracene, Indeno(1,2,3-cd)pyrene, TCDD-TEQ**	**Naphthalene**	**Bis(2-ethylhexyl) phthalate**	**NA**	

(1) For receptors evaluated for more than one exposure unit per medium (e.g., soil from AOC 1 and soil from AOC 2), the Receptor Totals are calculated using the maximum risk/hazard estimate for each medium so that exposures are not over estimated.
(2) Surface soil and subsurface soil combined.
Blank cells beneath the specified target risk columns (i.e., COPCs with Cancer Risks >10-4, COPCs with HI > 1) mean there were no COPCs meeting the specified target risk.
NA = Not Applicable. This pathway was not evaluated.
-- = Volatile COPCs were not present, therefore inhalation pathway was not evaluated.
0.0E+00 = COPCs were present, however no carcinogenic slope factors available to risk.

TABLE 7-1

Background Comparison-- AOC 1 Soil

Former Lockbourne Air Force Base, Lockbourne, Ohio

Inorganic Chemical Detected in AOC 1 Surface Soil	Maximum Detected Concentration (mg/kg)	Site-Specific Background Concentration* (mg/kg)	Ration of Maximum Detected Concentration to Background
Aluminum	26,000	1.90E+04	**1.4**
Antimony	1.40	na	**--**
Arsenic	21.0	2.20E+01	1.0
Barium	490	1.90E+02	**2.6**
Beryllium	3.32	1.20E+00	**2.8**
Cadmium	6.30	9.90E-01	**6.4**
Calcium	280,000	4.70E+04	**6.0**
Chromium, total	35.5	2.30E+01	**1.5**
Cobalt	12.0	2.00E+01	0.6
Copper	140	3.90E+01	**3.6**
Iron	38,000	4.10E+04	0.9
Lead	9,340	2.90E+01	**322**
Magnesium	39,000	1.50E+04	**2.6**
Manganese	900	1.10E+03	0.8
Mercury	0.79	na	**--**
Nickel	32.0	6.70E+01	0.5
Potassium	4,200	2.00E+03	**2.1**
Selenium	3.50	na	--
Silver	190	1.30E+00	**146**
Sodium	980	na	--
Thallium	2.80	na	--
Vanadium	36.0	4.50E+01	0.8
Zinc	1,650	1.20E+02	**13.8**

*Lesser of the maximum concentration and upper 95% tolerance limit (Table 3-3, Phase II Site Investigation, PMC, 2000).

Notes:

na = not available.

-- = no background comparison performed, constituent was retained.

Value in Bold = maximum detected site concentration > background concentration; constituent retained.

TABLE 7-2

Background Comparison--AOC 2Soil

Former Lockbourne Air Force Base, Lockbourne, Ohio

Inorganic Chemical Detected in AOC 2 Surface Soil	Maximum Detected Concentration (mg/kg)	Site-Specific Background Concentration* (mg/kg)	Ration of Maximum Detected Concentration to Background
Aluminum	16,000	1.90E+04	0.8
Antimony	nd	na	--
Arsenic	25.1	2.20E+01	**1.1**
Barium	200	1.90E+02	**1.1**
Beryllium	2.40	1.20E+00	**2.0**
Cadmium	0.67	9.90E-01	0.7
Calcium	100,000	4.70E+04	**2.1**
Chromium, total	22.0	2.30E+01	0.96
Cobalt	26.0	2.00E+01	**1.3**
Copper	23.0	3.90E+01	0.6
Iron	33,000	4.10E+04	0.8
Lead	40.2	2.90E+01	**1.4**
Magnesium	48,000	1.50E+04	**3.2**
Manganese	1,600	1.10E+03	**1.5**
Mercury	0.080	na	--
Nickel	30.0	6.70E+01	0.4
Potassium	3,300	2.00E+03	**1.7**
Selenium	0.60	na	--
Silver	0.64	1.30E+00	0.5
Sodium	210	na	--
Thallium	2.20	na	--
Vanadium	44.0	4.50E+01	0.98
Zinc	125	1.20E+02	**1.04**

*Lesser of the maximum concentration and upper 95% tolerance limit (Table 3-3, Phase II Site Investigation, PMC, 2000).

Notes:

na = not available.

-- = no background comparison performed, constituent was retained.

Value in Bold = maximum detected site concentration > background concentration; constituent retained.

TABLE 7-3

Background Comparison--West Ditch Sediment

Former Lockbourne Air Force Base, Lockbourne, Ohio

Parameter	West Ditch Maximum Concentration (MG/KG)	OEPA SRV[1]	Site Max to OEPA SRV	LCKSD03 Background	Site Max to Background Ration	Retained As COPEC
Aluminum	12,000	3.90E+04	0.3	--	--	No
Arsenic	22.0	1.80E+01	**1.2**	6.35	**2.8**	**Yes**
Barium	110	2.40E+02	0.5	--	--	No
Beryllium	0.56	8.00E-01 [2]	0.7	--	--	No
Cadmium	1.30	9.00E-01	**1.4**	1.6	0.6	No
Calcium [2]	160,000	1.20E+05	**1.3**	83000	**1.4**	**Yes**
Chromium, to	16.0	4.00E+01	0.4	--	--	No
Cobalt	16.0	1.20E+01 [2]	**1.3**	6.7	**1.8**	**Yes**
Copper	26.0	3.40E+01	0.8	--	--	No
Iron	28,000	3.30E+04	0.8	--	--	No
Lead	51.0	4.70E+01 [2]	**1.1**	20.2	**2.3**	**Yes**
Magnesium [2]	44,000	3.50E+04	**1.3**	21000	**1.7**	**Yes**
Manganese	420	7.80E+02	0.5	--	--	No
Mercury	0.042	1.20E-01 [2]	0.4	--	--	No
Nickel	36.0	4.20E+01	0.9	--	--	No
Potassium [2]	2,100	1.10E+04	0.2	--	--	No
Selenium	0.70	2.30E+00	0.3	--	--	No
Sodium [2]	230	NSV	NSV	ND	**--[3]**	**Yes**
Thallium	2.00	4.70E+00 [2]	0.4	--	--	No
Vanadium	29.0	4.00E+01 [2]	0.7	--	--	No
Zinc	120	1.60E+02	0.8	--	--	No

[1] Ohio EPA Sediment Reference Values (SRV), 2003; Region-specific value (ECBP) used unless otherwise noted

[2] State-wide value used

[3] Constituent retained as COPEC due not being detected in background sample

Notes:

ND = Not detected

NSV = No screening value available

OEPA = Ohio Environemental Protection Agency

TABLE 7-4

Background Comparison--East Ditch Sediment

Former Lockbourne Air Force Base, Lockbourne, Ohio

Parameter	East Ditch Maximum Concentration (MG/KG)	OEPA SRV[1]	Site Max to OEPA SRV	LCKSD01 Background	Site Max to Background Ration	Retained as COPEC?
Aluminum	4400	3.90E+04	0.1	--	--	No
Arsenic	10.1	1.80E+01	0.6	--	--	No
Calcium	130000	1.20E+05	**1.1**	110000	**1.2**	**Yes**
Chromium	9.6	4.00E+01	0.2	--	--	No
Cobalt	6.2	1.20E+01	0.5	--	--	No
Copper	18	3.40E+01	0.5	--	--	No
Iron	18000	3.30E+04	0.5	--	--	No
Lead	12.4	4.70E+01 [2]	0.3	--	--	No
Magnesium	46000	3.50E+04	**1.3**	43000	**1.1**	**Yes**
Manganese	380	7.80E+02	0.5	--	--	No
Nickel	19	4.20E+01	0.5	--	--	No
Selenium	0.704	--	**NSV**	4.03	0.2	No
Vanadium	15	4.00E+01 [2]	0.4	--	--	No
Zinc	73	1.60E+02	0.5	--	--	No

[1] Ohio EPA Sediment Reference Values (SRV), 2003; Region-specific value (ECBP) used unless otherwise noted

[2] State-wide value used

Notes:

NSV = No screening value available

OEPA = Ohio Environemental Protection Agency

TABLE 7-5

Background Comparison--East Ditch and West Ditch Surface Water

Former Lockbourne Air Force Base, Lockbourne, Ohio

	Inorganic Chemical Detected in Surface water	Maximum Detected Concentration (mg/L)	Site-Specific Background Concentration* (mg/L)	Ration of Maximum Detected Concentration to Background
East Ditch	Barium	0.080	0.070	**1.14**
	Calcium	110	0.005	**22000**
	Iron	0.42	0.640	0.66
	Magnesium	34	33.000	**1.03**
	Manganese	0.030	0.090	0.33
	Potassium	5.40	ND	--
	Sodium	6.50	9.300	0.70
	Thallium	0.0070	ND	--
	Arsenic, dissolved	0.02	ND	**--**
	Barium, dissolved	0.08	0.08	1.00
	Calcium, dissolved	110	110	1.00
	Magnesium, dissolved	34	33	**1.03**
	Manganese, dissolved	0.03	0.09	0.33
	Sodium, dissolved	6.60	9.3	0.71
	Thallium, dissolved	0.01	0.005	**1.60**
West Ditch	Aluminum	0.18	ND	--
	Arsenic	0.0050	ND	--
	Barium	0.081	0.08	**1.01**
	Calcium	98.0	95	**1.03**
	Copper	0.0036	ND	--
	Iron	0.78	0.29	**2.69**
	Lead	0.052	ND	--
	Magnesium	32.0	30	**1.07**
	Manganese	0.063	0.04	**1.58**
	Potassium	11.0	6.2	**1.77**
	Selenium	0.0015	ND	--
	Sodium	9.30	4	**2.33**
	Thallium	0.0070	0.006	**1.17**
	Zinc	0.092	ND	--
	Barium, dissolved	0.080	0.08	1.00
	Calcium, dissolved	96.0	97	0.99
	Magnesium, dissolved	31.0	31	1.00
	Manganese, dissolved	0.050	0.04	**1.25**
	Potassium, dissolved	7.70	ND	--
	Sodium, dissolved	7.10	4.2	**1.69**
	Thallium, dissolved	0.0060	0.005	**1.20**

Notes:

-- = no background comparison performed, constituent was retained.

Value in Bold = maximum detected site concentration > background concentration; constituent retained.

TABLE 7-6

Soil Screening Values--Direct Exposure

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Screening Value	Reference[1]
Inorganics (MG/KG)		
Aluminum	50.0	Efroymson et al., 1997b; microbe benchmark
Antimony	78.0	USEPA 2005d
Arsenic	18.0	USEPA 2005e
Barium	330	USEPA 2005f
Beryllium	40.0	USEPA 2005g
Cadmium	32.0	USEPA 2005h
Calcium 2	NSV	--
Chromium, total	0.40	Efroymson et al. 1997b
Cobalt	13.0	USEPA 2005i
Copper	70.0	USEPA 2007d
Lead	120	USEPA 2005j
Magnesium 2	NSV	--
Manganese	220	USEPA 2007e
Mercury	0.10	Efroymson et al. 1997b
Potassium 2	NSV	--
Selenium	0.52	USEPA 2007f
Silver	560	USEPA 2006a
Sodium 2	NSV	--
Thallium	1.00	Efroymson et al. 1997b
Zinc	120	USEPA 2007g
Pesticide/Polychlorinated Biphenyls (MG/KG)		
Aldrin	0.0033	USEPA Region 5, 2003c; ESL based on masked shrew
Chlordane, alpha-	0.22	USEPA Region 5, 2003c; ESL for total chlordane based on plant exposure
Chlordane, gamma-	0.22	USEPA Region 5, 2003c; ESL for total chlordane based on plant exposure
Chlordane, technical-	NSV	--
DDD, p,p'-	0.76	USEPA Region 5, 2003c; ESL based on masked shrew
DDE, p,p'-	0.60	USEPA Region 5, 2003c; ESL based on masked shrew
DDT, p,p'-	0.0035	USEPA Region 5, 2003c; ESL based on masked shrew
Dieldrin	0.0024	USEPA Region 5, 2003c; ESL based on masked shrew
Endosulfan A	0.12	USEPA Region 5, 2003c; ESL based on masked shrew
Endosulfan B	0.12	USEPA Region 5, 2003c; ESL based on masked shrew
Endosulfan sulfate	0.036	USEPA Region 5, 2003c; ESL based on masked shrew
Endrin	0.010	USEPA Region 5, 2003c; ESL based on masked shrew
Endrin aldehyde	0.011	USEPA Region 5, 2003c; ESL based on masked shrew
Endrin ketone	NSV	--
Heptachlor	0.0060	USEPA Region 5, 2003c; ESL based on masked shrew
Heptachlor epoxide	0.15	USEPA Region 5, 2003c; ESL based on masked shrew
Hexachlorocyclohexane, alpha-	NSV	--
Hexachlorocyclohexane, beta-	NSV	--
Hexachlorocyclohexane, delta-	NSV	--
Hexachlorocyclohexane, gamma- (Lindane)	NSV	--
Methoxychlor	0.020	USEPA Region 5, 2003c; ESL based on masked shrew
PCB 1016	0.037	Efroymson et al., 1997a; shrew NOAEL-based PRG for total PCBs
PCB 1221	0.037	Efroymson et al., 1997a; shrew NOAEL-based PRG for total PCBs
PCB 1232	0.037	Efroymson et al., 1997a; shrew NOAEL-based PRG for total PCBs
PCB 1242	0.037	Efroymson et al., 1997a; shrew NOAEL-based PRG for total PCBs
PCB 1248	0.037	Efroymson et al., 1997a; shrew NOAEL-based PRG for total PCBs
PCB 1254	0.037	Efroymson et al., 1997a; shrew NOAEL-based PRG for total PCBs
PCB 1260	0.037	Efroymson et al., 1997a; shrew NOAEL-based PRG for total PCBs
Toxaphene	0.12	USEPA Region 5, 2003c; ESL based on masked shrew
Herbicides (MG/KG)		
2,4,5-T	NSV	--
2,4,5-TP	NSV	--
2,4-D	0.027	USEPA Region 5, 2003c; ESL based on masked shrew

TABLE 7-6

Soil Screening Values--Direct Exposure

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Screening Value	Reference[1]
Semivolatile Organic Compounds (MG/KG)		
Acenaphthene	20.0	Efroymson et al., 1997c; plant benchmark
Acenaphthylene	682	USEPA Region 5, 2003c; ESL based on masked shrew
Anthracene	1,480	USEPA Region 5, 2003c; ESL based on masked shrew
Benz(a)anthracene	5.21	USEPA Region 5, 2003c; ESL based on masked shrew
Benzidine	NSV	--
Benzo(a)pyrene	1.52	USEPA Region 5, 2003c; ESL based on masked shrew
Benzo(b)fluoranthene	59.8	USEPA Region 5, 2003c; ESL based on masked shrew
Benzo(ghi)perylene	119	USEPA Region 5, 2003c; ESL based on masked shrew
Benzo(k)fluoranthene	148	USEPA Region 5, 2003c; ESL based on masked shrew
Benzoic acid	NSV	--
Benzyl alcohol	NSV	--
Bis(2-chloroethoxy) methane	0.30	USEPA Region 5, 2003c; ESL based on masked shrew
Bis(2-chloroethyl) ether	23.7	USEPA Region 5, 2003c; ESL based on masked shrew
Bis(2-chloroisopropyl) ether	NSV	
Bis(2-ethylhexyl) phthalate	0.93	USEPA Region 5, 2003c; ESL based on masked shrew
Bis(chloroisopropyl) ether	19.4	USEPA Region 5, 2003c; ESL based on masked shrew
Bromophenyl phenyl ether, 4-	NSV	--
Butylbenzyl phthalate	NSV	--
Carbazole	NSV	--
Chloroaniline, 4-	20.0	Efroymson et al., 1997c; Plant PRG for 3-Chloroaniline
Chloronaphthalene, 2-	NSV	--
Chlorophenol, 2-	7.00	Efroymson et al., 1997c; Earthworm PRG for 2-chlorophenol
Chlorophenyl phenyl ether, 4-	NSV	--
Chrysene	4.73	USEPA Region 5, 2003c; ESL based on masked shrew
Dibenz(ah)anthracene	18.4	USEPA Region 5, 2003c; ESL based on masked shrew
Dibenzofuran	NSV	--
Dichlorobenzene, 1,2-	20.0	Efroymson et al., 1997a; Earthworm PRG for 1,4-dichlorobenzene
Dichlorobenzene, 1,3-	20.0	Efroymson et al., 1997a; Earthworm PRG for 1,4-dichlorobenzene
Dichlorobenzene, 1,4-	20.0	Efroymson et al., 1997a; Earthworm PRG for 1,4-dichlorobenzene
Dichlorobenzidine, 3,3'-	0.65	--
Dichlorophenol, 2,4-	20.0	Efroymson et al., 1997a; Earthworm, plant PRG for 3,4-dichlorophenol
Diethyl phthalate	100	Efroymson et al., 1997a; Plant PRG
Dimethyl phthalate	734	USEPA Region 5, 2003c; ESL based on masked shrew
Dimethylphenol, 2,4-	0.010	USEPA Region 5, 2003c; ESL based on masked shrew
Di-n-butyl phthalate	0.15	USEPA Region 5, 2003c; ESL based on masked shrew
Dinitro-2-methylphenol, 4,6-	NSV	--
Dinitrophenol, 2,4-	20.0	Efroymson et al., 1997a; Plant PRG
Di-n-octyl phthalate	NSV	--
Fluoranthene	122	USEPA Region 5, 2003c; ESL based on masked shrew
Fluorene	30.0	Efroymson et al., 1997b; earthworm benchmark
Hexachlorobenzene	NSV	--
Hexachlorobutadiene	NSV	--
Hexachlorocyclopentadiene	NSV	--
Hexachloroethane	NSV	--
Indeno(1,2,3-cd)pyrene	109	USEPA Region 5, 2003c; ESL based on masked shrew
Isophorone	NSV	--
Methylnaphthalene, 2-	3.24	USEPA Region 5, 2003c; ESL based on masked shrew
Methylphenol, 2-	NSV	--
Methylphenol, 3- and/or 4-	NSV	--
Methylphenol, 4-	NSV	--
Methylphenol, 4-chloro-3-	NSV	--
Naphthalene	0.099	USEPA Region 5, 2003c; ESL based on masked shrew
Nitroaniline, 2-	74.1	USEPA Region 5, 2003c; ESL based on masked shrew
Nitroaniline, 3-	3.16	USEPA Region 5, 2003c; ESL based on masked shrew
Nitroaniline, 4-	21.9	USEPA Region 5, 2003c; ESL based on masked shrew
Nitrophenol, 2-	1.60	USEPA Region 5, 2003c; ESL based on masked shrew

TABLE 7-6

Soil Screening Values--Direct Exposure

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Screening Value	Reference[1]
Nitrophenol, 4-	7.00	Efroymson et al., 1997a; Earthworm PRG
Nitrosodi-N-propylamine, N-	NSV	--
Nitrosodiphenylamine, N-	0.55	USEPA Region 5, 2003c; ESL based on masked shrew
Pentachlorophenol	3.00	Efroymson et al., 1997a; Plant PRG
Phenanthrene	45.7	USEPA Region 5, 2003c; ESL based on masked shrew
Phenol	30.0	Efroymson et al., 1997a; Earthworm PRG
Pyrene	45.7	USEPA Region 5, 2003c; ESL based on masked shrew
Trichlorobenzene, 1,2,3-	20.0	Efroymson et al., 1997a; Earthworm PRG
Trichlorobenzene, 1,2,4-	20.0	Efroymson et al., 1997a; Earthworm PRG
Trichlorophenol, 2,4,5-	9.00	Efroymson et al., 1997a; Earthworm PRG
Trichlorophenol, 2,4,6-	4.00	Efroymson et al., 1997a; Plant PRG
Total Low Molecular Weight PAHs	29	USEPA 2007h
Total High Molecular Weight PAHs	18	USEPA 2007h
Explosives (MG/KG)		
Amino-2,6-dinitrotoluene, 4-	NSV	--
Amino-4,6-dinitrotoluene, 2-	NSV	--
Aminodinitrotoluenes, total	NSV	--
Dinitrobenzene, 1,3-	NSV	--
Dinitrotoluene, 2,4-	1.28	USEPA Region 5, 2003c; ESL for total chlordane based on plant exposure
Dinitrotoluene, 2,6-	0.033	USEPA Region 5, 2003c; ESL for total chlordane based on plant exposure
HMX	NSV	--
Nitrobenzene	1.31	USEPA Region 5, 2003c; ESL for total chlordane based on plant exposure
Nitrotoluene, 2-	NSV	--
Nitrotoluene, 3-	NSV	--
Nitrotoluene, 4-	NSV	--
RDX	NSV	--
Tetryl	NSV	--
Trinitrobenzene, 1,3,5-	4.30	USEPA Region 5, 2003c; ESL for total chlordane based on plant exposure
Trinitrotoluene, 2,4,6-	NSV	--
Volatile Organic Compounds (MG/KG)		
Acetone	2.50	USEPA Region 5, 2003c; ESL based on masked shrew
Benzene	0.26	USEPA Region 5, 2003c; ESL based on masked shrew
Bromobenzene	NSV	--
Bromochloromethane	NSV	--
Bromodichloromethane	0.54	USEPA Region 5, 2003c; ESL based on masked shrew
Bromoform	15.9	USEPA Region 5, 2003c; ESL based on masked shrew
Bromomethane	NSV	--
Butylbenzene, 1-	NSV	--
Butylbenzene, sec-	NSV	--
Butylbenzene, tert-	NSV	--
Carbon disulfide	0.094	USEPA Region 5, 2003c; ESL based on masked shrew
Carbon tetrachloride	2.98	USEPA Region 5, 2003c; ESL based on masked shrew
Chlorobenzene	40.0	Efroymson et al., 1997a; Earthworm PRG
Chloroethane	NSV	--
Chloroform	1.19	USEPA Region 5, 2003c; ESL based on masked shrew
Chloromethane	NSV	--
Chlorotoluene, 2-	NSV	--
Chlorotoluene, 4-	NSV	--
Dibromochloromethane	2.05	USEPA Region 5, 2003c; ESL based on masked shrew
Dibromochloropropane	0.035	USEPA Region 5, 2003c; ESL based on masked shrew
Dichlorodifluoromethane	39.5	USEPA Region 5, 2003c; ESL based on masked shrew
Dichloroethane, 1,1-	20.1	USEPA Region 5, 2003c; ESL based on masked shrew
Dichloroethane, 1,2-	21.2	USEPA Region 5, 2003c; ESL based on masked shrew
Dichloroethene, 1,1-	8.28	USEPA Region 5, 2003c; ESL based on masked shrew
Dichloroethene, 1,2-, cis-	0.78	USEPA Region 5, 2003c; ESL based on masked shrew (1,2-Dichloroethene (trans) used as surrogate)
Dichloroethene, 1,2-, trans-	0.78	USEPA Region 5, 2003c; ESL based on masked shrew

TABLE 7-6

Soil Screening Values--Direct Exposure

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Screening Value	Reference[1]
Dichloroethenes, 1,2-, total	NSV	--
Dichloropropane, 1,2-	32.7	USEPA Region 5, 2003c; ESL based on masked shrew
Dichloropropane, 1,3-	32.7	USEPA Region 5, 2003c; ESL based on masked shrew (1,2-Dichloropropane) used as surrogate)
Dichloropropane, 2,2-	32.7	USEPA Region 5, 2003c; ESL based on masked shrew (1,2-Dichloropropane) used as surrogate)
Dichloropropene, 1,1-	0.40	USEPA Region 5, 2003c; ESL based on masked shrew
Dichloropropene, 1,3-, cis-	0.40	USEPA Region 5, 2003c; ESL based on masked shrew
Dichloropropene, 1,3-, trans-	0.40	USEPA Region 5, 2003c; ESL based on masked shrew
Ethylbenzene	5.16	USEPA Region 5, 2003c; ESL based on masked shrew
Ethylene dibromide	NSV	--
Isopropylbenzene	NSV	--
Isopropyltoluene, 4-	NSV	--
Methyl ethyl ketone	89.6	USEPA Region 5, 2003c; ESL based on masked shrew
Methyl isobutyl ketone	NSV	--
Methyl n-butyl ketone	NSV	--
Methyl tert-butyl ether	NSV	--
Methylene bromide	65.0	USEPA Region 5, 2003c; ESL based on masked shrew
Methylene chloride	4.05	USEPA Region 5, 2003c; ESL based on masked shrew
Propylbenzene, 1-	NSV	--
Styrene	4.69	USEPA Region 5, 2003c; ESL based on masked shrew
Tetrachloroethane, 1,1,1,2-	0.13	USEPA Region 5, 2003c; ESL based on masked shrew
Tetrachloroethane, 1,1,2,2-	0.13	USEPA Region 5, 2003c; ESL based on masked shrew
Tetrachloroethene	9.92	USEPA Region 5, 2003c; ESL based on masked shrew
Toluene	5.45	USEPA Region 5, 2003c; ESL based on masked shrew
Trichloroethane, 1,1,1-	29.8	USEPA Region 5, 2003c; ESL based on masked shrew
Trichloroethane, 1,1,2-	28.6	USEPA Region 5, 2003c; ESL based on masked shrew
Trichloroethene	12.4	USEPA Region 5, 2003c; ESL based on masked shrew
Trichlorofluoromethane	16.4	USEPA Region 5, 2003c; ESL based on masked shrew
Trichloropropane, 1,2,3-	3.36	USEPA Region 5, 2003c; ESL based on masked shrew
Trimethylbenzene, 1,2,4-	NSV	--
Trimethylbenzene, 1,3,5-	NSV	--
Vinyl chloride	0.65	USEPA Region 5, 2003c; ESL based on masked shrew
Xylene, 1,2-	NSV	--
Xylene, 1,3- and/or 1,4-	NSV	--
Xylenes, total	10.0	USEPA Region 5, 2003c; ESL based on masked shrew
Dioxin/Furans (MG/KG)		
TCDD-TEQ	3.15E-07	Efroymson et al., 1997a; shrew NOAEL-based PRG

Notes:

[1] - See Section 9 of Text for Complete Reference

TABLE 7-7

Sediment Screening Values

Former Lockbourne Air Force Base, Lockbourne, Ohio

AnalyteName	Screening Value	Reference[1]
Inorganics (MG/KG)		
Arsenic	9.79	MacDonald et al. 2000
Calcium 2	NSV	
Cobalt	5.00E+01	USEPA Region 5 ESL, 2003c
Lead	35.8	MacDonald et al. 2000
Magnesium 2	NSV	
Sodium 2	NSV	
Pesticide/Polychlorinated Biphenyls (MG/KG)		
Aldrin	0.0032	USEPA Region 5 ESL, 2003c
Chlordane, alpha-	3.24E-03	USEPA Region 5 ESL, 2003c
Chlordane, gamma-	3.24E-03	USEPA Region 5 ESL, 2003c
Chlordane, technical-	NSV	
DDD, p,p'-	0.0049	MacDonald et al. 2000
DDE, p,p'-	0.0032	MacDonald et al. 2000
DDT, p,p'-	0.0042	MacDonald et al. 2000
Dieldrin	0.0019	USEPA Region 5 ESL, 2003c
Endosulfan A	0.0033	USEPA Region 5 ESL, 2003c
Endosulfan B	0.0019	USEPA Region 5 ESL, 2003c
Endosulfan sulfate	0.035	USEPA Region 5 ESL, 2003c
Endrin	0.0022	USEPA Region 5 ESL, 2003c
Endrin aldehyde	0.48	USEPA Region 5 ESL, 2003c
Endrin ketone	NSV	
Heptachlor	6.00E-04	USEPA Region 5 ESL, 2003c
Heptachlor epoxide	0.0025	USEPA Region 5 ESL, 2003c
Hexachlorocyclohexane, alpha-	NSV	
Hexachlorocyclohexane, beta-	NSV	
Hexachlorocyclohexane, delta-	NSV	
Hexachlorocyclohexane, gamma- (Lindane)	NSV	
Methoxychlor	0.014	USEPA Region 5 ESL, 2003c
PCB 1016	5.98E-02	MacDonald et al. 2000
PCB 1221	5.98E-02	MacDonald et al. 2000
PCB 1232	5.98E-02	MacDonald et al. 2000
PCB 1242	5.98E-02	MacDonald et al. 2000
PCB 1248	5.98E-02	MacDonald et al. 2000
PCB 1254	5.98E-02	MacDonald et al. 2000
PCB 1260	5.98E-02	MacDonald et al. 2000
Total PCBs	5.98E-02	MacDonald et al. 2000
Toxaphene	7.70E-05	
Herbicides (MG/KG)		
2,4,5-T		
2,4,5-TP		
2,4-D	1.27E+00	USEPA Region 5 ESL, 2003c
Dioxin/Furans (MG/KG)		
TCDD-TEQ	1.20E-07	USEPA Region 5 ESL, 2003c
Semivolatile Organic Compounds (MG/KG)		
Acenaphthene	0.0067	USEPA Region 5 ESL, 2003c
Acenaphthylene	0.0059	USEPA Region 5 ESL, 2003c
Anthracene	0.057	MacDonald et al. 2000
Benz(a)anthracene	0.11	MacDonald et al. 2000

TABLE 7-7
Sediment Screening Values
Former Lockbourne Air Force Base, Lockbourne, Ohio

AnalyteName	**Screening Value**	**Reference[1]**
Benzo(a)pyrene	0.15	MacDonald et al. 2000
Benzo(b)fluoranthene	10.4	USEPA Region 5 ESL, 2003c
Benzo(ghi)perylene	0.17	USEPA Region 5 ESL, 2003c
Benzo(k)fluoranthene	0.24	USEPA Region 5 ESL, 2003c
Bis(2-chloroethoxy) methane	NSV	
Bis(2-chloroethyl) ether	3.52	USEPA Region 5 ESL, 2003c
Bis(2-ethylhexyl) phthalate	0.182	USEPA Region 5 ESL, 2003c
Bis(chloroisopropyl) ether	NSV	
Bromophenyl phenyl ether, 4-	NSV	
Butylbenzyl phthalate	1.97	USEPA Region 5 ESL, 2003c
Carbazole	NSV	
Chloroaniline, 4-	0.15	USEPA Region 5 ESL, 2003c
Chloronaphthalene, 2-	0.42	USEPA Region 5 ESL, 2003c
Chlorophenol, 2-	0.032	USEPA Region 5 ESL, 2003c
Chlorophenyl phenyl ether, 4-	NSV	
Chrysene	0.17	MacDonald et al. 2000
Dibenz(ah)anthracene	0.033	MacDonald et al. 2000
Dibenzofuran	0.45	USEPA Region 5 ESL, 2003c
Dichlorobenzene, 1,2-	0.29	USEPA Region 5 ESL, 2003c
Dichlorobenzene, 1,3-	1.32	USEPA Region 5 ESL, 2003c
Dichlorobenzene, 1,4-	0.32	USEPA Region 5 ESL, 2003c
Dichlorobenzidine, 3,3'-	0.13	USEPA Region 5 ESL, 2003c
Dichlorophenol, 2,4-	0.082	USEPA Region 5 ESL, 2003c
Diethyl phthalate	0.30	USEPA Region 5 ESL, 2003c
Dimethyl phthalate	NSV	USEPA Region 5 ESL, 2003c
Dimethylphenol, 2,4-	0.30	USEPA Region 5 ESL, 2003c
Di-n-butyl phthalate	1.11	USEPA Region 5 ESL, 2003c
Dinitro-2-methylphenol, 4,6-	NSV	USEPA Region 5 ESL, 2003c
Dinitrophenol, 2,4-	0.0062	USEPA Region 5 ESL, 2003c
Di-n-octyl phthalate	40.6	USEPA Region 5 ESL, 2003c
Fluoranthene	0.42	MacDonald et al. 2000
Fluorene	0.077	USEPA Region 5 ESL, 2003c
Hexachlorobenzene	0.020	USEPA Region 5 ESL, 2003c
Hexachlorobutadiene	0.027	USEPA Region 5 ESL, 2003c
Hexachlorocyclopentadiene	0.90	USEPA Region 5 ESL, 2003c
Hexachloroethane	0.58	USEPA Region 5 ESL, 2003c
Indeno(1,2,3-cd)pyrene	0.20	USEPA Region 5 ESL, 2003c
Isophorone	NSV	
Methylnaphthalene, 2-	0.020	USEPA Region 5 ESL, 2003c
Methylphenol, 2-	NSV	
Methylphenol, 4-	NSV	
Methylphenol, 4-chloro-3-	NSV	
Naphthalene	0.18	MacDonald et al. 2000
Nitroaniline, 2-	NSV	
Nitroaniline, 3-	NSV	
Nitroaniline, 4-	NSV	
Nitrophenol, 2-	0.013	USEPA Region 5 ESL, 2003c, used 2-Nitrophenol as surrogate
Nitrophenol, 4-	0.013	USEPA Region 5 ESL, 2003c

TABLE 7-7

Sediment Screening Values

Former Lockbourne Air Force Base, Lockbourne, Ohio

AnalyteName	Screening Value	Reference[1]
Nitrosodi-N-propylamine, N-	NSV	
Nitrosodiphenylamine, N-	NSV	
Pentachlorophenol	NSV	
Phenanthrene	NSV	
Phenol	NSV	
Pyrene	0.20	MacDonald et al. 2000
Trichlorobenzene, 1,2,4-	5.06	USEPA Region 5 ESL, 2003c
Trichlorophenol, 2,4,5-	0.21	USEPA Region 5 ESL, 2003c
Trichlorophenol, 2,4,6-	0.21	USEPA Region 5 ESL, 2003c, used Trichlorophenol, 2,4,6-, as surrogate
Total Low Molecular Weight PAHs	NSV	USEPA Region 3 BTAG, 2006b
Total High Molecular Weight PAHs	NSV	USEPA Region 3 BTAG, 2006b
Total PAHs	NSV	MacDonald et al. 2000
Explosives (MG/KG)		
Amino-2,6-dinitrotoluene, 4-	NSV	
Amino-4,6-dinitrotoluene, 2-	NSV	
Dinitrobenzene, 1,3-	0.0086	USEPA Region 5 ESL, 2003c
Dinitrotoluene, 2,4-	0.014	USEPA Region 5 ESL, 2003c
Dinitrotoluene, 2,6-	0.040	USEPA Region 5 ESL, 2003c
HMX	NSV	
Nitrobenzene	0.15	USEPA Region 5 ESL, 2003c
Nitrotoluene, 2-	NSV	
Nitrotoluene, 3-	NSV	
Nitrotoluene, 4-	NSV	
RDX	NSV	
Tetryl	NSV	
Trinitrobenzene, 1,3,5-	NSV	
Trinitrotoluene, 2,4,6-	NSV	
Volatile Organic Compounds (MG/KG)		
Acetone	0.0099	USEPA Region 5 ESL, 2003c
Benzene	0.14	USEPA Region 5 ESL, 2003c
Bromodichloromethane	NSV	
Bromoform	0.49	USEPA Region 5 ESL, 2003c
Bromomethane	NSV	
Carbon disulfide	0.024	USEPA Region 5 ESL, 2003c
Carbon tetrachloride	1.45	USEPA Region 5 ESL, 2003c
Chlorobenzene	0.29	USEPA Region 5 ESL, 2003c
Chloroethane	NSV	
Chloroform	0.12	USEPA Region 5 ESL, 2003c
Chloromethane	NSV	
Dibromochloromethane	NSV	
Dichloroethane, 1,1-	5.75E-04	USEPA Region 5 ESL, 2003c
Dichloroethane, 1,2-	0.26	USEPA Region 5 ESL, 2003c
Dichloroethene, 1,1-	0.019	USEPA Region 5 ESL, 2003c
Dichloroethenes, 1,2-, total	NSV	
Dichloropropane, 1,2-	0.33	USEPA Region 5 ESL, 2003c
Dichloropropene, 1,3-, cis-	0.33	USEPA Region 5 ESL, 2003c
Dichloropropene, 1,3-, trans-	0.33	USEPA Region 5 ESL, 2003c
Ethylbenzene	0.18	USEPA Region 5 ESL, 2003c

TABLE 7-7

Sediment Screening Values

Former Lockbourne Air Force Base, Lockbourne, Ohio

AnalyteName	**Screening Value**	**Reference[1]**
Methyl ethyl ketone	0.042	USEPA Region 5 ESL, 2003c
Methyl isobutyl ketone	0.025	USEPA Region 5 ESL, 2003c
Methyl n-butyl ketone	NSV	
Methylene chloride	0.16	USEPA Region 5 ESL, 2003c
Styrene	0.25	USEPA Region 5 ESL, 2003c
Tetrachloroethane, 1,1,2,2-	0.85	USEPA Region 5 ESL, 2003c
Tetrachloroethene	0.99	USEPA Region 5 ESL, 2003c
Toluene	1.22	USEPA Region 5 ESL, 2003c
Trichloroethane, 1,1,1-	0.21	USEPA Region 5 ESL, 2003c
Trichloroethane, 1,1,2-	0.52	USEPA Region 5 ESL, 2003c
Trichloroethene	0.11	USEPA Region 5 ESL, 2003c
Vinyl chloride	0.20	USEPA Region 5 ESL, 2003c
Xylenes, total	0.43	USEPA Region 5 ESL, 2003c

Notes:

[1] - See Section 9 of Text for Complete Reference

TABLE 7-8

Surface Water Screening Values

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Screening Value	Reference[1]
Inorganics (MG/L)		
Aluminum	NSV	
Antimony	0.90	OEPA 2008b
Arsenic	0.34	OEPA 2008b
Barium	2.00	OEPA 2008b
Beryllium	0.093	OEPA 2008b
Cadmium	0.0045	OEPA 2008b
Calcium 2	NSV	
Chromium, total	1.80	OEPA 2008b
Cobalt	0.22	OEPA 2008b
Copper	0.014	OEPA 2008b
Iron	NSV	
Lead	0.12	OEPA 2008b
Magnesium 2	NSV	
Manganese	NSV	
Mercury	0.0017	OEPA 2008b
Nickel	0.47	OEPA 2008b
Potassium 2	NSV	
Selenium	0.0050	OEPA 2008b (OMZA used)
Silver	0.0016	OEPA 2008b
Sodium 2	NSV	
Thallium	0.079	OEPA 2008b
Vanadium	0.15	OEPA 2008b
Zinc	0.12	OEPA 2008b
Dissolved Metals (MG/L)		
Aluminum	NSV	
Antimony	9.00E-01	OEPA 2008b, Total SV Used
Arsenic	3.40E-01	OEPA 2008b
Barium	2.00E+00	OEPA 2008b, Total SV Used
Beryllium	9.30E-02	OEPA 2008b, Total SV Used
Cadmium	4.30E-03	OEPA 2008b
Calcium 2		
Chromium	5.70E-01	OEPA 2008b
Cobalt	2.20E-01	OEPA 2008b, Total SV Used
Copper	1.30E-02	OEPA 2008b
Iron		
Lead	9.70E-02	OEPA 2008b
Magnesium 2		
Manganese		
Mercury	1.40E-03	OEPA 2008b
Nickel	4.70E-01	OEPA 2008b
Potassium 2		
Selenium	4.60E-03	OEPA 2008b (OMZA used)
Silver	1.40E-03	OEPA 2008b
Sodium 2		
Thallium	7.90E-02	OEPA 2008b, Total SV Used
Vanadium	1.50E-01	OEPA 2008b, Total SV Used
Zinc	1.20E-01	OEPA 2008b

TABLE 7-8

Surface Water Screening Values

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Screening Value	Reference[1]
Pesticide/Polychlorinated Biphenyls (MG/L)		
Aldrin	1.70E-05	USEPA Region 5 ESL, 2003c
Chlordane, technical-	4.30E-05	USEPA Region 5 ESL, 2003c
DDD, p,p'-	NSV	
DDE, p,p'-	4.51E-12	USEPA Region 5 ESL, 2003c
DDT, p,p'-	1.10E-08	USEPA Region 5 ESL, 2003c
Dieldrin	2.40E-04	OEPA 2008b
Endosulfan A	5.60E-05	USEPA Region 5 ESL, 2003c
Endosulfan B	5.60E-05	USEPA Region 5 ESL, 2003c
Endosulfan sulfate	0.0022	USEPA Region 5 ESL, 2003c
Endrin	8.60E-05	OEPA 2008b
Endrin aldehyde	1.50E-04	USEPA Region 5 ESL, 2003c
Endrin ketone	NSV	
Heptachlor	3.80E-06	USEPA Region 5 ESL, 2003c
Heptachlor epoxide	3.80E-06	USEPA Region 5 ESL, 2003c
Hexachlorocyclohexane, alpha-	NSV	
Hexachlorocyclohexane, beta-	NSV	
Hexachlorocyclohexane, delta-	NSV	
Hexachlorocyclohexane, gamma- (Lindane)	9.50E-04	OEPA 2008b
Methoxychlor	NSV	
PCB 1016	1.20E-07	USEPA Region 5 ESL, 2003c (Used total PCBs)
PCB 1221	1.20E-07	USEPA Region 5 ESL, 2003c (Used total PCBs)
PCB 1232	1.20E-07	USEPA Region 5 ESL, 2003c (Used total PCBs)
PCB 1242	1.20E-07	USEPA Region 5 ESL, 2003c (Used total PCBs)
PCB 1248	1.20E-07	USEPA Region 5 ESL, 2003c (Used total PCBs)
PCB 1254	1.20E-07	USEPA Region 5 ESL, 2003c (Used total PCBs)
PCB 1260	1.20E-07	USEPA Region 5 ESL, 2003c (Used total PCBs)
Toxaphene	1.40E-07	USEPA Region 5 ESL, 2003c
Semivolatile Organic Compounds (MG/L)		
Acenaphthene	0.019	OEPA 2008b
Acenaphthylene	4.84	USEPA Region 5 ESL, 2003c
Anthracene	1.80E-04	OEPA 2008b
Benz(a)anthracene	2.50E-05	USEPA Region 5 ESL, 2003c
Benzo(a)pyrene	1.40E-05	USEPA Region 5 ESL, 2003c
Benzo(b)fluoranthene	0.0091	USEPA Region 5 ESL, 2003c
Benzo(ghi)perylene	0.0076	USEPA Region 5 ESL, 2003c
Benzo(k)fluoranthene	NSV	
Bis(2-chloroethoxy) methane	NSV	
Bis(2-chloroethyl) ether	19.0	USEPA Region 5 ESL, 2003c
Bis(2-ethylhexyl) phthalate	1.10	OEPA 2008b
Bis(chloroisopropyl) ether	NSV	
Bromophenyl phenyl ether, 4-	NSV	
Butylbenzyl phthalate	0.023	USEPA Region 5 ESL, 2003c
Carbazole	NSV	
Chloroaniline, 4-	0.23	USEPA Region 5 ESL, 2003c
Chloronaphthalene, 2-	3.96E-04	USEPA Region 5 ESL, 2003c
Chlorophenol, 2-	0.29	OEPA 2008b
Chlorophenyl phenyl ether, 4-	NSV	
Chrysene	NSV	
Dibenz(ah)anthracene	NSV	

TABLE 7-8

Surface Water Screening Values

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Screening Value	Reference[1]
Dibenzofuran	0.036	OEPA 2008b
Dichlorobenzene, 1,2-	0.13	OEPA 2008b
Dichlorobenzene, 1,3-	0.079	OEPA 2008b
Dichlorobenzene, 1,4-	0.057	OEPA 2008b
Dichlorobenzidine, 3,3'-	NSV	
Dichlorophenol, 2,4-	0.11	OEPA 2008b
Diethyl phthalate	9.80	OEPA 2008b
Dimethyl phthalate	3.20	OEPA 2008b
Dimethylphenol, 2,4-	0.14	OEPA 2008b
Di-n-butyl phthalate	0.0097	
Dinitro-2-methylphenol, 4,6-	NSV	
Dinitrophenol, 2,4-	0.019	USEPA Region 5 ESL, 2003c
Di-n-octyl phthalate	0.030	USEPA Region 5 ESL, 2003c
Fluoranthene	0.0037	OEPA 2008b
Fluorene	0.11	OEPA 2008b
Hexachlorobenzene	3.00E-07	USEPA Region 5 ESL, 2003c
Hexachlorobutadiene	5.30E-05	USEPA Region 5 ESL, 2003c
Hexachlorocyclopentadiene	0.077	USEPA Region 5 ESL, 2003c
Hexachloroethane	0.0080	USEPA Region 5 ESL, 2003c
Indeno(1,2,3-cd)pyrene	0.0043	USEPA Region 5 ESL, 2003c
Isophorone	0.92	USEPA Region 5 ESL, 2003c
Methylnaphthalene, 2-	0.33	USEPA Region 5 ESL, 2003c
Methylphenol, 2-	0.60	OEPA 2008b
Methylphenol, 4-	0.48	OEPA 2008b
Methylphenol, 4-chloro-3-	NSV	
Naphthalene	0.17	OEPA 2008b
Nitroaniline, 2-	NSV	
Nitroaniline, 3-	NSV	
Nitroaniline, 4-	NSV	
Nitrophenol, 2-	0.65	OEPA 2008b
Nitrophenol, 4-	0.65	OEPA 2008b, 2-Nitrophenol used as surrogate
Nitrosodi-N-propylamine, N-	NSV	
Nitrosodiphenylamine, N-	0.77	USEPA Region 5 ESL, 2003c
Pentachlorophenol	0.0040	USEPA Region 5 ESL, 2003c
Phenanthrene	0.031	OEPA 2008b
Phenol	4.70	OEPA 2008b
Pyrene	0.042	OEPA 2008b
Trichlorobenzene, 1,2,4-	0.030	USEPA Region 5 ESL, 2003c
Trichlorophenol, 2,4,5-	0.039	OEPA 2008b, 2,4,6--Trichlorophenol used as surrogate
Trichlorophenol, 2,4,6-	0.039	OEPA 2008b
Volatile Organic Compounds (MG/L)		
Acetone	1.70	USEPA Region 5 ESL, 2003c
Benzene	0.70	OEPA 2008b
Bromodichloromethane	NSV	
Bromoform	1.10	OEPA 2008b
Bromomethane	0.038	OEPA 2008b
Carbon disulfide	0.13	OEPA 2008b
Carbon tetrachloride	2.20	OEPA 2008b
Chlorobenzene	0.42	OEPA 2008b

TABLE 7-8
Surface Water Screening Values
Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	**Screening Value**	**Reference**[1]
Chloroethane	NSV	
Chloroform	1.30	OEPA 2008b
Chloromethane	NSV	
Dibromochloromethane	NSV	
Dichloroethane, 1,1-	0.047	USEPA Region 5 ESL, 2003c
Dichloroethane, 1,2-	9.60	OEPA 2008b
Dichloroethene, 1,1-	1.90	OEPA 2008b
Dichloroethenes, 1,2-, total	8.80	OEPA 2008b
Dichloropropane, 1,2-	3.30	OEPA 2008b
Dichloropropene, 1,3-, cis-	0.015	OEPA 2008b
Dichloropropene, 1,3-, trans-	0.015	OEPA 2008b
Ethylbenzene	0.55	OEPA 2008b
Methyl ethyl ketone	200	OEPA 2008b
Methyl isobutyl ketone	NSV	
Methyl n-butyl ketone	NSV	
Methylene chloride	11.0	OEPA 2008b
Styrene	0.032	USEPA Region 5 ESL, 2003c
Tetrachloroethane, 1,1,2,2-	0.91	OEPA 2008b
Tetrachloroethene	0.43	OEPA 2008b
Toluene	0.56	OEPA 2008b
Trichloroethane, 1,1,1-	0.69	OEPA 2008b
Trichloroethane, 1,1,2-	3.30	OEPA 2008b
Trichloroethene	2.00	OEPA 2008b
Vinyl chloride	8.40	OEPA 2008b
Xylenes, total	0.24	OEPA 2008b
Explosives (MG/L)		
Amino-2,6-dinitrotoluene, 4-	0.098	OEPA 2008b
Amino-4,6-dinitrotoluene, 2-	0.16	OEPA 2008b
Dinitrobenzene, 1,3-	0.10	OEPA 2008b
Dinitrotoluene, 2,4-	0.39	OEPA 2008b
Dinitrotoluene, 2,6-	0.73	OEPA 2008b
HMX	1.20	OEPA 2008b
Nitrobenzene	2.00	OEPA 2008b
Nitrotoluene, 2-	0.64	OEPA 2008b
Nitrotoluene, 3-	0.38	OEPA 2008b
Nitrotoluene, 4-	0.41	OEPA 2008b
RDX	0.52	OEPA 2008b
Tetryl	NSV	
Trinitrobenzene, 1,3,5-	NSV	
Trinitrotoluene, 2,4,6-	NSV	
Dioxin/Furans (MG/KG)		
TCDD-TEQ	3.00E-12	OEPA 2008b

Notes:

[1] - See Section 9 of Text for Complete Reference

TABLE 7-9

Soil Screening Values -- Food Web Exposures

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Screening Value	Reference[1]
Inorganics (MG/KG)		
Aluminum	NSV	
Antimony	0.27	USEPA 2005d
Arsenic	18.0	USEPA 2005e
Barium	2,000	USEPA 2005f
Beryllium	21.0	USEPA 2005g
Cadmium	0.36	USEPA 2005h
Calcium 2	NSV	
Chromium, total	26.0	USEPA 2008c
Cobalt	120	USEPA 2005i
Copper	28.0	USEPA 2007d
Lead	11.0	USEPA 2005j
Magnesium 2	NSV	
Manganese	4,000	USEPA 2007e
Mercury	0.10	USEPA Region 5, 2003c; ESL
Potassium 2	NSV	
Selenium	0.63	USEPA 2007f
Silver	4.20	USEPA 2006a
Sodium 2	NSV	
Thallium	0.057	USEPA Region 5, 2003c; ESL
Zinc	46.0	USEPA 2007e
Pesticide/Polychlorinated Biphenyls (MG/KG)		
Aldrin	0.0033	USEPA Region 5, 2003c; ESL
Chlordane, alpha-	0.22	USEPA Region 5, 2003c; ESL for total chlordane based on plant exposure
Chlordane, gamma-	0.22	USEPA Region 5, 2003c; ESL for total chlordane based on plant exposure
Chlordane, technical-	NSV	USEPA Region 5, 2003c; ESL based on masked shrew
DDD, p,p'-	0.76	USEPA Region 5, 2003c; ESL based on masked shrew
DDE, p,p'-	0.60	USEPA Region 5, 2003c; ESL based on masked shrew
DDT, p,p'-	0.0035	USEPA Region 5, 2003c; ESL based on masked shrew
Dieldrin	0.0024	USEPA Region 5, 2003c; ESL based on masked shrew
Endosulfan A	0.12	USEPA Region 5, 2003c; ESL based on masked shrew
Endosulfan B	0.12	USEPA Region 5, 2003c; ESL based on masked shrew
Endosulfan sulfate	0.036	USEPA Region 5, 2003c; ESL based on masked shrew
Endrin	0.010	USEPA Region 5, 2003c; ESL based on masked shrew
Endrin aldehyde	0.011	USEPA Region 5, 2003c; ESL based on masked shrew
Endrin ketone	NSV	
Heptachlor	0.0060	USEPA Region 5, 2003c; ESL based on masked shrew
Heptachlor epoxide	0.15	
Hexachlorocyclohexane, alpha-	NSV	
Hexachlorocyclohexane, beta-	NSV	
Hexachlorocyclohexane, delta-	NSV	
Hexachlorocyclohexane, gamma- (	NSV	
Methoxychlor	0.020	USEPA Region 5, 2003c; ESL based on masked shrew
PCB 1016	0.00033	USEPA Region 5, 2003c; ESL based on masked shrew
PCB 1221	0.00033	USEPA Region 5, 2003c; ESL based on masked shrew
PCB 1232	0.00033	USEPA Region 5, 2003c; ESL based on masked shrew
PCB 1242	0.00033	USEPA Region 5, 2003c; ESL based on masked shrew
PCB 1248	0.00033	USEPA Region 5, 2003c; ESL based on masked shrew
PCB 1254	0.00033	USEPA Region 5, 2003c; ESL based on masked shrew
PCB 1260	0.00033	USEPA Region 5, 2003c; ESL based on masked shrew
Total PCBs	0.00033	USEPA Region 5, 2003c; ESL based on masked shrew
Toxaphene	0.12	USEPA Region 5, 2003c; ESL based on masked shrew

TABLE 7-9

Soil Screening Values -- Food Web Exposures

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Screening Value	Reference[1]
Herbicides (MG/KG)		
2,4,5-T	NSV	
2,4,5-TP	NSV	
2,4-D	0.027	USEPA Region 5, 2003c; ESL based on masked shrew
Semivolatile Organic Compounds (MG/KG)		
Acenaphthene	682	USEPA Region 5, 2003c; ESL based on masked shrew
Acenaphthylene	682	USEPA Region 5, 2003c; ESL based on masked shrew
Anthracene	1,480	USEPA Region 5, 2003c; ESL based on masked shrew
Benz(a)anthracene	5.21	USEPA Region 5, 2003c; ESL based on masked shrew
Benzidine	NSV	
Benzo(a)pyrene	1.52	USEPA Region 5, 2003c; ESL based on masked shrew
Benzo(b)fluoranthene	59.8	USEPA Region 5, 2003c; ESL based on masked shrew
Benzo(ghi)perylene	119	USEPA Region 5, 2003c; ESL based on masked shrew
Benzo(k)fluoranthene	148	USEPA Region 5, 2003c; ESL based on masked shrew
Benzoic acid	NSV	
Benzyl alcohol	NSV	
Bis(2-chloroethoxy) methane	0.30	USEPA Region 5, 2003c; ESL based on masked shrew
Bis(2-chloroethyl) ether	23.7	USEPA Region 5, 2003c; ESL based on masked shrew
Bis(2-chloroisopropyl) ether	NSV	
Bis(2-ethylhexyl) phthalate	0.93	USEPA Region 5, 2003c; ESL based on masked shrew
Bis(chloroisopropyl) ether	19.4	USEPA Region 5, 2003c; ESL based on masked shrew
Bromophenyl phenyl ether, 4-	NSV	
Butylbenzyl phthalate	NSV	
Carbazole	NSV	
Chloroaniline, 4-	1.10	USEPA Region 5, 2003c; ESL based on masked shrew
Chloronaphthalene, 2-	0.012	USEPA Region 5, 2003c; ESL based on masked shrew
Chlorophenol, 2-	0.24	USEPA Region 5, 2003c; ESL based on masked shrew
Chlorophenyl phenyl ether, 4-	NSV	
Chrysene	4.73	USEPA Region 5, 2003c; ESL based on masked shrew
Dibenz(ah)anthracene	18.4	USEPA Region 5, 2003c; ESL based on masked shrew
Dibenzofuran	NSV	
Dichlorobenzene, 1,2-	2.96	USEPA Region 5, 2003c; ESL based on masked shrew
Dichlorobenzene, 1,3-	37.7	USEPA Region 5, 2003c; ESL based on masked shrew
Dichlorobenzene, 1,4-	0.55	USEPA Region 5, 2003c; ESL based on masked shrew
Dichlorobenzidine, 3,3'-	0.65	USEPA Region 5, 2003c; ESL based on masked shrew
Dichlorophenol, 2,4-	87.5	USEPA Region 5, 2003c; ESL based on masked shrew
Diethyl phthalate	24.8	USEPA Region 5, 2003c; ESL based on masked shrew
Dimethyl phthalate	734	USEPA Region 5, 2003c; ESL based on masked shrew
Dimethylphenol, 2,4-	0.010	USEPA Region 5, 2003c; ESL based on masked shrew
Di-n-butyl phthalate	0.15	USEPA Region 5, 2003c; ESL based on masked shrew
Dinitro-2-methylphenol, 4,6-	NSV	
Dinitrophenol, 2,4-	0.069	USEPA Region 5, 2003c; ESL based on masked shrew
Di-n-octyl phthalate	NSV	
Fluoranthene	122	USEPA Region 5, 2003c; ESL based on masked shrew
Fluorene	122	USEPA Region 5, 2003c; ESL based on masked shrew
Hexachlorobenzene	0.20	USEPA Region 5, 2003c; ESL based on masked shrew
Hexachlorobutadiene	NSV	
Hexachlorocyclopentadiene	NSV	
Hexachloroethane	NSV	
Indeno(1,2,3-cd)pyrene	109	USEPA Region 5, 2003c; ESL based on masked shrew
Isophorone	NSV	
Methylnaphthalene, 2-	3.24	USEPA Region 5, 2003c; ESL based on masked shrew
Methylphenol, 2-	NSV	

TABLE 7-9

Soil Screening Values -- Food Web Exposures

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Screening Value	Reference[1]
Methylphenol, 3- and/or 4-	NSV	
Methylphenol, 4-	NSV	
Methylphenol, 4-chloro-3-	NSV	
Naphthalene	0.099	USEPA Region 5, 2003c; ESL based on masked shrew
Nitroaniline, 2-	74.1	USEPA Region 5, 2003c; ESL based on masked shrew
Nitroaniline, 3-	3.16	USEPA Region 5, 2003c; ESL based on masked shrew
Nitroaniline, 4-	21.9	USEPA Region 5, 2003c; ESL based on masked shrew
Nitrophenol, 2-	1.60	USEPA Region 5, 2003c; ESL based on masked shrew (2-nitrophenol used as surrogate)
Nitrophenol, 4-	1.60	USEPA Region 5, 2003c; ESL based on masked shrew
Nitrosodi-N-propylamine, N-	NSV	
Nitrosodiphenylamine, N-	0.55	USEPA Region 5, 2003c; ESL based on masked shrew
Pentachlorophenol	0.12	USEPA Region 5, 2003c; ESL based on masked shrew
Phenanthrene	45.7	USEPA Region 5, 2003c; ESL based on masked shrew
Phenol	1,200	USEPA Region 5, 2003c; ESL based on masked shrew
Pyrene	45.7	USEPA Region 5, 2003c; ESL based on masked shrew
Trichlorobenzene, 1,2,3-	11.1	USEPA Region 5, 2003c; ESL based on masked shrew (1,2,4-Trichlorobenzene used as surrogate
Trichlorobenzene, 1,2,4-	11.1	USEPA Region 5, 2003c; ESL based on masked shrew
Trichlorophenol, 2,4,5-	14.1	USEPA Region 5, 2003c; ESL based on masked shrew
Trichlorophenol, 2,4,6-	9.94	USEPA Region 5, 2003c; ESL based on masked shrew
Total Low Molecular Weight PAHs	100	USEPA 2007h
Total High Molecular Weight PAHs	1.1	USEPA 2007h
Explosives (MG/KG)		
Amino-2,6-dinitrotoluene, 4-	NSV	
Amino-4,6-dinitrotoluene, 2-	NSV	
Aminodinitrotoluenes, total	NSV	
Dinitrobenzene, 1,3-	NSV	
Dinitrotoluene, 2,4-	1.28	USEPA Region 5, 2003c; ESL based on masked shrew
Dinitrotoluene, 2,6-	0.033	USEPA Region 5, 2003c; ESL based on masked shrew
HMX	NSV	
Nitrobenzene	1.31	USEPA Region 5, 2003c; ESL based on masked shrew
Nitrotoluene, 2-	NSV	
Nitrotoluene, 3-	NSV	
Nitrotoluene, 4-	NSV	
RDX	NSV	
Tetryl	NSV	
Trinitrobenzene, 1,3,5-	4.30	USEPA Region 5, 2003c; ESL based on masked shrew
Trinitrotoluene, 2,4,6-	NSV	

TABLE 7-9

Soil Screening Values -- Food Web Exposures

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Screening Value	Reference[1]
Volatile Organic Compounds (MG/KG)		
Acetone	2.50	USEPA Region 5, 2003c; ESL based on masked shrew
Benzene	0.26	USEPA Region 5, 2003c; ESL based on masked shrew
Bromobenzene	NSV	
Bromochloromethane	NSV	
Bromodichloromethane	0.54	USEPA Region 5, 2003c; ESL based on masked shrew
Bromoform	15.9	USEPA Region 5, 2003c; ESL based on masked shrew
Bromomethane	NSV	
Butylbenzene, 1-	NSV	
Butylbenzene, sec-	NSV	
Butylbenzene, tert-	NSV	
Carbon disulfide	0.094	USEPA Region 5, 2003c; ESL based on masked shrew
Carbon tetrachloride	2.98	USEPA Region 5, 2003c; ESL based on masked shrew
Chlorobenzene	13.1	USEPA Region 5, 2003c; ESL based on masked shrew
Chloroethane	NSV	
Chloroform	1.19	USEPA Region 5, 2003c; ESL based on masked shrew
Chloromethane	NSV	
Chlorotoluene, 2-	NSV	
Chlorotoluene, 4-	NSV	
Dibromochloromethane	2.05	USEPA Region 5, 2003c; ESL based on masked shrew
Dibromochloropropane	0.035	USEPA Region 5, 2003c; ESL based on masked shrew
Dichlorodifluoromethane	39.5	USEPA Region 5, 2003c; ESL based on masked shrew
Dichloroethane, 1,1-	20.1	USEPA Region 5, 2003c; ESL based on masked shrew
Dichloroethane, 1,2-	21.2	USEPA Region 5, 2003c; ESL based on masked shrew
Dichloroethene, 1,1-	8.28	USEPA Region 5, 2003c; ESL based on masked shrew
Dichloroethene, 1,2-, cis-	0.78	USEPA Region 5, 2003c; ESL based on masked shrew
Dichloroethene, 1,2-, trans-	0.78	USEPA Region 5, 2003c; ESL based on masked shrew
Dichloroethenes, 1,2-, total	NSV	USEPA Region 5, 2003c; ESL based on masked shrew
Dichloropropane, 1,2-	32.7	USEPA Region 5, 2003c; ESL based on masked shrew
Dichloropropane, 1,3-	32.7	USEPA Region 5, 2003c; ESL based on masked shrew
Dichloropropane, 2,2-	32.7	USEPA Region 5, 2003c; ESL based on masked shrew
Dichloropropene, 1,1-	0.40	USEPA Region 5, 2003c; ESL based on masked shrew
Dichloropropene, 1,3-, cis-	0.40	USEPA Region 5, 2003c; ESL based on masked shrew
Dichloropropene, 1,3-, trans-	0.40	USEPA Region 5, 2003c; ESL based on masked shrew
Ethylbenzene	5.16	USEPA Region 5, 2003c; ESL based on masked shrew
Ethylene dibromide	NSV	
Isopropylbenzene	NSV	
Isopropyltoluene, 4-	NSV	
Methyl ethyl ketone	89.6	USEPA Region 5, 2003c; ESL based on masked shrew
Methyl isobutyl ketone	NSV	
Methyl n-butyl ketone	NSV	
Methyl tert-butyl ether	NSV	
Methylene bromide	65.0	USEPA Region 5, 2003c; ESL based on masked shrew
Methylene chloride	4.05	USEPA Region 5, 2003c; ESL based on masked shrew
Propylbenzene, 1-	NSV	
Styrene	4.69	USEPA Region 5, 2003c; ESL based on masked shrew
Tetrachloroethane, 1,1,1,2-	0.13	USEPA Region 5, 2003c; ESL based on masked shrew
Tetrachloroethane, 1,1,2,2-	0.13	USEPA Region 5, 2003c; ESL based on masked shrew
Tetrachloroethene	9.92	USEPA Region 5, 2003c; ESL based on masked shrew
Toluene	5.45	USEPA Region 5, 2003c; ESL based on masked shrew
Trichloroethane, 1,1,1-	29.8	USEPA Region 5, 2003c; ESL based on masked shrew
Trichloroethane, 1,1,2-	28.6	USEPA Region 5, 2003c; ESL based on masked shrew
Trichloroethene	12.4	USEPA Region 5, 2003c; ESL based on masked shrew

TABLE 7-9

Soil Screening Values -- Food Web Exposures

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	**Screening Value**	**Reference**[1]
Trichlorofluoromethane	16.4	USEPA Region 5, 2003c; ESL based on masked shrew
Trichloropropane, 1,2,3-	3.36	USEPA Region 5, 2003c; ESL based on masked shrew
Trimethylbenzene, 1,2,4-	NSV	
Trimethylbenzene, 1,3,5-	NSV	
Vinyl chloride	0.65	USEPA Region 5, 2003c; ESL based on masked shrew
Xylene, 1,2-	NSV	
Xylene, 1,3- and/or 1,4-	NSV	
Xylenes, total	10.0	USEPA Region 5, 2003c; ESL based on masked shrew
Dioxin/Furans (MG/KG)		
TCDD-TEQ	3.15E-07	USEPA Region 5, 2003c; ESL based on masked shrew

Notes:

[1] - See Section 9 of Text for Complete Reference

TABLE 7-10

Sediment Bioaccumulation Factors For Benthic Invertebrates and Fish--Step 2

Former Lockbourne Air Force Base, Lockbourne, Ohio

Chemical	Sediment-Invertebrate BAF (dry weight)		Sediment-Fish BAF (dry weight)	
	Value	Reference	Value	Reference[1]
Inorganics				
Arsenic	0.690	Bechtel Jacobs 1998b	0.126	Pascoe et al. 1996
Cobalt	0.020	Baes et al. 1984	1.000	--
Lead	0.468	Bechtel Jacobs 1998a	0.070	Krantzberg and Boyd 1992
Pesticides/PCBs				
4,4'-DDD	0.350	Oliver and Niimi 1988	2.250	Oliver and Niimi 1988
4,4'-DDE	3.360	Oliver and Niimi 1988	26.20	Oliver and Niimi 1988
4,4'-DDT	2.280	Oliver and Niimi 1988	8.800	Oliver and Niimi 1988
Aroclor-1260	21.89	Bechtel Jacobs 1998b	12.94	Oliver and Niimi 1988
PCBs (total)	21.89	Bechtel Jacobs 1998b	12.94	Oliver and Niimi 1988
Semivolatile Organics				
2-Methylnaphthalene	1.000	--	1.000	--
Acenaphthene	2.040	Maruya et al. 1997	1.000	--
Anthracene	0.271	Maruya et al. 1997	1.000	--
Benzo(a)anthracene	1.400	Maruya et al. 1997	1.000	--
Benzo(a)pyrene	0.191	Maruya et al. 1997	1.000	--
Benzo(b)fluoranthene	0.160	Maruya et al. 1997	1.000	--
Benzo(g,h,i)perylene	0.295	Maruya et al. 1997	1.000	--
Benzo(k)fluoranthene	0.421	Maruya et al. 1997	1.000	--
bis(2-Ethylhexyl)phthalate	1.000	--	1.000	--
Chrysene	0.335	Maruya et al. 1997	1.000	--
Dibenzofuran	1.000	--	1.000	--
Fluoranthene	0.312	Maruya et al. 1997	1.000	--
Fluorene	1.130	Maruya et al. 1997	1.000	--
Indeno(1,2,3-cd)pyrene	0.355	Maruya et al. 1997	1.000	--
Naphthalene	1.000	--	1.000	--
Phenanthrene	0.652	Maruya et al. 1997	1.000	--
Pyrene	0.803	Maruya et al. 1997	1.000	--
Dioxin/Furans				
Dioxin/furan (TEQ) - Mammal (total)	0.360	USEPA 1993d	0.630	USEPA 1997a
Dioxin/furan (TEQ) - Bird (total)	0.360	USEPA 1993d	0.630	USEPA 1997a

Notes:

[1] - See Section 9 of Text for Complete Reference

TABLE 7-11

Sediment Bioaccumulation Factors For Aquatic Plants and Frogs - Step 2

Former Lockbourne Air Force Base, Lockbourne, Ohio

Chemical	Sediment-Plant BCF (dry weight)		Sediment-Frog BAF (dry weight)	
	Value	Reference	Value	Reference[1]
Inorganics				
Arsenic	1.103	Bechtel Jacobs 1998a	0.126	Pascoe et al. 1996
Cobalt	0.020	Baes et al. 1984	1.000	--
Lead	0.468	Bechtel Jacobs 1998a	0.070	Krantzberg and Boyd 1992
Pesticides/PCBs				
4,4'-DDD	0.0151	Travis and Arms 1988	2.250	Oliver and Niimi 1988
4,4'-DDE	0.0216	Travis and Arms 1988	26.20	Oliver and Niimi 1988
4,4'-DDT	0.0237	Travis and Arms 1988	8.800	Oliver and Niimi 1988
Aroclor-1260	0.0045	Travis and Arms 1988	12.94	Oliver and Niimi 1988
PCBs (total)	0.0068	Travis and Arms 1988	12.94	Oliver and Niimi 1988
Semivolatile Organics				
2-Methylnaphthalene	0.2157	Travis and Arms 1988	1.000	--
Acenaphthene	0.2564	Travis and Arms 1988	1.000	--
Anthracene	0.1051	Travis and Arms 1988	1.000	--
Benzo(a)anthracene	0.0222	Travis and Arms 1988	1.000	--
Benzo(a)pyrene	0.0135	Travis and Arms 1988	1.000	--
Benzo(b)fluoranthene	0.0174	Travis and Arms 1988	1.000	--
Benzo(g,h,i)perylene	0.0061	Travis and Arms 1988	1.000	--
Benzo(k)fluoranthene	0.0112	Travis and Arms 1988	1.000	--
bis(2-Ethylhexyl)phthalate	0.0029	Travis and Arms 1988	1.000	--
Chrysene	0.0289	Travis and Arms 1988	1.000	--
Dibenzofuran	0.1447	Travis and Arms 1988	1.000	--
Fluoranthene	0.0617	Travis and Arms 1988	1.000	--
Fluorene	0.1790	Travis and Arms 1988	1.000	--
Indeno(1,2,3-cd)pyrene	0.0061	Travis and Arms 1988	1.000	--
Naphthalene	0.5261	Travis and Arms 1988	1.000	--
Phenanthrene	0.1154	Travis and Arms 1988	1.000	--
Pyrene	0.0687	Travis and Arms 1988	1.000	--
Dioxin/Furans				
Dioxin/furan (TEQ) - Mammal (total)	0.0075	Travis and Arms 1988	0.630	USEPA 1997c
Dioxin/furan (TEQ) - Bird (total)	0.0075	Travis and Arms 1988	0.630	USEPA 1997c

Notes:

[1] - See Section 9 of Text for Complete Reference

TABLE 7-12

Exposure Parameters for Upper Trophic Level Ecological Receptors - Step 2

Former Lockbourne Air Force Base, Lockbourne, Ohio

Receptor	Body Weight (kg)		Water Ingestion Rate (L/day)		Food Ingestion Rate (kg/day - dry)	
	Value	Reference[1]	Value	Reference[1]	Value	Reference[1]
Birds						
Belted kingfisher	0.125	Dunning 1993	0.0211	allometric equation	0.0262	USEPA 1993d
Mallard	0.612	Bellrose 1980	0.0850	allometric equation	0.0830	allometric equation
Marsh wren	0.010	Dunning 1993	0.0033	allometric equation	0.0030	USEPA 1993a
Mammals						
Mink	0.726	Silva and Downing 1995	0.0286	USEPA 1993a	0.0345	USEPA 1993d
Muskrat	0.750	USEPA 1993	0.1426	allometric equation	0.0765	USEPA 1993d
White-tailed deer	52.1	Silva and Downing 1995	3.5636	allometric equation	0.2610	Sample and Suter 1994

Notes:

[1] - See Section 9 of Text for Complete Reference

TABLE 7-12

Exposure Parameters for Upper Trophic Level Ecological Receptors - Step 2

Former Lockbourne Air Force Base, Lockbourne, Ohio

Receptor	Dietary Composition (percent)							Soil/ Sediment Ingestion (percent)	
	Terr. Plants	Soil Invert.	Small Mammals	Fish/ Frogs	Aquatic Plants	Benthic Invert.	Reference[1]	Value	Reference[1]
Birds									
Belted kingfisher	0	0	0	84.0	0	16.0	USEPA 1993d	0	Sample and Suter 1994
Mallard	0	0	0	0	86.7	10.0	Palmer 1976	3.3	Beyer et al. 1994
Marsh wren	0	0	0	0	0	95.0	USEPA 1993d	5.0	Assumed based on diet
Mammals									
Mink	0	0	0	94.0	1.0	5.0	USEPA 1993d	0	Sample and Suter 1994
Muskrat	0	0	0	0	90.6	0	USEPA 1993d	9.4	Beyer et al. 1994 (raccoon)
White-tailed deer	98.0	0	0	0	0	0	Sample and Suter 1994	2.0	Beyer et al. 1994

TABLE 7-13

Uncertainty Factors Applied to Ingestion-Based Screening Values

Former Lockbourne Air Force Base, Lockbourne, Ohio

Convert From	Convert To	Uncertainty Factor
Chronic NOAEL	Chronic NOAEL	1
Subchornic LOAEL	Chronic LOAEL	4
Chronic LOAEL	Chronic NOAEL	5
Subchronic NOAEL	Chronic NOAEL	10
Subchronic LOAEL	Chronic NOAEL	20
Acute NOAEL	Chronic NOAEL	30
Acute LOAEL	Chronic NOAEL	50
LD50	Chronic NOAEL	100

Notes:

Uncertainty factors from: Wentsel. R.S. et al. 1996.

Durations are defined as follows (USEPA, August 1999; Sample et al. 1996
[see report text for complete references]):

- Acute: <14 days
- Subchronic: 14 - 90 days
- Chronic: >90 days or during critical life stage

TABLE 7-14
Ingestion Screening Values for Mammals
Former Lockbourne Air Force Base, Lockbourne, Ohio

Chemical	Test Organism	Body Weight (kg)	Duration	Exposure Route	Effect/Endpoint	LOAEL (mg/kg/d)	NOAEL (mg/kg/d)	Reference[1]	Receptor	
									Mink	Muskrat
Inorganics										
Aluminum	mouse	0.03	3 generations (390 days)	oral in water/diet	reproduction	245	49.0	ATSDR 2008	X	X
Arsenic	mouse	0.03	3 generations	oral in water	reproduction	1.26	0.25	Sample et al. 1996		X
Arsenic	dog	10	2 years	oral in diet	systemic	6	1.20	ATSDR 2000a	X	
Barium	rat	0.435	16 months	oral in water	growth/hypertension	19.8	5.10	Sample et al. 1996	X	X
Cobalt	rat	0.35	69 days	oral in diet	reproduction	20.0	5.00	ATSDR 2004c	X	X
Copper	mouse	0.03	1 month + GD 0-19	oral in diet	developmental	104	78.0	ATSDR 2004d		X
Copper	mink	1.00	357 days	oral in diet	reproduction	15.1	11.7	Sample et al. 1996	X	
Lead	rat	0.35	3 generations	oral in diet	reproduction	80.0	8.00	Sample et al. 1996	X	X
Manganese	rat	0.35	224 days	oral in diet	reproduction	284	88.0	Sample et al. 1996	X	X
Selenium	rat	0.35	1 year	oral in water	reproduction	0.33	0.20	Sample et al. 1996	X	X
Thallium	rat	0.365	60 days	oral in water	reproduction	0.185	0.037	Sample et al. 1996	X	X
Zinc	rat	0.35	GD 1-16	oral in diet	reproduction	320	160	Sample et al. 1996		X
Zinc	mink	1.00	25 weeks	oral	reproduction	104	20.8	ATSDR 2005	X	
Pesticides/PCBs										
4,4'-DDD	rat	0.35	2 years	oral in diet	reproduction	4.00	0.80	Sample et al. 1996		X
4,4'-DDD	dog	10.0	2 generations	oral in diet	reproduction	5.00	1.00	ATSDR 2002b	X	
4,4'-DDE	rat	0.35	2 years	oral in diet	reproduction	4.00	0.80	Sample et al. 1996		X
4,4'-DDE	dog	10.0	2 generations	oral in diet	reproduction	5.00	1.00	ATSDR 2002b	X	
4,4'-DDT	rat	0.35	2 years	oral in diet	reproduction	4.00	0.80	Sample et al. 1996		X
4,4'-DDT	dog	10.0	2 generations	oral in diet	reproduction	5.00	1.00	ATSDR 2002b	X	
Aroclor-1260	oldfield mouse	0.014	12 months	oral in diet	reproduction	0.68	0.14	Sample et al. 1996		X
Aroclor-1260	mink	1.00	4.5 months	oral in diet	reproduction	0.69	0.14	Sample et al. 1996	X	
PCBs (total)	oldfield mouse	0.014	12 months	oral in diet	reproduction	0.037	0.00	Sample et al. 1996		X
PCBs (total)	mink	1.00	4.5 months	oral in diet	reproduction	0.037	0.0037	Sample et al. 1996	X	
Semivolatile Organics										
2-Methylnaphthalene	--	--	--	--	--	NA	NA	--	X	X
Acenaphthene	mouse	0.03	13 weeks	oral (gavage)	reproduction	700	350	ATSDR 1995	X	X
Anthracene	mouse	0.03	13 weeks	oral (gavage)	reproduction	5,000	1,000	ATSDR 1995	X	X
Benzo(a)anthracene	mouse	0.03	GD 7-16	oral (gavage)	reproduction	10.0	2.00	Sample et al. 1996	X	X
Benzo(a)pyrene	mouse	0.03	GD 7-16	oral (gavage)	reproduction	10.0	2.00	Sample et al. 1996	X	X
Benzo(b)fluoranthene	mouse	0.03	GD 7-16	oral (gavage)	reproduction	10.0	2.00	Sample et al. 1996	X	X
Benzo(g,h,i)perylene	mouse	0.03	GD 7-16	oral (gavage)	reproduction	10.0	2.00	Sample et al. 1996	X	X
Benzo(k)fluoranthene	mouse	0.03	GD 7-16	oral (gavage)	reproduction	10.0	2.00	Sample et al. 1996	X	X
bis(2-Ethylhexyl)phthalate	mouse	0.03	105 days	oral in diet	reproduction	183	18.3	Sample et al. 1996	X	X
Chrysene	mouse	0.03	GD 7-16	oral (gavage)	reproduction	10.0	2.00	Sample et al. 1996	X	X
Dibenz(a,h)anthracene	mouse	0.03	GD 7-16	oral (gavage)	reproduction	10.0	2.00	Sample et al. 1996	X	X

TABLE 7-14

Ingestion Screening Values for Mammals

Former Lockbourne Air Force Base, Lockbourne, Ohio

Chemical	Test Organism	Body Weight (kg)	Duration	Exposure Route	Effect/Endpoint	LOAEL (mg/kg/d)	NOAEL (mg/kg/d)	Reference[1]	Receptor	
									Mink	Muskrat
Dibenzofuran	--	--	--	--	--	NA	NA	--	X	X
Fluoranthene	mouse	0.03	13 weeks	oral (gavage)	reproduction	2,500	500	ATSDR 1995	X	X
Fluorene	mouse	0.03	13 weeks	oral (gavage)	reproduction	2,500	500	ATSDR 1995	X	X
Indeno(1,2,3-cd)pyrene	mouse	0.03	GD 7-16	oral (gavage)	reproduction	10.0	2.00	Sample et al. 1996	X	X
Naphthalene	mouse	0.03	13 weeks	oral (gavage)	reproduction	1,000	200	ATSDR 1995	X	X
Phenanthrene	mouse	0.03	13 weeks	oral (gavage)	reproduction	2,500	500	ATSDR 1995	X	X
Pyrene	mouse	0.03	GD 7-16	oral (gavage)	reproduction	10.0	2.00	Sample et al. 1996	X	X
Volatile Organics										
Acetone	rat	0.35	90 days	oral (gavage)	liver/kidney	500	100	Sample et al. 1996	X	X
Dioxins/Furans										
Dioxin/furan (TEQ) - Mammal (total)	rat	0.35	3 generations	oral in diet	reproduction	0.00001	0.000001	Sample et al. 1996	X	X

Notes:

[1] - See Section 9 of Text for Complete Reference

TABLE 7-15

Ingestion Screening Values for Birds

Former Lockbourne Air Force Base, Lockbourne, Ohio

Chemical	Test Organism	Body Weight (kg)	Duration	Exposure Route	Effect/Endpoint	LOAEL (mg/kg/d)	NOAEL (mg/kg/d)	Reference[1]	Receptor		
									Belted Kingfisher	Mallard Duck	Marsh Wren
Inorganics											
Aluminum	ringed dove	0.155	4 months	oral in diet	reproduction	549	110	Sample et al. 1996	X	X	X
Arsenic	brown-headed cowbird	0.049	7 months	oral in diet	survival	7.38	2.46	Sample et al. 1996			X
Arsenic	mallard	1.00	128 days	oral in diet	survival	12.8	5.14	Sample et al. 1996	X	X	
Barium	chicken (chicks)	0.121	4 weeks	oral in diet	survival	41.7	20.8	Sample et al. 1996	X	X	X
Cobalt	--	--	--	--	--	NA	NA	--	X	X	X
Copper	chicken (chicks)	0.534	10 weeks	oral in diet	growth/survival	61.7	47.0	Sample et al. 1996	X	X	X
Lead	Japanese quail	0.15	12 weeks	oral in diet	reproduction	11.3	1.13	Sample et al. 1996		X	
Lead	American kestrel	0.13	7 months	oral in diet	reproduction	19.3	3.85	Sample et al. 1996	X		X
Manganese	Japanese quail	0.072	75 days	oral in diet	growth/behavior	4,885	977	Sample et al. 1996	X	X	X
Selenium	black-crowned night-heron	0.88	94 days	oral in diet	reproduction	9.00	1.80	Sample et al. 1996	X		
Selenium	mallard	1.00	100 days	oral in diet	reproduction	0.80	0.40	Sample et al. 1996		X	X
Thallium	European starling	0.082	acute	oral	survival	1.75	0.35	USEPA 1999	X	X	X
Zinc	chicken	1.94	44 weeks	oral in diet	reproduction	131	14.5	Sample et al. 1996	X	X	X
Pesticides/PCBs											
4,4'-DDD	mallard	1.00	2 years	oral in diet	reproduction	0.60	0.12	USEPA 1995a		X	X
4,4'-DDD	bald eagle	4.74	112 days	oral in diet	survival	3.00	0.30	USEPA 1995a	X		
4,4'-DDE	Japanese quail	0.11	3 generations	oral in diet	reproduction	5.00	0.50	USEPA 1995a			
4,4'-DDE	mallard	1.00	2 years	oral in diet	reproduction	0.60	0.12	USEPA 1995a		X	X
4,4'-DDE	bald eagle	4.74	112 days	oral in diet	survival	3.00	0.30	USEPA 1995a	X		
4,4'-DDT	mallard	1.00	2 years	oral in diet	reproduction	1.50	0.60	USEPA 1995a		X	X
4,4'-DDT	bald eagle	4.74	112 days	oral in diet	survival	3.00	0.30	USEPA 1995a	X		
Aroclor-1260	mallard	1.00	1 month	oral in diet	reproduction	7.50	1.50	USEPA 1995a	X	X	X
PCBs (total)	mallard	1.00	1 month	oral in diet	reproduction	7.50	1.50	USEPA 1995a	X	X	X
Semivolatile Organics											
2-Methylnaphthalene	chicken	1.50	35 days	oral in diet	reproduction	35.5	7.10	Rigdon and Neal 1963	X	X	X
Acenaphthene	chicken	1.50	35 days	oral in diet	reproduction	35.5	7.10	Rigdon and Neal 1963	X	X	X
Anthracene	chicken	1.50	35 days	oral in diet	reproduction	35.5	7.10	Rigdon and Neal 1963	X	X	X
Benzo(a)anthracene	chicken	1.50	35 days	oral in diet	reproduction	35.5	7.10	Rigdon and Neal 1963	X	X	X
Benzo(a)pyrene	chicken	1.50	35 days	oral in diet	reproduction	35.5	7.10	Rigdon and Neal 1963	X	X	X
Benzo(b)fluoranthene	chicken	1.50	35 days	oral in diet	reproduction	35.5	7.10	Rigdon and Neal 1963	X	X	X
Benzo(g,h,i)perylene	chicken	1.50	35 days	oral in diet	reproduction	35.5	7.10	Rigdon and Neal 1963	X	X	X
Benzo(k)fluoranthene	chicken	1.50	35 days	oral in diet	reproduction	35.5	7.10	Rigdon and Neal 1963	X	X	X
bis(2-Ethylhexyl)phthalate	ringed dove	0.155	4 weeks	oral in diet	reproduction	5.55	1.11	Sample et al. 1996	X	X	X
Chrysene	chicken	1.50	35 days	oral in diet	reproduction	35.5	7.10	Rigdon and Neal 1963	X	X	X

TABLE 7-15

Ingestion Screening Values for Birds

Former Lockbourne Air Force Base, Lockbourne, Ohio

Chemical	Test Organism	Body Weight (kg)	Duration	Exposure Route	Effect/Endpoint	LOAEL (mg/kg/d)	NOAEL (mg/kg/d)	Reference[1]	Receptor		
									Belted Kingfisher	Mallard Duck	Marsh Wren
Dibenz(a,h)anthracene	chicken	1.50	35 days	oral in diet	reproduction	35.5	7.10	Rigdon and Neal 1963	X	X	X
Dibenzofuran	--	--	--	--	--	NA	NA	--	X	X	X
Fluoranthene	chicken	1.50	35 days	oral in diet	reproduction	35.5	7.10	Rigdon and Neal 1963	X	X	X
Fluorene	chicken	1.50	35 days	oral in diet	reproduction	35.5	7.10	Rigdon and Neal 1963	X	X	X
Indeno(1,2,3-cd)pyrene	chicken	1.50	35 days	oral in diet	reproduction	35.5	7.10	Rigdon and Neal 1963	X	X	X
Naphthalene	chicken	1.50	35 days	oral in diet	reproduction	35.5	7.10	Rigdon and Neal 1963	X	X	X
Phenanthrene	chicken	1.50	35 days	oral in diet	reproduction	35.5	7.10	Rigdon and Neal 1963	X	X	X
Pyrene	chicken	1.50	35 days	oral in diet	reproduction	35.5	7.10	Rigdon and Neal 1963	X	X	X
Volatile Organics											
Acetone*	--	--	--	--	--	NA	NA	--	X	X	X
Dioxins/Furans											
Dioxin/furan (TEQ) - Mammal (total)	ring-necked pheasant	1.00	10 weeks	injection	reproduction	0.00014	0.000014	Sample et al. 1996	X	X	X
Dioxin/furan (TEQ) - Bird (total)	ring-necked pheasant	1.00	10 weeks	injection	reproduction	0.00014	0.000014	Sample et al. 1996	X	X	X

Notes:

[1] - See Section 9 of Text for Complete Reference

TABLE 7-16

Screening Statistics for Direct Exposures--AOC 1 Soil

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[3]
Detected Constituents							
Inorganics (MG/KG)							
Aluminum	-- - --	32 / 32	26,000	LCKSO-6 2-3	50.0	32 / 32	**520**
Antimony	5.20 - 66.0	2 / 32	1.40	EEGLKB-SS10	78	0 / 32	< 1
Barium	-- - --	48 / 48	490	EEGLKB-SS01	330	2 / 48	**1.5**
Beryllium	0.51 - 6.00	22 / 32	3.32	LCKSO-7 2-3	40	0 / 32	< 1
Cadmium	0.42 - 6.00	20 / 48	6.30	LCK-SO9B	32	0 / 48	< 1
Calcium [2]	-- - --	32 / 32	280,000	EEGLKB-SS01	NSV	-- / --	NSV
Chromium, total	11.0 - 11.0	47 / 48	35.5	LCK-SO6B	0.40	47 / 48	**89**
Copper	21.0 - 23.0	29 / 32	140	LCKSO-8 0-1	70	1 / 32	**2.0**
Lead	-- - --	48 / 48	9,340	LCKSO-8 0-1	120	4 / 48	**78**
Magnesium [2]	-- - --	32 / 32	39,000	EEGLKB-SS16	NSV	-- / --	NSV
Mercury	2.00E-05 - 0.33	22 / 48	0.79	LCK-SO6B	0.10	6 / 48	**7.9**
Potassium [2]	3,300 - 5,500	30 / 32	4,200	LCKSB-13 0-0.5	NSV	-- / --	NSV
Selenium	0.14 - 11.0	19 / 48	3.50	EEGLKB-SS02	0.52	16 / 48	**6.7**
Silver	0.42 - 11.0	4 / 48	190	EEGLKB-SS14	560	0 / 48	< 1
Sodium [2]	104 - 1,800	17 / 32	980	LCKSO-6 2-3	NSV	-- / --	NSV
Thallium	0.51 - 18.0	17 / 32	2.80	EEGLKB-SS02	1	17 / 32	**2.8**
Zinc	-- - --	48 / 48	1,650	LCK-SO6B	120	7 / 48	**14**
Pesticide/Polychlorinated Biphenyls (MG/KG)							
Chlordane, alpha-	0.0019 - 0.22	2 / 36	0.16	EEGLKB-SS12	0.22	0 / 36	< 1
Chlordane, gamma-	0.0019 - 0.22	3 / 36	0.44	EEGLKB-SS05	0.22	2 / 36	**2.0**
DDD, p,p'-	0.0020 - 0.22	6 / 40	0.36	EEGLKB-SS11	0.76	0 / 40	< 1
DDE, p,p'-	0.0020 - 0.22	8 / 40	0.20	EEGLKB-SS11	0.60	0 / 40	< 1
DDT, p,p'-	0.0020 - 0.22	11 / 40	0.42	EEGLKB-SS11	0.0035	11 / 40	**120**
PCB 1242	0.019 - 2.00	2 / 40	0.23	EEGLKB-SS05	0.371	0 / 40	< 1
PCB 1248	0.019 - 0.77	1 / 40	16.0	EEGLKB-SS10	0.371	1 / 40	**43**
PCB 1254	0.019 - 2.00	5 / 40	0.81	LCK-SODUP2	0.371	1 / 40	**2.2**
PCB 1260	0.019 - 2.00	3 / 40	0.26	EEGLKB-SS18	0.371	0 / 40	< 1
Total PCBs	-- - --	5 / 40	22	EEGLKB-SS10	0.371	5 / 40	**59**
Semivolatile Organic Compounds (MG/KG)							
Acenaphthene	0.038 - 8.10	19 / 41	85.0	EEGLKB-SS06	20.0	4 / 41	**4.3**
Acenaphthylene	0.038 - 8.10	9 / 41	1.90	EEGLKB-SS08	682	0 / 41	< 1
Anthracene	0.039 - 3.50	27 / 41	160	EEGLKB-SS05	1,480	0 / 41	< 1
Benz(a)anthracene	0.039 - 3.50	33 / 41	450	EEGLKB-SS05	5.21	9 / 41	**86**
Benzo(a)pyrene	0.039 - 3.50	32 / 41	380	EEGLKB-SS05	1.52	15 / 41	**250**

TABLE 7-16

Screening Statistics for Direct Exposures--AOC 1 Soil

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[3]
Benzo(b)fluoranthene	0.35 - 3.50	34 / 41	340	EEGLKB-SS05	59.8	6 / 41	**6**
Benzo(ghi)perylene	0.039 - 3.50	31 / 41	110	EEGLKB-SS05	119	0 / 41	< 1
Benzo(k)fluoranthene	0.35 - 3.50	34 / 41	340	EEGLKB-SS05	148	5 / 41	**2.3**
Benzoic acid	0.77 - 19.0	3 / 20	4.80	EEGLKB-SS02	NSV	-- / --	NSV
Bis(2-ethylhexyl) phthalate	0.19 - 4.70	8 / 41	16.0	LCKSB-12 0-0.5	0.93	3 / 41	**17.3**
Butylbenzyl phthalate	0.074 - 8.10	1 / 41	0.73	LCK-SO6B	NSV	-- / --	NSV
Carbazole	0.19 - 4.00	17 / 41	88.0	EEGLKB-SS06	NSV	-- / --	NSV
Chrysene	0.35 - 3.50	35 / 41	470	EEGLKB-SS05	4.73	10 / 41	**99**
Dibenz(ah)anthracene	0.038 - 3.50	22 / 41	71.0	EEGLKB-SS05	18.4	4 / 41	**3.9**
Dibenzofuran	0.077 - 8.10	16 / 41	42.0	EEGLKB-SS06	NSV	-- / --	NSV
Diethyl phthalate	0.074 - 8.10	1 / 41	1.30	LCK-SO6B	100	0 / 41	< 1
Di-n-butyl phthalate	0.040 - 8.10	1 / 41	2.60	LCK-SO6B	0.15	1 / 41	**17**
Di-n-octyl phthalate	0.35 - 9.20	1 / 41	15.0	LCKSB-12 0-0.5	NSV	-- / --	NSV
Fluoranthene	0.35 - 3.50	35 / 41	1,100	EEGLKB-SS05	122	5 / 41	**9.0**
Fluorene	0.038 - 8.10	17 / 41	67.0	EEGLKB-SS06	30.0	3 / 41	**2.2**
Indeno(1,2,3-cd)pyrene	0.039 - 3.50	30 / 41	130	EEGLKB-SS05	109	2 / 41	**1.2**
Methylnaphthalene, 2-	0.039 - 8.10	13 / 41	14.0	EEGLKB-SS06	3.24	6 / 41	**4.3**
Methylphenol, 3- and/or 4-	0.074 - 1.90	2 / 20	0.25	EEGLKB-SS05	NSV	-- / --	NSV
Naphthalene	0.039 - 8.10	11 / 41	13.0	EEGLKB-SS06	0.099	9 / 41	**131**
Phenanthrene	0.039 - 0.44	34 / 41	600	EEGLKB-SS06	45.7	6 / 41	**13**
Phenol	0.19 - 8.10	3 / 41	0.88	LCK-SO1A	30.0	0 / 41	< 1
Pyrene	0.040 - 3.50	33 / 41	870	EEGLKB-SS05	45.7	6 / 41	**19**
Total Low Molecular Weight PAHs	- - -	34 / 41	910	EEGLKB-SS06	28	8 / 41	**33**
Total High Molecular Weight PAHs	- - -	35 / 41	4,261	EEGLKB-SS05	18	14 / 41	**237**
Explosives (MG/KG)							
Trichlorobenzene, 1,2,4-	0.19 - 8.10	1 / 41	2.10	LCK-SO6B	20.0	0 / 41	< 1
Trinitrobenzene, 1,3,5-	7.00E-04 - 2.50	1 / 23	1.60	EEGLKB-SS02	4.30	0 / 23	< 1
Trinitrotoluene, 2,4,6-	5.00E-04 - 0.25	2 / 23	5.30	EEGLKB-SS08 Dup02	NSV	-- / --	NSV
Volatile Organic Compounds (MG/KG)							
Acetone	0.0090 - 0.029	20 / 41	34.0	EEGLKB-SS18	2.50	5 / 41	**14**
Ethylbenzene	0.0050 - 0.0083	1 / 40	0.026	LCK-SO6B-RE	5.16	0 / 40	< 1
Methylene chloride	0.0030 - 0.037	1 / 41	0.16	LCK-SO6B-RE	4.05	0 / 41	< 1
Toluene	0.0015 - 0.0083	10 / 40	0.014	LCK-SO6B-RE	5.45	0 / 40	< 1
Trichlorofluoromethane	0.0047 - 0.0083	14 / 20	0.0082	EEGLKB-SS03	16.4	0 / 20	< 1
Xylenes, total	0.0052 - 0.0070	1 / 20	0.033	LCK-SO6B-RE	10.0	0 / 20	< 1
Dioxin/Furans (MG/KG)							

TABLE 7-16

Screening Statistics for Direct Exposures--AOC 1 Soil

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[3]
Heptachlorodibenzofuran, 1,2,3,4,6,7,8-	5.00E-07 - 2.10E-06	13 / 15	3.17E-04	LCKSO-7 2-3	NSV	-- / --	NSV
Heptachlorodibenzofuran, 1,2,3,4,7,8,9-	7.00E-07 - 3.90E-06	4 / 15	1.52E-05	LCKSO-7 2-3	NSV	-- / --	NSV
Heptachlorodibenzofurans, total	6.00E-07 - 2.30E-06	13 / 15	0.0014	LCKSO-7 2-3	NSV	-- / --	NSV
Heptachlorodibenzo-p-dioxin, 1,2,3,4,6,7,8-	-- - --	15 / 15	0.0012	LCKSO-7 2-3	NSV	-- / --	NSV
Heptachlorodibenzo-p-dioxins, total	-- - --	15 / 15	0.0021	LCKSO-7 2-3	NSV	-- / --	NSV
Hexachlorodibenzofuran, 1,2,3,4,7,8-	4.00E-07 - 2.60E-06	6 / 12	5.00E-06	LCKSO-8 2-3	NSV	-- / --	NSV
Hexachlorodibenzofuran, 1,2,3,6,7,8-	4.00E-07 - 1.00E-06	7 / 15	7.70E-06	LCKSO-7 2-3	NSV	-- / --	NSV
Hexachlorodibenzofuran, 1,2,3,7,8,9-	1.20E-07 - 2.00E-06	2 / 15	2.50E-06	LCKSO-7 2-3	NSV	-- / --	NSV
Hexachlorodibenzofuran, 2,3,4,6,7,8-	3.00E-07 - 2.30E-06	4 / 11	2.90E-06	LCKSB-12 0-0.5	NSV	-- / --	NSV
Hexachlorodibenzofurans, total	5.40E-07 - 1.50E-05	12 / 15	3.19E-04	LCKSO-7 2-3	NSV	-- / --	NSV
Hexachlorodibenzo-p-dioxin, 1,2,3,4,7,8-	2.80E-07 - 2.90E-06	6 / 15	3.60E-05	LCKSO-7 2-3	NSV	-- / --	NSV
Hexachlorodibenzo-p-dioxin, 1,2,3,6,7,8-	4.00E-07 - 7.70E-06	9 / 15	1.18E-04	LCKSO-7 2-3	NSV	-- / --	NSV
Hexachlorodibenzo-p-dioxin, 1,2,3,7,8,9-	6.00E-07 - 5.10E-06	4 / 9	8.00E-06	LCKSB-13 0-0.5	NSV	-- / --	NSV
Hexachlorodibenzo-p-dioxins, total	2.10E-06 - 4.00E-06	12 / 15	5.53E-04	LCKSO-7 2-3	NSV	-- / --	NSV
Octachlorodibenzofuran	8.00E-07 - 8.30E-06	13 / 15	0.0013	LCKSO-7 2-3	NSV	-- / --	NSV
Octachlorodibenzo-p-dioxin	-- - --	15 / 15	0.016	EEGLKB-SS16	NSV	-- / --	NSV
Pentachlorodibenzofuran, 1,2,3,7,8-	1.20E-07 - 1.00E-06	3 / 15	7.60E-06	LCKSO-7 2-3	NSV	-- / --	NSV
Pentachlorodibenzofuran, 2,3,4,7,8-	4.00E-07 - 9.00E-07	4 / 15	7.80E-06	LCKSO-7 2-3	NSV	-- / --	NSV
Pentachlorodibenzofurans, total	4.00E-07 - 1.60E-06	12 / 15	1.11E-04	LCKSO-7 2-3	NSV	-- / --	NSV
Pentachlorodibenzo-p-dioxin, 1,2,3,7,8-	4.10E-07 - 1.50E-06	4 / 15	1.58E-05	LCKSO-7 2-3	NSV	-- / --	NSV
Pentachlorodibenzo-p-dioxins, total	4.70E-07 - 3.40E-06	9 / 15	6.98E-05	LCKSO-7 2-3	NSV	-- / --	NSV
TCDD-TEQ	-- - --	15 / 15	6.60E-05	LCKSO-7 2-3	3.15E-07	15 / 15	**210**
Tetrachlorodibenzofuran, 2,3,7,8-	4.60E-07 - 3.30E-06	7 / 15	1.63E-05	LCKSO-6 2-3	NSV	-- / --	NSV
Tetrachlorodibenzofurans, total	2.00E-07 - 4.00E-06	11 / 15	9.57E-05	LCKSO-7 2-3	NSV	-- / --	NSV
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-	1.80E-07 - 1.00E-06	6 / 15	4.80E-06	LCKSO-9 0-1	NSV	-- / --	NSV
Tetrachlorodibenzo-p-dioxins, total	2.90E-07 - 1.00E-06	11 / 15	4.86E-05	LCKSO-7 2-3	NSV	-- / --	NSV
Non-Detected Constituents							
Pesticide/Polychlorinated Biphenyls (MG/KG)							
Aldrin	0.0017 - 0.22	0 / 40	--	--	0.0033	-- / --	**66**
Chlordane, technical-	0.035 - 0.041	0 / 4	--	--	NSV	-- / --	NSV
Dieldrin	0.0020 - 0.40	0 / 40	--	--	0.0024	-- / --	**168**
Endosulfan A	0.0017 - 0.22	0 / 40	--	--	0.12	-- / --	**1.8**
Endosulfan B	0.0020 - 0.40	0 / 40	--	--	0.12	-- / --	**3.4**
Endosulfan sulfate	0.0020 - 0.22	0 / 40	--	--	0.036	-- / --	**6.1**
Endrin	0.0020 - 0.40	0 / 40	--	--	0.010	-- / --	**40**
Endrin aldehyde	0.0020 - 0.40	0 / 40	--	--	0.011	-- / --	**38**

TABLE 7-16
Screening Statistics for Direct Exposures--AOC 1 Soil
Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient^3
Endrin ketone	0.0020 - 0.22	0 / 40	--	--	NSV	-- / --	NSV
Heptachlor	0.0017 - 0.22	0 / 40	--	--	0.0060	-- / --	**37**
Heptachlor epoxide	0.0017 - 0.22	0 / 40	--	--	0.15	-- / --	**1.4**
Hexachlorocyclohexane, alpha-	0.0017 - 0.22	0 / 40	--	--	NSV	-- / --	NSV
Hexachlorocyclohexane, beta-	0.0017 - 0.22	0 / 40	--	--	NSV	-- / --	NSV
Hexachlorocyclohexane, delta-	0.0017 - 0.22	0 / 40	--	--	NSV	-- / --	NSV
Hexachlorocyclohexane, gamma- (Lindane)	0.0017 - 0.22	0 / 40	--	--	NSV	-- / --	NSV
Methoxychlor	0.0096 - 2.00	0 / 40	--	--	0.020	-- / --	**101**
PCB 1016	0.019 - 2.00	0 / 40	--	--	NSV	-- / --	NSV
PCB 1221	0.019 - 2.00	0 / 40	--	--	NSV	-- / --	NSV
PCB 1232	0.019 - 2.00	0 / 40	--	--	NSV	-- / --	NSV
Toxaphene	0.019 - 3.90	0 / 40	--	--	0.12	-- / --	**33**
Herbicides (MG/KG)							
2,4,5-T	0.012 - 0.026	0 / 16	--	--	NSV	-- / --	NSV
2,4,5-TP	0.012 - 0.026	0 / 16	--	--	NSV	-- / --	NSV
2,4-D	0.023 - 0.052	0 / 16	--	--	0.027	-- / --	**1.9**
Semivolatile Organic Compounds (MG/KG)							
Benzidine	3.70 - 92.0	0 / 20	--	--	NSV	-- / --	NSV
Benzyl alcohol	0.74 - 19.0	0 / 20	--	--	NSV	-- / --	NSV
Bis(2-chloroethoxy) methane	0.074 - 8.10	0 / 41	--	--	0.30	-- / --	**27**
Bis(2-chloroethyl) ether	0.074 - 8.10	0 / 41	--	--	23.7	-- / --	< 1
Bis(2-chloroisopropyl) ether	0.38 - 3.50	0 / 17	--	--	NSV	-- / --	NSV
Bis(chloroisopropyl) ether	0.19 - 8.10	0 / 24	--	--	19.4	-- / --	< 1
Bromophenyl phenyl ether, 4-	0.19 - 8.10	0 / 41	--	--	NSV	-- / --	NSV
Chloroaniline, 4-	0.35 - 19.0	0 / 41	--	--	20.0	-- / --	< 1
Chloronaphthalene, 2-	0.19 - 8.10	0 / 41	--	--	NSV	-- / --	NSV
Chlorophenol, 2-	0.19 - 8.10	0 / 41	--	--	7.00	-- / --	**1.2**
Chlorophenyl phenyl ether, 4-	0.19 - 8.10	0 / 41	--	--	NSV	-- / --	NSV
Dichlorobenzene, 1,2-	0.19 - 8.10	0 / 41	--	--	20.0	-- / --	< 1
Dichlorobenzene, 1,3-	0.19 - 8.10	0 / 41	--	--	20.0	-- / --	< 1
Dichlorobenzene, 1,4-	0.19 - 8.10	0 / 41	--	--	20.0	-- / --	< 1
Dichlorobenzidine, 3,3'-	0.19 - 8.10	0 / 41	--	--	0.65	-- / --	**13**
Dichlorophenol, 2,4-	0.35 - 9.20	0 / 41	--	--	20.0	-- / --	< 1
Dimethyl phthalate	0.074 - 8.10	0 / 41	--	--	734	-- / --	< 1
Dimethylphenol, 2,4-	0.35 - 9.20	0 / 41	--	--	0.010	-- / --	**920**
Dinitro-2-methylphenol, 4,6-	0.74 - 20.0	0 / 41	--	--	NSV	-- / --	NSV

TABLE 7-16

Screening Statistics for Direct Exposures--AOC 1 Soil

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[3]
Dinitrophenol, 2,4-	0.74 - 20.0	0 / 41	--	--	20.0	-- / --	< 1
Hexachlorobenzene	0.037 - 8.10	0 / 41	--	--	0.199	-- / --	**41**
Hexachlorobutadiene	0.19 - 8.10	0 / 41	--	--	NSV	-- / --	NSV
Hexachlorocyclopentadiene	0.35 - 19.0	0 / 41	--	--	NSV	-- / --	NSV
Hexachloroethane	0.19 - 8.10	0 / 41	--	--	NSV	-- / --	NSV
Isophorone	0.19 - 8.10	0 / 41	--	--	NSV	-- / --	NSV
Methylphenol, 2-	0.074 - 8.10	0 / 41	--	--	NSV	-- / --	NSV
Methylphenol, 4-	0.35 - 8.10	0 / 21	--	--	NSV	-- / --	NSV
Methylphenol, 4-chloro-3-	0.35 - 9.20	0 / 41	--	--	NSV	-- / --	NSV
Nitroaniline, 2-	0.19 - 20.0	0 / 41	--	--	74.1	-- / --	< 1
Nitroaniline, 3-	0.74 - 20.0	0 / 41	--	--	3.16	-- / --	**6.3**
Nitroaniline, 4-	0.74 - 20.0	0 / 41	--	--	21.9	-- / --	< 1
Nitrophenol, 2-	0.35 - 9.20	0 / 41	--	--	1.60	-- / --	**5.8**
Nitrophenol, 4-	0.74 - 20.0	0 / 41	--	--	7.00	-- / --	**2.9**
Nitrosodi-N-propylamine, N-	0.037 - 8.10	0 / 41	--	--	NSV	-- / --	NSV
Nitrosodiphenylamine, N-	0.037 - 8.10	0 / 41	--	--	0.55	-- / --	**14.9**
Pentachlorophenol	0.37 - 20.0	0 / 41	--	--	3.00	-- / --	**6.7**
Trichlorobenzene, 1,2,3-	0.0050 - 0.0083	0 / 20	--	--	20.0	-- / --	< 1
Trichlorophenol, 2,4,5-	0.37 - 20.0	0 / 41	--	--	9.00	-- / --	**2.22**
Trichlorophenol, 2,4,6-	0.19 - 8.10	0 / 41	--	--	4.00	-- / --	**2.03**
Explosives (MG/KG)							
Amino-2,6-dinitrotoluene, 4-	0.0011 - 5.00	0 / 7	--	--	NSV	-- / --	NSV
Amino-4,6-dinitrotoluene, 2-	9.00E-04 - 5.00	0 / 7	--	--	NSV	-- / --	NSV
Aminodinitrotoluenes, total	0.44 - 0.50	0 / 16	--	--	NSV	-- / --	NSV
Dinitrobenzene, 1,3-	5.00E-04 - 2.50	0 / 23	--	--	NSV	-- / --	NSV
Dinitrotoluene, 2,4-	5.00E-04 - 2.50	0 / 40	--	--	1.28	-- / --	**2.0**
Dinitrotoluene, 2,6-	5.00E-04 - 5.00	0 / 40	--	--	0.033	-- / --	**152**
HMX	9.00E-04 - 5.00	0 / 23	--	--	NSV	-- / --	NSV
Nitrobenzene	6.00E-04 - 2.50	0 / 40	--	--	1.31	-- / --	**1.9**
Nitrotoluene, 2-	9.00E-04 - 5.00	0 / 23	--	--	NSV	-- / --	NSV
Nitrotoluene, 3-	9.00E-04 - 5.00	0 / 23	--	--	NSV	-- / --	NSV
Nitrotoluene, 4-	0.0011 - 5.00	0 / 23	--	--	NSV	-- / --	NSV
RDX	5.00E-04 - 2.50	0 / 23	--	--	NSV	-- / --	NSV
Tetryl	0.0019 - 5.00	0 / 23	--	--	NSV	-- / --	NSV
Volatile Organic Compounds (MG/KG)							
Benzene	0.0050 - 0.044	0 / 41	--	--	0.26	-- / --	< 1

TABLE 7-16
Screening Statistics for Direct Exposures--AOC 1 Soil
Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[3]
Bromobenzene	0.0050 - 0.0083	0 / 20	--	--	NSV	-- / --	NSV
Bromochloromethane	0.0050 - 0.0083	0 / 20	--	--	NSV	-- / --	NSV
Bromodichloromethane	0.0050 - 0.044	0 / 41	--	--	0.54	-- / --	< 1
Bromoform	0.0050 - 0.044	0 / 41	--	--	15.9	-- / --	< 1
Bromomethane	0.0052 - 0.088	0 / 41	--	--	NSV	-- / --	NSV
Butylbenzene, 1-	0.0050 - 0.0083	0 / 20	--	--	NSV	-- / --	NSV
Butylbenzene, sec-	0.0050 - 0.0083	0 / 20	--	--	NSV	-- / --	NSV
Butylbenzene, tert-	0.0050 - 0.0083	0 / 20	--	--	NSV	-- / --	NSV
Carbon disulfide	0.0052 - 0.044	0 / 41	--	--	0.094	-- / --	< 1
Carbon tetrachloride	0.0050 - 0.044	0 / 41	--	--	2.98	-- / --	< 1
Chlorobenzene	0.0050 - 0.044	0 / 40	--	--	40.0	-- / --	< 1
Chloroethane	0.0050 - 0.088	0 / 41	--	--	NSV	-- / --	NSV
Chloroform	0.0050 - 0.044	0 / 41	--	--	1.19	-- / --	< 1
Chloromethane	0.0050 - 0.088	0 / 41	--	--	NSV	-- / --	NSV
Chlorotoluene, 2-	0.0050 - 0.0083	0 / 20	--	--	NSV	-- / --	NSV
Chlorotoluene, 4-	0.0050 - 0.0083	0 / 20	--	--	NSV	-- / --	NSV
Dibromochloromethane	0.0050 - 0.044	0 / 41	--	--	2.05	-- / --	< 1
Dibromochloropropane	0.0050 - 0.0083	0 / 20	--	--	0.035	-- / --	< 1
Dichlorodifluoromethane	0.0050 - 0.0083	0 / 20	--	--	39.5	-- / --	< 1
Dichloroethane, 1,1-	0.0050 - 0.044	0 / 41	--	--	20.1	-- / --	< 1
Dichloroethane, 1,2-	0.0050 - 0.044	0 / 41	--	--	21.2	-- / --	< 1
Dichloroethene, 1,1-	0.0050 - 0.044	0 / 41	--	--	8.28	-- / --	< 1
Dichloroethene, 1,2-, cis-	0.0050 - 0.0083	0 / 20	--	--	0.78	-- / --	< 1
Dichloroethene, 1,2-, trans-	0.0050 - 0.0083	0 / 20	--	--	0.78	-- / --	< 1
Dichloroethenes, 1,2-, total	0.0052 - 0.044	0 / 21	--	--	NSV	-- / --	NSV
Dichloropropane, 1,2-	0.0050 - 0.044	0 / 41	--	--	32.7	-- / --	< 1
Dichloropropane, 1,3-	0.0050 - 0.0083	0 / 20	--	--	32.7	-- / --	< 1
Dichloropropane, 2,2-	0.0050 - 0.0083	0 / 20	--	--	32.7	-- / --	< 1
Dichloropropene, 1,1-	0.0050 - 0.0083	0 / 20	--	--	0.40	-- / --	< 1
Dichloropropene, 1,3-, cis-	0.0050 - 0.044	0 / 41	--	--	0.40	-- / --	< 1
Dichloropropene, 1,3-, trans-	0.0050 - 0.044	0 / 41	--	--	0.40	-- / --	< 1
Ethylene dibromide	0.0050 - 0.0083	0 / 20	--	--	NSV	-- / --	NSV
Isopropylbenzene	0.0050 - 0.0083	0 / 20	--	--	NSV	-- / --	NSV
Isopropyltoluene, 4-	0.0050 - 0.0083	0 / 20	--	--	NSV	-- / --	NSV
Methyl ethyl ketone	0.010 - 0.088	0 / 41	--	--	89.6	-- / --	< 1
Methyl isobutyl ketone	0.010 - 0.088	0 / 40	--	--	NSV	-- / --	NSV

TABLE 7-16

Screening Statistics for Direct Exposures--AOC 1 Soil

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[3]
Methyl n-butyl ketone	0.010 - 0.088	0 / 40	--	--	NSV	-- / --	NSV
Methyl tert-butyl ether	0.0050 - 0.0083	0 / 20	--	--	NSV	-- / --	NSV
Methylene bromide	0.0050 - 0.0083	0 / 20	--	--	65.0	-- / --	< 1
Propylbenzene, 1-	0.0050 - 0.0083	0 / 20	--	--	NSV	-- / --	NSV
Styrene	0.0050 - 0.044	0 / 40	--	--	4.69	-- / --	< 1
Tetrachloroethane, 1,1,1,2-	0.0050 - 0.0083	0 / 20	--	--	0.13	-- / --	< 1
Tetrachloroethane, 1,1,2,2-	0.0050 - 0.044	0 / 40	--	--	0.13	-- / --	< 1
Tetrachloroethene	0.0050 - 0.044	0 / 40	--	--	9.92	-- / --	< 1
Trichloroethane, 1,1,1-	0.0050 - 0.044	0 / 41	--	--	29.8	-- / --	< 1
Trichloroethane, 1,1,2-	0.0050 - 0.044	0 / 41	--	--	28.6	-- / --	< 1
Trichloroethene	0.0050 - 0.044	0 / 41	--	--	12.4	-- / --	< 1
Trichloropropane, 1,2,3-	0.0050 - 0.0083	0 / 20	--	--	3.36	-- / --	< 1
Trimethylbenzene, 1,2,4-	0.0050 - 0.0083	0 / 20	--	--	NSV	-- / --	NSV
Trimethylbenzene, 1,3,5-	0.0050 - 0.0083	0 / 20	--	--	NSV	-- / --	NSV
Vinyl chloride	0.0050 - 0.088	0 / 41	--	--	0.65	-- / --	< 1
Xylene, 1,2-	0.0050 - 0.0083	0 / 20	--	--	NSV	-- / --	NSV
Xylene, 1,3- and/or 1,4-	0.0099 - 0.017	0 / 20	--	--	NSV	-- / --	NSV

[1] Shaded cells indicate hazard quotient based on reporting limits

[2] Macronutrient: Not considered to be a COPC

[3] HQs greater than 1 are in bold

Notes:

NSV = No Screening Value

TABLE 7-17

Screening Statistics for Direct Exposures--AOC 2 Soil

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Detected Constituents							
Inorganics (MG/KG)							
Arsenic	-- - --	16 / 16	25.1	LCK-SO3B	18	1 / 16	**1.4**
Barium	-- - --	16 / 16	200	LCKSB-11[3]	330	0 / 16	< 1
Beryllium	0.57 - 1.00	6 / 8	2.40	EEGLKB-SS21	40	0 / 8	< 1
Calcium [2]	-- - --	8 / 8	100,000	LCKSB-11 2-4	NSV	-- / --	NSV
Cobalt	-- - --	8 / 8	26.0	LCKSB-11[3]	13	1 / 8	**2.0**
Lead	-- - --	16 / 16	40.2	LCKSB-11[3]	120	0 / 16	< 1
Magnesium [2]	-- - --	8 / 8	48,000	LCKSB-11 2-4	NSV	-- / --	NSV
Manganese	990 - 990	7 / 8	1,600	LCKSB-11[3]	220	5 / 8	**7.3**
Mercury	0.061 - 0.13	5 / 16	0.080	LCK-SO3A	0.10	0 / 16	< 1
Potassium [2]	-- - --	8 / 8	3,300	LCKSB-11[3]	NSV	-- / --	NSV
Selenium	0.15 - 1.80	7 / 16	0.60	EEGLKB-SS21	0.52	3 / 16	**1.2**
Sodium [2]	110 - 320	3 / 8	210	EEGLKB-SS20 Dup01	NSV	-- / --	NSV
Thallium	0.57 - 1.00	4 / 8	2.20	EEGLKB-SS21	1	4 / 8	**2.2**
Zinc	-- - --	16 / 16	125	LCK-SO5B	120	1 / 16	**1.0**
Pesticide/Polychlorinated Biphenyls (MG/KG)							
DDD, p,p'-	0.0023 - 0.012	1 / 16	0.017	LCK-SO4A	0.76	0 / 16	< 1
DDE, p,p'-	0.0023 - 0.012	3 / 16	0.81	LCK-SO4A	0.60	1 / 16	**1.4**
DDT, p,p'-	0.0023 - 0.012	3 / 16	0.46	LCK-SO4A	0.0035	3 / 16	**131**
Semivolatile Organic Compounds (MG/KG)							
Acenaphthene	0.039 - 0.44	2 / 16	0.014	EEGLKB-SS21	20.0	0 / 16	< 1
Anthracene	0.039 - 0.44	2 / 16	0.045	EEGLKB-SS21	1,480	0 / 16	< 1
Benz(a)anthracene	0.044 - 0.44	4 / 16	0.17	EEGLKB-SS21	5.21	0 / 16	< 1
Benzo(a)pyrene	0.044 - 0.44	4 / 16	0.17	EEGLKB-SS21	1.52	0 / 16	< 1
Benzo(b)fluoranthene	0.38 - 0.44	5 / 16	0.16	EEGLKB-SS21	59.8	0 / 16	< 1
Benzo(ghi)perylene	0.38 - 0.44	5 / 16	0.11	EEGLKB-SS21	119	0 / 16	< 1
Benzo(k)fluoranthene	0.38 - 0.44	5 / 16	0.18	EEGLKB-SS21	148	0 / 16	< 1
Benzoic acid	0.79 - 0.89	1 / 4	1.10	EEGLKB-SS21	NSV	-- / --	NSV
Chrysene	0.38 - 0.44	5 / 16	0.22	EEGLKB-SS21	4.73	0 / 16	< 1
Dibenz(ah)anthracene	0.039 - 0.44	2 / 16	0.044	EEGLKB-SS21	18.4	0 / 16	< 1
Dibenzofuran	0.079 - 0.44	2 / 16	0.070	EEGLKB-SS21	NSV	-- / --	NSV
Di-n-butyl phthalate	0.038 - 0.44	1 / 16	0.041	LCK-SO4A	0.15	0 / 16	< 1
Fluoranthene	0.38 - 0.44	7 / 16	0.32	LCK-SO4A	122	0 / 16	< 1
Indeno(1,2,3-cd)pyrene	0.039 - 0.44	3 / 16	0.095	LCK-SO4A	109	0 / 16	< 1
Methylnaphthalene, 2-	0.039 - 0.44	2 / 16	0.28	EEGLKB-SS21	3.24	0 / 16	< 1

TABLE 7-17

Screening Statistics for Direct Exposures--AOC 2 Soil

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Naphthalene	0.044 - 0.44	4 / 16	0.12	EEGLKB-SS21	0.099	1 / 16	**1.2**
Nitrosodiphenylamine, N-	0.042 - 0.44	1 / 16	0.026	EEGLKB-SS20	0.55	0 / 16	< 1
Phenanthrene	0.38 - 0.44	5 / 16	0.36	EEGLKB-SS22	45.7	0 / 16	< 1
Pyrene	0.039 - 0.44	5 / 16	0.27	EEGLKB-SS21	45.7	0 / 16	< 1
Total Low Molecular Weight PAHs	- - -	5 / 16	0.9	EEGLKB-SS21	29	0 / 16	< 1
Total High Molecular Weight PAHs	- - -	7 / 16	1.7	LCK-SO4A	18	0 / 16	< 1
Volatile Organic Compounds (MG/KG)							
Trichlorofluoromethane	0.0052 - 0.0063	1 / 4	0.0049	EEGLKB-SS22	16.4	0 / 4	< 1
Dichloropropene, 1,3-, trans-	0.0052 - 0.0072	2 / 16	0.0050	LCK-SO5B	0.40	0 / 16	< 1
Methylene chloride	0.0050 - 0.023	4 / 16	0.012	LCK-SODUP1	4.05	0 / 16	< 1
Acetone	0.0050 - 0.024	5 / 16	40.0	EEGLKB-SS22	2.50	2 / 16	**16**
Dioxin/Furans (MG/KG)							
Heptachlorodibenzofuran, 1,2,3,4,6,7,8-	6.00E-07 - 2.10E-06	3 / 5	2.70E-06	LCKSB-11[3]	NSV	-- / --	NSV
Heptachlorodibenzofurans, total	7.00E-07 - 2.10E-06	3 / 5	5.40E-06	LCKSB-11[3]	NSV	-- / --	NSV
Heptachlorodibenzo-p-dioxin, 1,2,3,4,6,7,8-	-- - --	5 / 5	7.20E-06	EEGLKB-SS20 Dup01	NSV	-- / --	NSV
Heptachlorodibenzo-p-dioxins, total	-- - --	5 / 5	1.50E-05	EEGLKB-SS20 Dup01	NSV	-- / --	NSV
Hexachlorodibenzofuran, 1,2,3,4,7,8-	3.10E-07 - 5.00E-07	2 / 5	1.20E-06	LCKSB-10 0-0.5	NSV	-- / --	NSV
Hexachlorodibenzofuran, 1,2,3,6,7,8-	3.00E-07 - 4.50E-07	1 / 5	5.90E-07	LCKSB-10 0-0.5	NSV	-- / --	NSV
Hexachlorodibenzofuran, 2,3,4,6,7,8-	4.00E-07 - 5.00E-07	2 / 5	1.00E-06	LCKSB-10 0-0.5	NSV	-- / --	NSV
Hexachlorodibenzofurans, total	5.00E-07 - 1.30E-06	3 / 5	4.90E-06	LCKSB-10 0-0.5	NSV	-- / --	NSV
Hexachlorodibenzo-p-dioxin, 1,2,3,6,7,8-	3.00E-07 - 5.00E-07	2 / 5	5.90E-07	LCKSB-10 0-0.5	NSV	-- / --	NSV
Hexachlorodibenzo-p-dioxin, 1,2,3,7,8,9-	4.00E-07 - 5.00E-07	2 / 5	1.20E-06	LCKSB-11[3]	NSV	-- / --	NSV
Hexachlorodibenzo-p-dioxins, total	1.30E-06 - 4.60E-06	1 / 5	2.40E-06	LCKSB-10 0-0.5	NSV	-- / --	NSV
Octachlorodibenzofuran	5.00E-07 - 1.40E-06	3 / 5	5.60E-06	LCKSB-11 0-0.5	NSV	-- / --	NSV
Octachlorodibenzo-p-dioxin	2.50E-06 - 2.50E-06	4 / 5	4.20E-04	EEGLKB-SS20	NSV	-- / --	NSV
Pentachlorodibenzofurans, total	5.00E-07 - 5.00E-07	4 / 5	6.30E-06	LCKSB-10 0-0.5	NSV	-- / --	NSV
Pentachlorodibenzo-p-dioxins, total	5.00E-07 - 1.10E-06	1 / 5	8.70E-07	LCKSB-10 0-0.5	NSV	-- / --	NSV
TCDD-TEQ	-- - --	5 / 5	4.63E-06	EEGLKB-SS20	3.15E-07	5 / 5	**15**
Tetrachlorodibenzofuran, 2,3,7,8-	2.70E-07 - 4.00E-07	3 / 5	8.20E-07	LCKSB-18 0-0.5	NSV	-- / --	NSV
Tetrachlorodibenzofurans, total	4.00E-07 - 4.00E-07	4 / 5	2.90E-06	LCKSB-10 0-0.5	NSV	-- / --	NSV
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-	3.00E-07 - 5.00E-07	2 / 5	3.90E-06	EEGLKB-SS20	NSV	-- / --	NSV
Tetrachlorodibenzo-p-dioxins, total	8.90E-07 - 1.40E-06	3 / 5	3.90E-06	EEGLKB-SS20	NSV	-- / --	NSV

TABLE 7-17

Screening Statistics for Direct Exposures--AOC 2 Soil

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Non-Detected Constituents							
Inorganics (MG/KG)							
Antimony	5.40 - 13.0	0 / 8	--	--	78.0	-- / --	< 1
Pesticide/Polychlorinated Biphenyls (MG/KG)							
Aldrin	0.0019 - 0.012	0 / 16	--	--	0.0033	-- / --	**3.6**
Chlordane, alpha-	0.0020 - 0.012	0 / 12	--	--	0.22	-- / --	< 1
Chlordane, gamma-	0.0020 - 0.012	0 / 12	--	--	0.22	-- / --	< 1
Chlordane, technical-	0.038 - 0.039	0 / 4	--	--	NSV	-- / --	NSV
Dieldrin	0.0023 - 0.012	0 / 16	--	--	0.0024	-- / --	**5.0**
Endosulfan A	0.0019 - 0.012	0 / 16	--	--	0.12	-- / --	< 1
Endosulfan B	0.0023 - 0.012	0 / 16	--	--	0.12	-- / --	< 1
Endosulfan sulfate	0.0023 - 0.012	0 / 16	--	--	0.036	-- / --	< 1
Endrin	0.0023 - 0.012	0 / 16	--	--	0.010	-- / --	**1.2**
Endrin aldehyde	0.0023 - 0.012	0 / 16	--	--	0.011	-- / --	**1.1**
Endrin ketone	0.0023 - 0.012	0 / 16	--	--	NSV	-- / --	NSV
Heptachlor	0.0019 - 0.012	0 / 16	--	--	0.0060	-- / --	**2.0**
Heptachlor epoxide	0.0019 - 0.012	0 / 16	--	--	0.15	-- / --	< 1
Hexachlorocyclohexane, alpha-	0.0019 - 0.012	0 / 16	--	--	NSV	-- / --	NSV
Hexachlorocyclohexane, beta-	0.0019 - 0.012	0 / 16	--	--	NSV	-- / --	NSV
Hexachlorocyclohexane, delta-	0.0019 - 0.012	0 / 16	--	--	NSV	-- / --	NSV
Hexachlorocyclohexane, gamma- (Lindane)	0.0019 - 0.012	0 / 16	--	--	NSV	-- / --	NSV
Methoxychlor	0.011 - 0.056	0 / 16	--	--	0.020	-- / --	**2.8**
PCB 1016	0.020 - 0.045	0 / 16	--	--	NSV	-- / --	NSV
PCB 1221	0.020 - 0.089	0 / 16	--	--	NSV	-- / --	NSV
PCB 1232	0.020 - 0.045	0 / 16	--	--	NSV	-- / --	NSV
PCB 1242	0.020 - 0.045	0 / 16	--	--	NSV	-- / --	NSV
PCB 1248	0.020 - 0.045	0 / 16	--	--	NSV	-- / --	NSV
PCB 1254	0.020 - 0.045	0 / 16	--	--	NSV	-- / --	NSV
PCB 1260	0.020 - 0.045	0 / 16	--	--	NSV	-- / --	NSV
Toxaphene	0.023 - 0.22	0 / 16	--	--	0.12	-- / --	**1.8**

TABLE 7-17
Screening Statistics for Direct Exposures--AOC 2 Soil
Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Semivolatile Organic Compounds (MG/KG)							
Acenaphthylene	0.039 - 0.44	0 / 16	--	--	682	-- / --	< 1
Benzidine	3.90 - 4.40	0 / 4	--	--	NSV	-- / --	NSV
Benzyl alcohol	0.79 - 0.89	0 / 4	--	--	NSV	-- / --	NSV
Bis(2-chloroethoxy) methane	0.079 - 0.44	0 / 16	--	--	0.30	-- / --	**1.5**
Bis(2-chloroethyl) ether	0.079 - 0.44	0 / 16	--	--	23.7	-- / --	< 1
Bis(2-chloroisopropyl) ether	0.40 - 0.44	0 / 8	--	--	NSV	-- / --	NSV
Bis(2-ethylhexyl) phthalate	0.20 - 0.44	0 / 16	--	--	0.93	-- / --	< 1
Bis(chloroisopropyl) ether	0.20 - 0.39	0 / 8	--	--	19.4	-- / --	< 1
Bromophenyl phenyl ether, 4-	0.20 - 0.44	0 / 16	--	--	NSV	-- / --	NSV
Butylbenzyl phthalate	0.079 - 0.44	0 / 16	--	--	NSV	-- / --	NSV
Carbazole	0.20 - 0.44	0 / 16	--	--	NSV	-- / --	NSV
Chloroaniline, 4-	0.38 - 0.89	0 / 16	--	--	20.0	-- / --	< 1
Chloronaphthalene, 2-	0.20 - 0.44	0 / 16	--	--	NSV	-- / --	NSV
Chlorophenol, 2-	0.20 - 0.44	0 / 16	--	--	7.00	-- / --	< 1
Chlorophenyl phenyl ether, 4-	0.20 - 0.44	0 / 16	--	--	NSV	-- / --	NSV
Dichlorobenzene, 1,2-	0.20 - 0.44	0 / 16	--	--	20.0	-- / --	< 1
Dichlorobenzene, 1,3-	0.20 - 0.44	0 / 16	--	--	20.0	-- / --	< 1
Dichlorobenzene, 1,4-	0.20 - 0.44	0 / 16	--	--	20.0	-- / --	< 1
Dichlorobenzidine, 3,3'-	0.20 - 0.88	0 / 16	--	--	0.65	-- / --	**1.4**
Dichlorophenol, 2,4-	0.38 - 0.44	0 / 16	--	--	20.0	-- / --	< 1
Diethyl phthalate	0.079 - 0.44	0 / 16	--	--	100	-- / --	< 1
Dimethyl phthalate	0.079 - 0.44	0 / 16	--	--	734	-- / --	< 1
Dimethylphenol, 2,4-	0.38 - 0.44	0 / 16	--	--	0.010	-- / --	**44**
Dinitro-2-methylphenol, 4,6-	0.79 - 2.20	0 / 16	--	--	NSV	-- / --	NSV
Dinitrophenol, 2,4-	0.79 - 2.20	0 / 16	--	--	20.0	-- / --	< 1
Di-n-octyl phthalate	0.38 - 0.44	0 / 16	--	--	NSV	-- / --	NSV
Fluorene	0.039 - 0.44	0 / 16	--	--	30.0	-- / --	< 1
Hexachlorobenzene	0.039 - 0.44	0 / 16	--	--	NSV	-- / --	NSV
Hexachlorobutadiene	0.20 - 0.44	0 / 16	--	--	NSV	-- / --	NSV
Hexachlorocyclopentadiene	0.38 - 0.89	0 / 16	--	--	NSV	-- / --	NSV
Hexachloroethane	0.20 - 0.44	0 / 16	--	--	NSV	-- / --	NSV
Isophorone	0.20 - 0.44	0 / 16	--	--	NSV	-- / --	NSV
Methylphenol, 2-	0.079 - 0.44	0 / 16	--	--	NSV	-- / --	NSV
Methylphenol, 3- and/or 4-	0.079 - 0.089	0 / 4	--	--	NSV	-- / --	NSV
Methylphenol, 4-	0.38 - 0.44	0 / 12	--	--	NSV	-- / --	NSV

TABLE 7-17

Screening Statistics for Direct Exposures--AOC 2 Soil

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Methylphenol, 4-chloro-3-	0.38 - 0.44	0 / 16	--	--	NSV	-- / --	NSV
Nitroaniline, 2-	0.20 - 2.20	0 / 16	--	--	74.1	-- / --	< 1
Nitroaniline, 3-	0.79 - 2.20	0 / 16	--	--	3.16	-- / --	< 1
Nitroaniline, 4-	0.79 - 2.20	0 / 16	--	--	21.9	-- / --	< 1
Nitrophenol, 2-	0.38 - 0.44	0 / 16	--	--	1.60	-- / --	< 1
Nitrophenol, 4-	0.79 - 2.20	0 / 16	--	--	7.00	-- / --	< 1
Nitrosodi-N-propylamine, N-	0.039 - 0.44	0 / 16	--	--	NSV	-- / --	NSV
Pentachlorophenol	0.39 - 2.20	0 / 16	--	--	3.00	-- / --	< 1
Phenol	0.20 - 0.44	0 / 16	--	--	30.0	-- / --	< 1
Trichlorobenzene, 1,2,3-	0.0052 - 0.0072	0 / 4	--	--	20.0	-- / --	< 1
Trichlorobenzene, 1,2,4-	0.20 - 0.44	0 / 16	--	--	20.0	-- / --	< 1
Trichlorophenol, 2,4,5-	0.39 - 2.20	0 / 16	--	--	9.00	-- / --	< 1
Trichlorophenol, 2,4,6-	0.20 - 0.44	0 / 16	--	--	4.00	-- / --	< 1
Volatile Organic Compounds (MG/KG)							
Benzene	0.0052 - 0.0072	0 / 16	--	--	0.26	-- / --	< 1
Bromobenzene	0.0052 - 0.0072	0 / 4	--	--	NSV	-- / --	NSV
Bromochloromethane	0.0052 - 0.0072	0 / 4	--	--	NSV	-- / --	NSV
Bromodichloromethane	0.0052 - 0.0072	0 / 16	--	--	0.54	-- / --	< 1
Bromoform	0.0052 - 0.0072	0 / 16	--	--	15.9	-- / --	< 1
Bromomethane	0.0055 - 0.014	0 / 16	--	--	NSV	-- / --	NSV
Butylbenzene, 1-	0.0052 - 0.0072	0 / 4	--	--	NSV	-- / --	NSV
Butylbenzene, sec-	0.0052 - 0.0072	0 / 4	--	--	NSV	-- / --	NSV
Butylbenzene, tert-	0.0052 - 0.0072	0 / 4	--	--	NSV	-- / --	NSV
Carbon disulfide	0.0055 - 0.014	0 / 16	--	--	0.094	-- / --	< 1
Carbon tetrachloride	0.0052 - 0.0072	0 / 16	--	--	2.98	-- / --	< 1
Chlorobenzene	0.0052 - 0.0072	0 / 16	--	--	40.0	-- / --	< 1
Chloroethane	0.0052 - 0.014	0 / 16	--	--	NSV	-- / --	NSV
Chloroform	0.0052 - 0.0072	0 / 16	--	--	1.19	-- / --	< 1
Chloromethane	0.0052 - 0.014	0 / 16	--	--	NSV	-- / --	NSV
Chlorotoluene, 2-	0.0052 - 0.0072	0 / 4	--	--	NSV	-- / --	NSV
Chlorotoluene, 4-	0.0052 - 0.0072	0 / 4	--	--	NSV	-- / --	NSV
Dibromochloromethane	0.0052 - 0.0072	0 / 16	--	--	2.05	-- / --	< 1
Dibromochloropropane	0.0052 - 0.0072	0 / 4	--	--	0.035	-- / --	< 1
Dichlorodifluoromethane	0.0052 - 0.0072	0 / 4	--	--	39.5	-- / --	< 1
Dichloroethane, 1,1-	0.0052 - 0.0072	0 / 16	--	--	20.1	-- / --	< 1
Dichloroethane, 1,2-	0.0052 - 0.0072	0 / 16	--	--	21.2	-- / --	< 1

TABLE 7-17

Screening Statistics for Direct Exposures--AOC 2 Soil

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Dichloroethene, 1,1-	0.0052 - 0.0072	0 / 16	--	--	8.28	-- / --	< 1
Dichloroethene, 1,2-, cis-	0.0052 - 0.0072	0 / 4	--	--	0.78	-- / --	< 1
Dichloroethene, 1,2-, trans-	0.0052 - 0.0072	0 / 4	--	--	0.78	-- / --	< 1
Dichloroethenes, 1,2-, total	0.0055 - 0.0070	0 / 12	--	--	NSV	-- / --	NSV
Dichloropropane, 1,2-	0.0052 - 0.0072	0 / 16	--	--	32.7	-- / --	< 1
Dichloropropane, 1,3-	0.0052 - 0.0072	0 / 4	--	--	32.7	-- / --	< 1
Dichloropropane, 2,2-	0.0052 - 0.0072	0 / 4	--	--	32.7	-- / --	< 1
Dichloropropene, 1,1-	0.0052 - 0.0072	0 / 4	--	--	0.40	-- / --	< 1
Dichloropropene, 1,3-, cis-	0.0052 - 0.0072	0 / 16	--	--	0.40	-- / --	< 1
Ethylbenzene	0.0052 - 0.0072	0 / 16	--	--	5.16	-- / --	< 1
Ethylene dibromide	0.0052 - 0.0072	0 / 4	--	--	NSV	-- / --	NSV
Isopropylbenzene	0.0052 - 0.0072	0 / 4	--	--	NSV	-- / --	NSV
Isopropyltoluene, 4-	0.0052 - 0.0072	0 / 4	--	--	NSV	-- / --	NSV
Methyl ethyl ketone	0.011 - 0.029	0 / 16	--	--	89.6	-- / --	< 1
Methyl isobutyl ketone	0.011 - 0.029	0 / 16	--	--	NSV	-- / --	NSV
Methyl n-butyl ketone	0.011 - 0.029	0 / 16	--	--	NSV	-- / --	NSV
Methyl tert-butyl ether	0.0052 - 0.0072	0 / 4	--	--	NSV	-- / --	NSV
Methylene bromide	0.0052 - 0.0072	0 / 4	--	--	65.0	-- / --	< 1
Propylbenzene, 1-	0.0052 - 0.0072	0 / 4	--	--	NSV	-- / --	NSV
Styrene	0.0052 - 0.0072	0 / 16	--	--	4.69	-- / --	< 1
Tetrachloroethane, 1,1,1,2-	0.0052 - 0.0072	0 / 4	--	--	0.13	-- / --	< 1
Tetrachloroethane, 1,1,2,2-	0.0052 - 0.0072	0 / 16	--	--	0.13	-- / --	< 1
Tetrachloroethene	0.0052 - 0.0072	0 / 16	--	--	9.92	-- / --	< 1
Toluene	0.0052 - 0.0072	0 / 16	--	--	5.45	-- / --	< 1
Trichloroethane, 1,1,1-	0.0052 - 0.0072	0 / 16	--	--	29.8	-- / --	< 1
Trichloroethane, 1,1,2-	0.0052 - 0.0072	0 / 16	--	--	28.6	-- / --	< 1
Trichloroethene	0.0052 - 0.0072	0 / 16	--	--	12.4	-- / --	< 1
Trichloropropane, 1,2,3-	0.0052 - 0.0072	0 / 4	--	--	3.36	-- / --	< 1
Trimethylbenzene, 1,2,4-	0.0052 - 0.0072	0 / 4	--	--	NSV	-- / --	NSV
Trimethylbenzene, 1,3,5-	0.0052 - 0.0072	0 / 4	--	--	NSV	-- / --	NSV
Vinyl chloride	0.0052 - 0.014	0 / 16	--	--	0.65	-- / --	< 1
Xylene, 1,2-	0.0052 - 0.0072	0 / 4	--	--	NSV	-- / --	NSV
Xylene, 1,3- and/or 1,4-	0.010 - 0.014	0 / 4	--	--	NSV	-- / --	NSV
Xylenes, total	0.0055 - 0.0070	0 / 12	--	--	10.0	-- / --	< 1
Vinyl chloride	0.0052 - 0.013	0 / 12	--	--	0.65	-- / --	< 1
Xylenes, total	0.0052 - 0.0061	0 / 12	--	--	10.0	-- / --	< 1

TABLE 7-17

Screening Statistics for Direct Exposures--AOC 2 Soil

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Dioxin/Furans (MG/KG)							
Heptachlorodibenzofuran, 1,2,3,4,7,8,9-	4.80E-07 - 8.00E-07	0 / 5	--	--	NSV	-- / --	NSV
Hexachlorodibenzofuran, 1,2,3,7,8,9-	3.30E-07 - 6.00E-07	0 / 5	--	--	NSV	-- / --	NSV
Hexachlorodibenzo-p-dioxin, 1,2,3,4,7,8-	4.00E-07 - 6.00E-07	0 / 5	--	--	NSV	-- / --	NSV
Pentachlorodibenzofuran, 1,2,3,7,8-	3.00E-07 - 5.00E-07	0 / 5	--	--	NSV	-- / --	NSV
Pentachlorodibenzofuran, 2,3,4,7,8-	3.00E-07 - 5.00E-07	0 / 5	--	--	NSV	-- / --	NSV
Pentachlorodibenzo-p-dioxin, 1,2,3,7,8-	5.00E-07 - 8.00E-07	0 / 5	--	--	NSV	-- / --	NSV
Explosives (MG/KG)							
Amino-2,6-dinitrotoluene, 4-	0.0011 - 0.49	0 / 5	--	--	NSV	-- / --	NSV
Amino-4,6-dinitrotoluene, 2-	9.00E-04 - 0.49	0 / 5	--	--	NSV	-- / --	NSV
Aminodinitrotoluenes, total	0.45 - 0.50	0 / 8	--	--	NSV	-- / --	NSV
Dinitrobenzene, 1,3-	5.00E-04 - 0.25	0 / 13	--	--	NSV	-- / --	NSV
Dinitrotoluene, 2,4-	5.00E-04 - 0.25	0 / 16	--	--	1.28	-- / --	< 1
Dinitrotoluene, 2,6-	5.00E-04 - 0.49	0 / 16	--	--	0.033	-- / --	< 1
HMX	9.00E-04 - 2.20	0 / 13	--	--	NSV	-- / --	NSV
Nitrobenzene	6.00E-04 - 0.26	0 / 16	--	--	1.31	-- / --	< 1
Nitrotoluene, 2-	9.00E-04 - 1.00	0 / 13	--	--	NSV	-- / --	NSV
Nitrotoluene, 3-	9.00E-04 - 1.00	0 / 13	--	--	NSV	-- / --	NSV
Nitrotoluene, 4-	0.0011 - 3.00	0 / 13	--	--	NSV	-- / --	NSV
RDX	5.00E-04 - 1.10	0 / 13	--	--	NSV	-- / --	NSV
Tetryl	0.0019 - 0.75	0 / 13	--	--	NSV	-- / --	NSV
Trinitrobenzene, 1,3,5-	7.00E-04 - 0.25	0 / 13	--	--	4.30	-- / --	< 1
Trinitrotoluene, 2,4,6-	5.00E-04 - 0.25	0 / 13	--	--	NSV	-- / --	NSV
2,4,5-T	0.012 - 0.025	0 / 8	--	--	NSV	-- / --	NSV
2,4,5-TP	0.012 - 0.025	0 / 8	--	--	NSV	-- / --	NSV
2,4-D	0.024 - 0.050	0 / 8	--	--	0.027	-- / --	**1.8**

[1] Shaded cells indicate hazard quotient based on reporting limits

[2] Macronutrient: Not considered to be a COPC

NSV = No Screening Value

[3] - Result from Duplicate Sample: LCKSB-15 0-0.5

TABLE 7-18

Screening Statistics for Direct Exposures--West Ditch Sediment

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Detected Constituents							
Inorganics (MG/KG)							
Arsenic	-- - --	9 / 9	22.0	EEGLKB-SD02	9.79	8 / 9	**2.2**
Calcium [2]	-- - --	6 / 6	160,000	LCKSD-4	NSV	-- / --	NSV
Cobalt	-- - --	6 / 6	16.0	LCKSD-4	NSV	-- / --	NSV
Lead	-- - --	9 / 9	51.0	EEGLKB-SD04	35.8	1 / 9	**1.4**
Magnesium [2]	-- - --	6 / 6	44,000	LCKSD-4	NSV	-- / --	NSV
Sodium [2]	235 - 438	4 / 6	230	EEGLKB-SD03	NSV	-- / --	NSV
Pesticide/Polychlorinated Biphenyls (MG/KG)							
DDD, p,p'-	0.0038 - 0.011	6 / 9	0.077	EEGLKB-SD03	0.0049	6 / 9	**16**
DDE, p,p'-	0.0025 - 0.011	2 / 9	0.0091	EEGLKB-SD03	0.0032	2 / 9	**2.9**
DDT, p,p'-	0.0038 - 0.011	5 / 9	0.019	EEGLKB-SD03	0.0042	5 / 9	**4.6**
PCB 1260	0.019 - 0.073	1 / 9	0.023	EEGLKB-SD01	0.810	-- / --	NSV
Total PCBs		1 / 9	0.089	EEGLKB-SD01	0.0598	1 / 9	**1.5**
Semivolatile Organic Compounds (MG/KG)							
Acenaphthene	0.043 - 0.73	2 / 9	0.038	EEGLKB-SD02	0.0067	2 / 9	**5.7**
Anthracene	0.043 - 0.73	2 / 9	0.050	EEGLKB-SD02	0.057	0 / 9	< 1
Benz(a)anthracene	0.043 - 0.73	4 / 9	0.13	EEGLKB-SD02	0.11	1 / 9	**1.2**
Benzo(a)pyrene	0.043 - 0.73	4 / 9	0.17	LCK-SE1	0.15	1 / 9	**1.1**
Benzo(b)fluoranthene	0.043 - 0.39	5 / 9	0.47	LCKSD-4	10.4	0 / 9	< 1
Benzo(ghi)perylene	0.043 - 0.73	4 / 9	0.16	LCK-SE1	0.17	0 / 9	< 1
Benzo(k)fluoranthene	0.043 - 0.73	4 / 9	0.20	LCK-SE1	0.24	0 / 9	< 1
Bis(2-ethylhexyl) phthalate	0.22 - 0.73	4 / 9	0.15	EEGLKB-SD02	0.182	0 / 9	< 1
Chrysene	0.39 - 0.39	6 / 9	0.37	LCKSD-4	0.17	4 / 9	**2.2**
Dibenzofuran	0.079 - 0.73	1 / 9	0.020	EEGLKB-SD02 Dup04	0.45	0 / 9	< 1
Fluoranthene	0.39 - 0.39	7 / 9	0.71	LCKSD-4	0.42	3 / 9	**1.7**
Fluorene	0.039 - 0.73	2 / 9	0.050	LCK-SE1	0.077	0 / 9	< 1
Indeno(1,2,3-cd)pyrene	0.043 - 0.73	3 / 9	0.14	LCK-SE1	0.20	0 / 9	< 1
Methylnaphthalene, 2-	0.043 - 0.73	2 / 9	0.048	EEGLKB-SD03	0.020	2 / 9	**2.4**
Naphthalene	0.039 - 0.73	1 / 9	0.032	EEGLKB-SD02	0.18	0 / 9	< 1
Phenanthrene	0.043 - 0.73	3 / 9	0.21	EEGLKB-SD03	0.204	1 / 9	**1.03**
Pyrene	0.043 - 0.39	6 / 9	0.63	LCKSD-4	0.195	4 / 9	**3.2**
Total Low Molecular Weight PAHs	-- - --	3 9	2.56	LCKSD-4	0.076	3 / 9	**34**
Total High Molecualr Weight PAHs	-- - --	7 9	4.37	LCKSD-4	0.19	7 / 9	**23**
Total PAHs	-- - --	7 9	6.93	LCKSD-4	1.61	7 / 9	**4.3**

TABLE 7-18

Screening Statistics for Direct Exposures--West Ditch Sediment

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Volatile Organic Compounds (MG/KG)							
Acetone	0.0040 - 0.033	6 / 9	9.80	EEGLKB-SD02	0.0099	6 / 9	**990**
Chloroethane	0.0049 - 0.097	1 / 9	0.0048	EEGLKB-SD04	NSV	-- / --	NSV
Methyl ethyl ketone	0.011 - 0.097	1 / 9	0.036	LCKSD-4	0.042	0 / 9	< 1
Methylene chloride	0.0059 - 0.097	1 / 8	0.024	LCK-SE1-RE	0.16	0 / 8	< 1
Toluene	0.0049 - 0.024	3 / 9	0.0024	EEGLKB-SD04	1.22	0 / 9	< 1
Trichlorofluoromethane	0.0022 - 0.097	2 / 4	0.0038	EEGLKB-SD01	NSV	-- / --	NSV
Dioxin/Furans (MG/KG)							
Heptachlorodibenzofuran, 1,2,3,4,6,7,8-	1.70E-06 - 1.70E-06	1 / 2	1.00E-06	LCKSD-5	NSV	-- / --	NSV
Heptachlorodibenzofurans, total	1.70E-06 - 1.70E-06	1 / 2	2.00E-06	LCKSD-6	NSV	-- / --	NSV
Heptachlorodibenzo-p-dioxin, 1,2,3,4,6,7,8-	-- - --	2 / 2	2.10E-05	EEGLKB-SD01	NSV	-- / --	NSV
Heptachlorodibenzo-p-dioxins, total	-- - --	2 / 2	4.60E-05	EEGLKB-SD01	NSV	-- / --	NSV
Hexachlorodibenzofurans, total	1.50E-06 - 1.50E-06	1 / 2	9.20E-07	LCKSD-6	NSV	-- / --	NSV
Hexachlorodibenzo-p-dioxins, total	2.70E-06 - 2.70E-06	1 / 2	6.70E-06	LCKSD-5	NSV	-- / --	NSV
Octachlorodibenzofuran	2.80E-06 - 2.80E-06	1 / 2	1.50E-06	LCKSD-6	NSV	-- / --	NSV
Octachlorodibenzo-p-dioxin	-- - --	2 / 2	0.0013	EEGLKB-SD01	NSV	-- / --	NSV
Pentachlorodibenzofurans, total	1.50E-06 - 1.50E-06	1 / 2	1.20E-06	LCKSD-6	NSV	-- / --	NSV
Pentachlorodibenzo-p-dioxins, total	1.00E-06 - 1.00E-06	1 / 2	2.30E-06	LCKSD-5	NSV	-- / --	NSV
TCDD-TEQ	-- - --	2 / 2	4.06E-06	LCKSD-6	1.20E-07	2 / 2	**34**
Tetrachlorodibenzofurans, total	2.00E-07 - 2.00E-07	1 / 2	7.40E-07	EEGLKB-SD01	NSV	-- / --	NSV
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-	5.80E-07 - 5.80E-07	1 / 2	3.50E-06	LCKSD-6	NSV	-- / --	NSV
Tetrachlorodibenzo-p-dioxins, total	-- - --	2 / 2	3.50E-06	LCKSD-6	NSV	-- / --	NSV
Non-Detected Constituents							
Inorganics (MG/KG)							
Antimony	5.40 - 265	0 / 6	--	--	NSV	-- / --	NSV
Silver	0.41 - 4.30	0 / 9	--	--	0.50	-- / --	**8.6**
Pesticide/Polychlorinated Biphenyls (MG/KG)							
Aldrin	0.0019 - 0.011	0 / 9	--	--	0.0032	-- / --	**3.4**
Chlordane, alpha-	0.0019 - 0.011	0 / 7	--	--	0.0032	-- / --	**3.4**
Chlordane, gamma-	0.0019 - 0.011	0 / 7	--	--	0.0032	-- / --	**3.4**
Chlordane, technical-	0.039 - 0.073	0 / 2	--	--	NSV	-- / --	NSV
Dieldrin	0.0019 - 0.011	0 / 9	--	--	0.0019	-- / --	**5.8**
Endosulfan A	0.0019 - 0.011	0 / 9	--	--	0.0033	-- / --	**3.4**
Endosulfan B	0.0019 - 0.011	0 / 9	--	--	0.0019	-- / --	**5.7**
Endosulfan sulfate	0.0019 - 0.011	0 / 9	--	--	0.035	-- / --	< 1

TABLE 7-18

Screening Statistics for Direct Exposures--West Ditch Sediment

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Endrin	0.0019 - 0.011	0 / 9	--	--	0.0022	-- / --	**5.0**
Endrin aldehyde	0.0019 - 0.011	0 / 9	--	--	0.48	-- / --	< 1
Endrin ketone	0.0019 - 0.011	0 / 9	--	--	NSV	-- / --	NSV
Heptachlor	0.0019 - 0.011	0 / 9	--	--	6.00E-04	-- / --	**18**
Heptachlor epoxide	0.0019 - 0.011	0 / 9	--	--	0.0025	-- / --	**4.5**
Hexachlorocyclohexane, alpha-	0.0019 - 0.011	0 / 9	--	--	NSV	-- / --	NSV
Hexachlorocyclohexane, beta-	0.0019 - 0.011	0 / 9	--	--	NSV	-- / --	NSV
Hexachlorocyclohexane, delta-	0.0019 - 0.011	0 / 9	--	--	NSV	-- / --	NSV
Hexachlorocyclohexane, gamma- (Lindane)	0.0019 - 0.011	0 / 9	--	--	NSV	-- / --	NSV
Methoxychlor	0.0095 - 0.054	0 / 9	--	--	0.014	-- / --	**4.0**
PCB 1016	0.019 - 0.073	0 / 9	--	--	0.120	-- / --	< 1
PCB 1221	0.019 - 0.15	0 / 9	--	--	0.120	-- / --	**1.3**
PCB 1232	0.019 - 0.073	0 / 9	--	--	0.600	-- / --	< 1
PCB 1242	0.019 - 0.073	0 / 9	--	--	0.170	-- / --	< 1
PCB 1248	0.019 - 0.073	0 / 9	--	--	1.000	-- / --	< 1
PCB 1254	0.019 - 0.073	0 / 9	--	--	0.810	-- / --	< 1
Toxaphene	0.019 - 0.36	0 / 9	--	--	7.70E-05	-- / --	**4,675**
Semivolatile Organic Compounds (MG/KG)							
Acenaphthylene	0.036 - 0.73	0 / 9	--	--	0.0059	-- / --	**124**
Benzidine	3.60 - 4.80	0 / 3	--	--	NSV	-- / --	NSV
Benzoic acid	0.74 - 0.97	0 / 3	--	--	NSV	-- / --	NSV
Benzyl alcohol	0.74 - 0.97	0 / 4	--	--	0.0010	-- / --	**933**
Bis(2-chloroethoxy) methane	0.074 - 0.73	0 / 9	--	--	NSV	-- / --	NSV
Bis(2-chloroethyl) ether	0.074 - 0.73	0 / 9	--	--	3.52	-- / --	< 1
Bis(2-chloroisopropyl) ether	0.39 - 0.40	0 / 3	--	--	NSV	-- / --	NSV
Bis(chloroisopropyl) ether	0.18 - 0.73	0 / 6	--	--	NSV	-- / --	NSV
Bromophenyl phenyl ether, 4-	0.18 - 0.73	0 / 9	--	--	NSV	-- / --	NSV
Butylbenzyl phthalate	0.074 - 0.73	0 / 9	--	--	1.97	-- / --	< 1
Carbazole	0.18 - 0.73	0 / 9	--	--	NSV	-- / --	NSV
Chloroaniline, 4-	0.39 - 0.97	0 / 9	--	--	0.15	-- / --	**6.64**
Chloronaphthalene, 2-	0.18 - 0.73	0 / 9	--	--	0.42	-- / --	**1.75**
Chlorophenol, 2-	0.18 - 0.73	0 / 9	--	--	0.032	-- / --	**22.9**
Chlorophenyl phenyl ether, 4-	0.18 - 0.73	0 / 9	--	--	NSV	-- / --	NSV
Dibenz(ah)anthracene	0.036 - 0.73	0 / 9	--	--	0.033	-- / --	**22.1**
Dichlorobenzene, 1,2-	0.18 - 0.73	0 / 9	--	--	0.29	-- / --	**2.48**

TABLE 7-18

Screening Statistics for Direct Exposures--West Ditch Sediment

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Dichlorobenzene, 1,3-	0.18 - 0.73	0 / 9	--	--	1.32	-- / --	< 1
Dichlorobenzene, 1,4-	0.18 - 0.73	0 / 9	--	--	0.32	-- / --	**2.30**
Dichlorobenzidine, 3,3'-	0.18 - 0.79	0 / 9	--	--	0.13	-- / --	**6.22**
Dichlorophenol, 2,4-	0.36 - 0.73	0 / 9	--	--	0.082	-- / --	**8.94**
Diethyl phthalate	0.074 - 0.73	0 / 9	--	--	0.30	-- / --	**2.47**
Dimethyl phthalate	0.074 - 0.73	0 / 9	--	--	NSV	-- / --	NSV
Dimethylphenol, 2,4-	0.36 - 0.73	0 / 9	--	--	0.30	-- / --	**2.40**
Di-n-butyl phthalate	0.065 - 0.73	0 / 9	--	--	1.11	-- / --	< 1
Dinitro-2-methylphenol, 4,6-	0.74 - 2.00	0 / 9	--	--	NSV	-- / --	NSV
Dinitrophenol, 2,4-	0.74 - 2.00	0 / 8	--	--	0.0062	-- / --	**322**
Di-n-octyl phthalate	0.36 - 0.73	0 / 9	--	--	40.6	-- / --	< 1
Hexachlorobenzene	0.036 - 0.73	0 / 9	--	--	0.020	-- / --	**36.5**
Hexachlorobutadiene	0.18 - 0.73	0 / 9	--	--	0.027	-- / --	**27.5**
Hexachlorocyclopentadiene	0.39 - 0.97	0 / 8	--	--	0.90	-- / --	**1.08**
Hexachloroethane	0.18 - 0.73	0 / 9	--	--	0.58	-- / --	**1.25**
Isophorone	0.18 - 0.73	0 / 9	--	--	NSV	-- / --	NSV
Methylphenol, 2-	0.074 - 0.73	0 / 9	--	--	NSV	-- / --	NSV
Methylphenol, 3- and/or 4-	0.074 - 0.097	0 / 4	--	--	NSV	-- / --	NSV
Methylphenol, 4-	0.39 - 0.73	0 / 5	--	--	NSV	-- / --	NSV
Methylphenol, 4-chloro-3-	0.36 - 0.73	0 / 9	--	--	NSV	-- / --	NSV
Nitroaniline, 2-	0.18 - 2.00	0 / 9	--	--	NSV	-- / --	NSV
Nitroaniline, 3-	0.74 - 2.00	0 / 9	--	--	NSV	-- / --	NSV
Nitroaniline, 4-	0.74 - 2.00	0 / 9	--	--	NSV	-- / --	NSV
Nitrophenol, 2-	0.36 - 0.73	0 / 9	--	--	0.013	-- / --	**56.2**
Nitrophenol, 4-	0.74 - 2.00	0 / 9	--	--	0.013	-- / --	**154**
Nitrosodi-N-propylamine, N-	0.036 - 0.73	0 / 9	--	--	NSV	-- / --	NSV
Nitrosodiphenylamine, N-	0.036 - 0.73	0 / 9	--	--	NSV	-- / --	NSV
Pentachlorophenol	0.36 - 2.00	0 / 9	--	--	NSV	-- / --	NSV
Phenol	0.18 - 0.73	0 / 9	--	--	NSV	-- / --	NSV
Trichlorobenzene, 1,2,3-	0.0049 - 0.097	0 / 4	--	--	5.06	-- / --	0.019
Trichlorobenzene, 1,2,4-	0.18 - 0.73	0 / 9	--	--	5.06	-- / --	0.14
Trichlorophenol, 2,4,5-	0.36 - 2.00	0 / 9	--	--	0.21	-- / --	**9.62**
Trichlorophenol, 2,4,6-	0.18 - 0.73	0 / 9	--	--	0.21	-- / --	**3.51**

TABLE 7-18
Screening Statistics for Direct Exposures--West Ditch Sediment
Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Explosives (MG/KG)							
Amino-2,6-dinitrotoluene, 4-	0.50 - 1.10	0 / 4	--	--	NSV	-- / --	NSV
Amino-4,6-dinitrotoluene, 2-	0.50 - 0.90	0 / 4	--	--	NSV	-- / --	NSV
Aminodinitrotoluenes, total	0.46 - 0.49	0 / 3	--	--	NSV	-- / --	NSV
Dinitrobenzene, 1,3-	0.23 - 0.50	0 / 7	--	--	0.0086	-- / --	**58.1**
Dinitrotoluene, 2,4-	0.036 - 0.50	0 / 9	--	--	0.014	-- / --	**34.7**
Dinitrotoluene, 2,6-	0.036 - 0.50	0 / 9	--	--	0.040	-- / --	**12.6**
HMX	0.50 - 2.10	0 / 7	--	--	NSV	-- / --	NSV
Nitrobenzene	0.036 - 0.60	0 / 9	--	--	0.15	-- / --	**4.14**
Nitrotoluene, 2-	0.50 - 0.97	0 / 7	--	--	NSV	-- / --	NSV
Nitrotoluene, 3-	0.50 - 0.97	0 / 7	--	--	NSV	-- / --	NSV
Nitrotoluene, 4-	0.50 - 2.90	0 / 7	--	--	NSV	-- / --	NSV
RDX	0.25 - 1.00	0 / 7	--	--	NSV	-- / --	NSV
Tetryl	0.50 - 1.90	0 / 7	--	--	NSV	-- / --	NSV
Trinitrobenzene, 1,3,5-	0.23 - 0.70	0 / 7	--	--	NSV	-- / --	NSV
Trinitrotoluene, 2,4,6-	0.23 - 0.50	0 / 7	--	--	NSV	-- / --	NSV
2,4,5-T	0.012 - 0.024	0 / 3	--	--	NSV	-- / --	NSV
2,4,5-TP	0.012 - 0.024	0 / 3	--	--	NSV	-- / --	NSV
2,4-D	0.023 - 0.047	0 / 3	--	--	1.27	-- / --	< 1
Volatile Organic Compounds (MG/KG)							
Benzene	0.0049 - 0.024	0 / 9	--	--	0.14	-- / --	< 1
Bromobenzene	0.0049 - 0.097	0 / 4	--	--	NSV	-- / --	NSV
Bromochloromethane	0.0049 - 0.097	0 / 4	--	--	NSV	-- / --	NSV
Bromodichloromethane	0.0049 - 0.097	0 / 9	--	--	NSV	-- / --	NSV
Bromoform	0.0049 - 0.097	0 / 9	--	--	0.49	-- / --	< 1
Bromomethane	0.0059 - 0.097	0 / 9	--	--	NSV	-- / --	NSV
Butylbenzene, 1-	0.0049 - 0.097	0 / 4	--	--	NSV	-- / --	NSV
Butylbenzene, sec-	0.0049 - 0.097	0 / 4	--	--	NSV	-- / --	NSV
Butylbenzene, tert-	0.0049 - 0.097	0 / 4	--	--	NSV	-- / --	NSV
Carbon disulfide	0.0059 - 0.097	0 / 9	--	--	0.024	-- / --	**4.06**
Carbon tetrachloride	0.0049 - 0.097	0 / 9	--	--	1.45	-- / --	< 1
Chlorobenzene	0.0049 - 0.097	0 / 9	--	--	0.29	-- / --	< 1
Chloroform	0.0049 - 0.097	0 / 9	--	--	0.12	-- / --	< 1
Chloromethane	0.0049 - 0.097	0 / 9	--	--	NSV	-- / --	NSV
Chlorotoluene, 2-	0.0049 - 0.097	0 / 4	--	--	NSV	-- / --	NSV

TABLE 7-18

Screening Statistics for Direct Exposures--West Ditch Sediment

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Chlorotoluene, 4-	0.0049 - 0.097	0 / 4	--	--	NSV	-- / --	NSV
Dibromochloromethane	0.0049 - 0.097	0 / 9	--	--	NSV	-- / --	NSV
Dibromochloropropane	0.0049 - 0.097	0 / 4	--	--	NSV	-- / --	NSV
Dichlorodifluoromethane	0.0049 - 0.097	0 / 4	--	--	NSV	-- / --	NSV
Dichloroethane, 1,1-	0.0049 - 0.097	0 / 9	--	--	5.75E-04	-- / --	**169**
Dichloroethane, 1,2-	0.0049 - 0.097	0 / 9	--	--	0.26	-- / --	< 1
Dichloroethene, 1,1-	0.0049 - 0.097	0 / 9	--	--	0.019	-- / --	**5.00**
Dichloroethene, 1,2-, cis-	0.0049 - 0.097	0 / 4	--	--	0.65	-- / --	< 1
Dichloroethene, 1,2-, trans-	0.0049 - 0.097	0 / 4	--	--	0.65	-- / --	< 1
Dichloroethenes, 1,2-, total	0.0059 - 0.011	0 / 5	--	--	NSV	-- / --	NSV
Dichloropropane, 1,2-	0.0049 - 0.097	0 / 9	--	--	0.33	-- / --	< 1
Dichloropropane, 1,3-	0.0049 - 0.097	0 / 4	--	--	0.33	-- / --	< 1
Dichloropropane, 2,2-	0.0049 - 0.097	0 / 4	--	--	0.33	-- / --	< 1
Dichloropropene, 1,1-	0.0049 - 0.097	0 / 4	--	--	0.33	-- / --	< 1
Dichloropropene, 1,3-, cis-	0.0049 - 0.097	0 / 9	--	--	0.33	-- / --	< 1
Dichloropropene, 1,3-, trans-	0.0049 - 0.097	0 / 9	--	--	0.33	-- / --	< 1
Ethylbenzene	0.0049 - 0.024	0 / 9	--	--	0.18	-- / --	< 1
Ethylene dibromide	0.0049 - 0.097	0 / 4	--	--	NSV	-- / --	NSV
Isopropylbenzene	0.0049 - 0.097	0 / 4	--	--	NSV	-- / --	NSV
Isopropyltoluene, 4-	0.0049 - 0.097	0 / 4	--	--	NSV	-- / --	NSV
Methyl isobutyl ketone	0.011 - 0.097	0 / 9	--	--	0.025	-- / --	**3.9**
Methyl n-butyl ketone	0.011 - 0.097	0 / 9	--	--	NSV	-- / --	NSV
Methyl tert-butyl ether	0.0049 - 0.097	0 / 4	--	--	NSV	-- / --	NSV
Methylene bromide	0.0049 - 0.097	0 / 4	--	--	NSV	-- / --	NSV
Propylbenzene, 1-	0.0049 - 0.097	0 / 4	--	--	NSV	-- / --	NSV
Styrene	0.0049 - 0.097	0 / 9	--	--	0.25	-- / --	< 1
Tetrachloroethane, 1,1,1,2-	0.0049 - 0.097	0 / 4	--	--	0.85	-- / --	< 1
Tetrachloroethane, 1,1,2,2-	0.0049 - 0.097	0 / 9	--	--	0.85	-- / --	< 1
Tetrachloroethene	0.0049 - 0.097	0 / 9	--	--	0.99	-- / --	< 1
Trichloroethane, 1,1,1-	0.0049 - 0.097	0 / 9	--	--	0.21	-- / --	< 1
Trichloroethane, 1,1,2-	0.0049 - 0.097	0 / 9	--	--	0.52	-- / --	< 1
Trichloroethene	0.0049 - 0.097	0 / 9	--	--	0.11	-- / --	< 1
Trichloropropane, 1,2,3-	0.0049 - 0.097	0 / 4	--	--	NSV	-- / --	NSV
Trimethylbenzene, 1,2,4-	0.0049 - 0.097	0 / 4	--	--	NSV	-- / --	NSV
Trimethylbenzene, 1,3,5-	0.0049 - 0.097	0 / 4	--	--	NSV	-- / --	NSV

TABLE 7-18

Screening Statistics for Direct Exposures--West Ditch Sediment

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Vinyl chloride	0.0049 - 0.097	0 / 9	--	--	0.20	-- / --	< 1
Xylene, 1,2-	0.0049 - 0.024	0 / 4	--	--	NSV	-- / --	NSV
Xylene, 1,3- and/or 1,4-	0.0099 - 0.048	0 / 4	--	--	NSV	-- / --	NSV
Xylenes, total	0.0059 - 0.011	0 / 5	--	--	0.43	-- / --	< 1
Dioxin/Furans (MG/KG)							
Heptachlorodibenzofuran, 1,2,3,4,7,8,9-	3.20E-07 - 4.00E-07	0 / 2	--	--	NSV	-- / --	NSV
Hexachlorodibenzofuran, 1,2,3,4,7,8-	3.00E-07 - 9.40E-07	0 / 2	--	--	NSV	-- / --	NSV
Hexachlorodibenzofuran, 1,2,3,6,7,8-	2.00E-07 - 4.90E-07	0 / 2	--	--	NSV	-- / --	NSV
Hexachlorodibenzofuran, 1,2,3,7,8,9-	3.00E-07 - 3.50E-07	0 / 2	--	--	NSV	-- / --	NSV
Hexachlorodibenzofuran, 2,3,4,6,7,8-	4.90E-07 - 6.30E-07	0 / 2	--	--	NSV	-- / --	NSV
Hexachlorodibenzo-p-dioxin, 1,2,3,4,7,8-	4.00E-07 - 6.00E-07	0 / 2	--	--	NSV	-- / --	NSV
Hexachlorodibenzo-p-dioxin, 1,2,3,6,7,8-	4.00E-07 - 1.00E-06	0 / 2	--	--	NSV	-- / --	NSV
Hexachlorodibenzo-p-dioxin, 1,2,3,7,8,9-	4.00E-07 - 1.50E-06	0 / 2	--	--	NSV	-- / --	NSV
Pentachlorodibenzofuran, 1,2,3,7,8-	3.00E-07 - 5.20E-07	0 / 2	--	--	NSV	-- / --	NSV
Pentachlorodibenzofuran, 2,3,4,7,8-	3.00E-07 - 5.10E-07	0 / 2	--	--	NSV	-- / --	NSV
Pentachlorodibenzo-p-dioxin, 1,2,3,7,8-	5.00E-07 - 7.70E-07	0 / 2	--	--	NSV	-- / --	NSV
Tetrachlorodibenzofuran, 2,3,7,8-	2.00E-07 - 4.50E-07	0 / 2	--	--	NSV	-- / --	NSV

[1] Shaded cells indicate hazard quotient based on reporting limits

[2] Macronutrient - Not considered to be a COPC

Note:

NSV = No Screening Value

TABLE 7-19

Screening Statistics for Direct Exposures--East Ditch Sediment

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient*
Detected Constituents							
Inorganics (MG/KG)							
Calcium [2]	-- - --	1 / 1	130,000	LCKSD-2	NSV	-- / --	NSV
Magnesium [2]	-- - --	1 / 1	46,000	LCKSD-2	NSV	-- / --	NSV
Semivolatile Organic Compounds (MG/KG)							
Fluoranthene	-- - --	1 / 1	0.23	LCKSD-2	0.42	0 / 1	< 1
Pyrene	-- - --	1 / 1	0.22	LCKSD-2	0.20	1 / 1	**1.1**
Total Low Molecular Weight PAHs[1]	-- - --	0 1	1.44	LCKSD-4	0.076	3 / 9	**19**
Total High Molecualr Weight PAHs	-- - --	1 1	2.09	LCKSD-4	0.19	7 / 9	**11**
Total PAHs	-- - --	1 1	3.53	LCKSD-4	1.61	7 / 9	**2.2**
Volatile Organic Compounds (MG/KG)							
Acetone	-- - --	1 / 1	0.028	LCKSD-2	0.0099	1 / 1	**2.8**
Carbon disulfide	-- - --	1 / 1	0.0059	LCKSD-2	0.024	0 / 1	< 1
Methyl ethyl ketone	-- - --	1 / 1	0.0096	LCKSD-2	0.042	0 / 1	< 1
Non-Detected Constituents							
Pesticide/Polychlorinated Biphenyls (MG/KG)							
Aldrin	0.0020 - 0.0020	0 / 1	--	--	0.0032	-- / --	< 1
Chlordane, technical-	0.041 - 0.041	0 / 1	--	--	NSV	-- / --	NSV
DDD, p,p'-	0.0041 - 0.0041	0 / 1	--	--	0.0049	-- / --	< 1
DDE, p,p'-	0.0041 - 0.0041	0 / 1	--	--	0.0032	-- / --	**1.30**
DDT, p,p'-	0.0041 - 0.0041	0 / 1	--	--	0.0042	-- / --	< 1
Dieldrin	0.0041 - 0.0041	0 / 1	--	--	0.0019	-- / --	**2.16**
Endosulfan A	0.0020 - 0.0020	0 / 1	--	--	0.0033	-- / --	< 1
Endosulfan B	0.0041 - 0.0041	0 / 1	--	--	0.0019	-- / --	**2.11**
Endosulfan sulfate	0.0041 - 0.0041	0 / 1	--	--	0.035	-- / --	< 1
Endrin	0.0041 - 0.0041	0 / 1	--	--	0.0022	-- / --	**1.85**
Endrin aldehyde	0.0041 - 0.0041	0 / 1	--	--	0.48	-- / --	< 1
Endrin ketone	0.0041 - 0.0041	0 / 1	--	--	NSV	-- / --	NSV
Heptachlor	0.0020 - 0.0020	0 / 1	--	--	6.00E-04	-- / --	**3.33**
Heptachlor epoxide	0.0020 - 0.0020	0 / 1	--	--	0.0025	-- / --	< 1
Hexachlorocyclohexane, alpha-	0.0020 - 0.0020	0 / 1	--	--	NSV	-- / --	NSV

TABLE 7-19

Screening Statistics for Direct Exposures--East Ditch Sediment

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient*
Hexachlorocyclohexane, beta-	0.0020 - 0.0020	0 / 1	--	--	NSV	-- / --	NSV
Hexachlorocyclohexane, delta-	0.0020 - 0.0020	0 / 1	--	--	NSV	-- / --	NSV
Hexachlorocyclohexane, gamma- (Lindane)	0.0020 - 0.0020	0 / 1	--	--	NSV	-- / --	NSV
Methoxychlor	0.021 - 0.021	0 / 1	--	--	0.014	-- / --	**1.54**
PCB 1016	0.041 - 0.041	0 / 1	--	--	0.120	-- / --	< 1
PCB 1221	0.082 - 0.082	0 / 1	--	--	0.120	-- / --	< 1
PCB 1232	0.041 - 0.041	0 / 1	--	--	0.600	-- / --	< 1
PCB 1242	0.041 - 0.041	0 / 1	--	--	0.170	-- / --	< 1
PCB 1248	0.041 - 0.041	0 / 1	--	--	1.000	-- / --	< 1
PCB 1254	0.041 - 0.041	0 / 1	--	--	0.810	-- / --	< 1
PCB 1260	0.041 - 0.041	0 / 1	--	--	0.810	-- / --	< 1
Toxaphene	0.21 - 0.21	0 / 1	--	--	7.70E-05	-- / --	**2,727**
Semivolatile Organic Compounds (MG/KG)							
Acenaphthene	0.41 - 0.41	0 / 1	--	--	0.0067	-- / --	**61.1**
Acenaphthylene	0.41 - 0.41	0 / 1	--	--	0.0059	-- / --	**69.8**
Anthracene	0.41 - 0.41	0 / 1	--	--	0.057	-- / --	**7.17**
Benz(a)anthracene	0.41 - 0.41	0 / 1	--	--	0.11	-- / --	**3.80**
Benzo(a)pyrene	0.41 - 0.41	0 / 1	--	--	0.15	-- / --	**2.73**
Benzo(b)fluoranthene	0.41 - 0.41	0 / 1	--	--	10.4	-- / --	< 1
Benzo(ghi)perylene	0.41 - 0.41	0 / 1	--	--	0.17	-- / --	**2.41**
Benzo(k)fluoranthene	0.41 - 0.41	0 / 1	--	--	0.24	-- / --	**1.71**
Bis(2-chloroethoxy) methane	0.41 - 0.41	0 / 1	--	--	NSV	-- / --	NSV
Bis(2-chloroethyl) ether	0.41 - 0.41	0 / 1	--	--	3.52	-- / --	< 1
Bis(2-ethylhexyl) phthalate	0.41 - 0.41	0 / 1	--	--	0.182	-- / --	< 1
Bis(chloroisopropyl) ether	0.41 - 0.41	0 / 1	--	--	NSV	-- / --	NSV
Bromophenyl phenyl ether, 4-	0.41 - 0.41	0 / 1	--	--	NSV	-- / --	NSV
Butylbenzyl phthalate	0.41 - 0.41	0 / 1	--	--	1.97	-- / --	< 1
Carbazole	0.41 - 0.41	0 / 1	--	--	NSV	-- / --	NSV
Chloroaniline, 4-	0.41 - 0.41	0 / 1	--	--	0.15	-- / --	**2.81**
Chloronaphthalene, 2-	0.41 - 0.41	0 / 1	--	--	0.42	-- / --	< 1
Chlorophenol, 2-	0.41 - 0.41	0 / 1	--	--	0.032	-- / --	**13**
Chlorophenyl phenyl ether, 4-	0.41 - 0.41	0 / 1	--	--	NSV	-- / --	NSV

TABLE 7-19

Screening Statistics for Direct Exposures--East Ditch Sediment

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient*
Chrysene	0.41 - 0.41	0 / 1	--	--	0.17	-- / --	**2.47**
Dibenz(ah)anthracene	0.41 - 0.41	0 / 1	--	--	0.033	-- / --	**12**
Dibenzofuran	0.41 - 0.41	0 / 1	--	--	0.45	-- / --	< 1
Dichlorobenzene, 1,2-	0.41 - 0.41	0 / 1	--	--	0.29	-- / --	**1.4**
Dichlorobenzene, 1,3-	0.41 - 0.41	0 / 1	--	--	1.32	-- / --	< 1
Dichlorobenzene, 1,4-	0.41 - 0.41	0 / 1	--	--	0.32	-- / --	**1.3**
Dichlorobenzidine, 3,3'-	0.41 - 0.41	0 / 1	--	--	0.13	-- / --	**3.2**
Dichlorophenol, 2,4-	0.41 - 0.41	0 / 1	--	--	0.082	-- / --	**5.0**
Diethyl phthalate	0.41 - 0.41	0 / 1	--	--	0.30	-- / --	**1.4**
Dimethyl phthalate	0.41 - 0.41	0 / 1	--	--	NSV	-- / --	NSV
Dimethylphenol, 2,4-	0.41 - 0.41	0 / 1	--	--	0.30	-- / --	**1.3**
Di-n-butyl phthalate	0.41 - 0.41	0 / 1	--	--	1.11	-- / --	< 1
Dinitro-2-methylphenol, 4,6-	1.00 - 1.00	0 / 1	--	--	NSV	-- / --	NSV
Dinitrophenol, 2,4-	1.00 - 1.00	0 / 1	--	--	0.0062	-- / --	**161**
Di-n-octyl phthalate	0.41 - 0.41	0 / 1	--	--	40.6	-- / --	< 1
Fluorene	0.41 - 0.41	0 / 1	--	--	0.077	-- / --	**5**
Hexachlorobenzene	0.41 - 0.41	0 / 1	--	--	0.020	-- / --	**21**
Hexachlorobutadiene	0.41 - 0.41	0 / 1	--	--	0.027	-- / --	**15**
Hexachlorocyclopentadiene	0.41 - 0.41	0 / 1	--	--	0.90	-- / --	< 1
Hexachloroethane	0.41 - 0.41	0 / 1	--	--	0.58	-- / --	< 1
Indeno(1,2,3-cd)pyrene	0.41 - 0.41	0 / 1	--	--	0.20	-- / --	**2.1**
Isophorone	0.41 - 0.41	0 / 1	--	--	NSV	-- / --	NSV
Methylnaphthalene, 2-	0.41 - 0.41	0 / 1	--	--	0.020	-- / --	**20**
Methylphenol, 2-	0.41 - 0.41	0 / 1	--	--	NSV	-- / --	NSV
Methylphenol, 4-	0.41 - 0.41	0 / 1	--	--	NSV	-- / --	NSV
Methylphenol, 4-chloro-3-	0.41 - 0.41	0 / 1	--	--	NSV	-- / --	NSV
Naphthalene	0.41 - 0.41	0 / 1	--	--	0.18	-- / --	**2.3**
Nitroaniline, 2-	1.00 - 1.00	0 / 1	--	--	NSV	-- / --	NSV
Nitroaniline, 3-	1.00 - 1.00	0 / 1	--	--	NSV	-- / --	NSV
Nitroaniline, 4-	1.00 - 1.00	0 / 1	--	--	NSV	-- / --	NSV
Nitrophenol, 2-	0.41 - 0.41	0 / 1	--	--	0.013	-- / --	**32**
Nitrophenol, 4-	1.00 - 1.00	0 / 1	--	--	0.013	-- / --	**77**

TABLE 7-19

Screening Statistics for Direct Exposures--East Ditch Sediment

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient*
Nitrosodi-N-propylamine, N-	0.41 - 0.41	0 / 1	--	--	NSV	-- / --	NSV
Nitrosodiphenylamine, N-	0.41 - 0.41	0 / 1	--	--	NSV	-- / --	NSV
Pentachlorophenol	1.00 - 1.00	0 / 1	--	--	NSV	-- / --	NSV
Phenanthrene	0.41 - 0.41	0 / 1	--	--	NSV	-- / --	NSV
Phenol	0.41 - 0.41	0 / 1	--	--	NSV	-- / --	NSV
Trichlorobenzene, 1,2,4-	0.41 - 0.41	0 / 1	--	--	5.06	-- / --	< 1
Trichlorophenol, 2,4,5-	1.00 - 1.00	0 / 1	--	--	0.21	-- / --	**4.8**
Trichlorophenol, 2,4,6-	0.41 - 0.41	0 / 1	--	--	0.21	-- / --	**2.0**
Explosives (MG/KG)							
Amino-2,6-dinitrotoluene, 4-	1.10 - 1.10	0 / 1	--	--	NSV	-- / --	NSV
Amino-4,6-dinitrotoluene, 2-	0.90 - 0.90	0 / 1	--	--	NSV	-- / --	NSV
Dinitrobenzene, 1,3-	0.50 - 0.50	0 / 1	--	--	0.0086	-- / --	**58**
Dinitrotoluene, 2,4-	0.50 - 0.50	0 / 1	--	--	0.014	-- / --	**35**
Dinitrotoluene, 2,6-	0.50 - 0.50	0 / 1	--	--	0.040	-- / --	**13**
HMX	0.90 - 0.90	0 / 1	--	--	NSV	-- / --	NSV
Nitrobenzene	0.60 - 0.60	0 / 1	--	--	0.15	-- / --	**4.1**
Nitrotoluene, 2-	0.90 - 0.90	0 / 1	--	--	NSV	-- / --	NSV
Nitrotoluene, 3-	0.90 - 0.90	0 / 1	--	--	NSV	-- / --	NSV
Nitrotoluene, 4-	1.10 - 1.10	0 / 1	--	--	NSV	-- / --	NSV
RDX	0.50 - 0.50	0 / 1	--	--	NSV	-- / --	NSV
Tetryl	1.90 - 1.90	0 / 1	--	--	NSV	-- / --	NSV
Trinitrobenzene, 1,3,5-	0.70 - 0.70	0 / 1	--	--	NSV	-- / --	NSV
Trinitrotoluene, 2,4,6-	0.50 - 0.50	0 / 1	--	--	NSV	-- / --	NSV
Volatile Organic Compounds (MG/KG)							
Benzene	0.0062 - 0.0062	0 / 1	--	--	0.14	-- / --	< 1
Bromodichloromethane	0.0062 - 0.0062	0 / 1	--	--	NSV	-- / --	NSV
Bromoform	0.0062 - 0.0062	0 / 1	--	--	0.49	-- / --	< 1
Bromomethane	0.0062 - 0.0062	0 / 1	--	--	NSV	-- / --	NSV
Carbon tetrachloride	0.0062 - 0.0062	0 / 1	--	--	1.45	-- / --	< 1
Chlorobenzene	0.0062 - 0.0062	0 / 1	--	--	0.29	-- / --	< 1
Chloroethane	0.0062 - 0.0062	0 / 1	--	--	NSV	-- / --	NSV
Chloroform	0.0062 - 0.0062	0 / 1	--	--	0.12	-- / --	< 1

TABLE 7-19

Screening Statistics for Direct Exposures--East Ditch Sediment

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient*
Chloromethane	0.0062 - 0.0062	0 / 1	--	--	NSV	-- / --	NSV
Dibromochloromethane	0.0062 - 0.0062	0 / 1	--	--	NSV	-- / --	NSV
Dichloroethane, 1,1-	0.0062 - 0.0062	0 / 1	--	--	5.75E-04	-- / --	**11**
Dichloroethane, 1,2-	0.0062 - 0.0062	0 / 1	--	--	0.26	-- / --	< 1
Dichloroethene, 1,1-	0.0062 - 0.0062	0 / 1	--	--	0.019	-- / --	< 1
Dichloroethenes, 1,2-, total	0.0062 - 0.0062	0 / 1	--	--	NSV	-- / --	NSV
Dichloropropane, 1,2-	0.0062 - 0.0062	0 / 1	--	--	0.33	-- / --	< 1
Dichloropropene, 1,3-, cis-	0.0062 - 0.0062	0 / 1	--	--	0.33	-- / --	< 1
Dichloropropene, 1,3-, trans-	0.0062 - 0.0062	0 / 1	--	--	0.33	-- / --	< 1
Ethylbenzene	0.0062 - 0.0062	0 / 1	--	--	0.18	-- / --	< 1
Methyl isobutyl ketone	0.012 - 0.012	0 / 1	--	--	0.025	-- / --	< 1
Methyl n-butyl ketone	0.012 - 0.012	0 / 1	--	--	NSV	-- / --	NSV
Methylene chloride	0.0062 - 0.0062	0 / 1	--	--	0.16	-- / --	< 1
Styrene	0.0062 - 0.0062	0 / 1	--	--	0.25	-- / --	< 1
Tetrachloroethane, 1,1,2,2-	0.0062 - 0.0062	0 / 1	--	--	0.85	-- / --	< 1
Tetrachloroethene	0.0062 - 0.0062	0 / 1	--	--	0.99	-- / --	< 1
Toluene	0.0062 - 0.0062	0 / 1	--	--	1.22	-- / --	< 1
Trichloroethane, 1,1,1-	0.0062 - 0.0062	0 / 1	--	--	0.21	-- / --	< 1
Trichloroethane, 1,1,2-	0.0062 - 0.0062	0 / 1	--	--	0.52	-- / --	< 1
Trichloroethene	0.0062 - 0.0062	0 / 1	--	--	0.11	-- / --	< 1
Vinyl chloride	0.0062 - 0.0062	0 / 1	--	--	0.20	-- / --	< 1
Xylenes, total	0.0062 - 0.0062	0 / 1	--	--	0.43	-- / --	< 1
Xylenes, total	0.0062 - 0.0062	0 / 1	--	--	0.43	-- / --	0.014

Shaded cells indicate hazard quotient based on reporting limits

Note:

NSV = No Screening Value

TABLE 7-20

Screening Statistics for Direct Exposures-- West Ditch Surface Water

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Detected Constituents							
Inorganics (MG/L)							
Aluminum	0.10 - 0.10	4 / 5	0.18	LCKSW-7	NSV	-- / --	NSV
Arsenic	0.0018 - 0.020	1 / 8	0.0050	LCK-SW1	0.34	0 / 8	< 1
Barium	-- - --	8 / 8	0.081	EEGLKB-SW03	2.00	0 / 8	< 1
Calcium [2]	-- - --	5 / 5	98.0	LCKSW-7	NSV	-- / --	NSV
Copper	0.020 - 0.020	3 / 5	0.0036	EEGLKB-SW01	0.014	0 / 5	< 1
Iron	0.35 - 0.35	4 / 5	0.78	LCKSW-7	NSV	-- / --	NSV
Lead	0.0050 - 0.0075	3 / 8	0.052	LCK-SW1	0.12	0 / 8	< 1
Magnesium [2]	-- - --	5 / 5	32.0	LCKSW-7	NSV	-- / --	NSV
Manganese	-- - --	5 / 5	0.063	EEGLKB-SW03	NSV	-- / --	NSV
Potassium [2]	-- - --	5 / 5	11.0	LCKSW-7	NSV	-- / --	NSV
Selenium	0.0012 - 0.015	2 / 8	0.0015	LCK-SW1	0.0050	0 / 8	< 1
Sodium [2]	-- - --	5 / 5	9.30	EEGLKB-SW03	NSV	-- / --	NSV
Thallium	0.025 - 0.025	2 / 5	0.0070	LCKSW-7	0.079	0 / 5	< 1
Zinc	0.020 - 0.020	6 / 8	0.092	LCK-SW1	0.12	0 / 8	< 1
Dissolved Metals (MG/L)							
Manganese	-- - --	2 / 2	0.050	LCKSW-4	NSV	-- / --	NSV
Potassium [2]	-- - --	2 / 2	7.70	LCKSW-4	NSV	-- / --	NSV
Sodium [2]	-- - --	2 / 2	7.10	LCKSW-7	NSV	-- / --	NSV
Thallium	-- - --	2 / 2	0.0060	LCKSW-5	7.90E-02	-- / --	< 1
Semivolatile Organic Compounds (MG/L)							
Benzoic acid	0.020 - 0.020	1 / 2	0.020	EEGLKB-SW02	NSV	-- / --	NSV
Bis(2-ethylhexyl) phthalate	0.0051 - 0.010	1 / 8	0.028	EEGLKB-SW02 Dup04	1.10	0 / 8	< 1
Diethyl phthalate	0.0020 - 0.010	1 / 8	0.0040	LCK-SW1	9.80	0 / 8	< 1
Di-n-butyl phthalate	0.0051 - 0.010	1 / 8	0.0020	LCK-SW1	0.0097	0 / 8	< 1
Volatile Organic Compounds (MG/L)							
Methylene chloride	0.0010 - 0.0070	1 / 5	0.022	LCK-SW1	11.0	0 / 5	< 1

TABLE 7-20

Screening Statistics for Direct Exposures-- West Ditch Surface Water

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Dioxin/Furans (MG/L)							
Heptachlorodibenzo-p-dioxin, 1,2,3,4,6,7,8-	1.60E-09 - 1.60E-09	1 / 2	3.80E-09	LCKSW-6	NSV	-- / --	NSV
Heptachlorodibenzo-p-dioxins, total	1.60E-09 - 1.60E-09	1 / 2	3.80E-09	LCKSW-6	NSV	-- / --	NSV
Hexachlorodibenzofuran, 1,2,3,4,7,8-	7.80E-10 - 7.80E-10	1 / 2	3.10E-09	LCKSW-6	NSV	-- / --	NSV
Hexachlorodibenzofuran, 2,3,4,6,7,8-	8.10E-10 - 8.10E-10	1 / 2	4.50E-09	LCKSW-6	NSV	-- / --	NSV
Hexachlorodibenzofurans, total	1.00E-09 - 1.00E-09	1 / 2	4.50E-09	LCKSW-6	NSV	-- / --	NSV
Hexachlorodibenzo-p-dioxins, total	1.00E-09 - 1.00E-09	1 / 2	1.03E-08	LCKSW-5	NSV	-- / --	NSV
Octachlorodibenzo-p-dioxin	5.90E-09 - 5.90E-09	1 / 2	5.02E-08	LCKSW-6	NSV	-- / --	NSV
TCDD-TEQ	-- - --	2 / 2	5.44E-09	LCKSW-5	3.00E-12	2 / 2	**1,814**
Non-Detected Constituents							
Inorganics (MG/L)							
Antimony	0.050 - 0.060	0 / 5	--	--	0.90	-- / --	< 1
Beryllium	0.0040 - 0.0050	0 / 5	--	--	0.093	-- / --	< 1
Cadmium	0.0020 - 0.0050	0 / 8	--	--	0.0045	-- / --	< 1
Chromium, total	0.0042 - 0.010	0 / 8	--	--	1.80	-- / --	< 1
Cobalt	0.010 - 0.010	0 / 5	--	--	0.22	-- / --	< 1
Mercury	1.00E-04 - 2.00E-04	0 / 8	--	--	0.0017	-- / --	< 1
Nickel	0.010 - 0.040	0 / 5	--	--	0.47	-- / --	< 1
Silver	0.0035 - 0.010	0 / 8	--	--	0.0016	-- / --	**6.3**
Vanadium	0.010 - 0.010	0 / 5	--	--	0.15	-- / --	< 1
Dissolved Metals (MG/L)							
Aluminum	0.10 - 0.10	0 / 2	--	--	NSV	-- / --	NSV
Antimony	0.060 - 0.060	0 / 2	--	--	9.00E-01	-- / --	< 1
Arsenic	0.0050 - 0.0050	0 / 2	--	--	3.40E-01	-- / --	< 1
Beryllium	0.0050 - 0.0050	0 / 2	--	--	9.30E-02	-- / --	< 1
Cadmium	0.0050 - 0.0050	0 / 2	--	--	4.30E-03	-- / --	**1.163**
Cobalt	0.010 - 0.010	0 / 2	--	--	2.20E-01	-- / --	< 1
Copper	0.020 - 0.020	0 / 2	--	--	1.30E-02	-- / --	**1.538**
Iron	0.10 - 0.10	0 / 2	--	--	NSV	-- / --	NSV
Lead	0.0050 - 0.0050	0 / 2	--	--	9.70E-02	-- / --	< 1
Mercury	2.00E-04 - 2.00E-04	0 / 2	--	--	1.40E-03	-- / --	< 1
Nickel	0.040 - 0.040	0 / 2	--	--	4.70E-01	-- / --	< 1
Selenium	0.0050 - 0.0050	0 / 2	--	--	4.60E-03	-- / --	**1.087**

TABLE 7-20

Screening Statistics for Direct Exposures-- West Ditch Surface Water

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Silver	0.010 - 0.010	0 / 2	--	--	1.40E-03	-- / --	**7.143**
Vanadium	0.010 - 0.010	0 / 2	--	--	1.50E-01	-- / --	< 1
Zinc	0.020 - 0.020	0 / 2	--	--	1.20E-01	-- / --	< 1
Pesticide/Polychlorinated Biphenyls (MG/L)							
Aldrin	4.90E-05 - 5.10E-05	0 / 8	--	--	1.70E-05	-- / --	**3.0**
Chlordane, alpha-	4.90E-05 - 5.10E-05	0 / 6	--	--	4.30E-05	-- / --	**1.2**
Chlordane, gamma-	4.90E-05 - 5.10E-05	0 / 6	--	--	4.30E-05	-- / --	**1.2**
Chlordane, technical-	0.0010 - 0.0010	0 / 2	--	--	NSV	-- / --	NSV
DDD, p,p'-	4.90E-05 - 1.00E-04	0 / 8	--	--	NSV	-- / --	NSV
DDE, p,p'-	4.90E-05 - 1.00E-04	0 / 8	--	--	4.51E-12	-- / --	**22,172,949**
DDT, p,p'-	4.90E-05 - 1.00E-04	0 / 8	--	--	1.10E-08	-- / --	**9,091**
Dieldrin	4.90E-05 - 1.00E-04	0 / 8	--	--	2.40E-04	-- / --	< 1
Endosulfan A	4.90E-05 - 5.10E-05	0 / 8	--	--	5.60E-05	-- / --	< 1
Endosulfan B	4.90E-05 - 1.00E-04	0 / 8	--	--	5.60E-05	-- / --	**1.8**
Endosulfan sulfate	4.90E-05 - 1.00E-04	0 / 8	--	--	0.0022	-- / --	< 1
Endrin	4.90E-05 - 1.00E-04	0 / 8	--	--	8.60E-05	-- / --	**1.2**
Endrin aldehyde	4.90E-05 - 1.00E-04	0 / 8	--	--	1.50E-04	-- / --	< 1
Endrin ketone	4.90E-05 - 1.00E-04	0 / 8	--	--	NSV	-- / --	NSV
Heptachlor	4.90E-05 - 5.10E-05	0 / 8	--	--	3.80E-06	-- / --	**13**
Heptachlor epoxide	4.90E-05 - 5.10E-05	0 / 8	--	--	3.80E-06	-- / --	**13**
Hexachlorocyclohexane, alpha-	4.90E-05 - 5.10E-05	0 / 8	--	--	NSV	-- / --	NSV
Hexachlorocyclohexane, beta-	4.90E-05 - 5.10E-05	0 / 8	--	--	NSV	-- / --	NSV
Hexachlorocyclohexane, delta-	4.90E-05 - 5.10E-05	0 / 8	--	--	NSV	-- / --	NSV
Hexachlorocyclohexane, gamma- (Lindane)	4.90E-05 - 5.10E-05	0 / 8	--	--	9.50E-04	-- / --	< 1
Methoxychlor	2.40E-04 - 5.00E-04	0 / 8	--	--	NSV	-- / --	NSV
PCB 1016	4.90E-04 - 0.0010	0 / 8	--	--	1.2E-07	-- / --	**8333**
PCB 1221	4.90E-04 - 0.0020	0 / 8	--	--	1.2E-07	-- / --	**16667**
PCB 1232	4.90E-04 - 0.0010	0 / 8	--	--	1.2E-07	-- / --	**8333**
PCB 1242	4.90E-04 - 0.0010	0 / 8	--	--	1.2E-07	-- / --	**8333**
PCB 1248	4.90E-04 - 0.0010	0 / 8	--	--	1.2E-07	-- / --	**8333**
PCB 1254	4.90E-04 - 0.0010	0 / 8	--	--	1.2E-07	-- / --	**8333**
PCB 1260	4.90E-04 - 0.0010	0 / 8	--	--	1.2E-07	-- / --	**8333**
Toxaphene	4.90E-04 - 0.0050	0 / 8	--	--	1.40E-07	-- / --	**35714**

TABLE 7-20

Screening Statistics for Direct Exposures-- West Ditch Surface Water

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Semivolatile Organic Compounds (MG/L)							
Acenaphthene	0.0010 - 0.010	0 / 8	--	--	0.019	-- / --	< 1
Acenaphthylene	0.0010 - 0.010	0 / 8	--	--	4.84	-- / --	< 1
Anthracene	0.0010 - 0.010	0 / 8	--	--	1.80E-04	-- / --	**56**
Benz(a)anthracene	2.00E-04 - 0.010	0 / 8	--	--	2.50E-05	-- / --	**400**
Benzidine	0.10 - 0.10	0 / 2	--	--	NSV	-- / --	NSV
Benzo(a)pyrene	2.00E-04 - 0.010	0 / 8	--	--	1.40E-05	-- / --	**714**
Benzo(b)fluoranthene	2.00E-04 - 0.010	0 / 8	--	--	0.0091	-- / --	**1.1**
Benzo(ghi)perylene	0.0010 - 0.010	0 / 8	--	--	0.0076	-- / --	**1.3**
Benzo(k)fluoranthene	2.00E-04 - 0.010	0 / 8	--	--	NSV	-- / --	NSV
Benzyl alcohol	0.020 - 0.022	0 / 3	--	--	0.0086	-- / --	**2.6**
Bis(2-chloroethoxy) methane	0.0020 - 0.010	0 / 8	--	--	NSV	-- / --	NSV
Bis(2-chloroethyl) ether	0.0020 - 0.010	0 / 8	--	--	19.0	-- / --	< 1
Bis(2-chloroisopropyl) ether	0.010 - 0.010	0 / 3	--	--	3.00E-04	-- / --	**33**
Bis(chloroisopropyl) ether	0.0020 - 0.010	0 / 5	--	--	NSV	-- / --	NSV
Bromophenyl phenyl ether, 4-	0.0051 - 0.010	0 / 8	--	--	NSV	-- / --	NSV
Butylbenzyl phthalate	0.0020 - 0.010	0 / 8	--	--	0.023	-- / --	< 1
Carbazole	0.0051 - 0.010	0 / 7	--	--	NSV	-- / --	NSV
Chloroaniline, 4-	0.010 - 0.011	0 / 8	--	--	0.23	-- / --	< 1
Chloronaphthalene, 2-	0.0020 - 0.010	0 / 8	--	--	3.96E-04	-- / --	**25**
Chlorophenol, 2-	0.0051 - 0.010	0 / 8	--	--	0.29	-- / --	< 1
Chlorophenyl phenyl ether, 4-	0.0051 - 0.010	0 / 8	--	--	NSV	-- / --	NSV
Chrysene	5.10E-04 - 0.010	0 / 8	--	--	NSV	-- / --	NSV
Dibenz(ah)anthracene	2.00E-04 - 0.010	0 / 8	--	--	NSV	-- / --	NSV
Dibenzofuran	0.0020 - 0.010	0 / 8	--	--	0.036	-- / --	< 1
Dichlorobenzene, 1,2-	0.0020 - 0.010	0 / 8	--	--	0.13	-- / --	< 1
Dichlorobenzene, 1,3-	0.0020 - 0.010	0 / 8	--	--	0.079	-- / --	< 1
Dichlorobenzene, 1,4-	0.0020 - 0.010	0 / 8	--	--	0.057	-- / --	< 1
Dichlorobenzidine, 3,3'-	0.0051 - 0.020	0 / 8	--	--	NSV	-- / --	NSV
Dichlorophenol, 2,4-	0.010 - 0.011	0 / 8	--	--	0.11	-- / --	< 1
Dimethyl phthalate	0.0020 - 0.010	0 / 8	--	--	3.20	-- / --	< 1
Dimethylphenol, 2,4-	0.010 - 0.011	0 / 8	--	--	0.14	-- / --	< 1
Dinitro-2-methylphenol, 4,6-	0.020 - 0.050	0 / 7	--	--	NSV	-- / --	NSV

TABLE 7-20

Screening Statistics for Direct Exposures-- West Ditch Surface Water

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Dinitrophenol, 2,4-	0.020 - 0.050	0 / 7	--	--	0.019	-- / --	**2.6**
Di-n-octyl phthalate	0.010 - 0.011	0 / 8	--	--	0.030	-- / --	< 1
Fluoranthene	0.0010 - 0.010	0 / 8	--	--	0.0037	-- / --	**2.7**
Fluorene	0.0010 - 0.010	0 / 8	--	--	0.11	-- / --	< 1
Hexachlorobenzene	5.10E-04 - 0.010	0 / 8	--	--	3.00E-07	-- / --	**33,333**
Hexachlorobutadiene	0.0051 - 0.010	0 / 8	--	--	5.30E-05	-- / --	**189**
Hexachlorocyclopentadiene	0.010 - 0.020	0 / 7	--	--	0.077	-- / --	< 1
Hexachloroethane	0.0051 - 0.010	0 / 8	--	--	0.0080	-- / --	**1.3**
Indeno(1,2,3-cd)pyrene	2.00E-04 - 0.010	0 / 8	--	--	0.0043	-- / --	**2.3**
Isophorone	0.0020 - 0.010	0 / 8	--	--	0.92	-- / --	< 1
Methylnaphthalene, 2-	5.10E-04 - 0.010	0 / 8	--	--	0.33	-- / --	< 1
Methylphenol, 2-	0.0020 - 0.010	0 / 8	--	--	0.60	-- / --	< 1
Methylphenol, 3- and/or 4-	0.0020 - 0.0022	0 / 3	--	--	0.56	-- / --	< 1
Methylphenol, 4-	0.010 - 0.010	0 / 5	--	--	0.48	-- / --	< 1
Methylphenol, 4-chloro-3-	0.010 - 0.011	0 / 8	--	--	NSV	-- / --	NSV
Naphthalene	0.0010 - 0.010	0 / 8	--	--	0.17	-- / --	< 1
Nitroaniline, 2-	0.0051 - 0.050	0 / 8	--	--	NSV	-- / --	NSV
Nitroaniline, 3-	0.010 - 0.050	0 / 8	--	--	NSV	-- / --	NSV
Nitroaniline, 4-	0.010 - 0.050	0 / 7	--	--	NSV	-- / --	NSV
Nitrophenol, 2-	0.010 - 0.011	0 / 8	--	--	0.65	-- / --	< 1
Nitrophenol, 4-	0.020 - 0.050	0 / 8	--	--	0.65	-- / --	< 1
Nitrosodi-N-propylamine, N-	5.10E-04 - 0.010	0 / 8	--	--	NSV	-- / --	NSV
Nitrosodiphenylamine, N-	0.0010 - 0.010	0 / 8	--	--	0.77	-- / --	< 1
Pentachlorophenol	0.010 - 0.050	0 / 8	--	--	0.0040	-- / --	**13**
Phenanthrene	0.0010 - 0.010	0 / 8	--	--	0.031	-- / --	< 1
Phenol	0.0051 - 0.010	0 / 8	--	--	4.70	-- / --	< 1
Pyrene	0.0010 - 0.010	0 / 8	--	--	0.042	-- / --	< 1
Trichlorobenzene, 1,2,4-	0.0020 - 0.010	0 / 8	--	--	0.030	-- / --	< 1
Trichlorophenol, 2,4,5-	0.010 - 0.050	0 / 8	--	--	0.039	-- / --	**1.3**
Trichlorophenol, 2,4,6-	0.0051 - 0.010	0 / 8	--	--	0.039	-- / --	< 1

TABLE 7-20

Screening Statistics for Direct Exposures-- West Ditch Surface Water

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Explosives (MG/L)							
Amino-2,6-dinitrotoluene, 4-	6.00E-04 - 7.80E-04	0 / 3	--	--	0.098	-- / --	< 1
Amino-4,6-dinitrotoluene, 2-	5.00E-04 - 7.80E-04	0 / 3	--	--	0.16	-- / --	< 1
Aminodinitrotoluenes, total	3.90E-04 - 3.90E-04	0 / 3	--	--	NSV	-- / --	NSV
Dinitrobenzene, 1,3-	2.00E-04 - 3.90E-04	0 / 6	--	--	0.10	-- / --	< 1
Dinitrotoluene, 2,4-	2.00E-04 - 0.0011	0 / 8	--	--	0.39	-- / --	< 1
Dinitrotoluene, 2,6-	2.00E-04 - 7.80E-04	0 / 8	--	--	0.73	-- / --	< 1
HMX	4.00E-04 - 0.0017	0 / 6	--	--	1.20	-- / --	< 1
Nitrobenzene	2.00E-04 - 0.0011	0 / 8	--	--	2.00	-- / --	< 1
Nitrotoluene, 2-	6.00E-04 - 7.80E-04	0 / 6	--	--	0.64	-- / --	< 1
Nitrotoluene, 3-	4.00E-04 - 7.80E-04	0 / 6	--	--	0.38	-- / --	< 1
Nitrotoluene, 4-	4.00E-04 - 0.0023	0 / 6	--	--	0.41	-- / --	< 1
RDX	3.90E-04 - 8.70E-04	0 / 6	--	--	0.52	-- / --	< 1
Tetryl	4.00E-04 - 7.80E-04	0 / 6	--	--	NSV	-- / --	NSV
Trinitrobenzene, 1,3,5-	2.00E-04 - 5.00E-04	0 / 6	--	--	NSV	-- / --	NSV
Trinitrotoluene, 2,4,6-	2.00E-04 - 7.00E-04	0 / 6	--	--	NSV	-- / --	NSV
2,4,5-T	5.00E-04 - 5.10E-04	0 / 3	--	--	NSV	-- / --	NSV
2,4,5-TP	5.00E-04 - 5.10E-04	0 / 3	--	--	NSV	-- / --	NSV
2,4-D	0.0010 - 0.0010	0 / 3	--	--	NSV	-- / --	NSV
Volatile Organic Compounds (MG/L)							
Acetone	0.0090 - 0.010	0 / 5	--	--	1.70	-- / --	< 1
Benzene	0.0010 - 0.0050	0 / 5	--	--	0.70	-- / --	< 1
Bromodichloromethane	0.0010 - 0.0050	0 / 5	--	--	NSV	-- / --	NSV
Bromoform	0.0010 - 0.0050	0 / 5	--	--	1.10	-- / --	< 1
Bromomethane	0.0010 - 0.010	0 / 5	--	--	0.038	-- / --	< 1
Carbon disulfide	0.0010 - 0.0050	0 / 5	--	--	0.13	-- / --	< 1
Carbon tetrachloride	0.0010 - 0.0050	0 / 5	--	--	2.20	-- / --	< 1
Chlorobenzene	0.0010 - 0.0050	0 / 5	--	--	0.42	-- / --	< 1
Chloroethane	0.0020 - 0.010	0 / 5	--	--	NSV	-- / --	NSV
Chloroform	0.0010 - 0.0050	0 / 5	--	--	1.30	-- / --	< 1
Chloromethane	0.0020 - 0.010	0 / 5	--	--	NSV	-- / --	NSV
Dibromochloromethane	0.0010 - 0.0050	0 / 5	--	--	NSV	-- / --	NSV
Dichloroethane, 1,1-	0.0010 - 0.0050	0 / 5	--	--	0.047	-- / --	< 1

TABLE 7-20

Screening Statistics for Direct Exposures-- West Ditch Surface Water

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Dichloroethane, 1,2-	0.0010 - 0.0050	0 / 5	--	--	9.60	-- / --	< 1
Dichloroethene, 1,1-	0.0010 - 0.0050	0 / 5	--	--	1.90	-- / --	< 1
Dichloroethenes, 1,2-, total	0.0010 - 0.0050	0 / 5	--	--	8.80	-- / --	< 1
Dichloropropane, 1,2-	0.0010 - 0.0050	0 / 5	--	--	3.30	-- / --	< 1
Dichloropropene, 1,3-, cis-	0.0010 - 0.0050	0 / 5	--	--	0.015	-- / --	< 1
Dichloropropene, 1,3-, trans-	0.0010 - 0.0050	0 / 5	--	--	0.015	-- / --	< 1
Ethylbenzene	0.0010 - 0.0050	0 / 5	--	--	0.55	-- / --	< 1
Methyl ethyl ketone	0.010 - 0.010	0 / 5	--	--	200	-- / --	< 1
Methyl isobutyl ketone	0.010 - 0.010	0 / 5	--	--	NSV	-- / --	NSV
Methyl n-butyl ketone	0.010 - 0.010	0 / 5	--	--	NSV	-- / --	NSV
Styrene	0.0010 - 0.0050	0 / 5	--	--	0.032	-- / --	< 1
Tetrachloroethane, 1,1,2,2-	0.0010 - 0.0050	0 / 5	--	--	0.91	-- / --	< 1
Tetrachloroethene	0.0010 - 0.0050	0 / 5	--	--	0.43	-- / --	< 1
Toluene	0.0010 - 0.0050	0 / 5	--	--	0.56	-- / --	< 1
Trichloroethane, 1,1,1-	0.0010 - 0.0050	0 / 5	--	--	0.69	-- / --	< 1
Trichloroethane, 1,1,2-	0.0010 - 0.0050	0 / 5	--	--	3.30	-- / --	< 1
Trichloroethene	0.0010 - 0.0050	0 / 5	--	--	2.00	-- / --	< 1
Vinyl chloride	0.0010 - 0.010	0 / 5	--	--	8.40	-- / --	< 1
Xylenes, total	0.0010 - 0.0050	0 / 5	--	--	0.24	-- / --	< 1
Dioxin/Furans (MG/L)							
Heptachlorodibenzofuran, 1,2,3,4,6,7,8-	1.40E-09 - 2.30E-09	0 / 2	--	--	NSV	-- / --	NSV
Heptachlorodibenzofuran, 1,2,3,4,7,8,9-	9.90E-10 - 3.10E-09	0 / 2	--	--	NSV	-- / --	NSV
Heptachlorodibenzofurans, total	1.40E-09 - 2.70E-09	0 / 2	--	--	NSV	-- / --	NSV
Hexachlorodibenzofuran, 1,2,3,6,7,8-	4.80E-10 - 1.30E-09	0 / 2	--	--	NSV	-- / --	NSV
Hexachlorodibenzofuran, 1,2,3,7,8,9-	1.00E-09 - 1.90E-09	0 / 2	--	--	NSV	-- / --	NSV
Hexachlorodibenzo-p-dioxin, 1,2,3,4,7,8-	9.60E-10 - 2.90E-09	0 / 2	--	--	NSV	-- / --	NSV
Hexachlorodibenzo-p-dioxin, 1,2,3,6,7,8-	7.60E-10 - 2.40E-09	0 / 2	--	--	NSV	-- / --	NSV
Hexachlorodibenzo-p-dioxin, 1,2,3,7,8,9-	1.00E-09 - 2.50E-09	0 / 2	--	--	NSV	-- / --	NSV
Octachlorodibenzofuran	2.10E-09 - 4.60E-09	0 / 2	--	--	NSV	-- / --	NSV
Pentachlorodibenzofuran, 1,2,3,7,8-	4.60E-10 - 1.60E-09	0 / 2	--	--	NSV	-- / --	NSV
Pentachlorodibenzofuran, 2,3,4,7,8-	6.80E-10 - 1.50E-09	0 / 2	--	--	NSV	-- / --	NSV
Pentachlorodibenzofurans, total	6.80E-10 - 1.60E-09	0 / 2	--	--	NSV	-- / --	NSV
Pentachlorodibenzo-p-dioxin, 1,2,3,7,8-	7.40E-10 - 2.30E-09	0 / 2	--	--	NSV	-- / --	NSV

TABLE 7-20

Screening Statistics for Direct Exposures-- West Ditch Surface Water

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Pentachlorodibenzo-p-dioxins, total	7.40E-10 - 2.30E-09	0 / 2	--	--	NSV	-- / --	NSV
Tetrachlorodibenzofuran, 2,3,7,8-	3.80E-10 - 7.00E-09	0 / 2	--	--	NSV	-- / --	NSV
Tetrachlorodibenzofurans, total	3.80E-10 - 7.00E-09	0 / 2	--	--	NSV	-- / --	NSV
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-	3.80E-10 - 1.60E-09	0 / 2	--	--	NSV	-- / --	NSV
Tetrachlorodibenzo-p-dioxins, total	3.80E-10 - 1.60E-09	0 / 2	--	--	NSV	-- / --	NSV

[1] Shaded cells indicate hazard quotient based on reporting limits

[2] Macronutrient - Not considered to be a COPC

Note:

NSV - No Screening Value

TABLE 7-21

Screening Statistics-- East Ditch Surface Water

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Detected Constituents							
Inorganics (MG/L)							
Barium	-- - --	1 / 1	0.080	LCKSW-2	2.00	0 / 1	< 1
Calcium [2]	-- - --	1 / 1	110	LCKSW-2	NSV	-- / --	NSV
Magnesium [2]	-- - --	1 / 1	34.0	LCKSW-2	NSV	-- / --	NSV
Potassium [2]	-- - --	1 / 1	5.40	LCKSW-2	NSV	-- / --	NSV
Thallium	-- - --	1 / 1	0.0070	LCKSW-2	0.079	0 / 1	< 1
Dissolved Metals (MG/L)							
Arsenic	-- - --	1 / 1	0.023	LCKSW-2	0.34	-- / --	< 1
Calcium [2]	-- - --	1 / 1	110	LCKSW-2	NSV	-- / --	NSV
Magnesium [2]	-- - --	1 / 1	34.0	LCKSW-2	NSV	-- / --	NSV
Thallium	-- - --	1 / 1	0.0080	LCKSW-2	0.079	-- / --	< 1
Non-Detected Constituents							
Inorganics (MG/L)							
Aluminum	0.10 - 0.10	0 / 1	--	--	NSV	-- / --	NSV
Antimony	0.060 - 0.060	0 / 1	--	--	0.90	-- / --	< 1
Arsenic	0.0050 - 0.0050	0 / 1	--	--	0.34	-- / --	< 1
Beryllium	0.0050 - 0.0050	0 / 1	--	--	0.093	-- / --	< 1
Cadmium	0.0050 - 0.0050	0 / 1	--	--	0.0045	-- / --	**1.1**
Chromium, total	0.010 - 0.010	0 / 1	--	--	1.80	-- / --	< 1
Cobalt	0.010 - 0.010	0 / 1	--	--	0.22	-- / --	< 1
Copper	0.020 - 0.020	0 / 1	--	--	0.014	-- / --	**1.4**
Lead	0.0050 - 0.0050	0 / 1	--	--	0.12	-- / --	< 1
Mercury	2.00E-04 - 2.00E-04	0 / 1	--	--	0.0017	-- / --	< 1
Nickel	0.040 - 0.040	0 / 1	--	--	0.47	-- / --	< 1
Selenium	0.0050 - 0.0050	0 / 1	--	--	0.0050	-- / --	< 1
Silver	0.010 - 0.010	0 / 1	--	--	0.0016	-- / --	**6.3**
Vanadium	0.010 - 0.010	0 / 1	--	--	0.15	-- / --	< 1
Zinc	0.020 - 0.020	0 / 1	--	--	0.12	-- / --	< 1

TABLE 7-21

Screening Statistics-- East Ditch Surface Water

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Dissolved Metals (MG/L)							
Aluminum	0.10 - 0.10	0 / 1	--	--	NSV	-- / --	NSV
Antimony	0.060 - 0.060	0 / 1	--	--	9.00E-01	-- / --	< 1
Beryllium	0.0050 - 0.0050	0 / 1	--	--	9.30E-02	-- / --	< 1
Cadmium	0.0050 - 0.0050	0 / 1	--	--	4.30E-03	-- / --	**1.2**
Chromium	0.010 - 0.010	0 / 1	--	--	5.70E-01	-- / --	< 1
Cobalt	0.010 - 0.010	0 / 1	--	--	2.20E-01	-- / --	< 1
Copper	0.020 - 0.020	0 / 1	--	--	1.30E-02	-- / --	**1.5**
Iron	0.10 - 0.10	0 / 1	--	--	NSV	-- / --	NSV
Lead	0.0050 - 0.0050	0 / 1	--	--	9.70E-02	-- / --	< 1
Mercury	2.00E-04 - 2.00E-04	0 / 1	--	--	1.40E-03	-- / --	< 1
Nickel	0.040 - 0.040	0 / 1	--	--	4.70E-01	-- / --	< 1
Potassium [2]	5.00 - 5.00	0 / 1	--	--	NSV	-- / --	NSV
Selenium	0.0050 - 0.0050	0 / 1	--	--	4.60E-03	-- / --	**1.1**
Silver	0.010 - 0.010	0 / 1	--	--	1.40E-03	-- / --	**7.1**
Vanadium	0.010 - 0.010	0 / 1	--	--	1.50E-01	-- / --	< 1
Zinc	0.020 - 0.020	0 / 1	--	--	1.20E-01	-- / --	< 1
Pesticide/Polychlorinated Biphenyls (MG/L)							
Aldrin	5.00E-05 - 5.00E-05	0 / 1	--	--	1.70E-05	-- / --	**2.9**
Chlordane, technical-	0.0010 - 0.0010	0 / 1	--	--	NSV	-- / --	NSV
DDD, p,p'-	1.00E-04 - 1.00E-04	0 / 1	--	--	NSV	-- / --	NSV
DDE, p,p'-	1.00E-04 - 1.00E-04	0 / 1	--	--	4.51E-12	-- / --	**22,172,949**
DDT, p,p'-	1.00E-04 - 1.00E-04	0 / 1	--	--	1.10E-08	-- / --	**9,091**
Dieldrin	1.00E-04 - 1.00E-04	0 / 1	--	--	2.40E-04	-- / --	< 1
Endosulfan A	5.00E-05 - 5.00E-05	0 / 1	--	--	5.60E-05	-- / --	< 1
Endosulfan B	1.00E-04 - 1.00E-04	0 / 1	--	--	5.60E-05	-- / --	**1.8**
Endosulfan sulfate	1.00E-04 - 1.00E-04	0 / 1	--	--	0.0022	-- / --	< 1
Endrin	1.00E-04 - 1.00E-04	0 / 1	--	--	8.60E-05	-- / --	**1.2**
Endrin aldehyde	1.00E-04 - 1.00E-04	0 / 1	--	--	1.50E-04	-- / --	< 1
Endrin ketone	1.00E-04 - 1.00E-04	0 / 1	--	--	NSV	-- / --	NSV
Heptachlor	5.00E-05 - 5.00E-05	0 / 1	--	--	3.80E-06	-- / --	**13**
Heptachlor epoxide	5.00E-05 - 5.00E-05	0 / 1	--	--	3.80E-06	-- / --	**13**
Hexachlorocyclohexane, alpha-	5.00E-05 - 5.00E-05	0 / 1	--	--	NSV	-- / --	NSV
Hexachlorocyclohexane, beta-	5.00E-05 - 5.00E-05	0 / 1	--	--	NSV	-- / --	NSV

TABLE 7-21

Screening Statistics-- East Ditch Surface Water

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Hexachlorocyclohexane, delta-	5.00E-05 - 5.00E-05	0 / 1	--	--	NSV	-- / --	NSV
Hexachlorocyclohexane, gamma- (Lindane)	5.00E-05 - 5.00E-05	0 / 1	--	--	9.50E-04	-- / --	< 1
Methoxychlor	5.00E-04 - 5.00E-04	0 / 1	--	--	NSV	-- / --	NSV
PCB 1016	0.0010 - 0.0010	0 / 1	--	--	0.00000012	-- / --	**8333**
PCB 1221	0.0020 - 0.0020	0 / 1	--	--	0.00000012	-- / --	**16667**
PCB 1232	0.0010 - 0.0010	0 / 1	--	--	0.00000012	-- / --	**8333**
PCB 1242	0.0010 - 0.0010	0 / 1	--	--	0.00000012	-- / --	**8333**
PCB 1248	0.0010 - 0.0010	0 / 1	--	--	0.00000012	-- / --	**8333**
PCB 1254	0.0010 - 0.0010	0 / 1	--	--	0.00000012	-- / --	**8333**
PCB 1260	0.0010 - 0.0010	0 / 1	--	--	0.00000012	-- / --	**8333**
Toxaphene	0.0050 - 0.0050	0 / 1	--	--	1.40E-07	-- / --	**35714**
Semivolatile Organic Compounds (MG/L)							
Acenaphthene	0.010 - 0.010	0 / 1	--	--	0.019	-- / --	< 1
Acenaphthylene	0.010 - 0.010	0 / 1	--	--	4.84	-- / --	< 1
Anthracene	0.010 - 0.010	0 / 1	--	--	1.80E-04	-- / --	**56**
Benz(a)anthracene	0.010 - 0.010	0 / 1	--	--	2.50E-05	-- / --	**400**
Benzo(a)pyrene	0.010 - 0.010	0 / 1	--	--	1.40E-05	-- / --	**714**
Benzo(b)fluoranthene	0.010 - 0.010	0 / 1	--	--	0.0091	-- / --	**1.1**
Benzo(ghi)perylene	0.010 - 0.010	0 / 1	--	--	0.0076	-- / --	**1.3**
Benzo(k)fluoranthene	0.010 - 0.010	0 / 1	--	--	NSV	-- / --	NSV
Bis(2-chloroethoxy) methane	0.010 - 0.010	0 / 1	--	--	NSV	-- / --	NSV
Bis(2-chloroethyl) ether	0.010 - 0.010	0 / 1	--	--	19.0	-- / --	< 1
Bis(2-ethylhexyl) phthalate	0.010 - 0.010	0 / 1	--	--	1.10	-- / --	< 1
Bis(chloroisopropyl) ether	0.010 - 0.010	0 / 1	--	--	NSV	-- / --	NSV
Bromophenyl phenyl ether, 4-	0.010 - 0.010	0 / 1	--	--	NSV	-- / --	NSV
Butylbenzyl phthalate	0.010 - 0.010	0 / 1	--	--	0.023	-- / --	< 1
Carbazole	0.010 - 0.010	0 / 1	--	--	NSV	-- / --	NSV
Chloroaniline, 4-	0.010 - 0.010	0 / 1	--	--	0.23	-- / --	< 1
Chloronaphthalene, 2-	0.010 - 0.010	0 / 1	--	--	3.96E-04	-- / --	**25**
Chlorophenol, 2-	0.010 - 0.010	0 / 1	--	--	0.29	-- / --	< 1
Chlorophenyl phenyl ether, 4-	0.010 - 0.010	0 / 1	--	--	NSV	-- / --	NSV
Chrysene	0.010 - 0.010	0 / 1	--	--	NSV	-- / --	NSV
Dibenz(ah)anthracene	0.010 - 0.010	0 / 1	--	--	NSV	-- / --	NSV
Dibenzofuran	0.010 - 0.010	0 / 1	--	--	0.036	-- / --	< 1

TABLE 7-21
Screening Statistics-- East Ditch Surface Water
Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Dichlorobenzene, 1,2-	0.010 - 0.010	0 / 1	--	--	0.13	-- / --	< 1
Dichlorobenzene, 1,3-	0.010 - 0.010	0 / 1	--	--	0.079	-- / --	< 1
Dichlorobenzene, 1,4-	0.010 - 0.010	0 / 1	--	--	0.057	-- / --	< 1
Dichlorobenzidine, 3,3'-	0.010 - 0.010	0 / 1	--	--	NSV	-- / --	NSV
Dichlorophenol, 2,4-	0.010 - 0.010	0 / 1	--	--	0.11	-- / --	< 1
Diethyl phthalate	0.010 - 0.010	0 / 1	--	--	9.80	-- / --	< 1
Dimethyl phthalate	0.010 - 0.010	0 / 1	--	--	3.20	-- / --	< 1
Dimethylphenol, 2,4-	0.010 - 0.010	0 / 1	--	--	0.14	-- / --	< 1
Di-n-butyl phthalate	0.010 - 0.010	0 / 1	--	--	0.0097	-- / --	**1.03**
Dinitro-2-methylphenol, 4,6-	0.025 - 0.025	0 / 1	--	--	NSV	-- / --	NSV
Dinitrophenol, 2,4-	0.025 - 0.025	0 / 1	--	--	0.019	-- / --	**1.3**
Di-n-octyl phthalate	0.010 - 0.010	0 / 1	--	--	0.030	-- / --	< 1
Fluoranthene	0.010 - 0.010	0 / 1	--	--	0.0037	-- / --	**2.7**
Fluorene	0.010 - 0.010	0 / 1	--	--	0.11	-- / --	< 1
Hexachlorobenzene	0.010 - 0.010	0 / 1	--	--	3.00E-07	-- / --	**33,333**
Hexachlorobutadiene	0.010 - 0.010	0 / 1	--	--	5.30E-05	-- / --	**189**
Hexachlorocyclopentadiene	0.010 - 0.010	0 / 1	--	--	0.077	-- / --	< 1
Hexachloroethane	0.010 - 0.010	0 / 1	--	--	0.0080	-- / --	**1.3**
Indeno(1,2,3-cd)pyrene	0.010 - 0.010	0 / 1	--	--	0.0043	-- / --	**2.3**
Isophorone	0.010 - 0.010	0 / 1	--	--	0.92	-- / --	< 1
Methylnaphthalene, 2-	0.010 - 0.010	0 / 1	--	--	0.33	-- / --	< 1
Methylphenol, 2-	0.010 - 0.010	0 / 1	--	--	0.60	-- / --	< 1
Methylphenol, 4-	0.010 - 0.010	0 / 1	--	--	0.48	-- / --	< 1
Methylphenol, 4-chloro-3-	0.010 - 0.010	0 / 1	--	--	NSV	-- / --	NSV
Naphthalene	0.010 - 0.010	0 / 1	--	--	0.17	-- / --	< 1
Nitroaniline, 2-	0.025 - 0.025	0 / 1	--	--	NSV	-- / --	NSV
Nitroaniline, 3-	0.025 - 0.025	0 / 1	--	--	NSV	-- / --	NSV
Nitroaniline, 4-	0.025 - 0.025	0 / 1	--	--	NSV	-- / --	NSV
Nitrophenol, 2-	0.010 - 0.010	0 / 1	--	--	0.65	-- / --	< 1
Nitrophenol, 4-	0.025 - 0.025	0 / 1	--	--	0.65	-- / --	< 1
Nitrosodi-N-propylamine, N-	0.010 - 0.010	0 / 1	--	--	NSV	-- / --	NSV
Nitrosodiphenylamine, N-	0.010 - 0.010	0 / 1	--	--	0.77	-- / --	< 1
Pentachlorophenol	0.025 - 0.025	0 / 1	--	--	0.0040	-- / --	**6.3**
Phenanthrene	0.010 - 0.010	0 / 1	--	--	0.031	-- / --	< 1

TABLE 7-21

Screening Statistics-- East Ditch Surface Water

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Phenol	0.010 - 0.010	0 / 1	--	--	4.70	-- / --	< 1
Pyrene	0.010 - 0.010	0 / 1	--	--	0.042	-- / --	< 1
Trichlorobenzene, 1,2,4-	0.010 - 0.010	0 / 1	--	--	0.030	-- / --	< 1
Trichlorophenol, 2,4,5-	0.025 - 0.025	0 / 1	--	--	0.039	-- / --	< 1
Trichlorophenol, 2,4,6-	0.010 - 0.010	0 / 1	--	--	0.039	-- / --	< 1
Volatile Organic Compounds (MG/L)							
Acetone	0.010 - 0.010	0 / 1	--	--	1.70	-- / --	< 1
Benzene	0.0010 - 0.0010	0 / 1	--	--	0.70	-- / --	< 1
Bromodichloromethane	0.0010 - 0.0010	0 / 1	--	--	NSV	-- / --	NSV
Bromoform	0.0010 - 0.0010	0 / 1	--	--	1.10	-- / --	< 1
Bromomethane	0.0010 - 0.0010	0 / 1	--	--	0.038	-- / --	< 1
Carbon disulfide	0.0010 - 0.0010	0 / 1	--	--	0.13	-- / --	< 1
Carbon tetrachloride	0.0010 - 0.0010	0 / 1	--	--	2.20	-- / --	< 1
Chlorobenzene	0.0010 - 0.0010	0 / 1	--	--	0.42	-- / --	< 1
Chloroethane	0.0020 - 0.0020	0 / 1	--	--	NSV	-- / --	NSV
Chloroform	0.0010 - 0.0010	0 / 1	--	--	1.30	-- / --	< 1
Chloromethane	0.0020 - 0.0020	0 / 1	--	--	NSV	-- / --	NSV
Dibromochloromethane	0.0010 - 0.0010	0 / 1	--	--	NSV	-- / --	NSV
Dichloroethane, 1,1-	0.0010 - 0.0010	0 / 1	--	--	0.047	-- / --	< 1
Dichloroethane, 1,2-	0.0010 - 0.0010	0 / 1	--	--	9.60	-- / --	< 1
Dichloroethene, 1,1-	0.0010 - 0.0010	0 / 1	--	--	1.90	-- / --	< 1
Dichloroethenes, 1,2-, total	0.0010 - 0.0010	0 / 1	--	--	8.80	-- / --	< 1
Dichloropropane, 1,2-	0.0010 - 0.0010	0 / 1	--	--	3.30	-- / --	< 1
Dichloropropene, 1,3-, cis-	0.0010 - 0.0010	0 / 1	--	--	0.015	-- / --	< 1
Dichloropropene, 1,3-, trans-	0.0010 - 0.0010	0 / 1	--	--	0.015	-- / --	< 1
Ethylbenzene	0.0010 - 0.0010	0 / 1	--	--	0.55	-- / --	< 1
Methyl ethyl ketone	0.010 - 0.010	0 / 1	--	--	200	-- / --	< 1
Methyl isobutyl ketone	0.010 - 0.010	0 / 1	--	--	NSV	-- / --	NSV
Methyl n-butyl ketone	0.010 - 0.010	0 / 1	--	--	NSV	-- / --	NSV
Methylene chloride	0.0010 - 0.0010	0 / 1	--	--	11.0	-- / --	< 1
Styrene	0.0010 - 0.0010	0 / 1	--	--	0.032	-- / --	< 1
Tetrachloroethane, 1,1,2,2-	0.0010 - 0.0010	0 / 1	--	--	0.91	-- / --	< 1
Tetrachloroethene	0.0010 - 0.0010	0 / 1	--	--	0.43	-- / --	< 1
Toluene	0.0010 - 0.0010	0 / 1	--	--	0.56	-- / --	< 1

TABLE 7-21

Screening Statistics-- East Ditch Surface Water

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Trichloroethane, 1,1,1-	0.0010 - 0.0010	0 / 1	--	--	0.69	-- / --	< 1
Trichloroethane, 1,1,2-	0.0010 - 0.0010	0 / 1	--	--	3.30	-- / --	< 1
Trichloroethene	0.0010 - 0.0010	0 / 1	--	--	2.00	-- / --	< 1
Vinyl chloride	0.0010 - 0.0010	0 / 1	--	--	8.40	-- / --	< 1
Xylenes, total	0.0010 - 0.0010	0 / 1	--	--	0.24	-- / --	< 1
Dioxin/Furans (MG/L)							
Amino-2,6-dinitrotoluene, 4-	6.00E-04 - 6.00E-04	0 / 1	--	--	0.098	-- / --	< 1
Amino-4,6-dinitrotoluene, 2-	5.00E-04 - 5.00E-04	0 / 1	--	--	0.16	-- / --	< 1
Dinitrobenzene, 1,3-	2.00E-04 - 2.00E-04	0 / 1	--	--	0.10	-- / --	< 1
Dinitrotoluene, 2,4-	5.00E-04 - 5.00E-04	0 / 1	--	--	0.39	-- / --	< 1
Dinitrotoluene, 2,6-	5.00E-04 - 5.00E-04	0 / 1	--	--	0.73	-- / --	< 1
HMX	4.00E-04 - 4.00E-04	0 / 1	--	--	1.20	-- / --	< 1
Nitrobenzene	6.00E-04 - 6.00E-04	0 / 1	--	--	2.00	-- / --	< 1
Nitrotoluene, 2-	6.00E-04 - 6.00E-04	0 / 1	--	--	0.64	-- / --	< 1
Nitrotoluene, 3-	4.00E-04 - 4.00E-04	0 / 1	--	--	0.38	-- / --	< 1
Nitrotoluene, 4-	4.00E-04 - 4.00E-04	0 / 1	--	--	0.41	-- / --	< 1
RDX	6.00E-04 - 6.00E-04	0 / 1	--	--	0.52	-- / --	< 1
Tetryl	4.00E-04 - 4.00E-04	0 / 1	--	--	NSV	-- / --	NSV
Trinitrobenzene, 1,3,5-	5.00E-04 - 5.00E-04	0 / 1	--	--	NSV	-- / --	NSV
Trinitrotoluene, 2,4,6-	7.00E-04 - 7.00E-04	0 / 1	--	--	NSV	-- / --	NSV

[1] Shaded cells indicate hazard quotient based on reporting limits

[2] Macronutrient - Not considered to be a COPC

Note:

NSV = No Screening Value

TABLE 7-22

Screening Statistics--Food Web Exposures AOC 1 Soil--Step 2

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Detected Constituents							
Aluminum	-- - --	32 / 32	26,000	LCKSO-6 2-3	NSV	32 / 32	NSV
Antimony	5.20 - 66.0	2 / 32	1.40	EEGLKB-SS10	0.27	2 / 32	**5.2**
Barium	-- - --	48 / 48	490	EEGLKB-SS01	2,000	0 / 48	< 1
Beryllium	0.51 - 6.00	22 / 32	3.32	LCKSO-7 2-3	21.0	0 / 32	< 1
Cadmium	0.42 - 6.00	20 / 48	6.30	LCK-SO9B	0.36	16 / 48	**18**
Cobalt	11.0 - 11.0	31 / 32	12.0	LCKSO-1 2-3	120	0 / 32	< 1
Copper	21.0 - 23.0	29 / 32	140	LCKSO-8 0-1	28.0	7 / 32	**5.00**
Chromium, total	-- - --	16 / 16	22.0	LCKSB-15 0-0.5	26.0	0 / 16	< 1
Lead	-- - --	48 / 48	9,340	LCKSO-8 0-1	11.0	42 / 48	**849**
Mercury	2.00E-05 - 0.33	22 / 48	0.79	LCK-SO6B	0.10	6 / 48	**7.9**
Selenium	0.14 - 11.0	19 / 48	3.50	EEGLKB-SS02	0.63	13 / 48	**5.6**
Silver	0.42 - 11.0	4 / 48	190	EEGLKB-SS14	4.20	1 / 48	**45**
Thallium	0.51 - 18.0	17 / 32	2.80	EEGLKB-SS02	0.057	17 / 32	**49**
Zinc	-- - --	48 / 48	1,650	LCK-SO6B	46.0	39 / 48	**36**
Pesticide/Polychlorinated Biphenyls (MG/KG)							
Chlordane, alpha-	0.0019 - 0.22	2 / 36	0.16	EEGLKB-SS12	0.22	0 / 36	< 1
Chlordane, gamma-	0.0019 - 0.22	3 / 36	0.44	EEGLKB-SS05	0.22	2 / 36	**2.0**
DDD, p,p'-	0.0020 - 0.22	6 / 40	0.36	EEGLKB-SS11	0.76	0 / 40	< 1
DDE, p,p'-	0.0020 - 0.22	8 / 40	0.20	EEGLKB-SS11	0.60	0 / 40	< 1
DDT, p,p'-	0.0020 - 0.22	11 / 40	0.42	EEGLKB-SS11	0.0035	11 / 40	**120**
PCB 1242	0.019 - 2.00	2 / 40	0.23	EEGLKB-SS05	0.000332	2 / 40	**693**
PCB 1248	0.019 - 0.77	1 / 40	16.0	EEGLKB-SS10	0.000332	1 / 40	**48,193**
PCB 1254	0.019 - 2.00	5 / 40	0.81	LCK-SODUP2	0.000332	5 / 40	**2440**
PCB 1260	0.019 - 2.00	3 / 40	0.26	EEGLKB-SS18	0.000332	1 / 40	**783**
Total PCBs	-- - --	5 / 40	22	EEGLKB-SS10	0.000332	5 / 40	**66265**

TABLE 7-22

Screening Statistics--Food Web Exposures AOC 1 Soil--Step 2

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Semivolatile Organic Compounds (MG/KG)							
Acenaphthene	0.038 - 8.10	19 / 41	85.0	EEGLKB-SS06	682	0 / 41	< 1
Acenaphthylene	0.038 - 8.10	9 / 41	1.90	EEGLKB-SS08	682	0 / 41	< 1
Anthracene	0.039 - 3.50	27 / 41	160	EEGLKB-SS05	1,480	0 / 41	< 1
Benz(a)anthracene	0.039 - 3.50	33 / 41	450	EEGLKB-SS05	5.21	9 / 41	**86**
Benzo(a)pyrene	0.039 - 3.50	32 / 41	380	EEGLKB-SS05	1.52	15 / 41	**250**
Benzo(b)fluoranthene	0.35 - 3.50	34 / 41	340	EEGLKB-SS05	59.8	6 / 41	**5.7**
Benzo(ghi)perylene	0.039 - 3.50	31 / 41	110	EEGLKB-SS05	119	0 / 41	< 1
Benzo(k)fluoranthene	0.35 - 3.50	34 / 41	340	EEGLKB-SS05	148	5 / 41	**2.3**
Benzoic acid	0.77 - 19.0	3 / 20	4.80	EEGLKB-SS02	NSV	-- / --	NSV
Bis(2-ethylhexyl) phthalate	0.19 - 4.70	8 / 41	16.0	LCKSB-12 0-0.5	0.93	3 / 41	**17**
Butylbenzyl phthalate	0.074 - 8.10	1 / 41	0.73	LCK-SO6B	NSV	-- / --	NSV
Carbazole	0.19 - 4.00	17 / 41	88.0	EEGLKB-SS06	NSV	-- / --	NSV
Chrysene	0.35 - 3.50	35 / 41	470	EEGLKB-SS05	4.73	10 / 41	**99**
Dibenz(ah)anthracene	0.038 - 3.50	22 / 41	71.0	EEGLKB-SS05	18.4	4 / 41	**3.9**
Dibenzofuran	0.077 - 8.10	16 / 41	42.0	EEGLKB-SS06	NSV	-- / --	NSV
Diethyl phthalate	0.074 - 8.10	1 / 41	1.30	LCK-SO6B	24.8	0 / 41	< 1
Di-n-butyl phthalate	0.040 - 8.10	1 / 41	2.60	LCK-SO6B	0.15	1 / 41	**17**
Di-n-octyl phthalate	0.35 - 9.20	1 / 41	15.0	LCKSB-12 0-0.5	NSV	-- / --	NSV
Fluoranthene	0.35 - 3.50	35 / 41	1,100	EEGLKB-SS05	122	5 / 41	**9.0**
Fluorene	0.038 - 8.10	17 / 41	67.0	EEGLKB-SS06	122	0 / 41	< 1
Indeno(1,2,3-cd)pyrene	0.039 - 3.50	30 / 41	130	EEGLKB-SS05	109	2 / 41	**1.2**
Methylnaphthalene, 2-	0.039 - 8.10	13 / 41	14.0	EEGLKB-SS06	3.24	6 / 41	**4.3**
Methylphenol, 3- and/or 4-	0.074 - 1.90	2 / 20	0.25	EEGLKB-SS05	NSV	-- / --	NSV
Naphthalene	0.039 - 8.10	11 / 41	13.0	EEGLKB-SS06	0.099	9 / 41	**131**
Phenanthrene	0.039 - 0.44	34 / 41	600	EEGLKB-SS06	45.7	6 / 41	**13**
Phenol	0.19 - 8.10	3 / 41	0.88	LCK-SO1A	1,200	0 / 41	< 1
Pyrene	0.040 - 3.50	33 / 41	870	EEGLKB-SS05	45.7	6 / 41	**19**
Total Low Molecular Weight PAHs	- - -	34 / 41	910	EEGLKB-SS06	100	5 / 41	**9.1**
Total High Molecular Weight PAHs	- - -	35 / 41	4,261	EEGLKB-SS05	1.1	14 / 41	**3874**

TABLE 7-22

Screening Statistics--Food Web Exposures AOC 1 Soil--Step 2

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Explosives (MG/KG)							
Trichlorobenzene, 1,2,4-	0.19 - 8.10	1 / 41	2.10	LCK-SO6B	11.1	0 / 41	< 1
Trinitrobenzene, 1,3,5-	7.00E-04 - 2.50	1 / 23	1.60	EEGLKB-SS02	4.30	0 / 23	< 1
Trinitrotoluene, 2,4,6-	5.00E-04 - 0.25	2 / 23	5.30	EEGLKB-SS08 Dup02	NSV	-- / --	NSV
Volatile Organic Compounds (MG/KG)							
Acetone	0.0090 - 0.029	20 / 41	34.0	EEGLKB-SS18	2.50	5 / 41	**14**
Ethylbenzene	0.0050 - 0.0083	1 / 40	0.026	LCK-SO6B-RE	5.16	0 / 40	< 1
Methylene chloride	0.0030 - 0.037	1 / 41	0.16	LCK-SO6B-RE	4.05	0 / 41	< 1
Toluene	0.0015 - 0.0083	10 / 40	0.014	LCK-SO6B-RE	5.45	0 / 40	< 1
Trichlorofluoromethane	0.0047 - 0.0083	14 / 20	0.0082	EEGLKB-SS03	16.4	0 / 20	< 1
Xylenes, total	0.0052 - 0.0070	1 / 20	0.033	LCK-SO6B-RE	10.0	0 / 20	< 1
Dioxin/Furans (MG/KG)							
Heptachlorodibenzofuran, 1,2,3,4,6,7,8-	5.00E-07 - 2.10E-06	13 / 15	3.17E-04	LCKSO-7 2-3	NSV	-- / --	NSV
Heptachlorodibenzofuran, 1,2,3,4,7,8,9-	7.00E-07 - 3.90E-06	4 / 15	1.52E-05	LCKSO-7 2-3	NSV	-- / --	NSV
Heptachlorodibenzofurans, total	6.00E-07 - 2.30E-06	13 / 15	0.0014	LCKSO-7 2-3	NSV	-- / --	NSV
Heptachlorodibenzo-p-dioxin, 1,2,3,4,6,7,8-	-- - --	15 / 15	0.0012	LCKSO-7 2-3	NSV	-- / --	NSV
Heptachlorodibenzo-p-dioxins, total	-- - --	15 / 15	0.0021	LCKSO-7 2-3	NSV	-- / --	NSV
Hexachlorodibenzofuran, 1,2,3,4,7,8-	4.00E-07 - 2.60E-06	6 / 12	5.00E-06	LCKSO-8 2-3	NSV	-- / --	NSV
Hexachlorodibenzofuran, 1,2,3,6,7,8-	4.00E-07 - 1.00E-06	7 / 15	7.70E-06	LCKSO-7 2-3	NSV	-- / --	NSV
Hexachlorodibenzofuran, 1,2,3,7,8,9-	1.20E-07 - 2.00E-06	2 / 15	2.50E-06	LCKSO-7 2-3	NSV	-- / --	NSV
Hexachlorodibenzofuran, 2,3,4,6,7,8-	3.00E-07 - 2.30E-06	4 / 11	2.90E-06	LCKSB-12 0-0.5	NSV	-- / --	NSV
Hexachlorodibenzofurans, total	5.40E-07 - 1.50E-05	12 / 15	3.19E-04	LCKSO-7 2-3	NSV	-- / --	NSV
Hexachlorodibenzo-p-dioxin, 1,2,3,4,7,8-	2.80E-07 - 2.90E-06	6 / 15	3.60E-05	LCKSO-7 2-3	NSV	-- / --	NSV
Hexachlorodibenzo-p-dioxin, 1,2,3,6,7,8-	4.00E-07 - 7.70E-06	9 / 15	1.18E-04	LCKSO-7 2-3	NSV	-- / --	NSV
Hexachlorodibenzo-p-dioxin, 1,2,3,7,8,9-	6.00E-07 - 5.10E-06	4 / 9	8.00E-06	LCKSB-13 0-0.5	NSV	-- / --	NSV
Hexachlorodibenzo-p-dioxins, total	2.10E-06 - 4.00E-06	12 / 15	5.53E-04	LCKSO-7 2-3	NSV	-- / --	NSV
Octachlorodibenzofuran	8.00E-07 - 8.30E-06	13 / 15	0.0013	LCKSO-7 2-3	NSV	-- / --	NSV
Octachlorodibenzo-p-dioxin	-- - --	15 / 15	0.016	EEGLKB-SS16	NSV	-- / --	NSV
Pentachlorodibenzofuran, 1,2,3,7,8-	1.20E-07 - 1.00E-06	3 / 15	7.60E-06	LCKSO-7 2-3	NSV	-- / --	NSV
Pentachlorodibenzofuran, 2,3,4,7,8-	4.00E-07 - 9.00E-07	4 / 15	7.80E-06	LCKSO-7 2-3	NSV	-- / --	NSV
Pentachlorodibenzofurans, total	4.00E-07 - 1.60E-06	12 / 15	1.11E-04	LCKSO-7 2-3	NSV	-- / --	NSV

TABLE 7-22

Screening Statistics--Food Web Exposures AOC 1 Soil--Step 2

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient^1
Pentachlorodibenzo-p-dioxin, 1,2,3,7,8-	4.10E-07 - 1.50E-06	4 / 15	1.58E-05	LCKSO-7 2-3	NSV	-- / --	NSV
Pentachlorodibenzo-p-dioxins, total	4.70E-07 - 3.40E-06	9 / 15	6.98E-05	LCKSO-7 2-3	NSV	-- / --	NSV
TCDD-TEQ	-- - --	15 / 15	6.60E-05	LCKSO-7 2-3	3.15E-07	15 / 15	**210**
Tetrachlorodibenzofuran, 2,3,7,8-	4.60E-07 - 3.30E-06	7 / 15	1.63E-05	LCKSO-6 2-3	NSV	-- / --	NSV
Tetrachlorodibenzofurans, total	2.00E-07 - 4.00E-06	11 / 15	9.57E-05	LCKSO-7 2-3	NSV	-- / --	NSV
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-	1.80E-07 - 1.00E-06	6 / 15	4.80E-06	LCKSO-9 0-1	NSV	-- / --	NSV
Tetrachlorodibenzo-p-dioxins, total	2.90E-07 - 1.00E-06	11 / 15	4.86E-05	LCKSO-7 2-3	NSV	-- / --	NSV
Non-Detected Constituents							
Pesticide/Polychlorinated Biphenyls (MG/KG)							
Aldrin	0.0017 - 0.22	0 / 40	--	--	0.0033	-- / --	**66**
Chlordane, technical-	0.035 - 0.041	0 / 4	--	--	NSV	-- / --	NSV
Dieldrin	0.0020 - 0.40	0 / 40	--	--	0.0024	-- / --	**168**
Endosulfan A	0.0017 - 0.22	0 / 40	--	--	0.12	-- / --	**1.8**
Endosulfan B	0.0020 - 0.40	0 / 40	--	--	0.12	-- / --	**3.4**
Endosulfan sulfate	0.0020 - 0.22	0 / 40	--	--	0.036	-- / --	**6.1**
Endrin	0.0020 - 0.40	0 / 40	--	--	0.010	-- / --	**40**
Endrin aldehyde	0.0020 - 0.40	0 / 40	--	--	0.011	-- / --	**38**
Endrin ketone	0.0020 - 0.22	0 / 40	--	--	NSV	-- / --	NSV
Heptachlor	0.0017 - 0.22	0 / 40	--	--	0.0060	-- / --	**37**
Heptachlor epoxide	0.0017 - 0.22	0 / 40	--	--	0.15	-- / --	**1.4**
Hexachlorocyclohexane, alpha-	0.0017 - 0.22	0 / 40	--	--	NSV	-- / --	NSV
Hexachlorocyclohexane, beta-	0.0017 - 0.22	0 / 40	--	--	NSV	-- / --	NSV
Hexachlorocyclohexane, delta-	0.0017 - 0.22	0 / 40	--	--	NSV	-- / --	NSV
Hexachlorocyclohexane, gamma- (Lindane)	0.0017 - 0.22	0 / 40	--	--	NSV	-- / --	NSV
Methoxychlor	0.0096 - 2.00	0 / 40	--	--	0.020	-- / --	**101**
PCB 1016	0.019 - 2.00	0 / 40	--	--	0.037	-- / --	**54**
PCB 1221	0.019 - 2.00	0 / 40	--	--	0.037	-- / --	**54**
PCB 1232	0.019 - 2.00	0 / 40	--	--	0.037	-- / --	**54**
Toxaphene	0.019 - 3.90	0 / 40	--	--	0.12	-- / --	**33**

TABLE 7-22

Screening Statistics--Food Web Exposures AOC 1 Soil--Step 2

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Herbicides (MG/KG)							
2,4,5-T	0.012 - 0.026	0 / 16	--	--	NSV	-- / --	NSV
2,4,5-TP	0.012 - 0.026	0 / 16	--	--	NSV	-- / --	NSV
2,4-D	0.023 - 0.052	0 / 16	--	--	0.027	-- / --	**1.9**
Semivolatile Organic Compounds (MG/KG)							
Benzidine	3.70 - 92.0	0 / 20	--	--	NSV	-- / --	NSV
Benzyl alcohol	0.74 - 19.0	0 / 20	--	--	NSV	-- / --	NSV
Bis(2-chloroethoxy) methane	0.074 - 8.10	0 / 41	--	--	0.30	-- / --	**27**
Bis(2-chloroethyl) ether	0.074 - 8.10	0 / 41	--	--	23.7	-- / --	< 1
Bis(2-chloroisopropyl) ether	0.38 - 3.50	0 / 17	--	--	NSV	-- / --	NSV
Bis(chloroisopropyl) ether	0.19 - 8.10	0 / 24	--	--	19.4	-- / --	< 1
Bromophenyl phenyl ether, 4-	0.19 - 8.10	0 / 41	--	--	NSV	-- / --	NSV
Chloroaniline, 4-	0.35 - 19.0	0 / 41	--	--	1.10	-- / --	**17**
Chloronaphthalene, 2-	0.19 - 8.10	0 / 41	--	--	0.012	-- / --	**664**
Chlorophenol, 2-	0.19 - 8.10	0 / 41	--	--	0.24	-- / --	**33**
Chlorophenyl phenyl ether, 4-	0.19 - 8.10	0 / 41	--	--	NSV	-- / --	NSV
Dichlorobenzene, 1,2-	0.19 - 8.10	0 / 41	--	--	2.96	-- / --	**2.7**
Dichlorobenzene, 1,3-	0.19 - 8.10	0 / 41	--	--	37.7	-- / --	< 1
Dichlorobenzene, 1,4-	0.19 - 8.10	0 / 41	--	--	0.55	-- / --	**15**
Dichlorobenzidine, 3,3'-	0.19 - 8.10	0 / 41	--	--	0.65	-- / --	**13**
Dichlorophenol, 2,4-	0.35 - 9.20	0 / 41	--	--	87.5	-- / --	< 1
Dimethyl phthalate	0.074 - 8.10	0 / 41	--	--	734	-- / --	< 1
Dimethylphenol, 2,4-	0.35 - 9.20	0 / 41	--	--	0.010	-- / --	**920**
Dinitro-2-methylphenol, 4,6-	0.74 - 20.0	0 / 41	--	--	NSV	-- / --	NSV
Dinitrophenol, 2,4-	0.74 - 20.0	0 / 41	--	--	0.069	-- / --	**290**
Hexachlorobenzene	0.037 - 8.10	0 / 41	--	--	0.20	-- / --	**41**
Hexachlorobutadiene	0.19 - 8.10	0 / 41	--	--	NSV	-- / --	NSV
Hexachlorocyclopentadiene	0.35 - 19.0	0 / 41	--	--	NSV	-- / --	NSV
Hexachloroethane	0.19 - 8.10	0 / 41	--	--	NSV	-- / --	NSV
Isophorone	0.19 - 8.10	0 / 41	--	--	NSV	-- / --	NSV
Methylphenol, 2-	0.074 - 8.10	0 / 41	--	--	NSV	-- / --	NSV

TABLE 7-22

Screening Statistics--Food Web Exposures AOC 1 Soil--Step 2

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Semivolatile Organic Compounds (MG/KG)	0.35 - 8.10	0 / 21	--	--	NSV	-- / --	NSV
Methylphenol, 4-chloro-3-	0.35 - 9.20	0 / 41	--	--	NSV	-- / --	NSV
Nitroaniline, 2-	0.19 - 20.0	0 / 41	--	--	74.1	-- / --	< 1
Nitroaniline, 3-	0.74 - 20.0	0 / 41	--	--	3.16	-- / --	**6.3**
Nitroaniline, 4-	0.74 - 20.0	0 / 41	--	--	21.9	-- / --	< 1
Nitrophenol, 2-	0.35 - 9.20	0 / 41	--	--	1.60	-- / --	**5.8**
Nitrophenol, 4-	0.74 - 20.0	0 / 41	--	--	1.60	-- / --	**13**
Nitrosodi-N-propylamine, N-	0.037 - 8.10	0 / 41	--	--	NSV	-- / --	NSV
Nitrosodiphenylamine, N-	0.037 - 8.10	0 / 41	--	--	0.55	-- / --	**15**
Pentachlorophenol	0.37 - 20.0	0 / 41	--	--	0.12	-- / --	**168**
Trichlorobenzene, 1,2,3-	0.0050 - 0.0083	0 / 20	--	--	11.1	-- / --	< 1
Trichlorophenol, 2,4,5-	0.37 - 20.0	0 / 41	--	--	14.1	-- / --	**1.4**
Trichlorophenol, 2,4,6-	0.19 - 8.10	0 / 41	--	--	9.94	-- / --	< 1
Explosives (MG/KG)							
Amino-2,6-dinitrotoluene, 4-	0.0011 - 5.00	0 / 7	--	--	NSV	-- / --	NSV
Amino-4,6-dinitrotoluene, 2-	9.00E-04 - 5.00	0 / 7	--	--	NSV	-- / --	NSV
Aminodinitrotoluenes, total	0.44 - 0.50	0 / 16	--	--	NSV	-- / --	NSV
Dinitrobenzene, 1,3-	5.00E-04 - 2.50	0 / 23	--	--	NSV	-- / --	NSV
Dinitrotoluene, 2,4-	5.00E-04 - 2.50	0 / 40	--	--	1.28	-- / --	**2.0**
Dinitrotoluene, 2,6-	5.00E-04 - 5.00	0 / 40	--	--	0.033	-- / --	**152**
HMX	9.00E-04 - 5.00	0 / 23	--	--	NSV	-- / --	NSV
Nitrobenzene	6.00E-04 - 2.50	0 / 40	--	--	1.31	-- / --	**1.9**
Nitrotoluene, 2-	9.00E-04 - 5.00	0 / 23	--	--	NSV	-- / --	NSV
Nitrotoluene, 3-	9.00E-04 - 5.00	0 / 23	--	--	NSV	-- / --	NSV
Nitrotoluene, 4-	0.0011 - 5.00	0 / 23	--	--	NSV	-- / --	NSV
RDX	5.00E-04 - 2.50	0 / 23	--	--	NSV	-- / --	NSV
Tetryl	0.0019 - 5.00	0 / 23	--	--	NSV	-- / --	NSV

TABLE 7-22

Screening Statistics--Food Web Exposures AOC 1 Soil--Step 2

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Volatile Organic Compounds (MG/KG)							
Benzene	0.0050 - 0.044	0 / 41	--	--	0.26	-- / --	< 1
Bromobenzene	0.0050 - 0.0083	0 / 20	--	--	NSV	-- / --	NSV
Bromochloromethane	0.0050 - 0.0083	0 / 20	--	--	NSV	-- / --	NSV
Bromodichloromethane	0.0050 - 0.044	0 / 41	--	--	0.54	-- / --	< 1
Bromoform	0.0050 - 0.044	0 / 41	--	--	15.9	-- / --	< 1
Bromomethane	0.0052 - 0.088	0 / 41	--	--	NSV	-- / --	NSV
Butylbenzene, 1-	0.0050 - 0.0083	0 / 20	--	--	NSV	-- / --	NSV
Butylbenzene, sec-	0.0050 - 0.0083	0 / 20	--	--	NSV	-- / --	NSV
Butylbenzene, tert-	0.0050 - 0.0083	0 / 20	--	--	NSV	-- / --	NSV
Carbon disulfide	0.0052 - 0.044	0 / 41	--	--	0.094	-- / --	< 1
Carbon tetrachloride	0.0050 - 0.044	0 / 41	--	--	2.98	-- / --	< 1
Chlorobenzene	0.0050 - 0.044	0 / 40	--	--	13.1	-- / --	< 1
Chloroethane	0.0050 - 0.088	0 / 41	--	--	NSV	-- / --	NSV
Chloroform	0.0050 - 0.044	0 / 41	--	--	1.19	-- / --	< 1
Chloromethane	0.0050 - 0.088	0 / 41	--	--	NSV	-- / --	NSV
Chlorotoluene, 2-	0.0050 - 0.0083	0 / 20	--	--	NSV	-- / --	NSV
Chlorotoluene, 4-	0.0050 - 0.0083	0 / 20	--	--	NSV	-- / --	NSV
Dibromochloromethane	0.0050 - 0.044	0 / 41	--	--	2.05	-- / --	< 1
Dibromochloropropane	0.0050 - 0.0083	0 / 20	--	--	0.035	-- / --	< 1
Dichlorodifluoromethane	0.0050 - 0.0083	0 / 20	--	--	39.5	-- / --	< 1
Dichloroethane, 1,1-	0.0050 - 0.044	0 / 41	--	--	20.1	-- / --	< 1
Dichloroethane, 1,2-	0.0050 - 0.044	0 / 41	--	--	21.2	-- / --	< 1
Dichloroethene, 1,1-	0.0050 - 0.044	0 / 41	--	--	8.28	-- / --	< 1
Dichloroethene, 1,2-, cis-	0.0050 - 0.0083	0 / 20	--	--	0.78	-- / --	< 1
Dichloroethene, 1,2-, trans-	0.0050 - 0.0083	0 / 20	--	--	0.78	-- / --	< 1
Dichloroethenes, 1,2-, total	0.0052 - 0.044	0 / 21	--	--	NSV	-- / --	NSV
Dichloropropane, 1,2-	0.0050 - 0.044	0 / 41	--	--	32.7	-- / --	< 1
Dichloropropane, 1,3-	0.0050 - 0.0083	0 / 20	--	--	32.7	-- / --	< 1
Dichloropropane, 2,2-	0.0050 - 0.0083	0 / 20	--	--	32.7	-- / --	< 1
Dichloropropene, 1,1-	0.0050 - 0.0083	0 / 20	--	--	0.40	-- / --	< 1

TABLE 7-22

Screening Statistics--Food Web Exposures AOC 1 Soil--Step 2

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Dichloropropene, 1,3-, cis-	0.0050 - 0.044	0 / 41	--	--	0.40	-- / --	< 1
Dichloropropene, 1,3-, trans-	0.0050 - 0.044	0 / 41	--	--	0.40	-- / --	< 1
Ethylene dibromide	0.0050 - 0.0083	0 / 20	--	--	NSV	-- / --	NSV
Isopropylbenzene	0.0050 - 0.0083	0 / 20	--	--	NSV	-- / --	NSV
Isopropyltoluene, 4-	0.0050 - 0.0083	0 / 20	--	--	NSV	-- / --	NSV
Methyl ethyl ketone	0.010 - 0.088	0 / 41	--	--	89.6	-- / --	< 1
Methyl isobutyl ketone	0.010 - 0.088	0 / 40	--	--	NSV	-- / --	NSV
Methyl n-butyl ketone	0.010 - 0.088	0 / 40	--	--	NSV	-- / --	NSV
Methyl tert-butyl ether	0.0050 - 0.0083	0 / 20	--	--	NSV	-- / --	NSV
Methylene bromide	0.0050 - 0.0083	0 / 20	--	--	65.0	-- / --	< 1
Propylbenzene, 1-	0.0050 - 0.0083	0 / 20	--	--	NSV	-- / --	NSV
Styrene	0.0050 - 0.044	0 / 40	--	--	4.69	-- / --	< 1
Tetrachloroethane, 1,1,1,2-	0.0050 - 0.0083	0 / 20	--	--	0.13	-- / --	< 1
Tetrachloroethane, 1,1,2,2-	0.0050 - 0.044	0 / 40	--	--	0.13	-- / --	< 1
Tetrachloroethene	0.0050 - 0.044	0 / 40	--	--	9.92	-- / --	< 1
Trichloroethane, 1,1,1-	0.0050 - 0.044	0 / 41	--	--	29.8	-- / --	< 1
Trichloroethane, 1,1,2-	0.0050 - 0.044	0 / 41	--	--	28.6	-- / --	< 1
Trichloroethene	0.0050 - 0.044	0 / 41	--	--	12.4	-- / --	< 1
Trichloropropane, 1,2,3-	0.0050 - 0.0083	0 / 20	--	--	3.36	-- / --	< 1
Trimethylbenzene, 1,2,4-	0.0050 - 0.0083	0 / 20	--	--	NSV	-- / --	NSV
Trimethylbenzene, 1,3,5-	0.0050 - 0.0083	0 / 20	--	--	NSV	-- / --	NSV
Vinyl chloride	0.0050 - 0.088	0 / 41	--	--	0.65	-- / --	< 1
Xylene, 1,2-	0.0050 - 0.0083	0 / 20	--	--	NSV	-- / --	NSV
Xylene, 1,3- and/or 1,4-	0.0099 - 0.017	0 / 20	--	--	NSV	-- / --	NSV

[1] Shaded cells indicate hazard quotient based on reporting limits

[2] Macronutrient: Not considered to be a COPC

Note:

NSV = No Screening Value

TABLE 7-23

Screening Statistics--Food Web Exposures AOC 2 Soil --Step 2

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Detected Constituents							
Inorganics (MG/KG)							
Arsenic	-- - --	16 / 16	25.1	LCK-SO3B	18	1 / 16	**1.4**
Barium	-- - --	16 / 16	200	LCKSB-11[3]	2,000	0 / 16	< 1
Beryllium	0.57 - 1.00	6 / 8	2.40	EEGLKB-SS21	21	0 / 8	< 1
Calcium [2]	-- - --	8 / 8	100,000	LCKSB-11 2-4	NSV	-- / --	NSV
Cobalt	-- - --	8 / 8	26.0	LCKSB-11[3]	120	0 / 8	< 1
Lead	-- - --	16 / 16	40.2	LCKSB-11[3]	11	14 / 16	**3.7**
Magnesium [2]	-- - --	8 / 8	48,000	LCKSB-11 2-4	NSV	-- / --	NSV
Manganese	990 - 990	7 / 8	1,600	LCKSB-11[3]	4,000	0 / 8	< 1
Mercury	0.061 - 0.13	5 / 16	0.080	LCK-SO3A	0.10	0 / 16	< 1
Potassium [2]	-- - --	8 / 8	3,300	LCKSB-11[3]	NSV	-- / --	NSV
Selenium	0.15 - 1.80	7 / 16	0.60	EEGLKB-SS21	0.63	0 / 16	< 1
Sodium [2]	110 - 320	3 / 8	210	EEGLKB-SS20 Dup01	NSV	-- / --	NSV
Thallium	0.57 - 1.00	4 / 8	2.20	EEGLKB-SS21	0.057	4 / 8	**39**
Zinc	-- - --	16 / 16	125	LCK-SO5B	46.0	14 / 16	**2.7**
Pesticide/Polychlorinated Biphenyls (MG/KG)							
DDD, p,p'-	0.0023 - 0.012	1 / 16	0.017	LCK-SO4A	0.76	0 / 16	< 1
DDE, p,p'-	0.0023 - 0.012	3 / 16	0.81	LCK-SO4A	0.60	1 / 16	**1.4**
DDT, p,p'-	0.0023 - 0.012	3 / 16	0.46	LCK-SO4A	0.0035	3 / 16	**131**
Semivolatile Organic Compounds (MG/KG)							
Acenaphthene	0.039 - 0.44	2 / 16	0.014	EEGLKB-SS21	682	0 / 16	< 1
Anthracene	0.039 - 0.44	2 / 16	0.045	EEGLKB-SS21	1,480	0 / 16	< 1
Benz(a)anthracene	0.044 - 0.44	4 / 16	0.17	EEGLKB-SS21	5.21	0 / 16	< 1
Benzo(a)pyrene	0.044 - 0.44	4 / 16	0.17	EEGLKB-SS21	1.52	0 / 16	< 1
Benzo(b)fluoranthene	0.38 - 0.44	5 / 16	0.16	EEGLKB-SS21	59.8	0 / 16	< 1
Benzo(ghi)perylene	0.38 - 0.44	5 / 16	0.11	EEGLKB-SS21	119	0 / 16	< 1
Benzo(k)fluoranthene	0.38 - 0.44	5 / 16	0.18	EEGLKB-SS21	148	0 / 16	< 1
Benzoic acid	0.79 - 0.89	1 / 4	1.10	EEGLKB-SS21	NSV	-- / --	NSV
Chrysene	0.38 - 0.44	5 / 16	0.22	EEGLKB-SS21	4.73	0 / 16	< 1

TABLE 7-23

Screening Statistics--Food Web Exposures AOC 2 Soil --Step 2

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient^1
Dibenz(ah)anthracene	0.039 - 0.44	2 / 16	0.044	EEGLKB-SS21	18.4	0 / 16	< 1
Dibenzofuran	0.079 - 0.44	2 / 16	0.070	EEGLKB-SS21	NSV	-- / --	NSV
Di-n-butyl phthalate	0.038 - 0.44	1 / 16	0.041	LCK-SO4A	0.15	0 / 16	< 1
Fluoranthene	0.38 - 0.44	7 / 16	0.32	LCK-SO4A	122	0 / 16	< 1
Indeno(1,2,3-cd)pyrene	0.039 - 0.44	3 / 16	0.095	LCK-SO4A	109	0 / 16	< 1
Methylnaphthalene, 2-	0.039 - 0.44	2 / 16	0.28	EEGLKB-SS21	3.24	0 / 16	< 1
Naphthalene	0.044 - 0.44	4 / 16	0.12	EEGLKB-SS21	0.099	1 / 16	**1.2**
Nitrosodiphenylamine, N-	0.042 - 0.44	1 / 16	0.026	EEGLKB-SS20	0.55	0 / 16	< 1
Phenanthrene	0.38 - 0.44	5 / 16	0.36	EEGLKB-SS22	45.7	0 / 16	< 1
Pyrene	0.039 - 0.44	5 / 16	0.27	EEGLKB-SS21	45.7	0 / 16	< 1
Total Low Molecular Weight PAHs	- - -	5 / 16	0.9	EEGLKB-SS21	100	0 / 16	< 1
Total High Molecular Weight PAHs	- - -	7 / 16	1.7	LCK-SO4A	1.1	1 / 16	**1.6**
Volatile Organic Compounds (MG/KG)							
Acetone	0.0050 - 0.024	5 / 16	40.0	EEGLKB-SS22	2.50	2 / 16	**16**
Dichloropropene, 1,3-, trans-	0.0052 - 0.0072	2 / 16	0.0050	LCK-SO5B	0.40	0 / 16	< 1
Methylene chloride	0.0050 - 0.023	4 / 16	0.012	LCK-SODUP1	4.05	0 / 16	< 1
Trichlorofluoromethane	0.0052 - 0.0063	1 / 4	0.0049	EEGLKB-SS22	16.4	0 / 4	< 1
Dioxin/Furans (MG/KG)							
Hexachlorodibenzofuran, 1,2,3,6,7,8-	3.00E-07 - 4.50E-07	1 / 5	5.90E-07	LCKSB-10 0-0.5	NSV	-- / --	NSV
Hexachlorodibenzo-p-dioxins, total	1.30E-06 - 4.60E-06	1 / 5	2.40E-06	LCKSB-10 0-0.5	NSV	-- / --	NSV
Pentachlorodibenzo-p-dioxins, total	5.00E-07 - 1.10E-06	1 / 5	8.70E-07	LCKSB-10 0-0.5	NSV	-- / --	NSV
Hexachlorodibenzofuran, 1,2,3,4,7,8-	3.10E-07 - 5.00E-07	2 / 5	1.20E-06	LCKSB-10 0-0.5	NSV	-- / --	NSV
Hexachlorodibenzofuran, 2,3,4,6,7,8-	4.00E-07 - 5.00E-07	2 / 5	1.00E-06	LCKSB-10 0-0.5	NSV	-- / --	NSV
Hexachlorodibenzo-p-dioxin, 1,2,3,6,7,8-	3.00E-07 - 5.00E-07	2 / 5	5.90E-07	LCKSB-10 0-0.5	NSV	-- / --	NSV
Hexachlorodibenzo-p-dioxin, 1,2,3,7,8,9-	4.00E-07 - 5.00E-07	2 / 5	1.20E-06	LCKSB-11^3	NSV	-- / --	NSV
Tetrachlorodibenzo-p-dioxin, 2,3,7,8-	3.00E-07 - 5.00E-07	2 / 5	3.90E-06	EEGLKB-SS20	NSV	-- / --	NSV
Heptachlorodibenzofuran, 1,2,3,4,6,7,8-	6.00E-07 - 2.10E-06	3 / 5	2.70E-06	LCKSB-11^3	NSV	-- / --	NSV
Heptachlorodibenzofurans, total	7.00E-07 - 2.10E-06	3 / 5	5.40E-06	LCKSB-11^3	NSV	-- / --	NSV
Hexachlorodibenzofurans, total	5.00E-07 - 1.30E-06	3 / 5	4.90E-06	LCKSB-10 0-0.5	NSV	-- / --	NSV
Octachlorodibenzofuran	5.00E-07 - 1.40E-06	3 / 5	5.60E-06	LCKSB-11 0-0.5	NSV	-- / --	NSV
Tetrachlorodibenzofuran, 2,3,7,8-	2.70E-07 - 4.00E-07	3 / 5	8.20E-07	LCKSB-18 0-0.5	NSV	-- / --	NSV

TABLE 7-23

Screening Statistics--Food Web Exposures AOC 2 Soil --Step 2

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Tetrachlorodibenzo-p-dioxins, total	8.90E-07 - 1.40E-06	3 / 5	3.90E-06	EEGLKB-SS20	NSV	-- / --	NSV
Octachlorodibenzo-p-dioxin	2.50E-06 - 2.50E-06	4 / 5	4.20E-04	EEGLKB-SS20	NSV	-- / --	NSV
Pentachlorodibenzofurans, total	5.00E-07 - 5.00E-07	4 / 5	6.30E-06	LCKSB-10 0-0.5	NSV	-- / --	NSV
Tetrachlorodibenzofurans, total	4.00E-07 - 4.00E-07	4 / 5	2.90E-06	LCKSB-10 0-0.5	NSV	-- / --	NSV
Heptachlorodibenzo-p-dioxin, 1,2,3,4,6,7,8-	-- - --	5 / 5	7.20E-06	EEGLKB-SS20 Dup01	NSV	-- / --	NSV
Heptachlorodibenzo-p-dioxins, total	-- - --	5 / 5	1.50E-05	EEGLKB-SS20 Dup01	NSV	-- / --	NSV
TCDD-TEQ	-- - --	5 / 5	4.63E-06	EEGLKB-SS20	3.15E-07	5 / 5	**15**
Non-Detected Constituents							
Inorganics (MG/KG)							
Antimony	5.40 - 13.0	0 / 8	--	--	0.27	-- / --	**48**
Pesticide/Polychlorinated Biphenyls (MG/KG)							
Aldrin	0.0019 - 0.012	0 / 16	--	--	0.0033	-- / --	**3.6**
Chlordane, alpha-	0.0020 - 0.012	0 / 12	--	--	0.22	-- / --	< 1
Chlordane, gamma-	0.0020 - 0.012	0 / 12	--	--	0.22	-- / --	< 1
Chlordane, technical-	0.038 - 0.039	0 / 4	--	--	NSV	-- / --	NSV
Dieldrin	0.0023 - 0.012	0 / 16	--	--	0.0024	-- / --	**5.0**
Endosulfan A	0.0019 - 0.012	0 / 16	--	--	0.12	-- / --	< 1
Endosulfan B	0.0023 - 0.012	0 / 16	--	--	0.12	-- / --	< 1
Endosulfan sulfate	0.0023 - 0.012	0 / 16	--	--	0.036	-- / --	< 1
Endrin	0.0023 - 0.012	0 / 16	--	--	0.010	-- / --	**1.2**
Endrin aldehyde	0.0023 - 0.012	0 / 16	--	--	0.011	-- / --	**1.1**
Endrin ketone	0.0023 - 0.012	0 / 16	--	--	NSV	-- / --	NSV
Heptachlor	0.0019 - 0.012	0 / 16	--	--	0.0060	-- / --	**2.0**
Heptachlor epoxide	0.0019 - 0.012	0 / 16	--	--	0.15	-- / --	< 1
Hexachlorocyclohexane, alpha-	0.0019 - 0.012	0 / 16	--	--	NSV	-- / --	NSV
Hexachlorocyclohexane, beta-	0.0019 - 0.012	0 / 16	--	--	NSV	-- / --	NSV
Hexachlorocyclohexane, delta-	0.0019 - 0.012	0 / 16	--	--	NSV	-- / --	NSV
Hexachlorocyclohexane, gamma- (Lindane	0.0019 - 0.012	0 / 16	--	--	NSV	-- / --	NSV
Methoxychlor	0.011 - 0.056	0 / 16	--	--	0.020	-- / --	**2.8**
PCB 1016	0.020 - 0.045	0 / 16	--	--	0.000332	-- / --	**136**
PCB 1221	0.020 - 0.089	0 / 16	--	--	0.000332	-- / --	**268**

TABLE 7-23

Screening Statistics--Food Web Exposures AOC 2 Soil --Step 2

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
PCB 1232	0.020 - 0.045	0 / 16	--	--	0.000332	-- / --	**136**
PCB 1242	0.020 - 0.045	0 / 16	--	--	0.000332	-- / --	**136**
PCB 1248	0.020 - 0.045	0 / 16	--	--	0.000332	-- / --	**136**
PCB 1254	0.020 - 0.045	0 / 16	--	--	0.000332	-- / --	**136**
PCB 1260	0.020 - 0.045	0 / 16	--	--	0.000332	-- / --	**136**
Toxaphene	0.023 - 0.22	0 / 16	--	--	0.12	-- / --	**1.8**
Semivolatile Organic Compounds (MG/KG)							
Acenaphthylene	0.039 - 0.44	0 / 16	--	--	682	-- / --	< 1
Benzidine	3.90 - 4.40	0 / 4	--	--	NSV	-- / --	NSV
Benzyl alcohol	0.79 - 0.89	0 / 4	--	--	NSV	-- / --	NSV
Bis(2-chloroethoxy) methane	0.079 - 0.44	0 / 16	--	--	0.30	-- / --	**1.46**
Bis(2-chloroethyl) ether	0.079 - 0.44	0 / 16	--	--	23.7	-- / --	< 1
Bis(2-chloroisopropyl) ether	0.40 - 0.44	0 / 8	--	--	NSV	-- / --	NSV
Bis(2-ethylhexyl) phthalate	0.20 - 0.44	0 / 16	--	--	0.93	-- / --	< 1
Bis(chloroisopropyl) ether	0.20 - 0.39	0 / 8	--	--	19.4	-- / --	< 1
Bromophenyl phenyl ether, 4-	0.20 - 0.44	0 / 16	--	--	NSV	-- / --	NSV
Butylbenzyl phthalate	0.079 - 0.44	0 / 16	--	--	NSV	-- / --	NSV
Carbazole	0.20 - 0.44	0 / 16	--	--	NSV	-- / --	NSV
Chloroaniline, 4-	0.38 - 0.89	0 / 16	--	--	1.10	-- / --	< 1
Chloronaphthalene, 2-	0.20 - 0.44	0 / 16	--	--	0.012	-- / --	**36**
Chlorophenol, 2-	0.20 - 0.44	0 / 16	--	--	0.24	-- / --	**1.8**
Chlorophenyl phenyl ether, 4-	0.20 - 0.44	0 / 16	--	--	NSV	-- / --	NSV
Dichlorobenzene, 1,2-	0.20 - 0.44	0 / 16	--	--	2.96	-- / --	< 1
Dichlorobenzene, 1,3-	0.20 - 0.44	0 / 16	--	--	37.7	-- / --	< 1
Dichlorobenzene, 1,4-	0.20 - 0.44	0 / 16	--	--	0.55	-- / --	< 1
Dichlorobenzidine, 3,3'-	0.20 - 0.88	0 / 16	--	--	0.65	-- / --	**1.4**
Dichlorophenol, 2,4-	0.38 - 0.44	0 / 16	--	--	87.5	-- / --	< 1
Diethyl phthalate	0.079 - 0.44	0 / 16	--	--	24.8	-- / --	< 1
Dimethyl phthalate	0.079 - 0.44	0 / 16	--	--	734	-- / --	< 1
Dimethylphenol, 2,4-	0.38 - 0.44	0 / 16	--	--	0.010	-- / --	**44**
Dinitro-2-methylphenol, 4,6-	0.79 - 2.20	0 / 16	--	--	NSV	-- / --	NSV

TABLE 7-23

Screening Statistics--Food Web Exposures AOC 2 Soil --Step 2

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Dinitrophenol, 2,4-	0.79 - 2.20	0 / 16	--	--	0.069	-- / --	**32**
Di-n-octyl phthalate	0.38 - 0.44	0 / 16	--	--	NSV	-- / --	NSV
Fluorene	0.039 - 0.44	0 / 16	--	--	122	-- / --	< 1
Hexachlorobenzene	0.039 - 0.44	0 / 16	--	--	0.20	-- / --	**2.21**
Hexachlorobutadiene	0.20 - 0.44	0 / 16	--	--	NSV	-- / --	NSV
Hexachlorocyclopentadiene	0.38 - 0.89	0 / 16	--	--	NSV	-- / --	NSV
Hexachloroethane	0.20 - 0.44	0 / 16	--	--	NSV	-- / --	NSV
Isophorone	0.20 - 0.44	0 / 16	--	--	NSV	-- / --	NSV
Methylphenol, 2-	0.079 - 0.44	0 / 16	--	--	NSV	-- / --	NSV
Methylphenol, 3- and/or 4-	0.079 - 0.089	0 / 4	--	--	NSV	-- / --	NSV
Methylphenol, 4-	0.38 - 0.44	0 / 12	--	--	NSV	-- / --	NSV
Methylphenol, 4-chloro-3-	0.38 - 0.44	0 / 16	--	--	NSV	-- / --	NSV
Nitroaniline, 2-	0.20 - 2.20	0 / 16	--	--	74.1	-- / --	< 1
Nitroaniline, 3-	0.79 - 2.20	0 / 16	--	--	3.16	-- / --	< 1
Nitroaniline, 4-	0.79 - 2.20	0 / 16	--	--	21.9	-- / --	< 1
Nitrophenol, 2-	0.38 - 0.44	0 / 16	--	--	1.60	-- / --	< 1
Nitrophenol, 4-	0.79 - 2.20	0 / 16	--	--	1.60	-- / --	**1.4**
Nitrosodi-N-propylamine, N-	0.039 - 0.44	0 / 16	--	--	NSV	-- / --	NSV
Pentachlorophenol	0.39 - 2.20	0 / 16	--	--	0.12	-- / --	**18**
Phenol	0.20 - 0.44	0 / 16	--	--	1,200	-- / --	< 1
Trichlorobenzene, 1,2,3-	0.0052 - 0.0072	0 / 4	--	--	11.1	-- / --	< 1
Trichlorobenzene, 1,2,4-	0.20 - 0.44	0 / 16	--	--	11.1	-- / --	< 1
Trichlorophenol, 2,4,5-	0.39 - 2.20	0 / 16	--	--	14.1	-- / --	< 1
Trichlorophenol, 2,4,6-	0.20 - 0.44	0 / 16	--	--	9.94	-- / --	< 1
Volatile Organic Compounds (MG/KG)							
Benzene	0.0052 - 0.0072	0 / 16	--	--	0.26	-- / --	< 1
Bromobenzene	0.0052 - 0.0072	0 / 4	--	--	NSV	-- / --	NSV
Bromochloromethane	0.0052 - 0.0072	0 / 4	--	--	NSV	-- / --	NSV
Bromodichloromethane	0.0052 - 0.0072	0 / 16	--	--	0.54	-- / --	< 1
Bromoform	0.0052 - 0.0072	0 / 16	--	--	15.9	-- / --	< 1
Bromomethane	0.0055 - 0.014	0 / 16	--	--	NSV	-- / --	NSV

TABLE 7-23

Screening Statistics--Food Web Exposures AOC 2 Soil --Step 2

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Butylbenzene, 1-	0.0052 - 0.0072	0 / 4	--	--	NSV	-- / --	NSV
Butylbenzene, sec-	0.0052 - 0.0072	0 / 4	--	--	NSV	-- / --	NSV
Butylbenzene, tert-	0.0052 - 0.0072	0 / 4	--	--	NSV	-- / --	NSV
Carbon disulfide	0.0055 - 0.014	0 / 16	--	--	0.094	-- / --	< 1
Carbon tetrachloride	0.0052 - 0.0072	0 / 16	--	--	2.98	-- / --	< 1
Chlorobenzene	0.0052 - 0.0072	0 / 16	--	--	13.1	-- / --	< 1
Chloroethane	0.0052 - 0.014	0 / 16	--	--	NSV	-- / --	NSV
Chloroform	0.0052 - 0.0072	0 / 16	--	--	1.19	-- / --	< 1
Chloromethane	0.0052 - 0.014	0 / 16	--	--	NSV	-- / --	NSV
Chlorotoluene, 2-	0.0052 - 0.0072	0 / 4	--	--	NSV	-- / --	NSV
Chlorotoluene, 4-	0.0052 - 0.0072	0 / 4	--	--	NSV	-- / --	NSV
Dibromochloromethane	0.0052 - 0.0072	0 / 16	--	--	2.05	-- / --	< 1
Dibromochloropropane	0.0052 - 0.0072	0 / 4	--	--	0.035	-- / --	< 1
Dichlorodifluoromethane	0.0052 - 0.0072	0 / 4	--	--	39.5	-- / --	< 1
Dichloroethane, 1,1-	0.0052 - 0.0072	0 / 16	--	--	20.1	-- / --	< 1
Dichloroethane, 1,2-	0.0052 - 0.0072	0 / 16	--	--	21.2	-- / --	< 1
Dichloroethene, 1,1-	0.0052 - 0.0072	0 / 16	--	--	8.28	-- / --	< 1
Dichloroethene, 1,2-, cis-	0.0052 - 0.0072	0 / 4	--	--	0.78	-- / --	< 1
Dichloroethene, 1,2-, trans-	0.0052 - 0.0072	0 / 4	--	--	0.78	-- / --	< 1
Dichloroethenes, 1,2-, total	0.0055 - 0.0070	0 / 12	--	--	NSV	-- / --	NSV
Dichloropropane, 1,2-	0.0052 - 0.0072	0 / 16	--	--	32.7	-- / --	< 1
Dichloropropane, 1,3-	0.0052 - 0.0072	0 / 4	--	--	32.7	-- / --	< 1
Dichloropropane, 2,2-	0.0052 - 0.0072	0 / 4	--	--	32.7	-- / --	< 1
Dichloropropene, 1,1-	0.0052 - 0.0072	0 / 4	--	--	0.40	-- / --	< 1
Dichloropropene, 1,3-, cis-	0.0052 - 0.0072	0 / 16	--	--	0.40	-- / --	< 1
Ethylbenzene	0.0052 - 0.0072	0 / 16	--	--	5.16	-- / --	< 1
Ethylene dibromide	0.0052 - 0.0072	0 / 4	--	--	NSV	-- / --	NSV
Isopropylbenzene	0.0052 - 0.0072	0 / 4	--	--	NSV	-- / --	NSV
Isopropyltoluene, 4-	0.0052 - 0.0072	0 / 4	--	--	NSV	-- / --	NSV
Methyl ethyl ketone	0.011 - 0.029	0 / 16	--	--	89.6	-- / --	< 1
Methyl isobutyl ketone	0.011 - 0.029	0 / 16	--	--	NSV	-- / --	NSV

TABLE 7-23

Screening Statistics--Food Web Exposures AOC 2 Soil --Step 2

Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient^1
Methyl n-butyl ketone	0.011 - 0.029	0 / 16	--	--	NSV	-- / --	NSV
Methyl tert-butyl ether	0.0052 - 0.0072	0 / 4	--	--	NSV	-- / --	NSV
Methylene bromide	0.0052 - 0.0072	0 / 4	--	--	65.0	-- / --	< 1
Propylbenzene, 1-	0.0052 - 0.0072	0 / 4	--	--	NSV	-- / --	NSV
Styrene	0.0052 - 0.0072	0 / 16	--	--	4.69	-- / --	< 1
Tetrachloroethane, 1,1,1,2-	0.0052 - 0.0072	0 / 4	--	--	0.13	-- / --	< 1
Tetrachloroethane, 1,1,2,2-	0.0052 - 0.0072	0 / 16	--	--	0.13	-- / --	< 1
Tetrachloroethene	0.0052 - 0.0072	0 / 16	--	--	9.92	-- / --	< 1
Toluene	0.0052 - 0.0072	0 / 16	--	--	5.45	-- / --	< 1
Trichloroethane, 1,1,1-	0.0052 - 0.0072	0 / 16	--	--	29.8	-- / --	< 1
Trichloroethane, 1,1,2-	0.0052 - 0.0072	0 / 16	--	--	28.6	-- / --	< 1
Trichloroethene	0.0052 - 0.0072	0 / 16	--	--	12.4	-- / --	< 1
Trichloropropane, 1,2,3-	0.0052 - 0.0072	0 / 4	--	--	3.36	-- / --	< 1
Trimethylbenzene, 1,2,4-	0.0052 - 0.0072	0 / 4	--	--	NSV	-- / --	NSV
Trimethylbenzene, 1,3,5-	0.0052 - 0.0072	0 / 4	--	--	NSV	-- / --	NSV
Vinyl chloride	0.0052 - 0.014	0 / 16	--	--	0.65	-- / --	< 1
Xylene, 1,2-	0.0052 - 0.0072	0 / 4	--	--	NSV	-- / --	NSV
Xylene, 1,3- and/or 1,4-	0.010 - 0.014	0 / 4	--	--	NSV	-- / --	NSV
Xylenes, total	0.0055 - 0.0070	0 / 12	--	--	10.0	-- / --	< 1
Trichloropropane, 1,2,3-					3.36	0	0.0
Trimethylbenzene, 1,2,4-					NSV	-- --	NSV
Trimethylbenzene, 1,3,5-					NSV	-- --	NSV
Vinyl chloride	0.0052 - 0.013	0 / 12	--	--	0.65	-- / --	< 1
Xylene, 1,2-					NSV	-- --	NSV
Xylene, 1,3- and/or 1,4-					NSV	-- --	NSV
Xylenes, total	0.0052 - 0.0061	0 / 12	--	--	10.0	-- / --	< 1
Heptachlorodibenzofuran, 1,2,3,4,7,8,9-	4.80E-07 - 8.00E-07	0 / 5	--	--	NSV	-- / --	NSV
Hexachlorodibenzofuran, 1,2,3,7,8,9-	3.30E-07 - 6.00E-07	0 / 5	--	--	NSV	-- / --	NSV
Hexachlorodibenzo-p-dioxin, 1,2,3,4,7,8-	4.00E-07 - 6.00E-07	0 / 5	--	--	NSV	-- / --	NSV
Pentachlorodibenzofuran, 1,2,3,7,8-	3.00E-07 - 5.00E-07	0 / 5	--	--	NSV	-- / --	NSV
Pentachlorodibenzofuran, 2,3,4,7,8-	3.00E-07 - 5.00E-07	0 / 5	--	--	NSV	-- / --	NSV

TABLE 7-23
Screening Statistics--Food Web Exposures AOC 2 Soil --Step 2
Former Lockbourne Air Force Base, Lockbourne, Ohio

Analyte Name	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]
Pentachlorodibenzo-p-dioxin, 1,2,3,7,8-	5.00E-07 - 8.00E-07	0 / 5	--	--	NSV	-- / --	NSV
Amino-2,6-dinitrotoluene, 4-	0.0011 - 0.49	0 / 5	--	--	NSV	-- / --	NSV
Amino-4,6-dinitrotoluene, 2-	9.00E-04 - 0.49	0 / 5	--	--	NSV	-- / --	NSV
Aminodinitrotoluenes, total	0.45 - 0.50	0 / 8	--	--	NSV	-- / --	NSV
Dinitrobenzene, 1,3-	5.00E-04 - 0.25	0 / 13	--	--	NSV	-- / --	NSV
Dinitrotoluene, 2,4-	5.00E-04 - 0.25	0 / 16	--	--	1.28	-- / --	< 1
Dinitrotoluene, 2,6-	5.00E-04 - 0.49	0 / 16	--	--	0.033	-- / --	**15**
HMX	9.00E-04 - 2.20	0 / 13	--	--	NSV	-- / --	NSV
Nitrobenzene	6.00E-04 - 0.26	0 / 16	--	--	1.31	-- / --	< 1
Nitrotoluene, 2-	9.00E-04 - 1.00	0 / 13	--	--	NSV	-- / --	NSV
Nitrotoluene, 3-	9.00E-04 - 1.00	0 / 13	--	--	NSV	-- / --	NSV
Nitrotoluene, 4-	0.0011 - 3.00	0 / 13	--	--	NSV	-- / --	NSV
RDX	5.00E-04 - 1.10	0 / 13	--	--	NSV	-- / --	NSV
Tetryl	0.0019 - 0.75	0 / 13	--	--	NSV	-- / --	NSV
Trinitrobenzene, 1,3,5-	7.00E-04 - 0.25	0 / 13	--	--	4.30	-- / --	< 1
Trinitrotoluene, 2,4,6-	5.00E-04 - 0.25	0 / 13	--	--	NSV	-- / --	NSV
2,4,5-T	0.012 - 0.025	0 / 8	--	--	NSV	-- / --	NSV
2,4,5-TP	0.012 - 0.025	0 / 8	--	--	NSV	-- / --	NSV
2,4-D	0.024 - 0.050	0 / 8	--	--	0.027	-- / --	**1.8**

[1] Shaded cells indicate hazard quotient based on reporting limits

[2] Macronutrient: Not considered to be a COPC

NSV = No Screening Value

3 - Result from Duplicate Sample: LCKSB-15 0-0.5

TABLE 7-24

Summary of Hazard Quotients for Food Web Exposures - West Ditch

Former Lockbourne Air Force Base, Lockbourne, Ohio

Chemical	Mink			Muskrat			Marsh wren			Belted kingfisher			Mallard		
	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC
Inorganics															
Aluminum	< 1	< 1	< 1	NA	NA	NA	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Arsenic	< 1	< 1	< 1	**9.7**	**1.9**	**4.4**	**1.9**	< 1	**1.1**	< 1	< 1	< 1	< 1	< 1	< 1
Barium	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Cobalt	< 1	< 1	< 1	< 1	< 1	< 1	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Lead	< 1	< 1	< 1	< 1	< 1	< 1	**1.5**	< 1	< 1	< 1	< 1	< 1	**2.9**	< 1	< 1
Manganese	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Selenium	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Thallium	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Zinc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Pesticides/PCBs															
4,4'-DDD	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
4,4'-DDE	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
4,4'-DDT	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
PCBs (total)	**15.2**	**1.5**	**4.8**	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Semivolatile Organics															
2-Methylnaphthalene	NA	NA	NA	NA	NA	NA	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Acenaphthene	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Acenaphthylene	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anthracene	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Benzo(a)anthracene	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Benzo(a)pyrene	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Benzo(b)fluoranthene	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Benzo(g,h,i)perylene	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Benzo(k)fluoranthene	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
bis(2-Ethylhexyl)phthalate	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Chrysene	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Di-n-butylphthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-octylphthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Fluorene	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Indeno(1,2,3-cd)pyrene	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Naphthalene	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Phenanthrene	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Phenol	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pyrene	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Volatile Organics															
Acetone	< 1	< 1	< 1	< 1	< 1	< 1	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dioxin/Furans (MG/KG)															
Dioxin/furan (TEQ) - Mammal (total)	< 1	< 1	< 1	< 1	< 1	< 1	--	--	--	--	--	--	--	--	--
Dioxin/furan (TEQ) - Bird (total)	--	--	--	--	--	--	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1

TABLE 7-25

Summary of Hazard Quotients for Food Web Exposures - East Ditch

Former Lockbourne Air Force Base, Lockbourne, Ohio

Chemical	**Mink**			**Muskrat**			**Marsh wren**			**Belted kingfisher**			**Mallard**		
	NOAEL	**LOAEL**	**MATC**	**NOAEL**	**LOAEL**	**MATC**	**NOAEL**	**LOAEL**	**MATC**	**NOAEL**	**LOAEL**	**MATC**	**NOAEL**	**LOAEL**	**MATC**
Inorganics															
Barium	<0.01	<0.01	<0.01	NA	NA	NA	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Thallium	0.01	<0.01	<0.01	NA	NA	NA	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Semivolatile Organics															
Fluoranthene	<0.01	<0.01	<0.01	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Pyrene	<0.01	<0.01	<0.01	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Volatile Organics															
Acetone	<0.01	<0.01	<0.01	< 1	< 1	< 1	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 7-26

Soil Bioconcentration Factors For Plants and Soil Invertebrates - Step 3

Former Lockbourne Air Force Base, Lockbourne, Ohio

Chemical	Soil-Plant BCF (dry weight)		Soil-Invertebrate BAF (dry weight)	
	Value	Reference[1]	Value	Reference[1]
Inorganics				
Aluminum	0.004	Baes et al. 1984	0.039	Sample et al. 1998a
Antimony	0.200	Baes et al. 1984	0.063	Helmke et al. 1979
Cadmium	0.514	Bechtel Jacobs 1998a	7.660	Sample et al. 1998a
Copper	0.123	Bechtel Jacobs 1998a	0.468	Sample et al. 1998a
Lead	0.038	Bechtel Jacobs 1998a	0.307	Sample et al. 1998a
Mercury	0.344	Bechtel Jacobs 1998a	1.186	Sample et al. 1998a
Selenium	0.567	Bechtel Jacobs 1998a	0.982	Sample et al. 1998a
Silver	0.013	Bechtel Jacobs 1998a	2.045	Sample et al. 1998a
Thallium	0.004	Baes et al. 1984	1.000	--
Zinc	0.358	Bechtel Jacobs 1998a	2.482	Sample et al. 1998a
Pesticides/PCBs				
4,4'-DDT	0.0065	Travis and Arms 1988	0.70	Menzie et al. 1992
Aroclor-1242	0.0224	Travis and Arms 1988	4.30	Sample et al. 1998a
Aroclor-1248	0.0101	Travis and Arms 1988	4.30	Sample et al. 1998a
Aroclor-1254	0.0068	Travis and Arms 1988	4.30	Sample et al. 1998a
Aroclor-1260	0.0045	Travis and Arms 1988	4.30	Sample et al. 1998a
PCBs (total)	0.0068	Travis and Arms 1988	4.30	Sample et al. 1998a
Semivolatile Organics				
Benzo(a)anthracene	0.0197	Travis and Arms 1988	0.27	Beyer and Stafford 1993
Benzo(a)pyrene	0.0114	Travis and Arms 1988	0.34	Beyer and Stafford 1993
Benzo(b)fluoranthene	0.0101	Travis and Arms 1988	0.21	Beyer and Stafford 1993
Benzo(k)fluoranthene	0.0101	Travis and Arms 1988	0.21	Beyer and Stafford 1993
Butylbenzylphthalate	0.0617	Travis and Arms 1988	1.00	--
Carbazole	0.3258	Travis and Arms 1988	1.00	--
Chrysene	0.0197	Travis and Arms 1988	0.44	Beyer and Stafford 1993
Dibenz(a,h)anthracene	0.0053	Travis and Arms 1988	0.49	Beyer and Stafford 1993
Dibenzofuran	0.1447	Travis and Arms 1988	1.00	--
Di-n-butylphthalate	0.0838	Travis and Arms 1988	1.00	--
Di-n-octylphthalate	0.0008	Travis and Arms 1988	1.00	--
Fluoranthene	0.0425	Travis and Arms 1988	0.37	Beyer and Stafford 1993
Fluorene	0.1428	Travis and Arms 1988	0.20	Beyer and Stafford 1993

TABLE 7-26

Soil Bioconcentration Factors For Plants and Soil Invertebrates - Step 3

Former Lockbourne Air Force Base, Lockbourne, Ohio

Chemical	Soil-Plant BCF (dry weight)		Soil-Invertebrate BAF (dry weight)	
	Value	Reference[1]	Value	Reference[1]
Naphthalene	0.4425	Travis and Arms 1988	0.21	Beyer and Stafford 1993
Phenanthrene	0.0908	Travis and Arms 1988	0.28	Beyer and Stafford 1993
Pyrene	0.0431	Travis and Arms 1988	0.39	Beyer and Stafford 1993
Volatile Organics				
Acetone	53.2991	Travis and Arms 1988	1.00	--
Explosives				
2,4,6,Trinitrotoluene	2.3987	Travis and Arms 1988	1.00	--
Dioxin/Furans				
Dioxin/furan (TEQ) - Mammal (total)	0.0065	Travis and Arms 1988	8.27	Sample et al. 1998a
Dioxin/furan (TEQ) - Bird (total)	0.0065	Travis and Arms 1988	8.27	Sample et al. 1998a

Notes:

[1] - See Section 9 of Text for Complete Reference

TABLE 7-27

Soil Bioaccumulation Factors For Small Mammals - Step 3

Former Lockbourne Air Force Base, Lockbourne, Ohio

Chemical	Soil-Mouse BAF (dry weight)		Soil-Shrew BAF (dry weight)	
	Value	Reference[1]	Value	Reference[1]
Inorganics				
Aluminum	0.062	Sample et al. 1998b	0.026	Sample et al. 1998b
Antimony	--	see text	--	see text
Cadmium	0.144	Sample et al. 1998b	2.212	Sample et al. 1998b
Copper	0.111	Sample et al. 1998b	0.502	Sample et al. 1998b
Lead	0.055	Sample et al. 1998b	0.148	Sample et al. 1998b
Mercury	0.054	Sample et al. 1998b	0.067	Sample et al. 1998b
Selenium	0.258	Sample et al. 1998b	0.273	Sample et al. 1998b
Silver	0.151	Sample et al. 1998b	0.036	Sample et al. 1998b
Thallium	0.112	Sample et al. 1998b	0.112	Sample et al. 1998b
Zinc	0.509	Sample et al. 1998b	0.862	Sample et al. 1998b
Pesticides/PCBs				
4,4'-DDT	--	see text	--	see text
Aroclor-1242	--	see text	--	see text
Aroclor-1248	--	see text	--	see text
Aroclor-1254	--	see text	--	see text
Aroclor-1260	--	see text	--	see text
PCBs (total)	--	see text	--	see text
Semivolatile Organics				
Benzo(a)anthracene	--	see text	--	see text
Benzo(a)pyrene	--	see text	--	see text
Benzo(b)fluoranthene	--	see text	--	see text
Benzo(k)fluoranthene	--	see text	--	see text
bis(2-Ethylhexyl)phthalate	--	see text	--	see text
Butylbenzylphthalate	--	see text	--	see text
Carbazole	--	see text	--	see text
Chrysene	--	see text	--	see text
Dibenz(a,h)anthracene	--	see text	--	see text
Dibenzofuran	--	see text	--	see text
Di-n-butylphthalate	--	see text	--	see text
Di-n-octylphthalate	--	see text	--	see text
Fluoranthene	--	see text	--	see text
Naphthalene	--	see text	--	see text
Phenanthrene	--	see text	--	see text
Pyrene	--	see text	--	see text
Volatile Organics				
Acetone	--	see text	--	see text
Explosives				
2,4,6,Trinitrotoluene	--	see text	--	see text
Dioxin/Furans				
Dioxin/furan (TEQ) - Mammal (total)	1.067	Sample et al. 1998b	1.067	Sample et al. 1998b
Dioxin/furan (TEQ) - Bird (total)	1.067	Sample et al. 1998b	1.067	Sample et al. 1998b

Notes:

[1] - See Section 9 of Text for Complete Reference

TABLE 7-28

Sediment Bioaccumulation Factors For Benthic Invertebrates, Fish, and Aquatic Plants- Step 3

Former Lockbourne Air Force Base, Lockbourne, Ohio

Chemical	Sediment-Invertebrate BAF (dry weight)		Sediment-Fish BAF (dry weight)		Sediment-Plant BCF (dry weight)	
	Value	Reference[1]	Value	Reference[1]	Value	Reference[1]
Inorganics						
Arsenic	0.466	Bechtel Jacobs 1998b	0.126	Pascoe et al. 1996	0.037	Bechtel Jacobs 1998a
Lead	0.080	Bechtel Jacobs 1998b	0.070	Krantzberg and Boyd 1992	0.038	Bechtel Jacobs 1998a
Pesticides/PCBs						
PCBs (total)	1.919	Bechtel Jacobs 1998b	12.940	Oliver and Niimi 1988	0.0068	Travis and Arms 1988

Notes:

[1] - See Section 9 of Text for Complete Reference

TABLE 7-29

Exposure Parameters for Upper Trophic Level Ecological Receptors - Step 3

Former Lockbourne Air Force Base, Lockbourne, Ohio

Receptor	Body Weight (kg)		Water Ingestion Rate (L/day)		Food Ingestion Rate (kg/day - dry)	
	Value	Reference[1]	Value	Reference[1]	Value	Reference[1]
Birds						
American robin	0.077	USEPA 1993d	0.0106	allometric equation	0.0055	Levey and Karasov 1989
Belted kingfisher	0.148	Dunning 1993	0.0164	allometric equation	0.0180	USEPA 1993a
Mallard	1.18	Bellrose 1980	0.0658	allometric equation	0.0647	allometric equation
Marsh wren	0.011	Dunning 1993	0.0029	allometric equation	0.0025	USEPA 1993d
Mourning dove	0.127	Tomlinson et al. 1994	0.0148	allometric equation	0.0151	allometric equation
Mammals						
Deer mouse	0.017	Silva and Downing 1995	0.0030	USEPA 1993d	0.0005	USEPA 1993d
Mink	0.777	Silva and Downing 1995	0.0218	USEPA 1993d	0.0263	USEPA 1993d
Muskrat	1.17	Silva and Downing 1995	0.1139	allometric equation	0.0596	USEPA 1993d
Red fox	4.06	Silva and Downing 1995	0.3494	allometric equation	0.1231	Sample and Suter 1994
Short-tailed shrew	0.017	USEPA 1993d	0.0038	USEPA 1993d	0.0015	USEPA 1993d

TABLE 7-29

Exposure Parameters for Upper Trophic Level Ecological Receptors - Step 3

Former Lockbourne Air Force Base, Lockbourne, Ohio

Receptor	Dietary Composition (percent)							Soil/ Sediment Ingestion (percent)	
	Terr. Plants	Soil Invert.	Small Mammals	Fish/ Frogs	Aquatic Plants	Benthic Invert.	Reference[1]	Value	Reference[1]
Birds									
American robin	51.9	43.5	0	0	0	0	Martin et al. 1951	4.6	Sample and Suter 1994
Belted kingfisher	0	0	0	84.0	0	16.0	USEPA 1993d	0	Sample and Suter 1994
Mallard	0	0	0	0	86.7	10.0	Palmer 1976	3.3	Beyer et al. 1994
Marsh wren	0	0	0	0	0	95.0	USEPA 1993d	5.0	Assumed based on diet
Mourning dove	95.0	0	0	0	0	0	Tomlinson et al. 1994	5.0	Assumed based on diet
Mammals									
Deer mouse	53.0	45.0	0	0	0	0	Martin et al. 1951	2.0	Beyer et al. 1994
Mink	0	0	0	94.0	1.0	5.0	USEPA 1993d	0	Sample and Suter 1994
Muskrat	0	0	0	0	90.6	0	USEPA 1993d	9.4	Beyer et al. 1994 (raccoon)
Red fox	7.0	2.8	87.4	0	0	0	USEPA 1993d	2.8	Beyer et al. 1994
Short-tailed shrew	4.7	82.3	0	0	0	0	USEPA 1993d; Sample and Suter 1994	13.0	Sample and Suter 1994

Notes:

[1] - See Section 9 of Text for Complete Reference

TABLE 7-30

Ingestion Screening Values for Mammals

Former Lockbourne Air Force Base, Lockbourne, Ohio

Chemical	Test Organism	Body Weight (kg)	Duration	Exposure Route	Effect/Endpoint	LOAEL (mg/kg/d)	NOAEL (mg/kg/d)	Reference[1]	Receptor		
									Deermouse	Red Fox	Shrew
Inorganics											
Aluminum	mouse	0.03	3 generations (390 days)	oral in water/diet	reproduction	245	49.0	ATSDR 2008	X	X	X
Antimony	mouse	0.03	lifetime	oral in water	lifespan/longevity	1.25	0.25	Sample et al. 1996	X	X	X
Cadmium	rat	0.303	6 weeks	oral (gavage)	reproduction	10.0	1.00	Sample et al. 1996	X		X
Cadmium	dog	10.0	3 months	oral in diet	reproduction	3.75	0.75	ATSDR 1999a		X	
Copper	mouse	0.03	1 month + GD 0-19	oral in diet	developmental	104	78.0	ATSDR 2004c	X		X
Copper	mink	1.00	357 days	oral in diet	reproduction	15.1	11.7	Sample et al. 1996		X	
Lead	rat	0.35	3 generations	oral in diet	reproduction	80.0	8.00	Sample et al. 1996	X	X	X
Mercury	rat	0.35	3 generations	oral in diet	reproduction	0.07	0.02	Sample et al. 1996	X		X
Mercury	mink	1.00	93 days	oral in diet	survival/weight loss	0.07	0.02	Sample et al. 1996		X	
Selenium	rat	0.35	1 year	oral in water	reproduction	0.33	0.20	Sample et al. 1996	X	X	X
Silver	rat	0.35	2 weeks	oral in water	survival	45.3	9.06	ATSDR 1990	X	X	X
Thallium	rat	0.365	60 days	oral in water	reproduction	0.185	0.037	Sample et al. 1996	X	X	X
Zinc	rat	0.35	GD 1-16	oral in diet	reproduction	320	160	Sample et al. 1996	X		X
Zinc	mink	1.00	25 weeks	oral	reproduction	104	20.8	ATSDR 2005		X	
Pesticides/PCBs											
4,4'-DDT	rat	0.35	2 years	oral in diet	reproduction	4.00	0.80	Sample et al. 2002b	X		X
4,4'-DDT	dog	10.0	2 generations	oral in diet	reproduction	5.00	1.00	ATSDR 1994b		X	
Aroclor-1242	oldfield mouse	0.014	12 months	oral in diet	reproduction	0.68	0.14	Sample et al. 1996	X		X
Aroclor-1242	mink	1.00	7 months	oral in diet	reproduction	0.69	0.14	Sample et al. 1996		X	
Aroclor-1248	oldfield mouse	0.014	12 months	oral in diet	reproduction	0.68	0.14	Sample et al. 1996	X		X
Aroclor-1248	mink	1.00	4.5 months	oral in diet	reproduction	0.69	0.14	Sample et al. 1996		X	
Aroclor-1254	oldfield mouse	0.014	12 months	oral in diet	reproduction	0.68	0.14	Sample et al. 1996	X		X
Aroclor-1254	mink	1.00	4.5 months	oral in diet	reproduction	0.69	0.14	Sample et al. 1996		X	
Aroclor-1260	oldfield mouse	0.014	12 months	oral in diet	reproduction	0.68	0.14	Sample et al. 1996	X		X
Aroclor-1260	mink	1.00	4.5 months	oral in diet	reproduction	0.69	0.14	Sample et al. 1996		X	
PCBs (total)	oldfield mouse	0.014	12 months	oral in diet	reproduction	0.037	0.00	Sample et al. 1996	X		X
PCBs (total)	mink	1.00	4.5 months	oral in diet	reproduction	0.037	0.0037	Sample et al. 1996		X	
Semivolatile Organics											
Benzo(a)anthracene	mouse	0.03	GD 7-16	oral (gavage)	reproduction	10.0	2.00	Sample et al. 1996	X	X	X
Benzo(a)pyrene	mouse	0.03	GD 7-16	oral (gavage)	reproduction	10.0	2.00	Sample et al. 1996	X	X	X
Benzo(b)fluoranthene	mouse	0.03	GD 7-16	oral (gavage)	reproduction	10.0	2.00	Sample et al. 1996	X	X	X
Benzo(k)fluoranthene	mouse	0.03	GD 7-16	oral (gavage)	reproduction	10.0	2.00	Sample et al. 1996	X	X	X
bis(2-Ethylhexyl)phthalate	mouse	0.03	105 days	oral in diet	reproduction	183	18.3	Sample et al. 1996	X	X	X
Butylbenzylphthalate	--	--	--	--	--	NA	NA	--	X	X	X
Carbazole	--	--	--	--	--	NA	NA	--	X	X	X
Chrysene	mouse	0.03	GD 7-16	oral (gavage)	reproduction	10.0	2.00	Sample et al. 1996	X	X	X
Dibenz(a,h)anthracene	mouse	0.03	GD 7-16	oral (gavage)	reproduction	10.0	2.00	Sample et al. 1996	X	X	X

TABLE 7-30

Ingestion Screening Values for Mammals

Former Lockbourne Air Force Base, Lockbourne, Ohio

Chemical	Test Organism	Body Weight (kg)	Duration	Exposure Route	Effect/Endpoint	LOAEL (mg/kg/d)	NOAEL (mg/kg/d)	Reference[1]	Receptor		
									Deermouse	Red Fox	Shrew
Dibenzofuran	--	--	--	--	--	NA	NA	--	X	X	X
Di-n-butylphthalate	mouse	0.03	105 days	oral in diet	reproduction	1,833	550	Sample et al. 1996	X	X	X
Di-n-octylphthalate	mouse	0.03	105 days	oral in diet	reproduction	550	110	Sample et al. 1996	X	X	X
Fluoranthene	mouse	0.03	13 weeks	oral (gavage)	reproduction	2,500	500	ATSDR 1995	X	X	X
Naphthalene	mouse	0.03	13 weeks	oral (gavage)	reproduction	1,000	200	ATSDR 1995	X	X	X
Phenanthrene	mouse	0.03	13 weeks	oral (gavage)	reproduction	2,500	500	ATSDR 1995	X	X	X
Pyrene	mouse	0.03	GD 7-16	oral (gavage)	reproduction	10.0	2.00	Sample et al. 1996	X	X	X
Volatile Organics											
Acetone	rat	0.35	90 days	oral (gavage)	liver/kidney	500	100	Sample et al. 1996	X	X	X
Dioxins/Furans											
Dioxin/furan (TEQ) - Mammal (total)	rat	0.35	3 generations	oral in diet	reproduction	0.00001	0.000001	Sample et al. 1996	X	X	X
Dioxin/furan (TEQ) - Bird (total)	rat	0.35	3 generations	oral in diet	reproduction	0.00001	0.000001	Sample et al. 1996	X	X	X

Notes:

[1] - See Section 9 of Text for Complete Reference

TABLE 7-31

Ingestion Screening Values for Birds

Former Lockbourne Air Force Base, Lockbourne, Ohio

Chemical	Test Organism	Body Weight (kg)	Duration	Exposure Route	Effect/Endpoint	LOAEL (mg/kg/d)	NOAEL (mg/kg/d)	Reference[1]	Receptor		
									American Robin	Mourning Dove	Red-Tailed Hawk
Inorganics											
Aluminum	ringed dove	0.155	4 months	oral in diet	reproduction	549	110	Sample et al. 1996	X	X	X
Antimony	--	--	--	--	--	NA	NA	--	X	X	X
Cadmium	mallard	1.15	90 days	oral in diet	reproduction	20.0	1.45	Sample et al. 1996	X	X	X
Copper	chicken (chicks)	0.534	10 weeks	oral in diet	growth/survival	61.7	47.0	Sample et al. 1996	X	X	X
Lead	Japanese quail	0.15	12 weeks	oral in diet	reproduction	11.3	1.13	Sample et al. 1996		X	
Lead	American kestrel	0.13	7 months	oral in diet	reproduction	19.3	3.85	Sample et al. 1996	X		X
Mercury	red-tailed hawk	1.10	12 weeks	oral in diet	survival/neurological	0.30	0.05	USEPA 1995a	X		X
Mercury	Japanese quail	0.15	1 year	oral in diet	reproduction	0.30	0.05	Sample et al. 1996		X	
Selenium	screech owl	0.20	13.7 weeks	oral in diet	reproduction	1.50	0.44	Sample et al. 1996	X	X	X
Silver	chicken (chicks)	0.80	not specified	oral in diet	growth	35.0	7.00	Eisler 1996	X	X	X
Thallium	European starling	0.082	acute	oral	survival	1.75	0.35	USEPA 1999	X	X	X
Zinc	chicken	1.94	44 weeks	oral in diet	reproduction	131	14.5	Sample et al. 1996	X	X	X
Pesticides/PCBs											
4,4'-DDT	Japanese quail	0.11	3 generations	oral in diet	reproduction	5.00	0.50	USEPA 1995a	X	X	
4,4'-DDT	barn owl	0.47	2 years	oral in diet	reproduction	0.40	0.08	Blus 1996			X
Aroclor-1242	ring-necked pheasant	1.00	17 weeks	oral	reproduction	1.80	0.36	Sample et al. 1996		X	
Aroclor-1242	screech owl	0.181	2 generations	oral in diet	reproduction	2.05	0.41	Sample et al. 1996	X		X
Aroclor-1248	ring-necked pheasant	1.00	17 weeks	oral	reproduction	1.80	0.36	Sample et al. 1996		X	
Aroclor-1248	screech owl	0.181	2 generations	oral in diet	reproduction	2.05	0.41	Sample et al. 1996	X		X
Aroclor-1254	ring-necked pheasant	1.00	17 weeks	oral	reproduction	1.80	0.36	Sample et al. 1996		X	
Aroclor-1254	screech owl	0.181	2 generations	oral in diet	reproduction	2.05	0.41	Sample et al. 1996	X		X
Aroclor-1260	ring-necked pheasant	1.00	17 weeks	oral	reproduction	1.80	0.36	Sample et al. 1996		X	
Aroclor-1260	screech owl	0.181	2 generations	oral in diet	reproduction	2.05	0.41	Sample et al. 1996	X		X
PCBs (total)	ring-necked pheasant	1.00	17 weeks	oral	reproduction	0.58	0.29	Sample et al. 1996		X	
PCBs (total)	screech owl	0.181	2 generations	oral in diet	reproduction	0.58	0.29	Sample et al. 1996	X		X
Semivolatile Organics											
Benzo(a)anthracene	chicken	1.50	35 days	oral in diet	reproduction	35.5	7.10	Rigdon and Neal 1963	X	X	X
Benzo(a)pyrene	chicken	1.50	35 days	oral in diet	reproduction	35.5	7.10	Rigdon and Neal 1963	X	X	X
Benzo(b)fluoranthene	chicken	1.50	35 days	oral in diet	reproduction	35.5	7.10	Rigdon and Neal 1963	X	X	X
Benzo(k)fluoranthene	chicken	1.50	35 days	oral in diet	reproduction	35.5	7.10	Rigdon and Neal 1963	X	X	X
bis(2-Ethylhexyl)phthalate	ringed dove	0.155	4 weeks	oral in diet	reproduction	5.55	1.11	Sample et al. 1996	X	X	X
Butylbenzylphthalate	--	--	--	--	--	NA	NA	--	X	X	X
Carbazole	--	--	--	--	--	NA	NA	--	X	X	X
Chrysene	chicken	1.50	35 days	oral in diet	reproduction	35.5	7.10	Rigdon and Neal 1963	X	X	X
Dibenz(a,h)anthracene	chicken	1.50	35 days	oral in diet	reproduction	35.5	7.10	Rigdon and Neal 1963	X	X	X
Di-n-butylphthalate	ringed dove	0.155	4 weeks	oral in diet	reproduction	1.10	0.22	Sample et al. 1996	X	X	X
Di-n-octylphthalate	--	--	--	--	--	NA	NA	--	X	X	X
Fluoranthene	chicken	1.50	35 days	oral in diet	reproduction	35.5	7.10	Rigdon and Neal 1963	X	X	X
Naphthalene	chicken	1.50	35 days	oral in diet	reproduction	35.5	7.10	Rigdon and Neal 1963	X	X	X

TABLE 7-31

Ingestion Screening Values for Birds

Former Lockbourne Air Force Base, Lockbourne, Ohio

Chemical	Test Organism	Body Weight (kg)	Duration	Exposure Route	Effect/Endpoint	LOAEL (mg/kg/d)	NOAEL (mg/kg/d)	Reference[1]	Receptor		
									American Robin	Mourning Dove	Red-Tailed Hawk
Phenanthrene	chicken	1.50	35 days	oral in diet	reproduction	35.5	7.10	Rigdon and Neal 1963	X	X	X
Pyrene	chicken	1.50	35 days	oral in diet	reproduction	35.5	7.10	Rigdon and Neal 1963	X	X	X
Volatile Organics											
Acetone	--	--	--	--	--	NA	NA	--	X	X	X
Dioxins/Furans											
Dioxin/furan (TEQ) - Mammal (total)	ring-necked pheasant	1.00	10 weeks	injection	reproduction	0.00014	0.000014	Sample et al. 1996	X	X	X

Notes:

[1] - See Section 9 of Text for Complete Reference

TABLE 7-32

Screening Statistics - AOC 1 Soil - Direct Exposures - Step 3

Former Lockbourne Air Force Base, Lockbourne, Ohio

AnalyteName	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Arithmetic Mean	95% UCL	Screening Value	Frequency of Exceedance	Mean Hazard Quotient^1	95% UCL HQ
Inorganics (MG/KG)										
Aluminum	-- - --	32 / 32	26,000	LCKSO-6 2-3	7,666	9263	50.0	32 / 32	153	185
Barium	-- - --	48 / 48	490	EEGLKB-SS01	112	128.90	330	2 / 48	< 1	< 1
Chromium, total	11.0 - 11.0	47 / 48	35.5	LCK-SO6B	12.3	13.56	0.40	47 / 48	31	34
Copper	21.0 - 23.0	29 / 32	140	LCKSO-8 0-1	24.8	29.85	70.0	1 / 32	< 1	< 1
Lead	-- - --	48 / 48	9,340	LCKSO-8 0-1	238	2,170	120	4 / 48	2.0	18
Mercury	2.00E-05 - 0.33	22 / 48	0.79	LCK-SO6B	0.077	0.24	0.10	6 / 48	< 1	2.4
Selenium	0.14 - 11.0	19 / 48	3.50	EEGLKB-SS02	0.89	1.64	0.52	16 / 48	1.7	3.2
Thallium	0.51 - 18.0	17 / 32	2.80	EEGLKB-SS02	2.06	3.70	1.00	17 / 32	2.1	2.8^2
Zinc	-- - --	48 / 48	1,650	LCK-SO6B	121	274.4	120	7 / 48	1.01	2.3
Pesticide/Polychlorinated Biphenyls (MG/KG)										
Chlordane, gamma-	0.0019 - 0.22	3 / 36	0.44	EEGLKB-SS05	0.052	0.206	0.22	2 / 36	< 1	< 1
DDT, p,p'-	0.0020 - 0.22	11 / 40	0.42	EEGLKB-SS11	0.059	0.200	0.0035	11 / 40	17	57
PCB 1248	0.019 - 0.77	1 / 40	16.0	EEGLKB-SS10	0.44	4.41	0.371	1 / 40	1.2	12
PCB 1254	0.019 - 2.00	5 / 40	0.81	LCK-SODUP2	0.092	0.410	0.371	1 / 40	< 1	1.1
Total PCBs	-- - --	5 40	22	EEGLKB-SS10	0.901	6.35	0.371	5 / 40	2.4	17
Semivolatile Organic Compounds (MG/KG)										
Acenaphthene	0.038 - 8.10	19 / 41	85.0	EEGLKB-SS06	4.93	29.79	20.0	4 / 41	< 1	1.5
Benz(a)anthracene	0.039 - 3.50	33 / 41	450	EEGLKB-SS05	37.0	188.2	5.21	9 / 41	7.1	36.1
Benzo(a)pyrene	0.039 - 3.50	32 / 41	380	EEGLKB-SS05	32.7	165	1.52	15 / 41	22	108
Benzo(b)fluoranthene	0.35 - 3.50	34 / 41	340	EEGLKB-SS05	28.5	141.30	59.8	6 / 41	< 1	2.4
Benzo(k)fluoranthene	0.35 - 3.50	34 / 41	340	EEGLKB-SS05	29.2	148.90	148	5 / 41	< 1	1.01
Benzoic acid	0.77 - 19.0	3 / 20	4.80	EEGLKB-SS02	2.10	8.055	NSV	-- / --	NSV	NSV
Bis(2-ethylhexyl) phthalate	0.19 - 4.70	8 / 41	16.0	LCKSB-12 0-0.5	0.90	4.8	0.93	3 / 41	< 1	5.2
Butylbenzyl phthalate	0.074 - 8.10	1 / 41	0.73	LCK-SO6B	0.38	1.446	NSV	-- / --	NSV	NSV
Carbazole	0.19 - 4.00	17 / 41	88.0	EEGLKB-SS06	5.16	32.18	NSV	-- / --	NSV	NSV
Chrysene	0.35 - 3.50	35 / 41	470	EEGLKB-SS05	37.7	196.7	4.73	10 / 41	8.0	42
Dibenz(ah)anthracene	0.038 - 3.50	22 / 41	71.0	EEGLKB-SS05	5.14	28.30	18.4	4 / 41	< 1	1.5
Dibenzofuran	0.077 - 8.10	16 / 41	42.0	EEGLKB-SS06	2.92	15.65	NSV	-- / --	NSV	NSV
Di-n-butyl phthalate	0.040 - 8.10	1 / 41	2.60	LCK-SO6B	0.55	1.87	0.15	1 / 41	3.6	12
Di-n-octyl phthalate	0.35 - 9.20	1 / 41	15.0	LCKSB-12 0-0.5	1.03	4.829	NSV	-- / --	NSV	NSV
Fluoranthene	0.35 - 3.50	35 / 41	1,100	EEGLKB-SS05	87.7	467.80	122	5 / 41	< 1	3.8
Fluorene	0.038 - 8.10	17 / 41	67.0	EEGLKB-SS06	4.69	26.69	30.0	3 / 41	< 1	< 1
Indeno(1,2,3-cd)pyrene	0.039 - 3.50	30 / 41	130	EEGLKB-SS05	12.5	60.63	109	2 / 41	< 1	< 1
Methylnaphthalene, 2-	0.039 - 8.10	13 / 41	14.0	EEGLKB-SS06	1.14	1.52	3.24	6 / 41	< 1	< 1
Methylphenol, 3- and/or 4-	0.074 - 1.90	2 / 20	0.25	EEGLKB-SS05	0.20	0.78	NSV	-- / --	NSV	NSV
Naphthalene	0.039 - 8.10	11 / 41	13.0	EEGLKB-SS06	0.84	4	0.099	9 / 41	8.4	42
Phenanthrene	0.039 - 0.44	34 / 41	600	EEGLKB-SS06	45.5	243.1	45.7	6 / 41	< 1	5.3
Pyrene	0.040 - 3.50	33 / 41	870	EEGLKB-SS05	67.3	358.8	45.7	6 / 41	1.5	7.9
Total Low Molecular Weight PAHs	- - -	34 / 41	910	EEGLKB-SS06	68.26	366.8	28	8 / 41	2.4	13
Total High Molecular Weight PAHs	- - -	35 / 41	4,261	EEGLKB-SS05	349	1802	18	14 / 41	19	100
Explosives (MG/KG)										
Trinitrotoluene, 2,4,6-	5.00E-04 - 0.25	2 / 23	5.30	EEGLKB-SS08 Dup02	0.50	3.31	NSV	-- / --	NSV	NSV
Volatile Organic Compounds (MG/KG)										
Acetone	0.0090 - 0.029	20 / 41	34.0	EEGLKB-SS18	1.38	9.8	2.50	5 / 41	< 1	3.9
Dioxin/Furans (MG/KG)										
TCDD-TEQ	-- - --	15 / 15	6.60E-05	LCKSO-7 2-3	9.33E-06	0.000018	3.15E-07	15 / 15	30	57.1

NSV - No Screening Value

1 - Shaded cells indicate hazard quotient based on reporting limits

2 - HQ based on maximum concentration due to 95 percent UCL exceeding Maximum Value

TABLE 7-33
Screening Statistics - AOC 2 Soil - Direct Exposures - Step 3
Former Lockbourne Air Force Base, Lockbourne,
Ohio

AnalyteName	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Arithmetic Mean	95%	Screening Value	Frequency of Exceedance	Mean Hazard Quotient[1]	95% UCL HQ
Inorganics (MG/KG)										
Arsenic	-- - --	16 / 16	25.1	LCK-SO3B	10.7	13.3	18.0	1 / 16	< 1	< 1
Cobalt	-- - --	8 / 8	26.0	LCKSB-11[2]	9.35	19.99	13.0	1 / 8	< 1	1.5
Manganese	990 - 990	7 / 8	1,600	LCKSB-11[2]	511	915	220	5 / 8	2.3	4.2
Selenium	0.15 - 1.80	7 / 16	0.60	EEGLKB-SS21	0.44	0.53	0.52	3 / 16	< 1	1.02
Thallium	0.57 - 1.00	4 / 8	2.20	EEGLKB-SS21	1.26	--	1.00	4 / 8	1.3	2.2[3]
Zinc	-- - --	16 / 16	125	LCK-SO5B	70.1	79.5	120	1 / 16	< 1	< 1
Pesticide/Polychlorinated Biphenyls (MG/KG)										
DDE, p,p'-	0.0023 - 0.012	3 / 16	0.81	LCK-SO4A	0.066	0.571	0.60	1 / 16	< 1	< 1
DDT, p,p'-	0.0023 - 0.012	3 / 16	0.46	LCK-SO4A	0.043	0.332	0.0035	3 / 16	12	95
Semivolatile Organic Compounds (MG/KG)										
Naphthalene	0.044 - 0.44	4 / 16	0.12	EEGLKB-SS21	0.16	0.24	0.099	1 / 16	1.2	2.4
Volatile Organic Compounds (MG/KG)										
Acetone	0.0050 - 0.024	5 / 16	40.0	EEGLKB-SS22	2.79	27.56	2.50	2 / 16	1.1	11
Dioxin/Furans (MG/KG)										
TCDD-TEQ	-- - --	5 / 5	4.63E-06	EEGLKB-SS20	2.38E-06	--	3.15E-07	5 / 5	7.54	15[4]

NSV - No Screening Value

1 - Shaded cells indicate hazard quotient based on reporting limits

2 - Result from Duplicate Sample: LCKSB-15 0-0.5

3 - HQ based on maximum concentration due to 95 percent UCL exceeding Maximum Value

4 - HQ based on maximum concentration due to insufficient samples to calculate UCL

TABLE 7-34
Screening Statistics - Direct Exposures for West Ditch Sediment - Step 3
Former Lockbourne Air Force Base, Lockbourne, Ohio

AnalyteName	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	95% UCL	Screening Value	Frequency of Exceedance	Maximum Hazard Quotient[1]	95% UCL HQ
Inorganics (MG/KG)									
Arsenic	-- - --	9 / 9	22.0	EEGLKB-SD02	16.6	9.79	8 / 9	2.2	1.7
Cobalt	-- - --	6 / 6	16.0	LCKSD-4	--	NSV	-- / --	NSV	NSV
Lead	-- - --	9 / 9	51.0	EEGLKB-SD04	29.75	35.8	1 / 9	1.4	< 1
Pesticide/Polychlorinated Biphenyls (MG/KG)									
DDD, p,p'-	0.0038 - 0.011	6 / 9	0.077	EEGLKB-SD03	0.0412	0.0049	6 / 9	16	8.4
DDE, p,p'-	0.0025 - 0.011	2 / 9	0.0091	EEGLKB-SD03	0.00611	0.0032	2 / 9	2.9	1.9
DDT, p,p'-	0.0038 - 0.011	5 / 9	0.019	EEGLKB-SD03	0.0101	0.0042	5 / 9	4.6	2.4
PCB 1260	0.019 - 0.073	1 / 9	0.023	EEGLKB-SD01	0.0245	0.810	-- / --	4.6	< 1
Total PCBs	-- - --	1 / 9	0.089	EEGLKB-SD01	0.185	0.0598	1 / 9	1.5	3.1
Semivolatile Organic Compounds (MG/KG)									
Acenaphthene	0.043 - 0.73	2 / 9	0.038	EEGLKB-SD02	0.21	0.0067	2 / 9	5.7	5.7
Benz(a)anthracene	0.043 - 0.73	4 / 9	0.13	EEGLKB-SD02	0.03	0.11	1 / 9	1.2	1.2
Benzo(a)pyrene	0.043 - 0.73	4 / 9	0.17	LCK-SE1	0.22	0.15	1 / 9	1.1	< 1
Chrysene	0.39 - 0.39	6 / 9	0.37	LCKSD-4	0.25	0.17	4 / 9	2.2	1.11
Fluoranthene	0.39 - 0.39	7 / 9	0.71	LCKSD-4	0.48	0.42	3 / 9	1.7	< 1
Methylnaphthalene, 2-	0.043 - 0.73	2 / 9	0.048	EEGLKB-SD03	0.22	0.020	2 / 9	2.4	2.4
Phenanthrene	0.043 - 0.73	3 / 9	0.21	EEGLKB-SD03	0.23	NSV	-- / --	NSV	NSV
Pyrene	0.043 - 0.39	6 / 9	0.63	LCKSD-4	0.36	0.20	4 / 9	3.2	1.2
Total Low Molecular Weight PAHs	-- - --	3 9	2.56	LCKSD-4	1.483	0.076	3 / 9	34	20
Total High Molecualr Weight PAHs	-- - --	7 9	4.37	LCKSD-4	2.52	0.19	7 / 9	23	13
Total PAHs	-- - --	7 9	6.93	LCKSD-4	3.97	1.61	7 / 9	4.3	2.5
Volatile Organic Compounds (MG/KG)									
Acetone	0.0040 - 0.033	6 / 9	9.80	EEGLKB-SD02	12.01	0.0099	6 / 9	990	1213
Chloroethane	0.0049 - 0.097	1 / 9	0.0048	EEGLKB-SD04	0.0308	NSV	-- / --	NSV	NSV
Methyl ethyl ketone	0.011 - 0.097	1 / 9	0.036	LCKSD-4	0.0288	0.042	0 / 9	< 1	< 1
Methylene chloride	0.0059 - 0.097	1 / 8	0.024	LCK-SE1-RE	0.038	0.16	0 / 8	< 1	< 1
Toluene	0.0049 - 0.024	3 / 9	0.0024	EEGLKB-SD04	0.00858	1.22	0 / 9	< 1	< 1
Trichlorofluoromethane	0.0022 - 0.097	2 / 4	0.0038	EEGLKB-SD01	--	NSV	-- / --	NSV	NSV
Dioxin/Furans (MG/KG)									
TCDD-TEQ	-- - --	2 / 2	4.06E-06	LCKSD-6	--	1.20E-07	2 / 2	34	--

NSV - No Screening Value

1 - Shaded cells indicate hazard quotient based on reporting limits

2 - Macronutrient - Not considered to be a COPC

TABLE 7-35

Screening Statistics - Food Web Exposures for AOC 1 Soil - Step 3

Former Lockbourne Air Force Base, Lockbourne, Ohio

AnalyteName	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Arithmetic Mean	95% UCL	Screening Value	Frequency of Exceedance	Mean Hazard Quotient[1]	95% UCL HQ
Inorganics (MG/KG)										
Aluminum	-- - --	32 / 32	26,000	LCKSO-6 2-3	7,666	9263	NSV	-- / --	NSV	NSV
Antimony	5.20 - 66.0	2 / 32	1.40	EEGLKB-SS10	6.32	12.20	0.27	2 / 32	5.2	45
Cadmium	0.42 - 6.00	20 / 48	6.30	LCK-SO9B	0.81	1.51	0.36	16 / 48	2.2	4.2
Copper	21.0 - 23.0	29 / 32	140	LCKSO-8 0-1	24.8	29.9	28.0	7 / 32	< 1	1.1
Lead	-- - --	48 / 48	9,340	LCKSO-8 0-1	238	2,170	11.0	42 / 48	22	197
Mercury	2.00E-05 - 0.33	22 / 48	0.79	LCK-SO6B	0.077	0.240	0.10	6 / 48	< 1	2.4
Selenium	0.14 - 11.0	19 / 48	3.50	EEGLKB-SS02	0.89	1.64	0.63	13 / 48	1.4	2.6
Silver	0.42 - 11.0	4 / 48	190	EEGLKB-SS14	4.84	44.10	4.20	1 / 48	1.2	11
Thallium	0.51 - 18.0	17 / 32	2.80	EEGLKB-SS02	2.06	--	0.057	17 / 32	36	49[2]
Zinc	-- - --	48 / 48	1,650	LCK-SO6B	121	274	46.0	39 / 48	2.6	6.0
Pesticide/Polychlorinated Biphenyls (MG/KG)										
Chlordane, gamma-	0.0019 - 0.22	3 / 36	0.44	EEGLKB-SS05	0.052	0.206	0.22	2 / 36	< 1	< 1
DDT, p,p'-	0.0020 - 0.22	11 / 40	0.42	EEGLKB-SS11	0.059	0.200	0.0035	11 / 40	17	57
PCB 1242	0.019 - 2.00	2 / 40	0.23	EEGLKB-SS05	0.074	0.339	0.000332	2 / 40	223	1021
PCB 1248	0.019 - 0.77	1 / 40	16.0	EEGLKB-SS10	0.44	4.41	0.000332	1 / 40	1327	13289
PCB 1254	0.019 - 2.00	5 / 40	0.81	LCK-SODUP2	0.092	0.410	0.000332	5 / 40	277	1235
PCB 1260	0.019 - 2.00	3 / 40	0.26	EEGLKB-SS18	0.071	0.338	0.000332	1 / 40	215	1018
Total PCBs	-- - --	5 40	22	EEGLKB-SS10	0.901	6.35	0.000332	5 / 40	2714	19127
Semivolatile Organic Compounds (MG/KG)										
Benz(a)anthracene	0.039 - 3.50	33 / 41	450	EEGLKB-SS05	37.0	450	5.21	9 / 41	7.1	86
Benzo(a)pyrene	0.039 - 3.50	32 / 41	380	EEGLKB-SS05	32.7	380	1.52	15 / 41	22	250
Benzo(b)fluoranthene	0.35 - 3.50	34 / 41	340	EEGLKB-SS05	28.5	340	59.8	6 / 41	< 1	5.7
Benzo(k)fluoranthene	0.35 - 3.50	34 / 41	340	EEGLKB-SS05	29.2	148.90	148	5 / 41	< 1	1.01
Benzoic acid	0.77 - 19.0	3 / 20	4.80	EEGLKB-SS02	2.10	8.055	NSV	-- / --	NSV	NSV
Bis(2-ethylhexyl) phthalate	0.19 - 4.70	8 / 41	16.0	LCKSB-12 0-0.5	0.90	16.0	0.93	3 / 41	< 1	17
Butylbenzyl phthalate	0.074 - 8.10	1 / 41	0.73	LCK-SO6B	0.38	1.446	NSV	-- / --	NSV	NSV
Carbazole	0.19 - 4.00	17 / 41	88.0	EEGLKB-SS06	5.16	32.18	NSV	-- / --	NSV	NSV
Chrysene	0.35 - 3.50	35 / 41	470	EEGLKB-SS05	37.7	196.7	4.73	10 / 41	8.0	42
Dibenz(ah)anthracene	0.038 - 3.50	22 / 41	71.0	EEGLKB-SS05	5.14	28.30	18.4	4 / 41	< 1	1.5
Dibenzofuran	0.077 - 8.10	16 / 41	42.0	EEGLKB-SS06	2.92	15.65	NSV	-- / --	NSV	NSV
Di-n-butyl phthalate	0.040 - 8.10	1 / 41	2.60	LCK-SO6B	0.55	1.87	0.15	1 / 41	3.6	12
Di-n-octyl phthalate	0.35 - 9.20	1 / 41	15.0	LCKSB-12 0-0.5	1.03	4.829	NSV	-- / --	NSV	NSV
Fluoranthene	0.35 - 3.50	35 / 41	1,100	EEGLKB-SS05	87.7	467.80	122	5 / 41	< 1	3.8
Indeno(1,2,3-cd)pyrene	0.039 - 3.50	30 / 41	130	EEGLKB-SS05	12.5	60.63	109	2 / 41	< 1	< 1
Methylnaphthalene, 2-	0.039 - 8.10	13 / 41	14.0	EEGLKB-SS06	1.14	1.52	3.24	6 / 41	< 1	< 1
Methylphenol, 3- and/or 4-	0.074 - 1.90	2 / 20	0.25	EEGLKB-SS05	0.20	0.78	NSV	-- / --	NSV	NSV
Naphthalene	0.039 - 8.10	11 / 41	13.0	EEGLKB-SS06	0.84	4	0.099	9 / 41	8.4	42

TABLE 7-35

Screening Statistics - Food Web Exposures for AOC 1 Soil - Step 3

Former Lockbourne Air Force Base, Lockbourne, Ohio

AnalyteName	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Arithmetic Mean	95% UCL	Screening Value	Frequency of Exceedance	Mean Hazard Quotient^1	95% UCL HQ
Phenanthrene	0.039 - 0.44	34 / 41	600	EEGLKB-SS06	45.5	243.1	45.7	6 / 41	< 1	5.3
Pyrene	0.040 - 3.50	33 / 41	870	EEGLKB-SS05	67.3	358.8	45.7	6 / 41	1.5	7.9
Total Low Molecular Weight PAHs	- - -	34 / 41	910	EEGLKB-SS06	68.26	366.8	100	5 / 41	< 1	3.7
Total High Molecular Weight PAHs	- - -	35 / 41	4,261	EEGLKB-SS05	349	1802	1.1	37 / 41	317	1638
Explosives (MG/KG)										
Trinitrotoluene, 2,4,6-	5.00E-04 - 0.25	2 / 23	5.30	EEGLKB-SS08 Dup02	0.50	3.31	NSV	-- / --	NSV	NSV
Volatile Organic Compounds (MG/KG)										
Acetone	0.0090 - 0.029	20 / 41	34.0	EEGLKB-SS18	1.38	34.00	2.50	5 / 41	< 1	14
Dioxin/Furans (MG/KG)										
TCDD-TEQ	-- - --	15 / 15	6.60E-05	LCKSO-7 2-3	9.33E-06	6.60E-05	3.15E-07	15 / 15	30	210

NSV - No Screening Value

1 - Shaded cells indicate hazard quotient based on reporting limits

2 - HQ based on maximum concentration due to 95 percent UCL exceeding Maximum Value

TABLE 7-36

Summary of Hazard Quotients for Food Web Exposures Soil, AOC 1 - Step 3

Former Lockbourne Air Force Base, Lockbourne, Ohio

Chemical	Short-tailed shrew			Deer mouse			Red fox			American robin			Mourning dove			Red-tailed hawk		
	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC
Inorganics																		
Aluminum	2.7	< 1	1.2	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Antimony	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	--	--	--	--	--	--	--	--	--
Cadmium	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Copper	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Lead	9.2	< 1	2.9	1.5	< 1	< 1	< 1	< 1	< 1	8.0	1.6	3.6	20	2.0	6.2	1.5	< 1	< 1
Mercury	1.2	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Selenium	0.70	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Silver	0.78	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Thallium	6.4	1.3	2.9	1.1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Zinc	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	1.8	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Pesticides/PCBs																		
4,4'-DDT	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Aroclor-1242	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Aroclor-1248	10.52	2.10	4.71	1.93	< 1	< 1	< 1	< 1	< 1	1.5	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Aroclor-1254	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Aroclor-1260	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
PCBs (total)	557	56	176	102	10	32	26	2.6	8.1	3.0	1.5	2.1	< 1	< 1	< 1	< 1	< 1	< 1
Semivolatile Organics																		
Benzo(a)anthracene	7.0	1.4	3.1	1.0	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Benzo(a)pyrene	6.9	1.4	3.1	1.0	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Benzo(b)fluoranthene	4.6	< 1	2.0	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Benzo(k)fluoranthene	2.0	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
bis(2-Ethylhexyl)phthalate	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Butylbenzylphthalate	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carbazole	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chrysene	4.29	< 1	1.92	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Dibenz(a,h)anthracene	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Dibenzofuran	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Di-n-butylphthalate	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Di-n-octylphthalate	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	--	--	--	--	--	--	--	--	--
Fluoranthene	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	1.08	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Naphthalene	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Phenanthrene	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Pyrene	7.19	1.44	3.22	1.19	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Volatile Organics																		
Acetone	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	--	--	--	--	--	--	--	--	--
Explosives																		
2,4,6,Trinitrotoluene	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	--	--	--	--	--	--	--	--	--
Dioxin/Furans																		
Dioxin/furan (TEQ) - Mammal (total)	45.97	4.60	15	8.5	< 1	2.7	2.7	< 1	< 1	--	--	--	--	--	--	--	--	--
Dioxin/furan (TEQ) - Bird (total)	--	--	--	--	--	--	--	--	--	1.8	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1

TABLE 7-37

Screening Statistics - Food Web Exposures for AOC 2 Soil - Step 3

Former Lockbourne Air Force Base, Lockbourne, Ohio

AnalyteName	Range of Non-Detect Values	Frequency of Detection	Maximum Concentration Detected	Sample ID of Maximum Detected Concentration	Arithmetic Mean	95% UCL	Screening Value	Frequency of Exceedance	Mean Hazard Quotient[1]	95% UCL HQ
Inorganics (MG/KG)										
Arsenic	-- - --	16 / 16	25.1	LCK-SO3B	10.7	13.3	18.0	1 / 16	< 1	< 1
Cobalt	-- - --	8 / 8	26.0	LCKSB-11[2]	9.35	19.99	28.0	0 / 8	< 1	< 1
Manganese	990 - 990	7 / 8	1,600	LCKSB-11[2]	511	915	4,000	0 / 8	< 1	< 1
Selenium	0.15 - 1.80	7 / 16	0.60	EEGLKB-SS21	0.44	0.53	0.63	0 / 16	< 1	< 1
Thallium	0.57 - 1.00	4 / 8	2.20	EEGLKB-SS21	1.26	--	0.057	4 / 8	22	38[3]
Pesticide/Polychlorinated Biphenyls (MG/KG)										
DDE, p,p'-	0.0023 - 0.012	3 / 16	0.81	LCK-SO4A	0.066	0.571	0.60	1 / 16	< 1	< 1
DDT, p,p'-	0.0023 - 0.012	3 / 16	0.46	LCK-SO4A	0.043	0.332	0.0035	3 / 16	12	95
Volatile Organic Compounds (MG/KG)										
Acetone	0.0050 - 0.024	5 / 16	40.0	EEGLKB-SS22	2.79	27.56	2.50	2 / 16	1.1	11
Dioxin/Furans (MG/KG)										
TCDD-TEQ	-- - --	5 / 5	4.63E-06	EEGLKB-SS20	2.38E-06	--	3.15E-07	5 / 5	7.5	15[4]

NSV - No Screening Value

1 - Shaded cells indicate hazard quotient based on reporting limits

2 - Result from Duplicate Sample: LCKSB-15 0-0.5

3 - HQ based on maximum concentration due to 95 percent UCL exceeding Maximum Value

4 - HQ based on maximum concentration due to insufficient samples to calculate UCL

TABLE 7-38

Summary of Hazard Quotients for Food Web Exposures Soil, AOC 2 - Step 3

Former Lockbourne Air Force Base, Lockbourne, Ohio

Chemical	Short-tailed shrew			Deer mouse			Red fox			American robin			Mourning dove			Red-tailed hawk		
	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC
Inorganics																		
Thallium	5	1.1	2.2	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Pesticides/PCBs																		
4,4'-DDT	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Volatile Organics																		
Acetone	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	--	--	--	--	--	--	--	--	--
Dioxin/Furans																		
Dioxin/furan (TEQ) - Mammal (total)	3.71	< 1	1.17	< 1	< 1	< 1	< 1	< 1	< 1	--	--	--	--	--	--	--	--	--
Dioxin/furan (TEQ) - Bird (total)	--	--	--	--	--	--	--	--	--	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1

TABLE 7-39

Summary of Hazard Quotients for Food Web Exposures Soil, West Ditch - Step 3

Former Lockbourne Air Force Base, Lockbourne, Ohio

Chemical	Mink			Muskrat			Marsh wren			Belted kingfisher			Mallard		
	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC	NOAEL	LOAEL	MATC
Inorganics															
Arsenic	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Lead	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Pesticides/PCBs															
PCBs (total)	10.0	< 1	3.2	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1

TABLE 7-40
Attributes for Judging Measures of Effects
Former Lockbourne Air Force Base, Lockbourne, Ohio

Category/Attribute	Description
I. Relationship between Measure of Effect and Assessment Endpoint	
▪ Degree of Association	The extent to which the measure of effect is representative of, correlated with, or applicable to the assessment endpoint; in particular, with respect to similarity of effect, target organ, mechanism of action, and level of ecological organization.
▪ Stressor/Response	The ability of an endpoint to demonstrate effects from chronic exposure to the stressor and to correlate the effects with the degree of exposure, susceptibility, and magnitude of effect.
▪ Utility of Measure	The ability to judge results of the study against well-accepted standards, criteria, or objective measures (e.g., sediment quality criteria and toxicity thresholds). As such, the attribute describes the applicability, certainty, and scientific basis of the measure, as well as the sensitivity of a benchmark in detecting environmental harm.
II. Data Quality	
▪ Quality of Data	The degree to which data quality objectives (DQOs) and other recognized characteristics of high quality studies are met. The appropriateness of data collection and analysis practices, as well as the implementation of the experimental design and the minimization of confounding factors strongly influence the data quality.
III. Study Design	
▪ Site-specificity	The extent to which chemical and/or biological data, media, species, environmental conditions, and habitat types used in the study reflect the site of interest.
▪ Stressor-specificity	The degree to which the measure of effect is associated with the specific stressor(s) of concern. Some measures of effects respond to a broad range of stressors, complicating interpretation of results, while others are more specific to a particular stressor.
▪ Sensitivity	The ability to detect a response in the measure of effect, expressed as a percentage of the total possible variability that the endpoint is able to detect. Additionally, this attribute reflects the ability of the measure of effect to discriminate between responses to a stressor and those resulting from natural or design variability and uncertainty.
▪ Spatial Representativeness	The degree of compatibility or overlap between the study area and locations of measurements or samples, stressors, ecological receptors, and potential exposure points.
▪ Temporal Representativeness	The compatibility or overlap between when data were collected or the period for which data are representative and the period during which effects of concern would be likely to be detected. Also linked to this attribute is the number of measurement or sampling events and the expected variability over time.
▪ Quantitativeness	The degree to which numbers can be used to describe the magnitude of response to the stressor. Some measure of effects yield qualitative or hierarchical results, while others are more quantitative. In addition, this attribute encompasses the extent to which biological significance can be interpreted from statistical significance.
▪ Use of a Standard Method	The extent to which the study follows protocols recommended by a recognized scientific authority (e.g., study designs or chemical measures published in the Code of Federal Regulations, developed by ASTM, or repeatedly published in the peer-reviewed scientific literature). This attribute also reflects the suitability and applicability of the method to the endpoint and the site, as well as any modifications made to the method.

TABLE 7-41
Score Definitions
Former Lockbourne Air Force Base, Lockbourne, Ohio

Attribute Category	**Score/Definitions**		
	Low	**Medium**	**High**
I. Relationship between Measurement and Assessment Endpoint	▪ Assessment endpoint is measured only indirectly. A weak correlation exists between the measurement and assessment endpoint. ▪ Endpoint response to stressor not demonstrated previously but is expected to occur based upon observations of similar stressors. ▪ Measure developed by investigator, has limited applicability, weak scientific basis, and relatively insensitive benchmark.	▪ Endpoints linked by the effect, target organ, and mechanism of action evaluated are not the same, or levels of ecological organization differ; or all of the above criteria are met but the assessment endpoint is not directly measured. ▪ Endpoint response to stressor has been noted, but not necessarily proven or has a statistically significant correlation ▪ Measure ranges from a personal index with limited applicability or a weak scientific basis or relatively insensitive benchmark to a well-accepted measure developed by a third party with moderate certainty, and scientific basis, and the benchmark is moderately sensitive.	▪ Assessment endpoint is measured directly ▪ A statistically significant correlation exists ▪ Measure was developed by a third party, is well accepted, and has very high levels of certainty and applicability, strong scientific basis, and is sensitive.
II. Data Quality	▪ Three or more DQOs not met; or ▪ DQOs just meet the needs of the risk assessment; or ▪ No documentation exists for not meeting DQOs and not discussion of that impact on the risk assessment provided	▪ One to two DQOs are not met; DQOs meet the risk assessment needs or are rigorous and comprehensive; and reasons for not meeting DQOs and the impact on the risk assessment are provided.	▪ DQOs are rigorous and comprehensive ▪ All DQOs were met
III. Study Design	▪ Only one or two of the following is derived from or reflects the site: data, media, species, environmental conditions, benchmark, and habitat type ▪ Measure of effect responds in the expected manner to various non-related stressors. ▪ Only changes greater than 1,000 times can be detected.	▪ Three to five of the following is derived from or reflects the site: data, media, species, environmental conditions, benchmark, and habitat type ▪ Measure of effect responds in the expected manner to closely related stressors. ▪ Changes between 2 and 1,000 times can be detected ▪ The locations of two to four of the following are overlapped spatially: study area, sampling/measurement site, stressors, receptors, and points of potential exposure	▪ Data, media, species, environmental conditions, benchmark, and habitat type are derived from or reflect the site conditions ▪ Particular stressor is known to be the only site-related stressor that the measure of effect responds in the expected manner. ▪ Changes of less than 2 times can be detected

TABLE 7-41
Score Definitions
Former Lockbourne Air Force Base, Lockbourne, Ohio

Attribute Category	**Score/Definitions**		
	Low	**Medium**	**High**
III. Study Design (cont.)	▪ Only two of the following are spatially overlapped, but only to a limited extent: study area, sampling/ measurement site, stressors, receptors, and points of potential exposures. ▪ Measurements were collected during a season when effects are not expected to be most observable and a single sampling or measurement event is conducted and there is high variability in the parameter over time. ▪ Results are qualitative and subjective. ▪ Method not previously published and is not an impact assessment, field survey, toxicity test, benchmark approach, toxicity quotient or tissue residue analysis.	▪ Ranges from measurements collected during a season different from when effects would be most observable or a single sampling or measurement was collected that also has high variability to measurements collected during the same period that effects would be most observable during two sampling or measurement events and have moderate variability. ▪ Results range from qualitative but objective to quantitative, can be tested for statistical significance, but do not reflect biological significance ▪ Ranges from the method being an impact assessment, field survey, toxicity test, benchmark approach, toxicity quotient, or tissue residue analysis, but the application has not been published or standardized to a standard method that is directly applicable to the measure of effect, but needs slight modifications or the methodology published in two peer-reviewed studies.	▪ At least five of the following are spatially overlapped: study area, sampling/measurement site, stressors, receptors, and points of potential exposures. ▪ Measurements were collected during the same periods that effects would be expected to be most observable and at least two sampling events are conducted and variability is low; or multiple sampling events are conducted and variability is moderate to high. ▪ Results are quantitative and can be tested for statistical significance. ▪ A standard method exists that was developed to test a measure of effect such as this with no modifications necessary or the methodology was used in three or more peer-reviewed studies.

TABLE 7-42

Measure of Effect Weighting

Former Lockbourne Air Force Base, Lockbourne, Ohio

Category/Attribute	Attribute Weighting Factor	Measure of effect Scoring	
		Modeled Exposure and Effects	**Rationale**
I. Relationship between Measurement and Assessment Endpoints			
▪ Degree of Association	High	Medium	Exposure models were species-specific, but effects data were benchmark values for surrogate mammalian species
▪ Stressor/Response	High	Medium	Exposure modeling was species and chemical-specific, but benchmarks instead of site-specific toxicity studies were used
▪ Utility of Measure	High	Medium	Modeled exposure and effects procedures used are standardized and widely accepted, the primary limitation is lack of receptor-specific effects data
II. Data Quality			
▪ Quality of data	High	High	Exposure and effect data were gathered primarily from peer reviewed scientific literature
III. Study Design			
▪ Site-specificity	High	Medium	Media concentrations used in exposure models were site-specific, but other exposure parameters were literature-based
▪ Stressor-specificity	High	High	Modeled exposure and effects were specific to each of the COECs
▪ Sensitivity	High	N/A	Modeled exposure and effects do not compare potential effects associated with other stressors
▪ Spatial representativeness	High	Medium	Modeled exposures relied on abiotic media data collected throughout the Lockbourne landfill, but may not reflect all potential exposures to target species
▪ Temporal representativeness	High	High	Model exposure and effects lines of evidence spanned critical life stages and in general tissue data used was collected when exposure was expected to be high
▪ Quantitativeness	High	Medium	Exposure and effects modeling is quantitative but does not propagate uncertainty associated with modeling procedures
▪ Use of a standard method	Medium	Medium	Generally accepted exposure and effects modeling procedures were followed.
Total Score	**---**	Medium-High	---

* Adapted from scaling presented in Menzie et al., 1996

TABLE 7-43
Scoring Sheet for Evidence of Harm and Magnitude: Habitat: Terrestrial – AOC 1
Former Lockbourne Air Force Base, Lockbourne, Ohio

Measures of Effects (Target Receptor)	**Weighting Score (high, medium or low)**	**Evidence of Harm (Yes/No/Undetermined)**	**Magnitude (High/Low)**
Lower-Trophic Terrestrial	Medium-High	Yes	High
American Robin	Medium-High	Yes	Low
Mourning Dove	Medium-High	Yes	Low
Red-tailed Hawk	Medium-High	No	---
Deer Mouse	Medium-High	Yes	Low
Short-tailed Shrew	Medium-High	Yes	High
Red Fox	Medium-High	Yes	Low

Adapted from: Menzie et al., 1996.

TABLE 7-44
Scoring Sheet for Evidence of Harm and Magnitude: Habitat: Terrestrial – AOC 2
Former Lockbourne Air Force Base, Lockbourne, Ohio

Measures of Effects (Target Receptor)	**Weighting Score (high, medium or low)**	**Evidence of Harm (Yes/No/Undetermined)**	**Magnitude (High/Low)**
Lower-Trophic Terrestrial	Medium-High	Yes	Low
American Robin	Medium-High	Yes	Low
Mourning Dove	Medium-High	Yes	Low
Red-tailed Hawk	Medium-High	No	---
Deer Mouse	Medium-High	Yes	Low
Short-tailed Shrew	Medium-High	Yes	High
Red Fox	Medium-High	Yes	Low

Adapted from: Menzie et al., 1996.

TABLE 7-45

Scoring Sheet for Evidence of Harm and Magnitude: Habitat: Aquatic – West Ditch

Former Lockbourne Air Force Base, Lockbourne, Ohio

Measures of Effects (Target Receptor)	**Weighting Score (high, medium or low)**	**Evidence of Harm (Yes/No/Undetermined)**	**Magnitude (High/Low)**
Lower Trophic Receptors	Medium-High	Surface Water: Yes Sediment: Yes	Surface Water: -High Sediment: High
Marsh Wren	Medium-High	No	---
Mallard	Medium-High	No	---
Belted Kingfisher	Medium-High	No	---
Muskrat	Medium-High	No	---
Mink	Medium-High	No	---

Adapted from: Menzie et al., 1996.

TABLE 7-46

Scoring Sheet for Evidence of Harm and Magnitude: Habitat: Aquatic – East Ditch

Former Lockbourne Air Force Base, Lockbourne, Ohio

Measures of Effects (Target Receptor)	**Weighting Score (high, medium or low)**	**Evidence of Harm (Yes/No/Undetermined)**	**Magnitude (High/Low)**
Lower Trophic Receptors	Medium-High	Surface Water: No Sediment: Yes	Surface Water: --- Sediment: High
Marsh Wren	Medium-High	No	--
Mallard	Medium-High	No	--
Belted Kingfisher	Medium-High	No	--
Muskrat	Medium-High	No	--
Mink	Medium-High	No	--

Adapted from: Menzie et al., 1996.

TABLE 7-47

Ecological Risk Assessment COPC Summary

Former Lockbourne Air Force Base, Lockbourne, Ohio

	Direct Exposures						Food Web Exposures					
	AOC 1	AOC 2	West Ditch	East Ditch	West Ditch	East Ditch	AOC 1	AOC 2	AOC 1	AOC 2	West Ditch	East Ditch
COPC	Surface Soil		Sediment		Surface Water		Terrestrial (Mammals)		Terrestrial (Avian)		Aquatic (Mammals / Avian)	
Inorganics (MG/KG)												
Aluminium	X											
Arsenic			X									
Cadmium												
Chromium	X											
Cobalt		X										
Copper												
Lead	X								X			
Manganese		X										
Mercury	X											
Selenium	X	X										
Silver												
Thallium	X	X					X	X				
Vanadium												
Zinc	X											
Pesticide/Polychlorinated Biphenyls (MG/KG)												
DDD p,p'-			X									
DDE, p,p'-			X									
DDT, p,p'-	X	X	X									
PCB 1248	X						X					
PCB 1254	X											
Total PCBs	X		X				X		X			
Semivolatile Organic Compounds (MG/KG)												
Acenaphthene	X		X									
Benzo(a)anthracene	X		X				X					
Benzo(a)pyrene	X		X				X					
Benzo(b)fluoranthene	X											
Benzo(k)fluoranthene	X											
Bis(2-ethylhexyl) phthalate	X											
Chrysene	X		X									
Dibenzo(a,h)anthracene	X											
Di-n-butyl phthalate	X											
Fluoranthene	X		X									
Methylnaphthalene-2			X									
Phenanthrene	X		X									
Pyrene	X		X	X			X					
Total Low Molecular Weight PAHs	X		X	X								
Total High Molecular Weight PAHs	X		X	X								
Total PAHs			X	X								
Dioxin/Furans (MG/KG)												
TCDD-TEQ	X	X	X		X							
Dioxin/furan (TEQ) - Mammal (ind)							X					

Figures

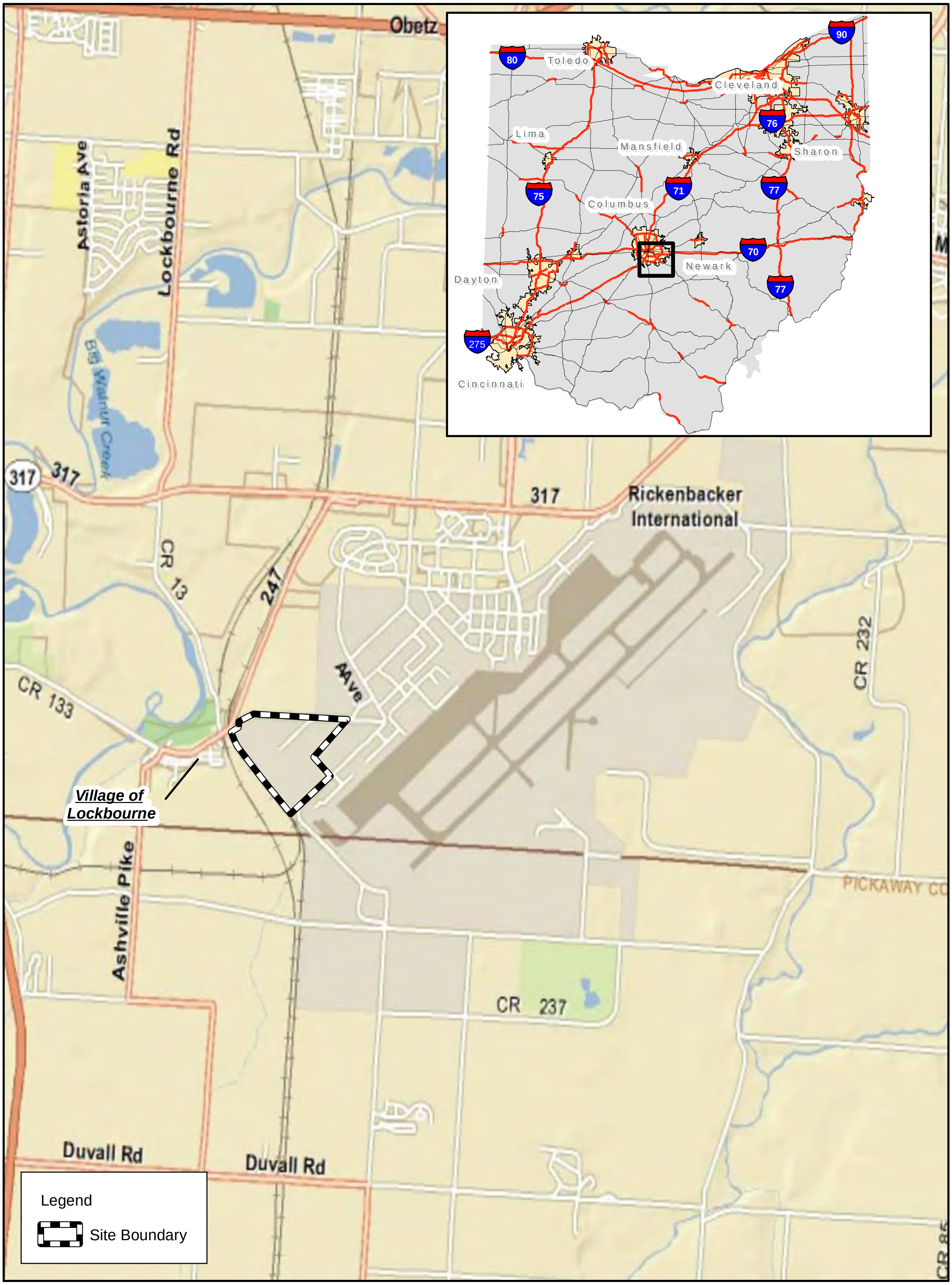


Figure 1-1
Site Location Map
Remedial Investigation Report
Former Lockbourne Air Force Base Landfill, Lockbourne, Ohio

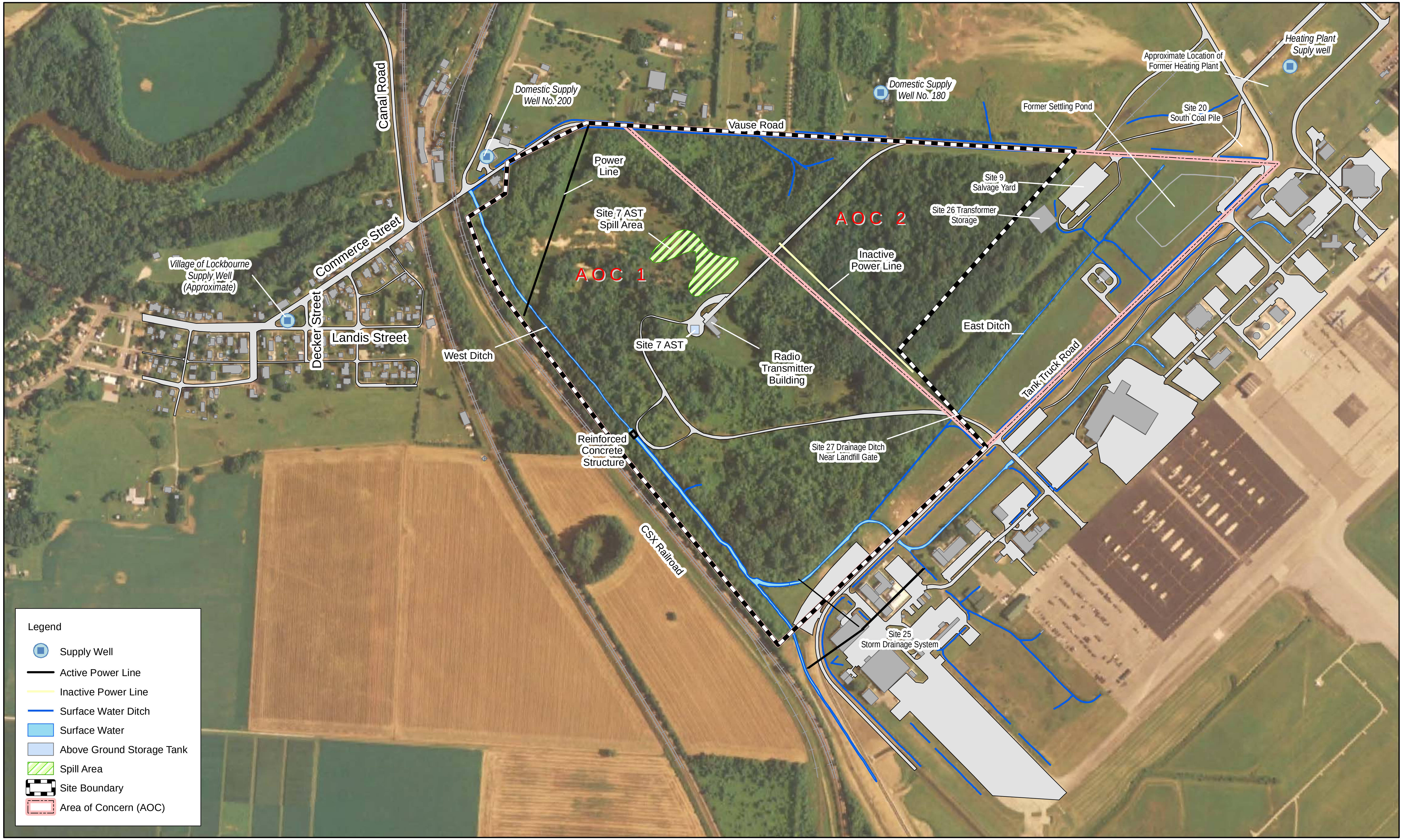
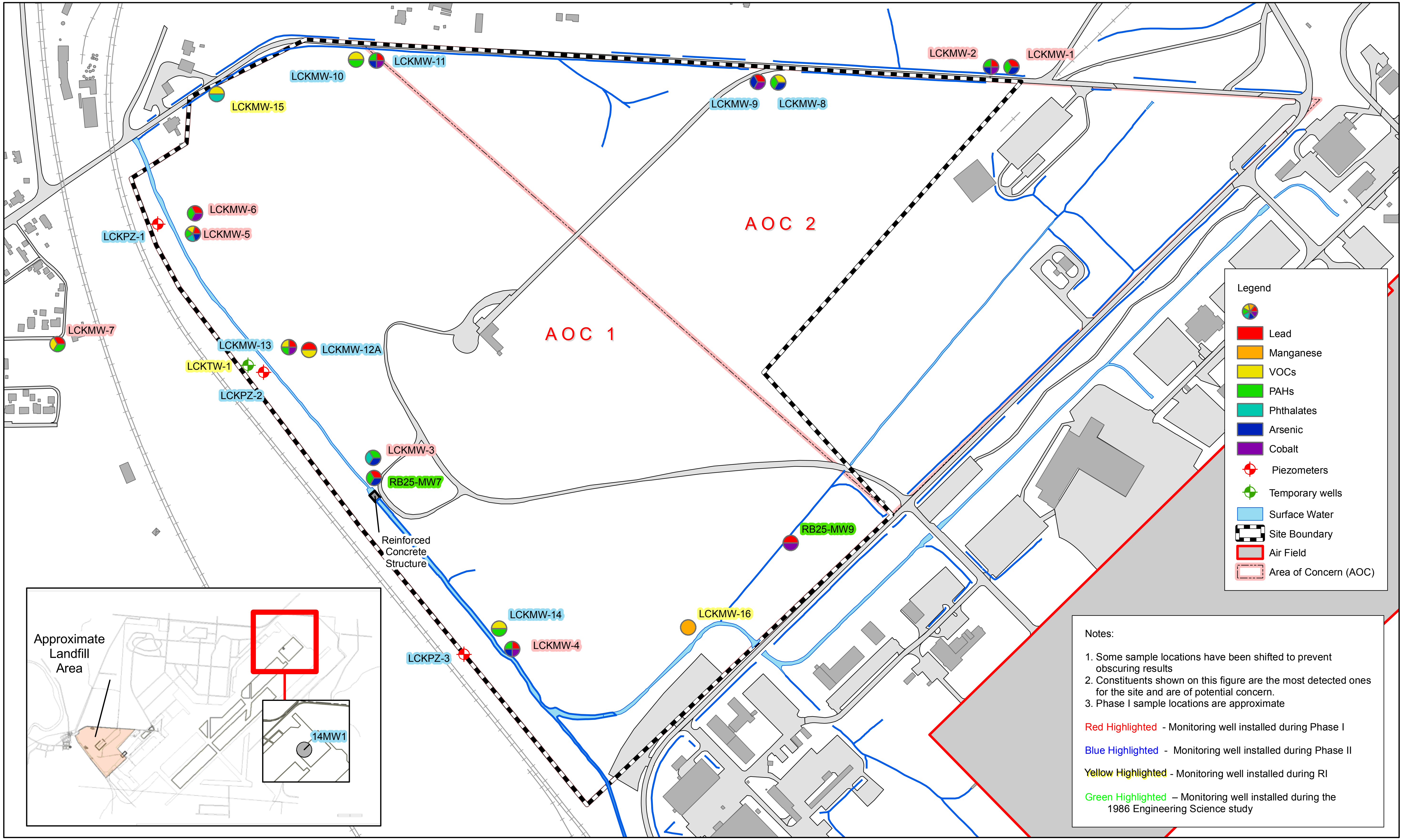


Figure 1-2
Site Features Map
Remedial Investigation Report
Former Lockbourne Air Force Base, Landfill, Ohio

CH2MHILL



Notes:

1. Some sample locations have been shifted to prevent obscuring results
2. Constituents shown on this figure are the most detected ones for the site and are of potential concern.
3. Phase I sample locations are approximate

Red Highlighted - Monitoring well installed during Phase I

Blue Highlighted - Monitoring well installed during Phase II

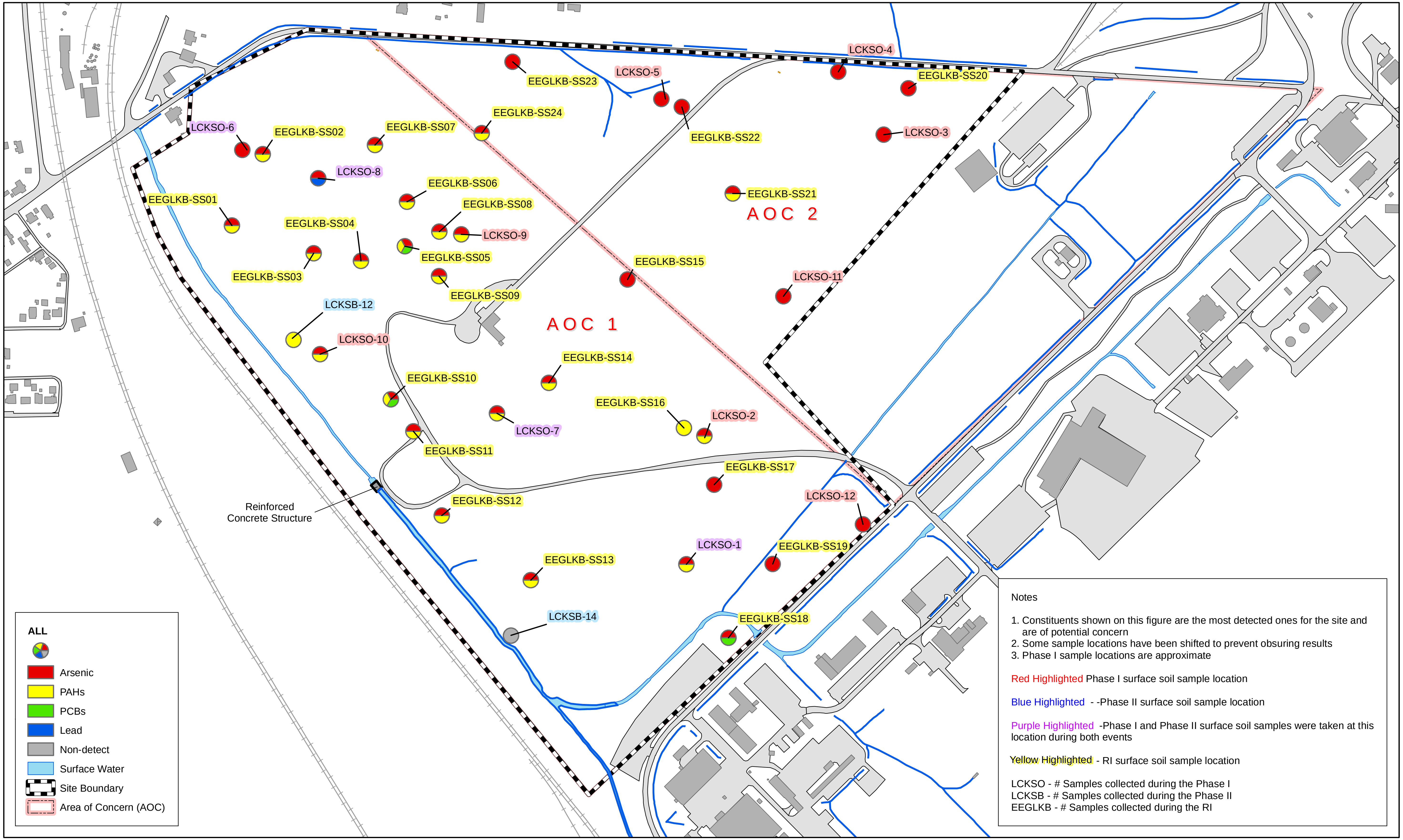
Yellow Highlighted - Monitoring well installed during RI

Green Highlighted – Monitoring well installed during the 1986 Engineering Science study

Figure 2-1
Monitoring Well Locations and Most Common Detections
Remedial Investigation Report
Former Lockbourne Air Force Base Landfill, Ohio

CH2MHILL

\\CORVUS\GROUPS\GIS\PROJECTS\GEOBASE\LOCKBOURNE_AFB\REPORTS\05_REPORT\MAPFILES\FIGURE 2-1 (MONITORING WELL).MXD KBUCKVOL 2/10/10



Notes

1. Constituents shown on this figure are the most detected ones for the site and are of potential concern
2. Some sample locations have been shifted to prevent obsuring results
3. Phase I sample locations are approximate

Red Highlighted Phase I surface soil sample location

Blue Highlighted - -Phase II surface soil sample location

Purple Highlighted -Phase I and Phase II surface soil samples were taken at this location during both events

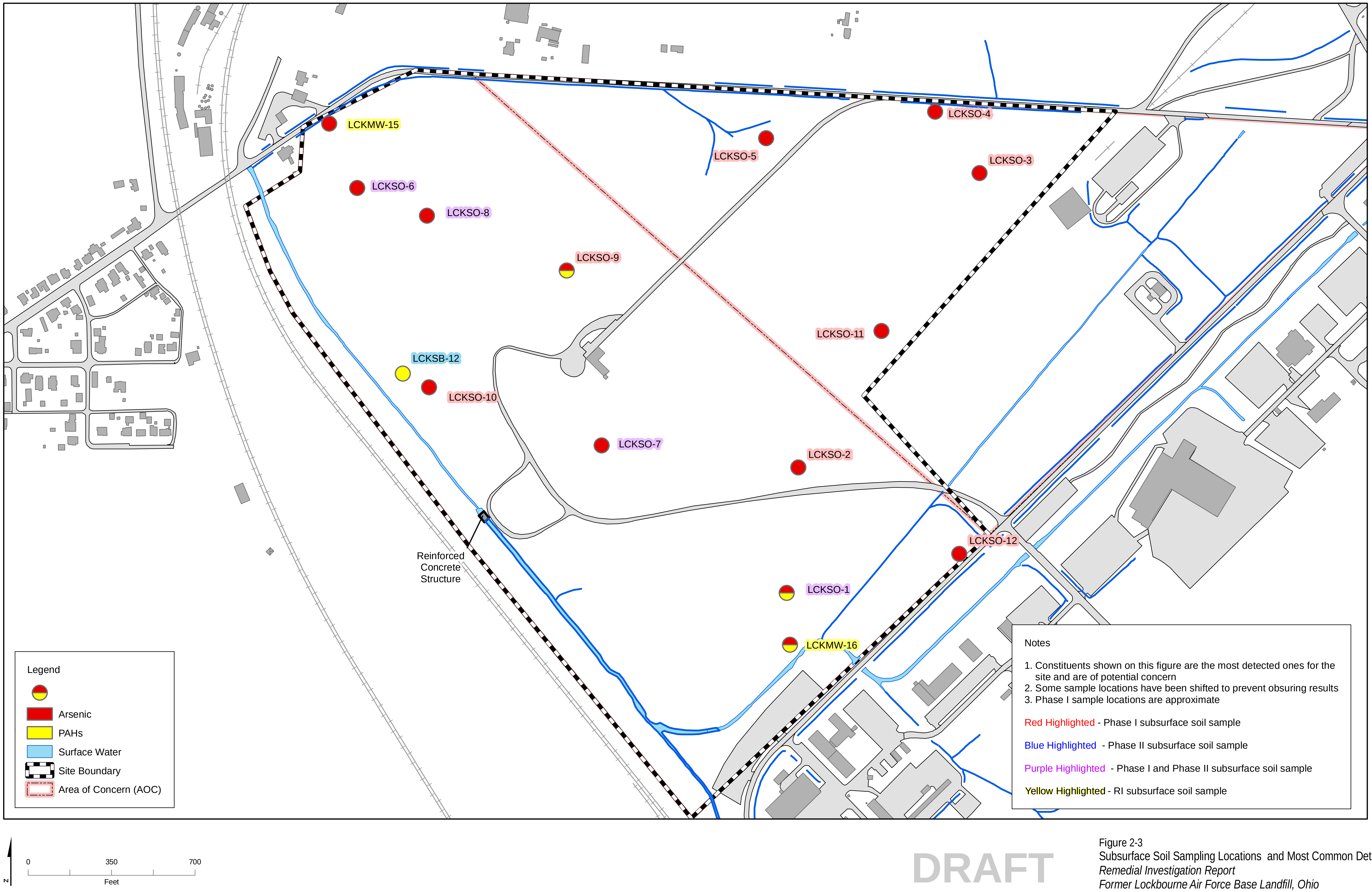
Yellow Highlighted - RI surface soil sample location

LCKSO - # Samples collected during the Phase I
LCKSB - # Samples collected during the Phase II
EEGLKB - # Samples collected during the RI

DRAFT

Figure 2-2
Surface Soil Sampling Locations and Most Common Detections
Remedial Investigation Report
Former Lockbourne Air Force Base Landfill, Ohio

CH2MHILL



Notes

1. Constituents shown on this figure are the most detected ones for the site and are of potential concern
2. Some sample locations have been shifted to prevent obsuring results
3. Phase I sample locations are approximate

Red Highlighted - Phase I subsurface soil sample

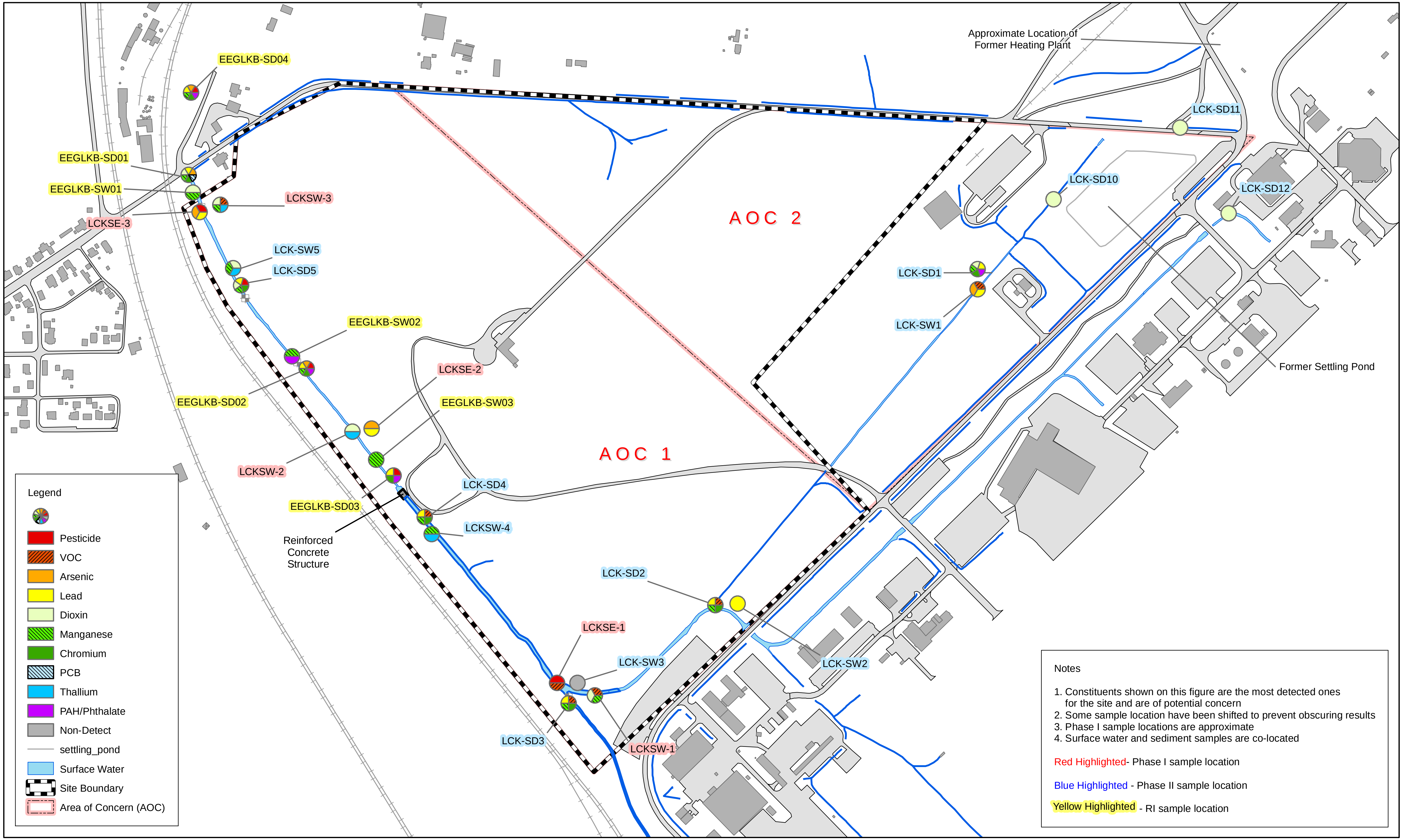
Blue Highlighted - Phase II subsurface soil sample

Purple Highlighted - Phase I and Phase II subsurface soil sample

Yellow Highlighted - RI subsurface soil sample

Figure 2-3
Subsurface Soil Sampling Locations and Most Common Detections
Remedial Investigation Report
Former Lockbourne Air Force Base Landfill, Ohio

CH2MHILL



Notes

1. Constituents shown on this figure are the most detected ones for the site and are of potential concern
2. Some sample location have been shifted to prevent obscuring results
3. Phase I sample locations are approximate
4. Surface water and sediment samples are co-located

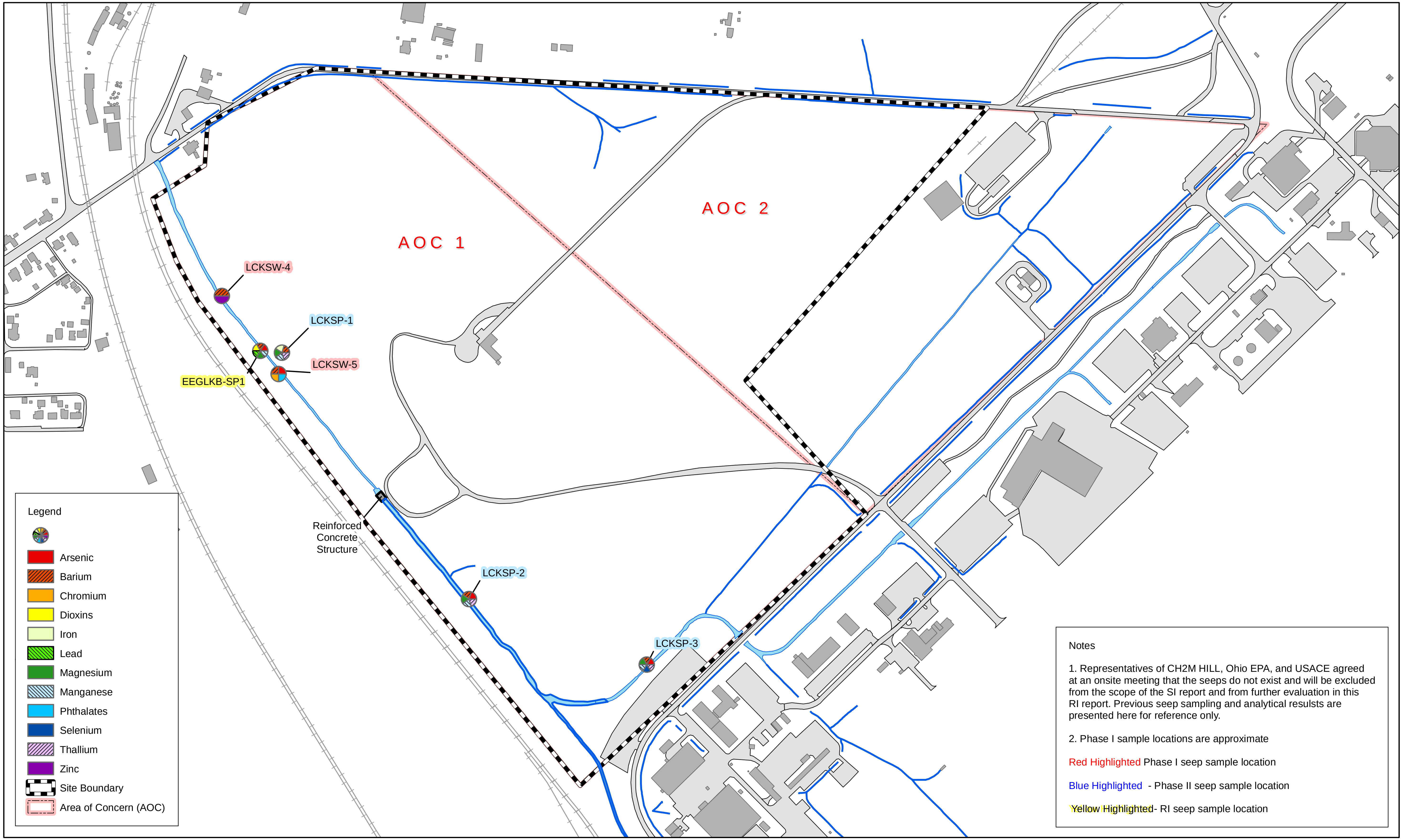
Red Highlighted- Phase I sample location

Blue Highlighted - Phase II sample location

Yellow Highlighted - RI sample location

Figure 2-4
Surface Water and Sediment Sample Locations and Most Common Detections
Remedial Investigation Report
Former Lockbourne Air Force Base Landfill, Ohio

CH2MHILL



Legend

- 🟥 Arsenic
- ▨ Barium
- 🟧 Chromium
- 🟨 Dioxins
- ▢ Iron
- ▨ Lead
- 🟩 Magnesium
- ▨ Manganese
- 🟦 Phthalates
- 🟦 Selenium
- ▨ Thallium
- 🟪 Zinc
- ▩ Site Boundary
- ▢ Area of Concern (AOC)

Notes

1. Representatives of CH2M HILL, Ohio EPA, and USACE agreed at an onsite meeting that the seeps do not exist and will be excluded from the scope of the SI report and from further evaluation in this RI report. Previous seep sampling and analytical resulsts are presented here for reference only.

2. Phase I sample locations are approximate

Red Highlighted Phase I seep sample location

Blue Highlighted - Phase II seep sample location

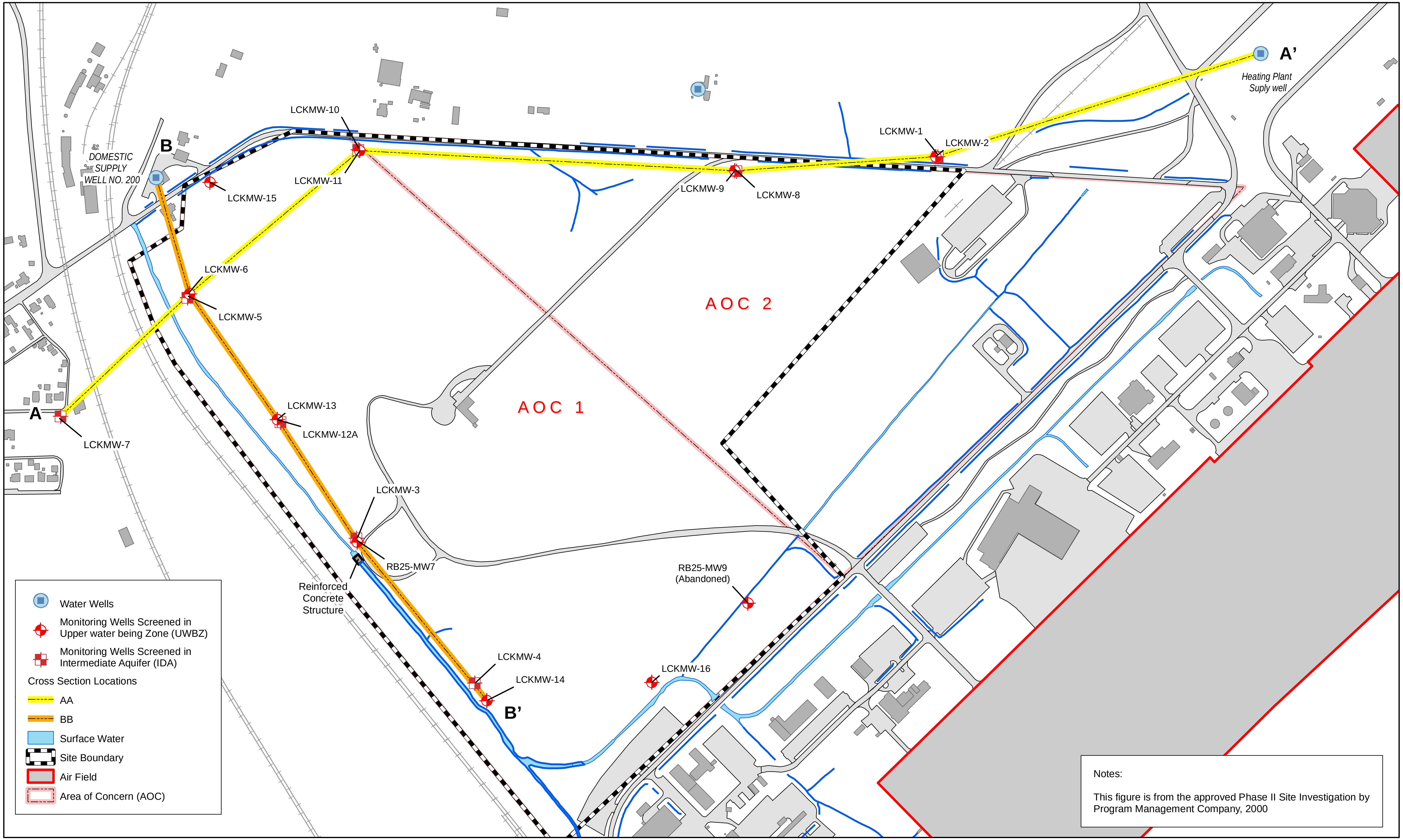
Yellow Highlighted- RI seep sample location

DRAFT

Figure 2-5
Seep Sampling Locations and Most Common Detections
Remedial Investigation Report
Former Lockbourne Air Force Base Landfill, Ohio

CH2MHILL

\\CORVUS\GROUPS\GIS\PROJECTS\GEOBASE\LOCKBOURNE_AFB\REPORTS\368856_RI\MAPFILES\FIGURE 2-5 (SEEP SAMPLING LOCATIONS).MXD KBUCKVOL 3/1/10



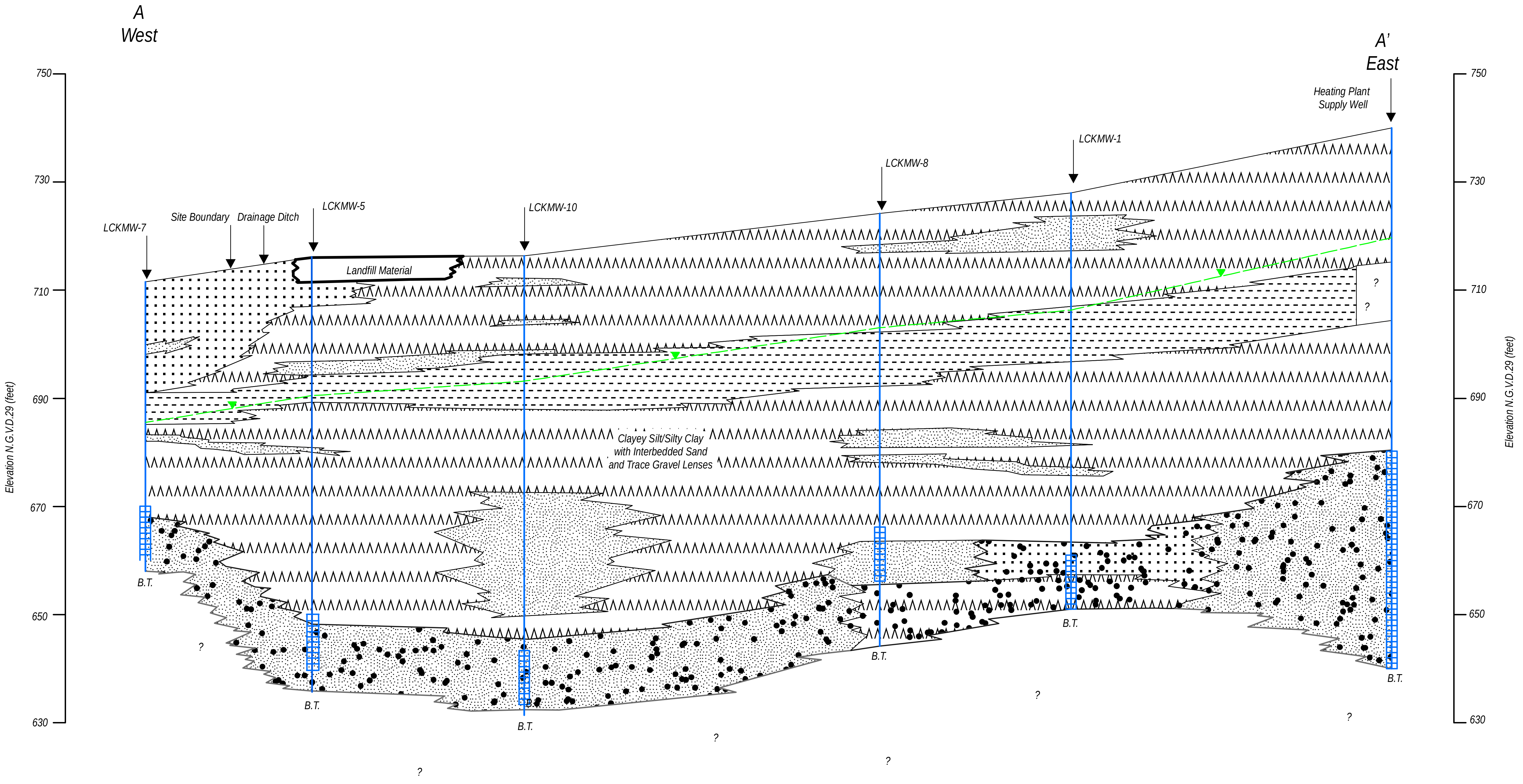
Notes:

This figure is from the approved Phase II Site Investigation by Program Management Company, 2000

Figure 3-1
Cross Section Index Map
Remedial Investigation Report
Former Lockbourne Air Force Base, Landfill, Ohio

CH2MHILL

\\CORVUS\GROUPS\GIS\PROJECTS\GEOBASE\LOCKBOURNE_AFB\REPORTS\368856_RI\MAPFILES\FIGURE 3-1 (CROSS SECTION).MXD KBUCKVOL 2/9/2010 14:23:19



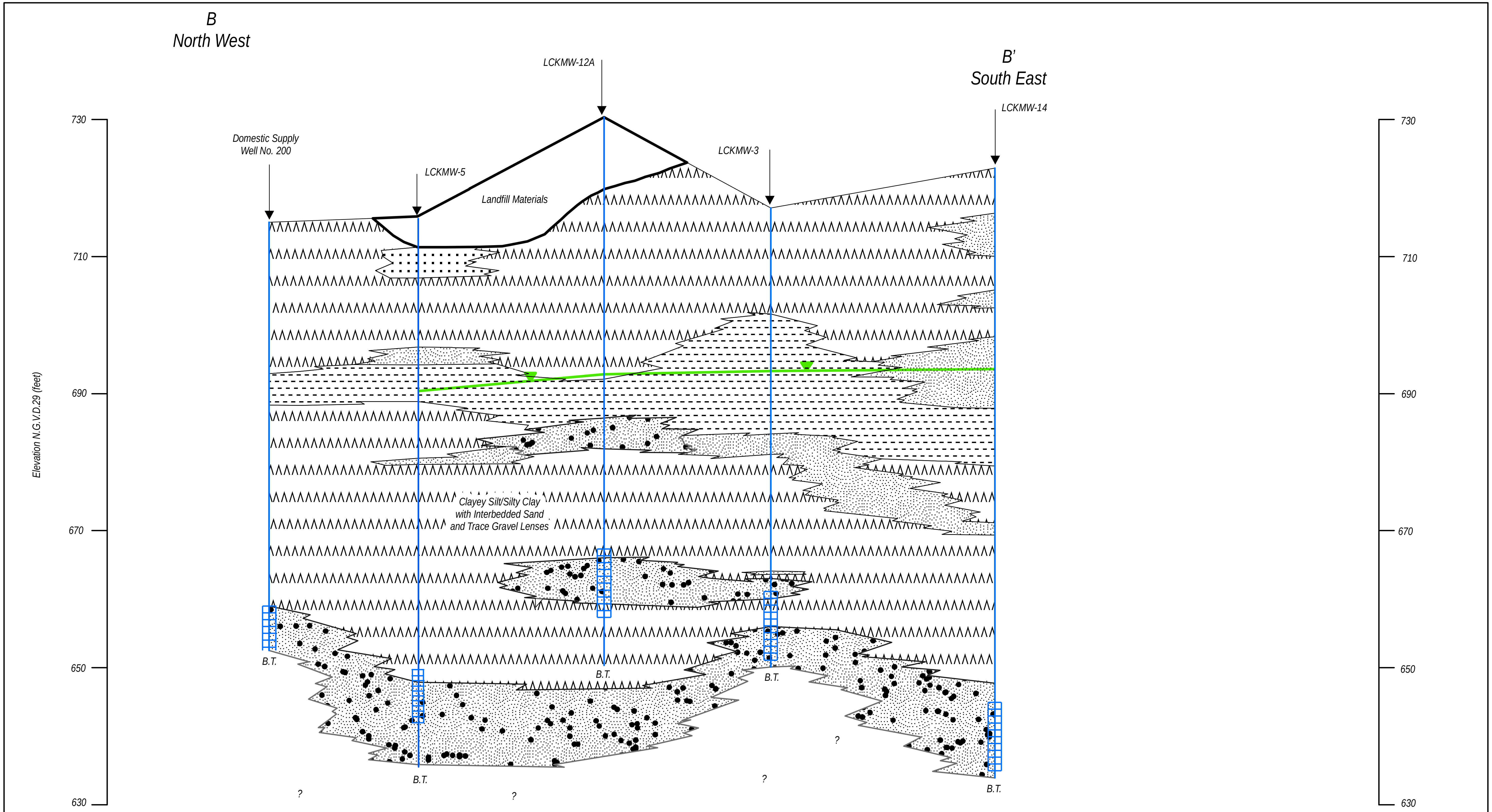
Notes:
This figure is from the approved Phase II Site Investigation by Program Management Company, 2000
Vertical Exaggeration = 25x

N
0 250 500
Feet

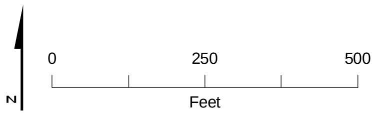
- Deep Potentiometric Surface
▭ Lime/Fly Ash Landfill Cover
▦ Sandy Silt (SP-SM)
▨ Clayey Silt/Silty Clay (CL)
▦ Gravel/Cobbles
▤ Gray Clay (CL)
▒ Sand (SM)
Well Screen Interval
B.T. Boring Terminal

Figure 3-2
Cross Section A-A'
Remedial Investigation Report
Former Lockbourne Air Force Base Landfill, Ohio

CH2MHILL



Notes:
This figure is from the approved Phase II Site Investigation by Program Management Company, 2000
Vertical Exaggeration = 25x

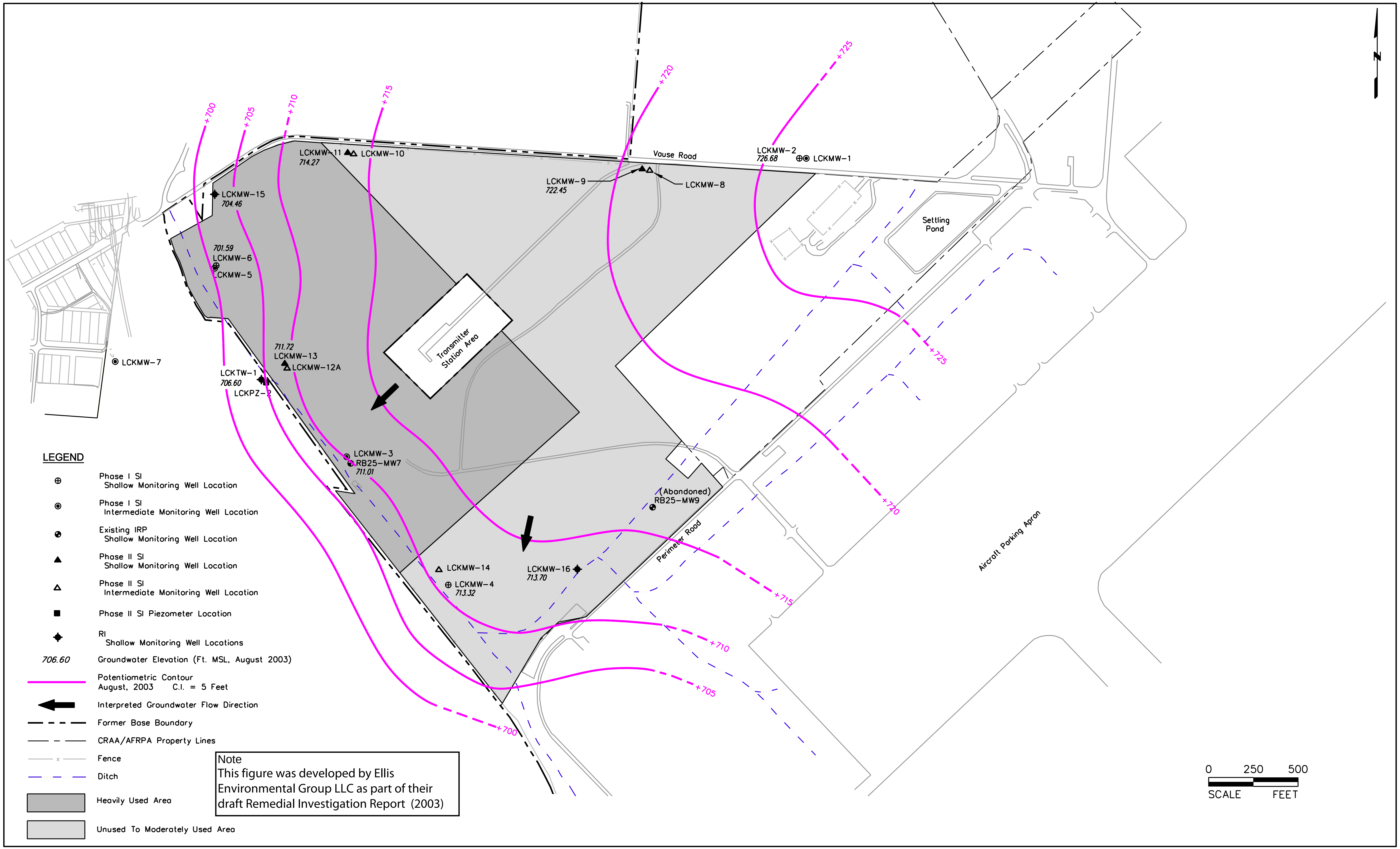


Layer

- 🟩 Deep Potentiometric Surface
- ▭ Lime/Fly Ash Landfill Cover
- ▨ Sandy Silt (SP-SM)
- ▨ Clayey Silt/Silty Clay (CL)
- ▨ Gravel/Cobbles
- ▨ Gray Clay (CL)
- ▨ Sand (SM)
- Well Screen Interval
- B.T. Boring Terminal

Figure 3-3
Cross Section B-B'
Remedial Investigation Report
Former Lockbourne Air Force Base Landfill, Ohio

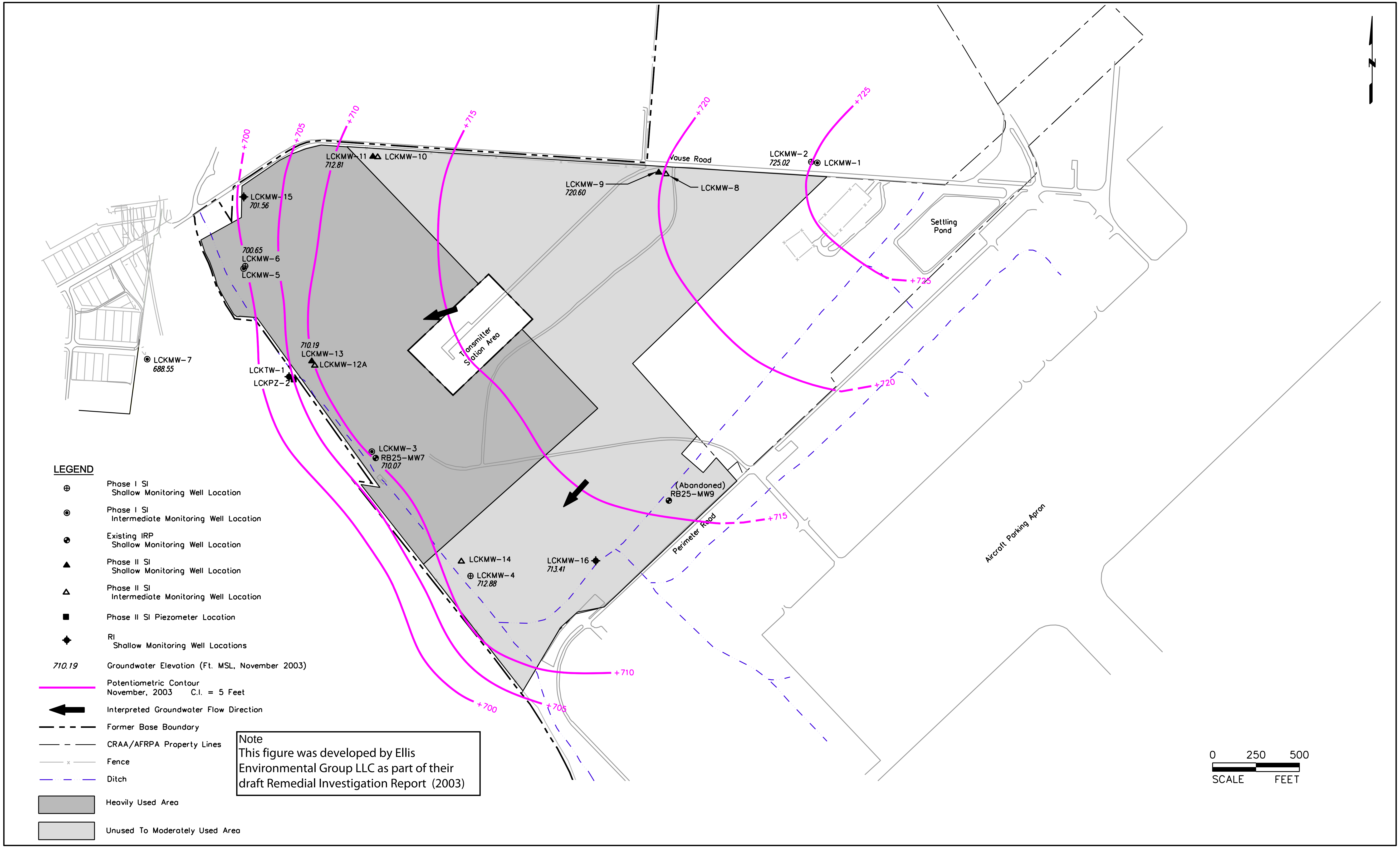
CH2MHILL



Note
This figure was developed by Ellis Environmental Group LLC as part of their draft Remedial Investigation Report (2003)

Figure 3-4
RI UWBZ Potentiometric Surface Map, August 2003
Site Monitoring Well Network
Remedial Investigation Report
Former Lockbourne Air Force Base Landfill, Lockbourne , Ohio

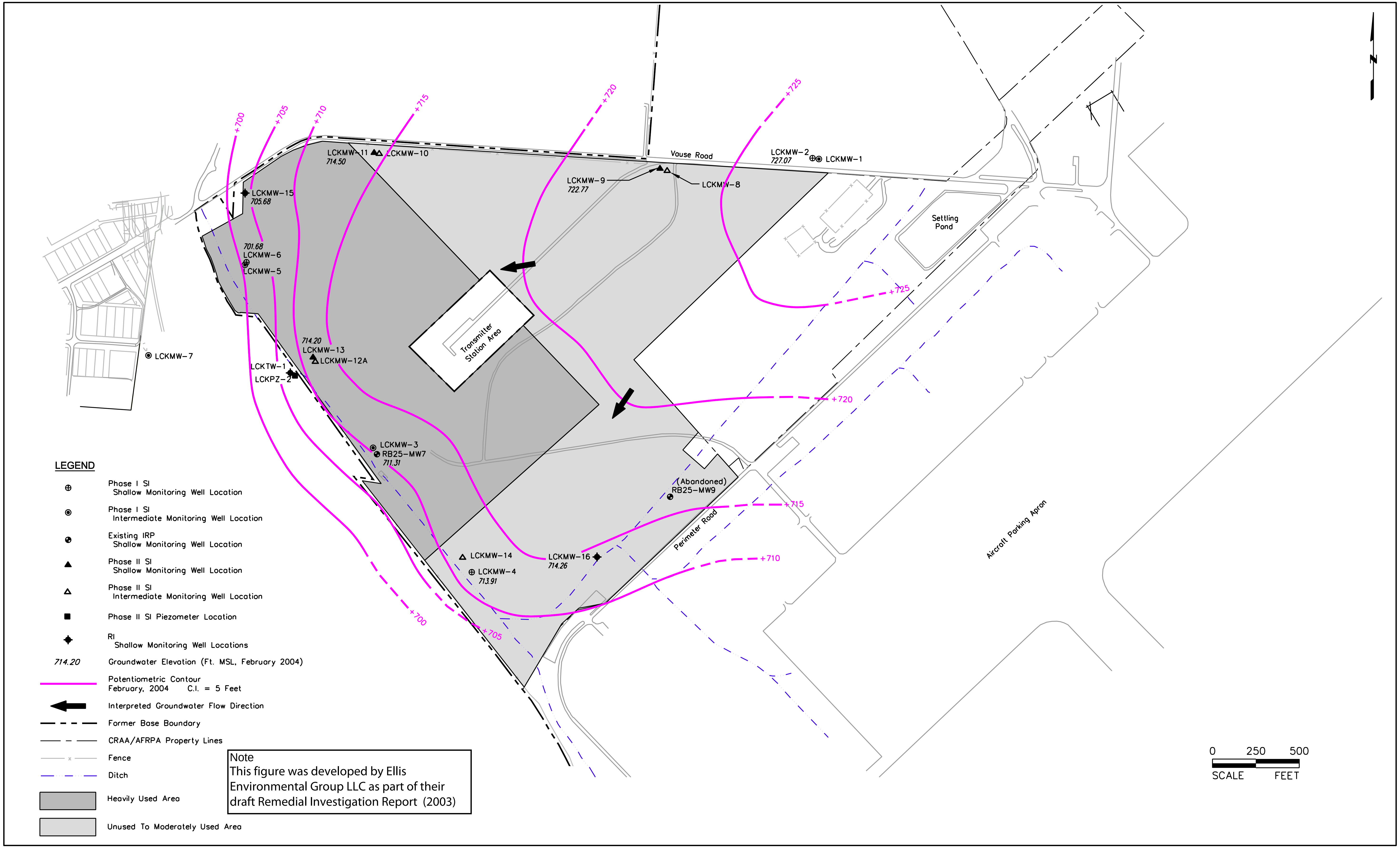
CH2MHILL



Note
This figure was developed by Ellis Environmental Group LLC as part of their draft Remedial Investigation Report (2003)

Figure 3-5
RI UWBZ Potentiometric Surface Map, November 2003
Site Monitoring Well Network
Remedial Investigation Report
Former Lockbourne Air Force Base Landfill, Lockbourne, Ohio

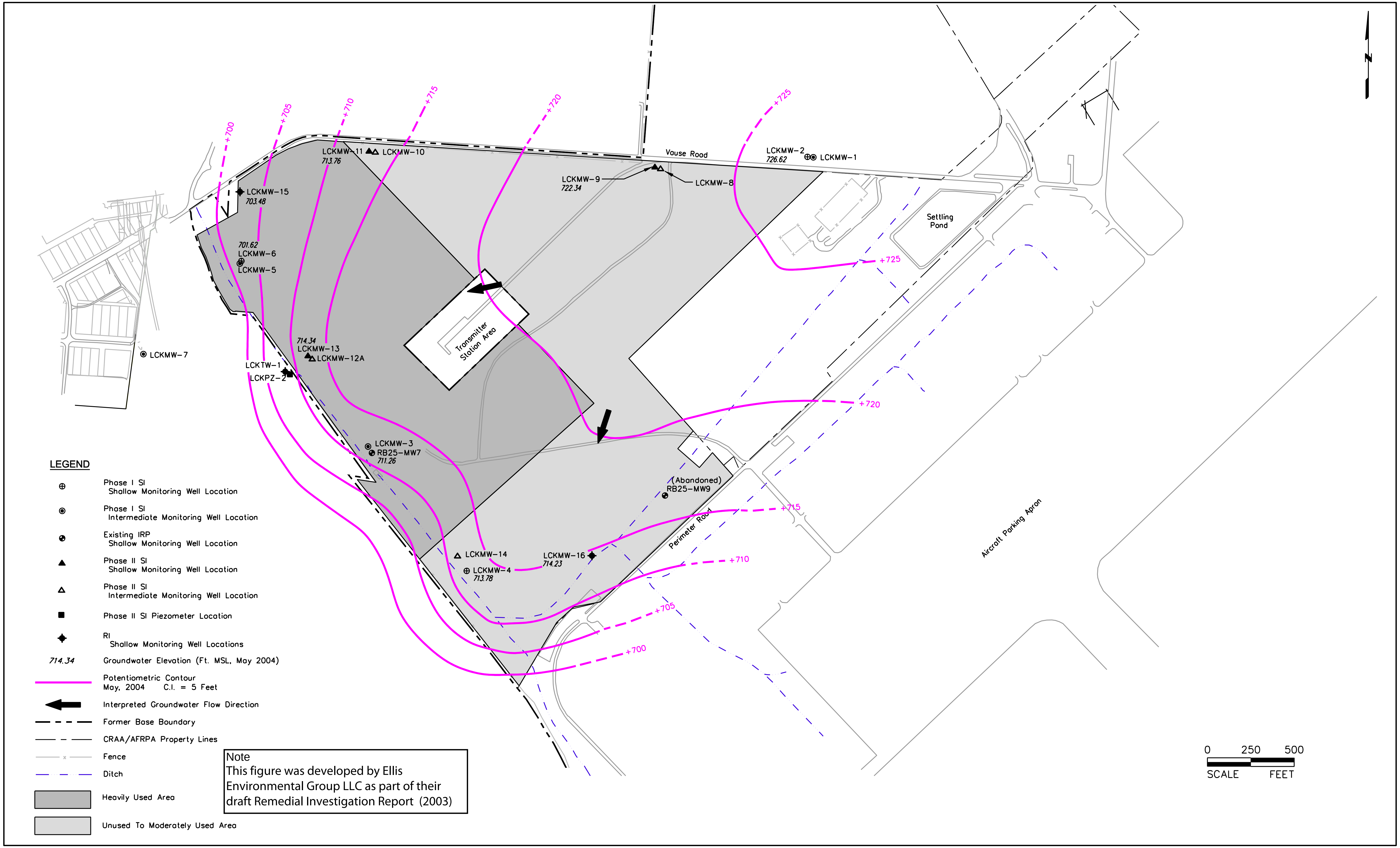
CH2MHILL



Note
This figure was developed by Ellis Environmental Group LLC as part of their draft Remedial Investigation Report (2003)

Figure 3-6
RI UWBZ Potentiometric Surface Map, February 2004
Site Monitoring Well Network
Remedial Investigation Report
Former Lockbourne Air Force Base Landfill, Lockbourne, Ohio

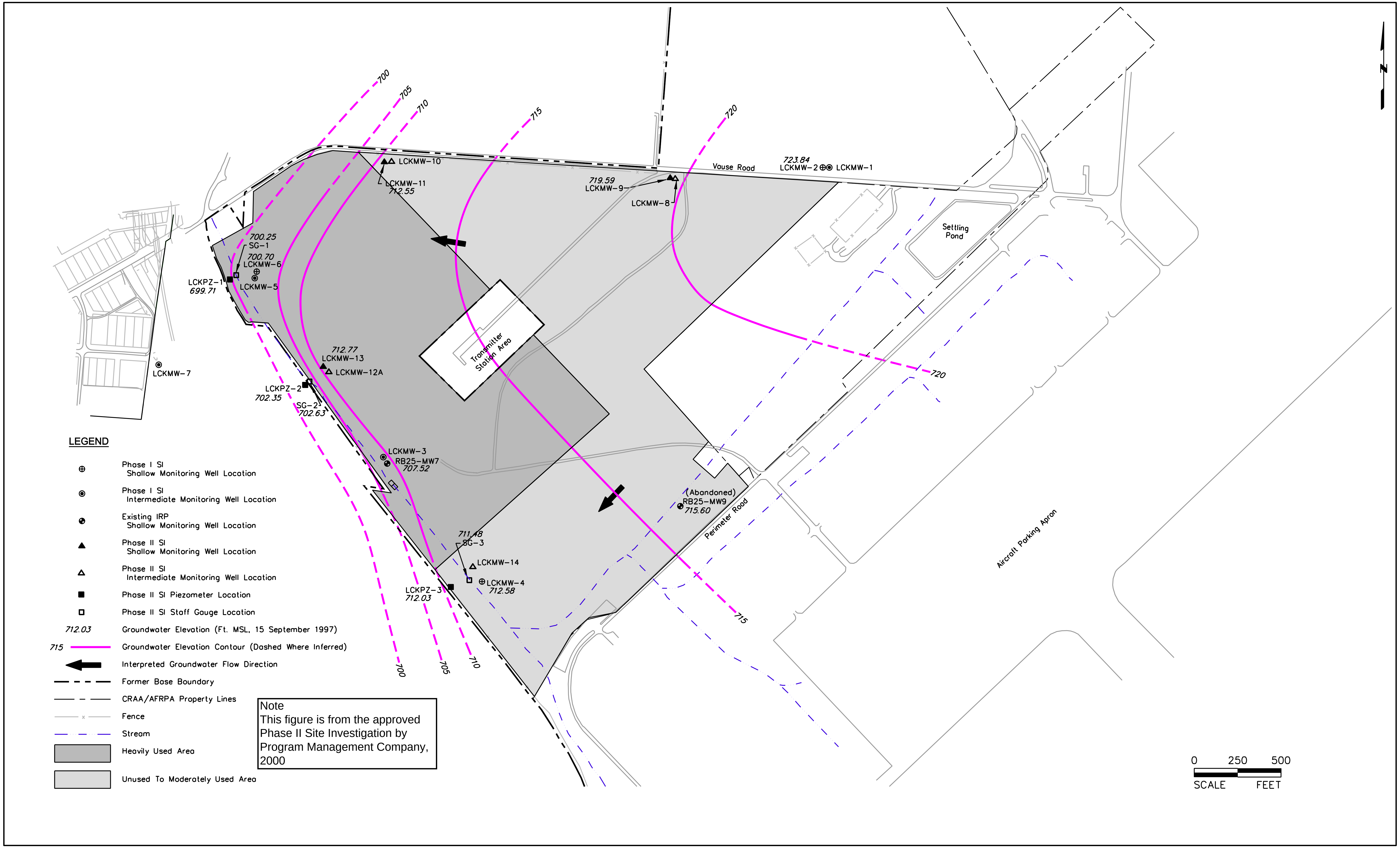
CH2MHILL



Note
This figure was developed by Ellis Environmental Group LLC as part of their draft Remedial Investigation Report (2003)

Figure 3-7
RI UWBZ Potentiometric Surface Map, May 2004
Site Monitoring Well Network
Remedial Investigation Report
Former Lockbourne Air Force Base Landfill, Lockbourne, Ohio

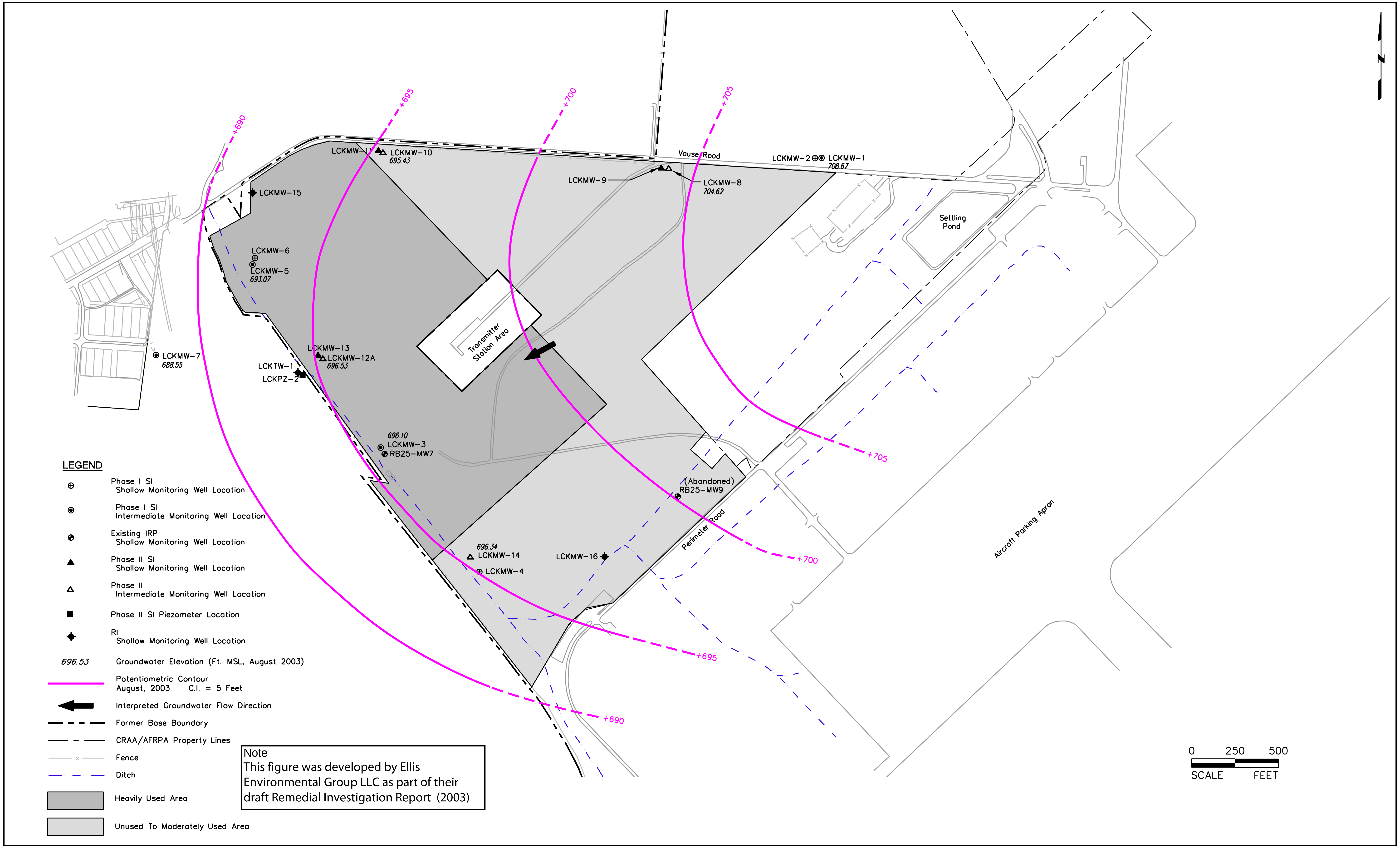
CH2MHILL



Note
This figure is from the approved Phase II Site Investigation by Program Management Company, 2000

Figure 3-8
Phase II SI UWBZ Potentiometric Surface Map
Site Monitoring Well Network
Remedial Investigation Report
Former Lockbourne Air Force Base Landfill, Lockbouren, Ohio

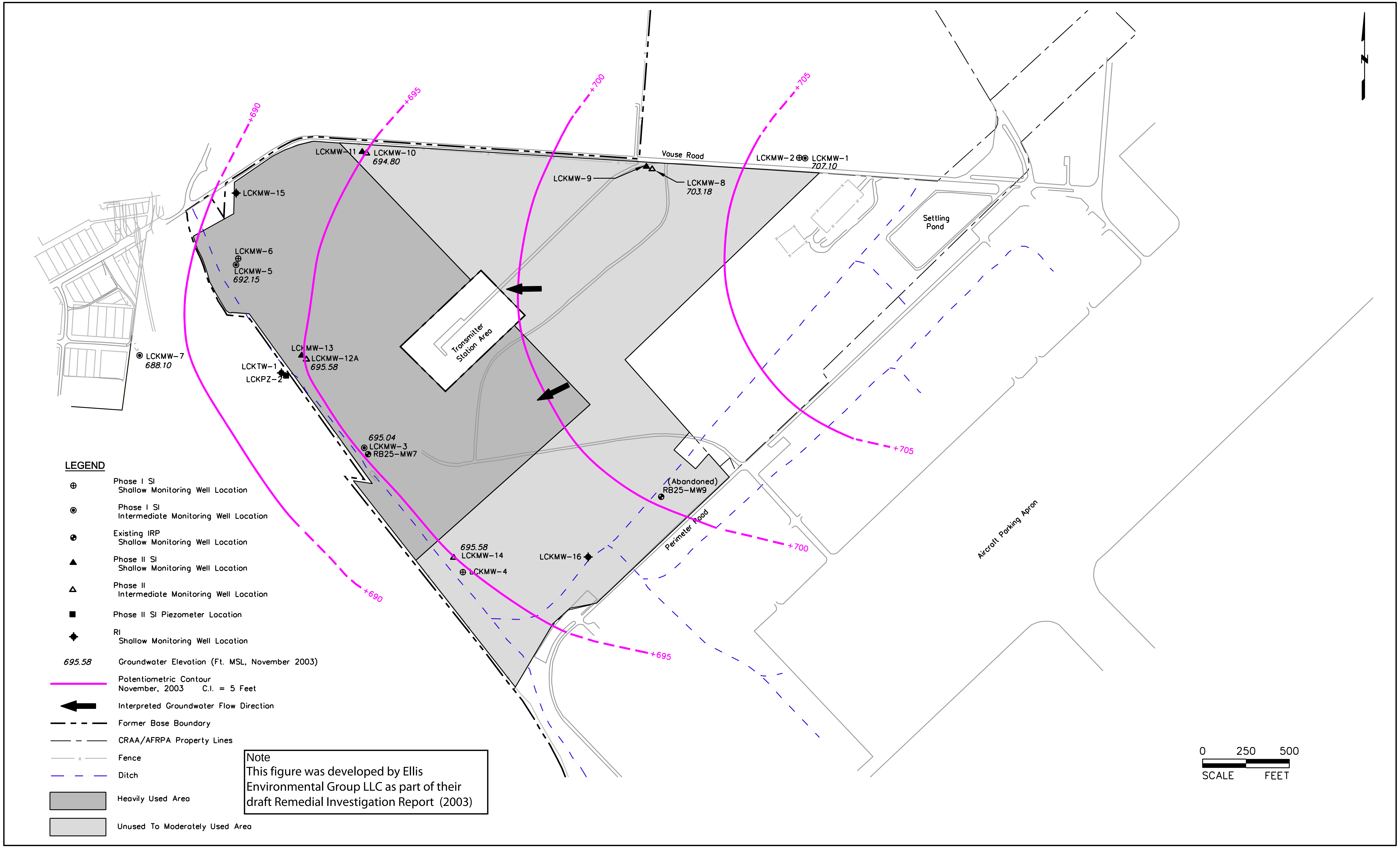
CH2MHILL



Note
This figure was developed by Ellis Environmental Group LLC as part of their draft Remedial Investigation Report (2003)

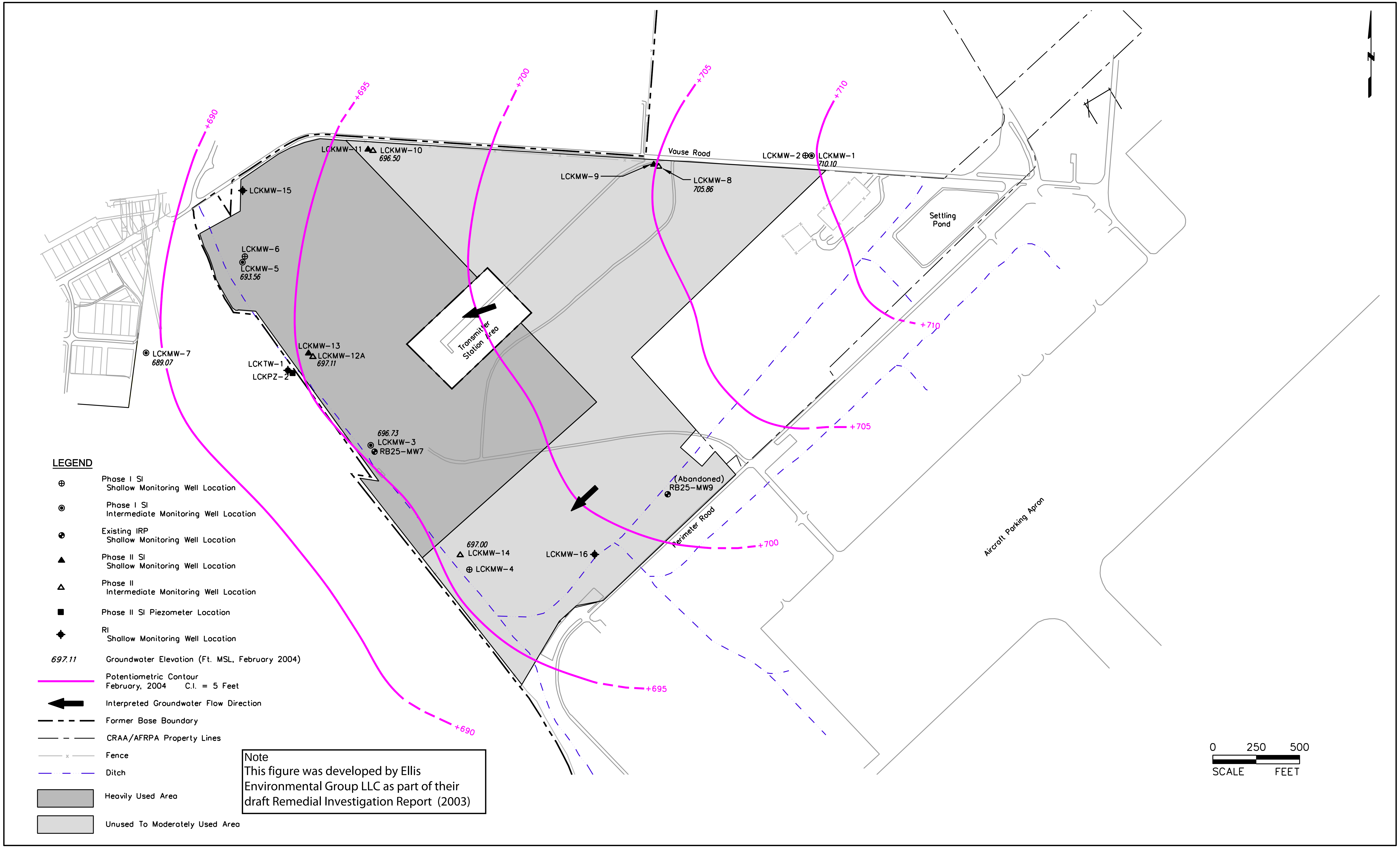
Figure 3-9
RI IDA Potentiometric Surface Map, August 2003
Site Monitoring Well Network
Remedial Investigation Report
Former Lockbourne Air Force Base Landfill, Lockbourne, Ohio

CH2MHILL



Note
This figure was developed by Ellis Environmental Group LLC as part of their draft Remedial Investigation Report (2003)

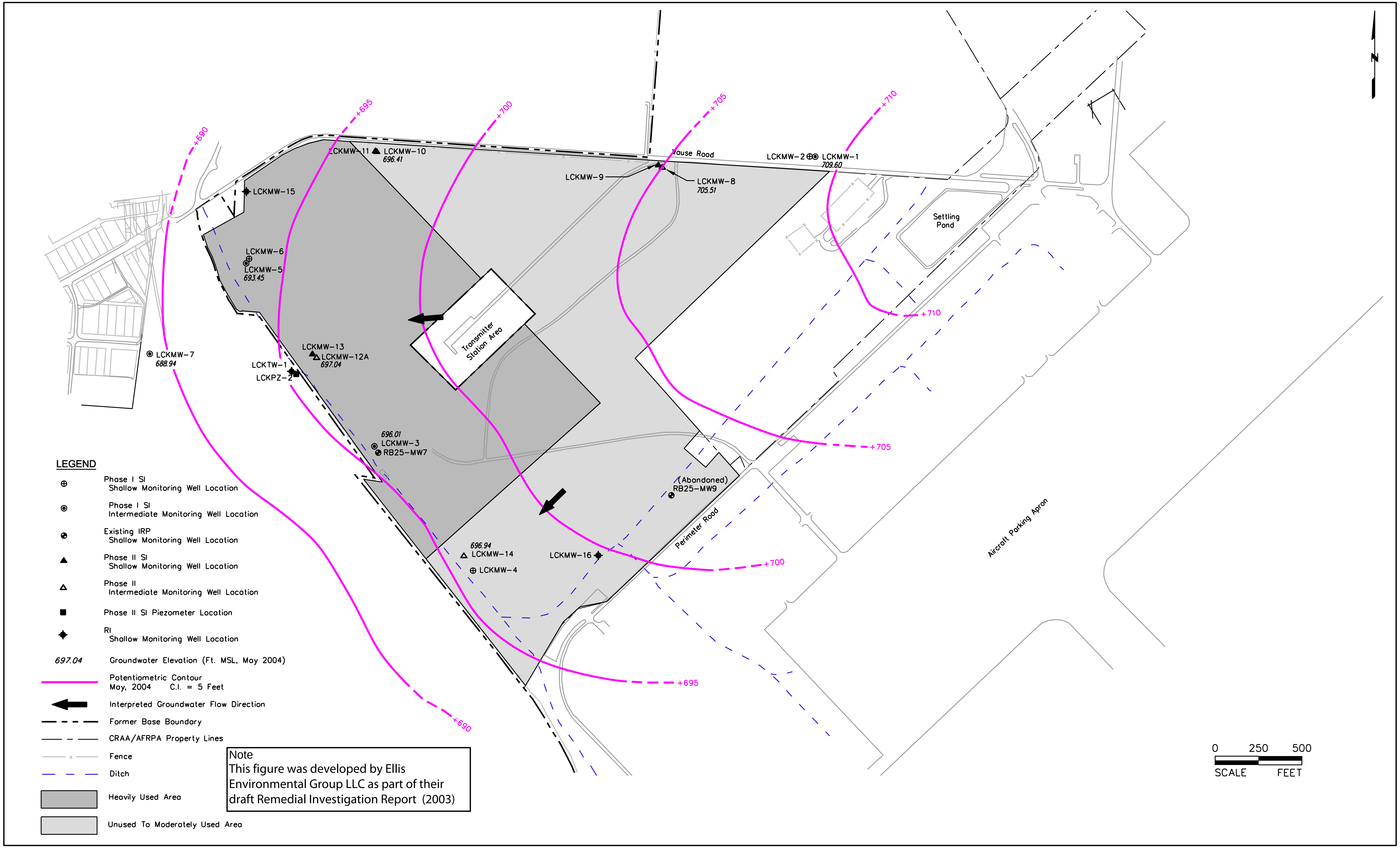
Figure 3-10
RI IDA Potentiometric Surface Map, November 2003
Site Monitoring Well Network
Remedial Investigation Report
Former Lockbourne Air Force Base Landfill, Lockbourne, Ohio



Note
This figure was developed by Ellis Environmental Group LLC as part of their draft Remedial Investigation Report (2003)

Figure 3-11
RI IDA Potentiometric Surface Map, February 2004
Site Monitoring Well Network
Remedial Investigation Report
Former Lockbourne Air Force Base Landfill, Lockbourne, Ohio

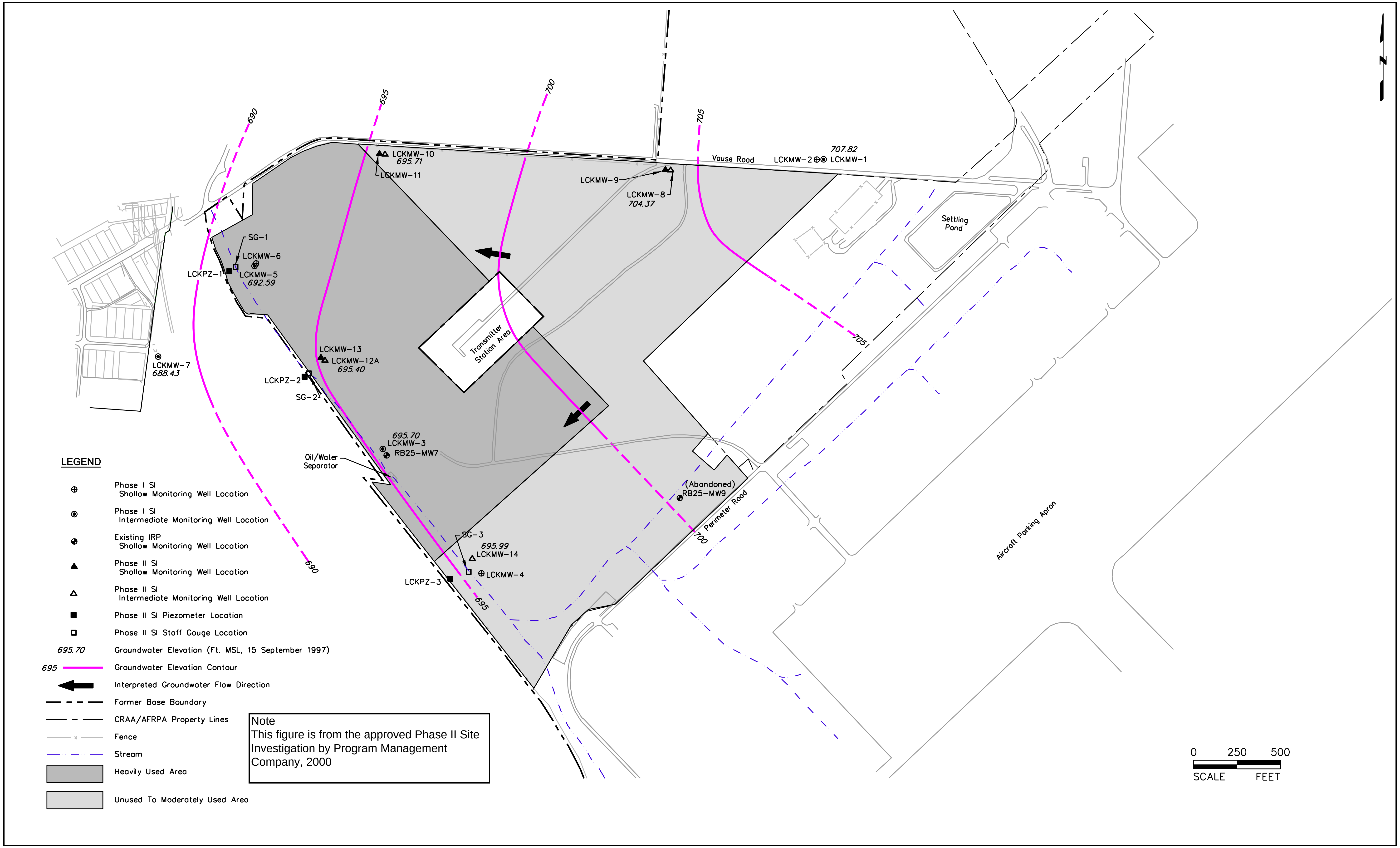
CH2MHILL



Note
This figure was developed by Ellis Environmental Group LLC as part of their draft Remedial Investigation Report (2003)

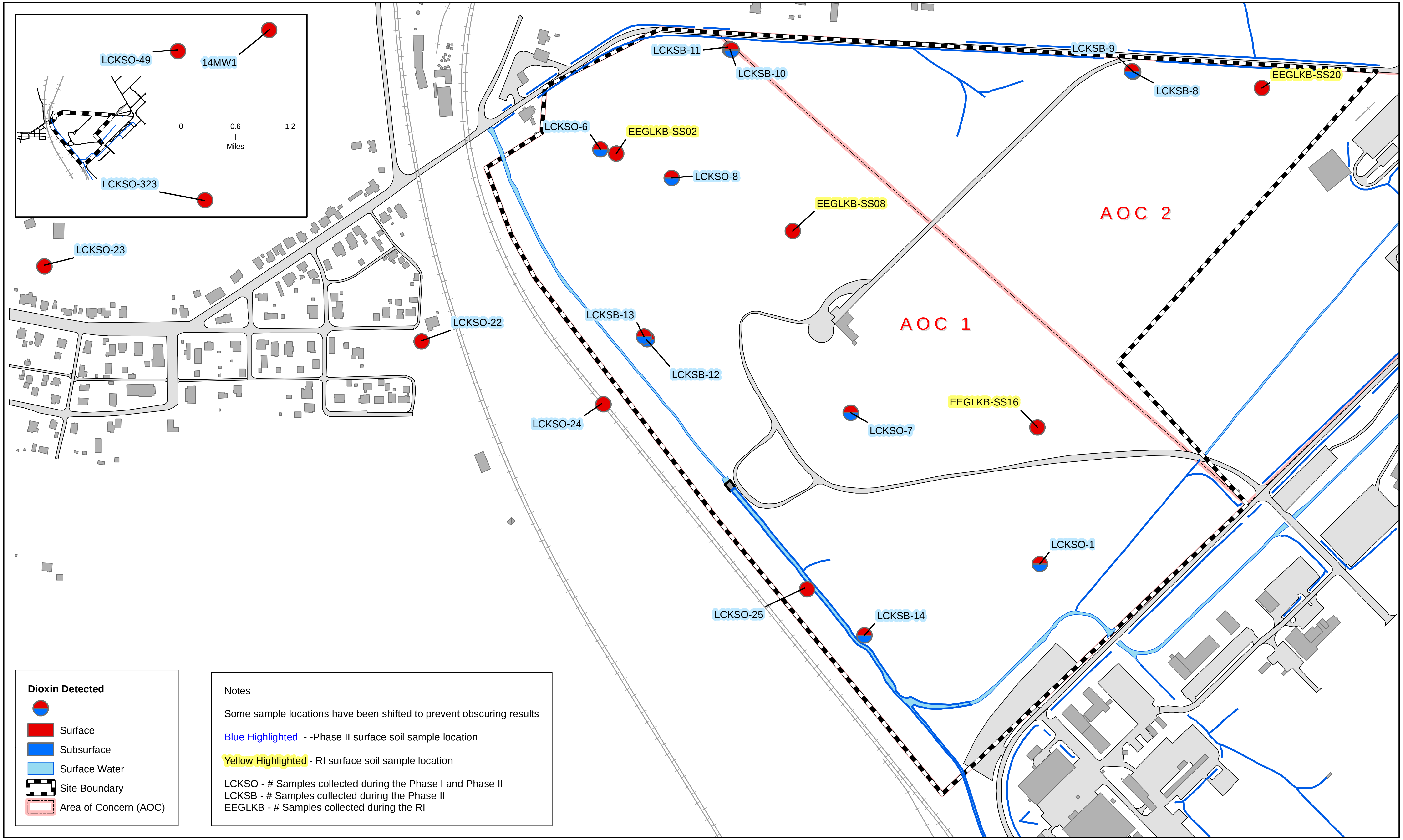
Figure 3-12
RI IDA Potentiometric Surface Map, May 2004
Site Monitoring Well Network
Remedial Investigation Report
Former Lockbourne Air Force Base Landfill, Lockbourne, Ohio

CH2MHILL



Note
This figure is from the approved Phase II Site Investigation by Program Management Company, 2000

Figure 3-13
Phase II SI IDA Potentiometric Surface Map
Site Monitoring Well Network
Remedial Investigation Report
Former Lockbourne Air Force Base Landfill, Lockbourne, Ohio



Dioxin Detected

- 🟥 Surface
- 🟦 Subsurface
- 🟦 Surface Water
- ▨ Site Boundary
- ▭ Area of Concern (AOC)

Notes

Some sample locations have been shifted to prevent obscuring results

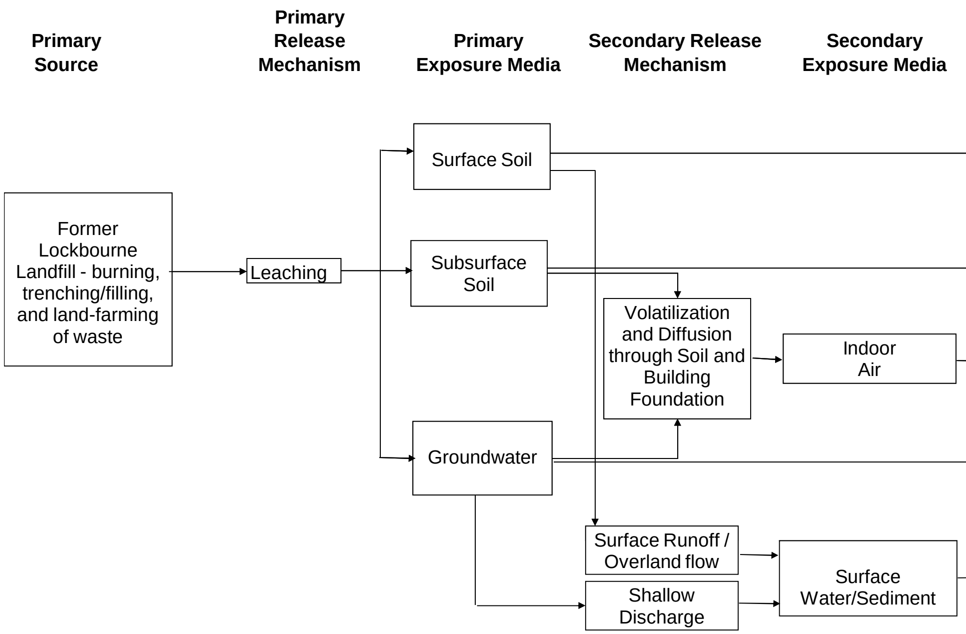
Blue Highlighted - -Phase II surface soil sample location

Yellow Highlighted - RI surface soil sample location

LCKSO - # Samples collected during the Phase I and Phase II
LCKSB - # Samples collected during the Phase II
EEGLKB - # Samples collected during the RI

Figure 4-1
Dioxins Detected in Surface and Subsurface Soil Samples
Remedial Investigation Report
Former Lockbourne Air Force Base Landfill, Ohio

\\CORVUS\GROUPS\GIS\PROJECTS\GEOBASE\LOCKBOURNE_AFB\REPORTS\05_REPORT\MAPFILES\FIGURE 4-1 (DIOXINS SUBSURFACE AND SURFACE SOIL).MXD KBUCKVOL 2/9/2010 14:34:13

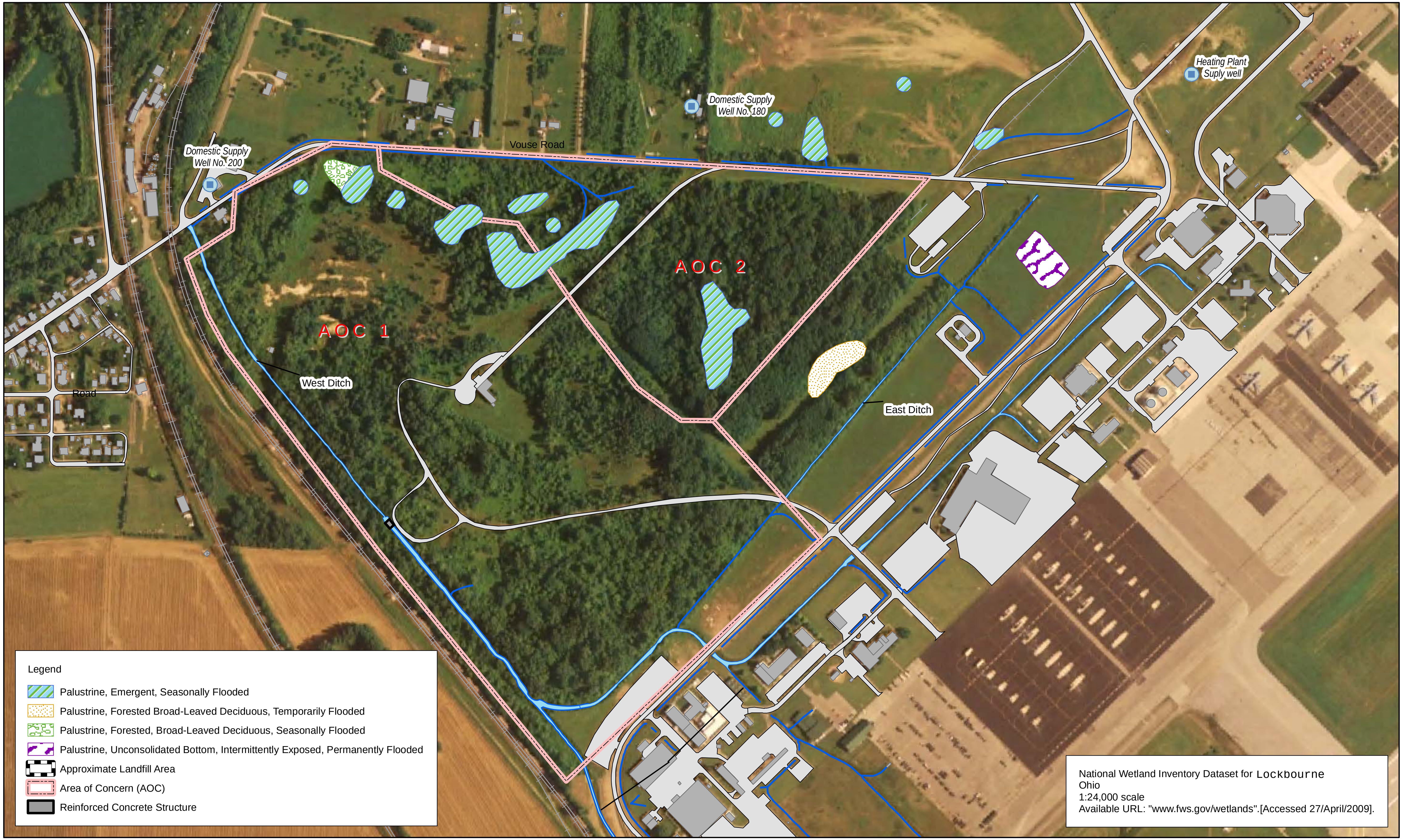


Potential Human Receptors

Exposure Route	Maintenance Worker	Trespasser	Off-Site Industrial Worker	On-Site Facility Worker	Construction Worker	Off-Site Resident
Ingestion	X	X	NA	X	NA	NA
Dermal Contact	X	X	NA	X	NA	NA
Inhalation	X	X	X	X	NA	NA
Ingestion	NA	NA	NA	NA	X	NA
Dermal Contact	NA	NA	NA	NA	X	NA
Inhalation	NA	NA	NA	NA	X	NA
Inhalation	NA	NA	NA	X	NA	X[1]
Ingestion	NA	NA	NA	NA	NA	X
Dermal Contact	NA	NA	NA	NA	X	X
Inhalation	NA	NA	NA	NA	X	X
Ingestion	NA	X	NA	NA	X	NA
Dermal Contact	NA	X	NA	NA	X	NA
Inhalation	NA	X	NA	NA	X	NA

NA - Not Applicable or pathway is incomplete
X - Potentially complete exposure pathways
X[1] - No chemicals of potential concern were identifed for indoor air via vapor intrusion of groundwater

Figure 6-1
Conceptual Site Model for the Human Health Risk Assessment
Remedial Investigation Report
Former Lockbourne Air Force Base, Lockbourne, Ohio

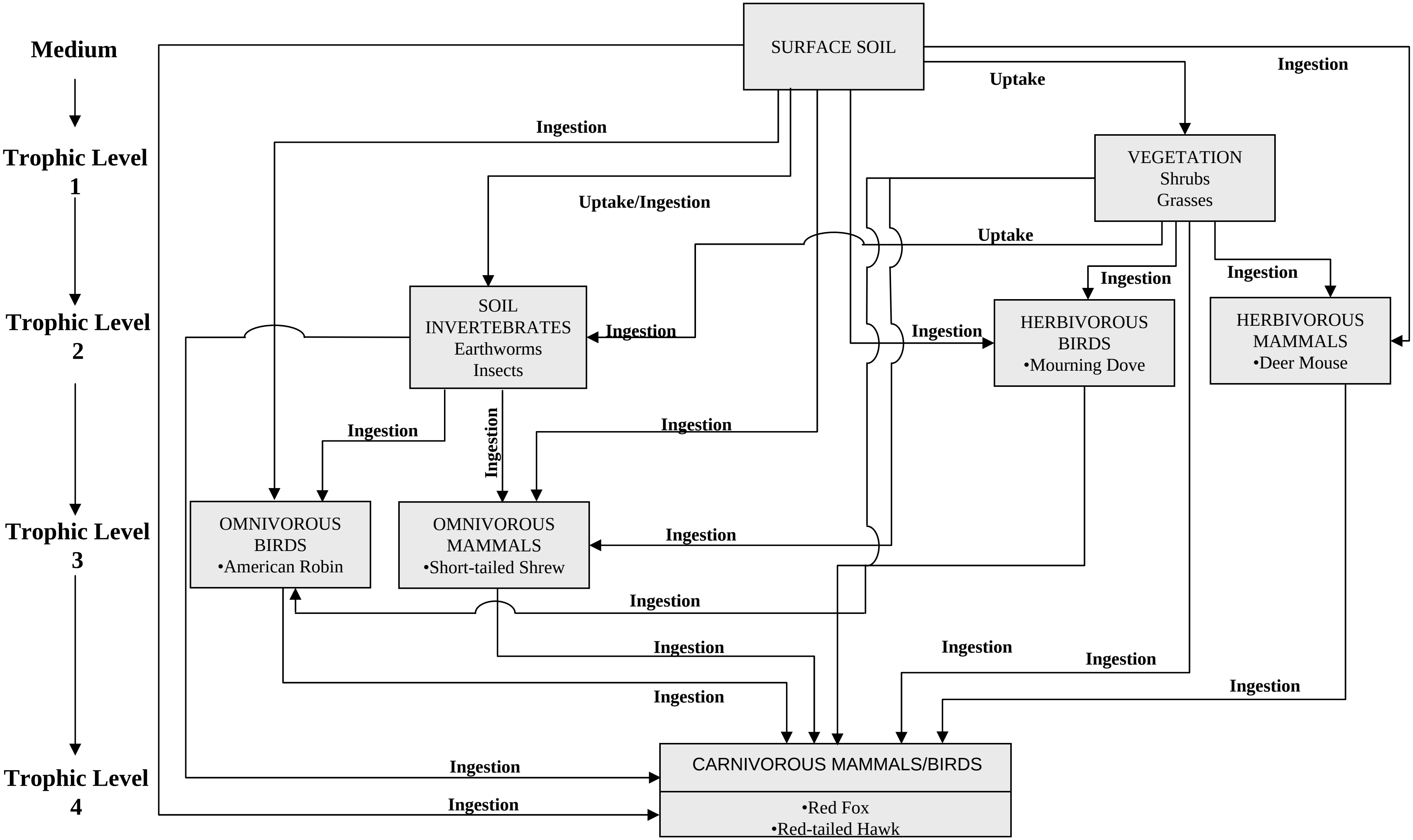


National Wetland Inventory Dataset for Lockbourne
Ohio
1:24,000 scale
Available URL: "www.fws.gov/wetlands".[Accessed 27/April/2009].

DRAFT

Figure 7-1
Wetlands Identified by the National Wetland Inventory
Remedial Investigation Report
Former Lockbourne Air Force Base Landfill, Lockbourne, Ohio

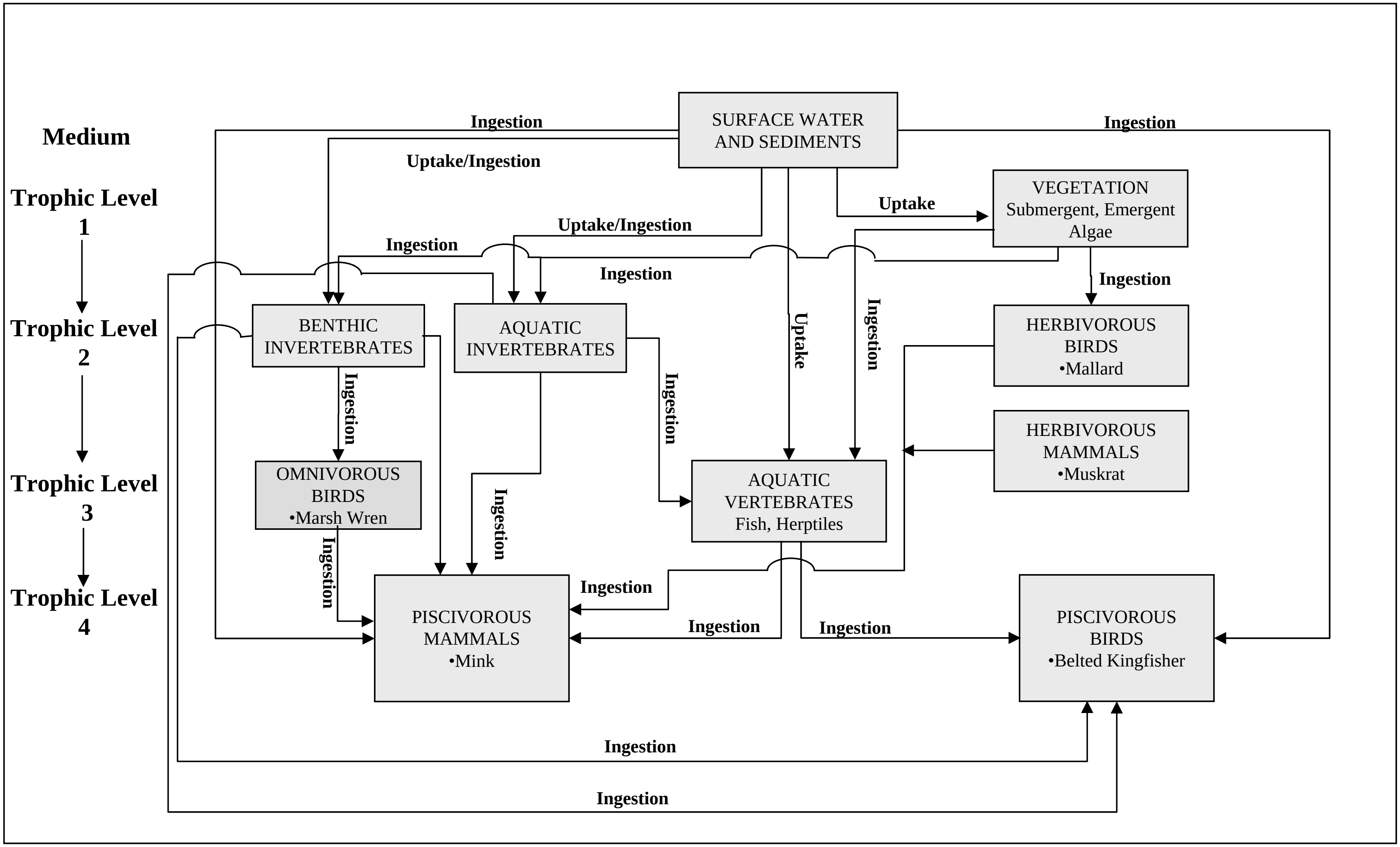
CH2MHILL



LEGEND

•	Representative species
→	Pathway evaluated for at least one species in feeding guild
▭	Feeding guild evaluated

Figure 7-2
Site Conceptual Model for the Terrestrial Ecosystem
Remedial Investigation Report
Former Lockbourne Air Force Base Landfill, Lockbourne, Ohio



LEGEND

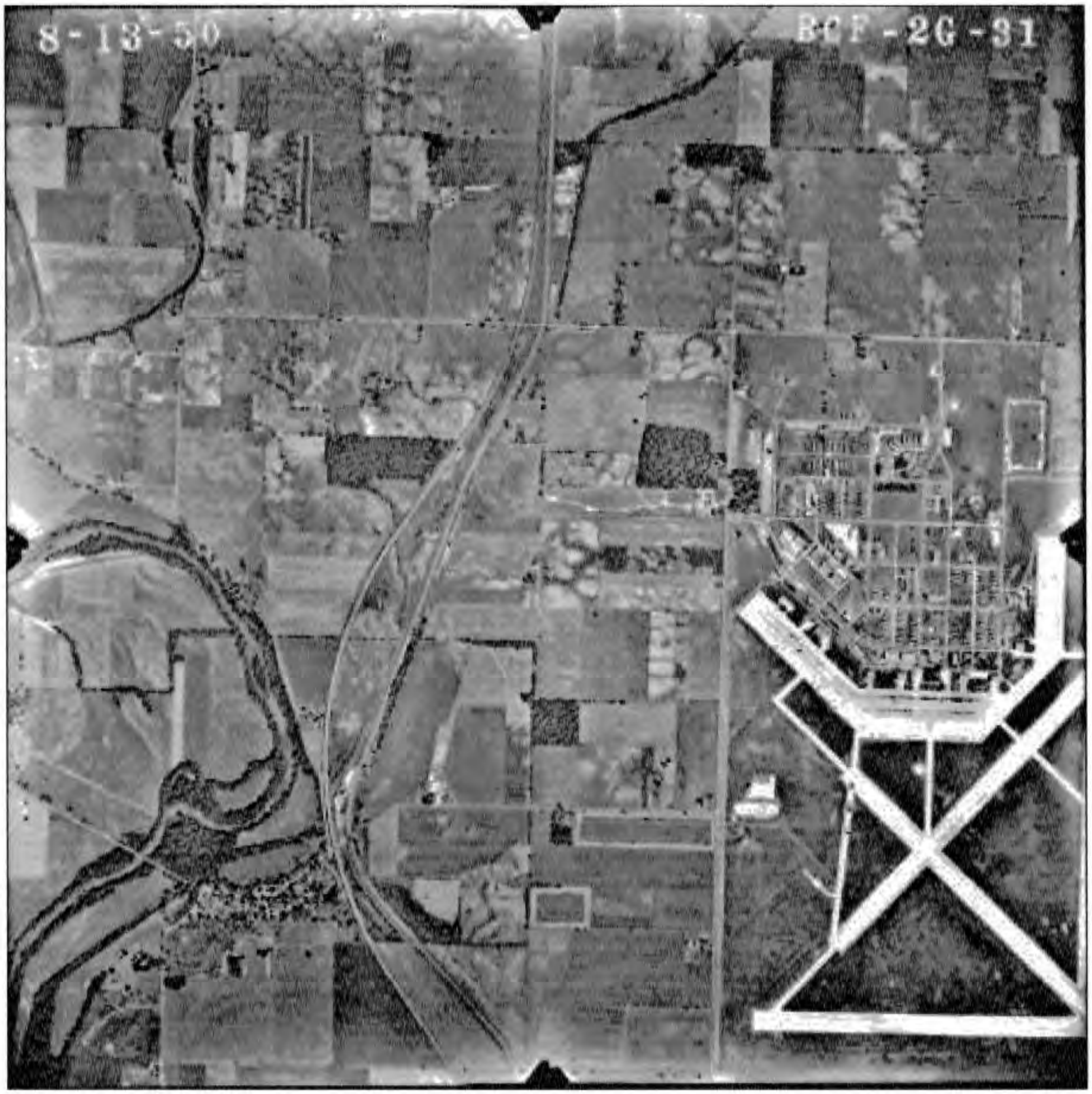
•	Representative species
→	Pathway evaluated for at least one species in feeding guild
▭	Feeding guild evaluated

FIGURE 7-3
Site Conceptual Model for the Aquatic Ecosystem
Remedial Investigation Report
Former Lockbourne Air Force Base Landfill, Lockbourne, Ohio

Appendix A
Historical Aerial Photographs

Photo from August 13, 1950

(credit unknown)



Approximate north
all photos

Photo from August 22, 1957
(credit unknown)

Photo from June 19, 1960
(credit unknown)

Photo from April 14, 1964
(credit unknown)

Photo from October 1, 1971

(credit unknown)

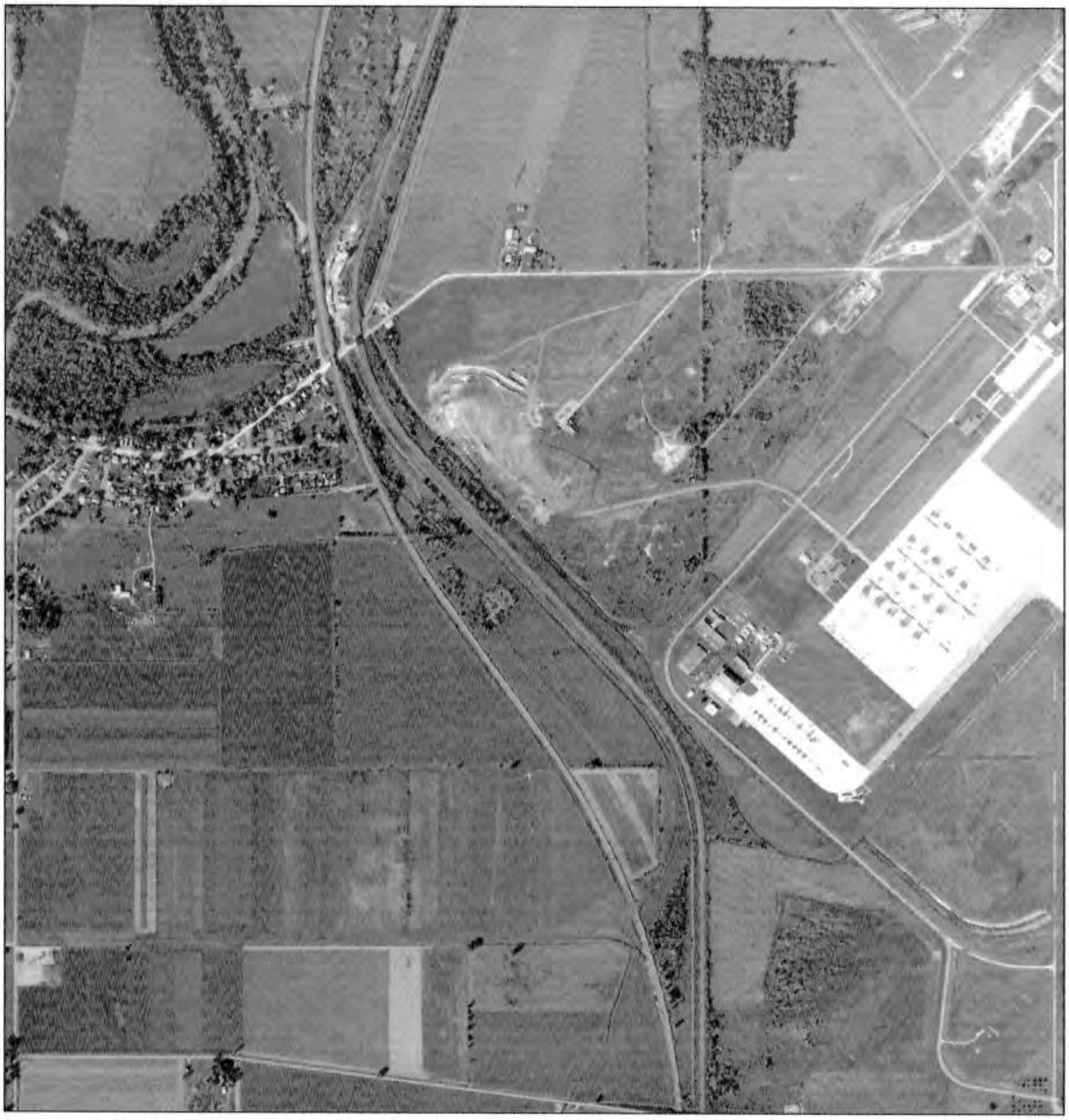


Photo from September 30, 1980
(credit unknown)

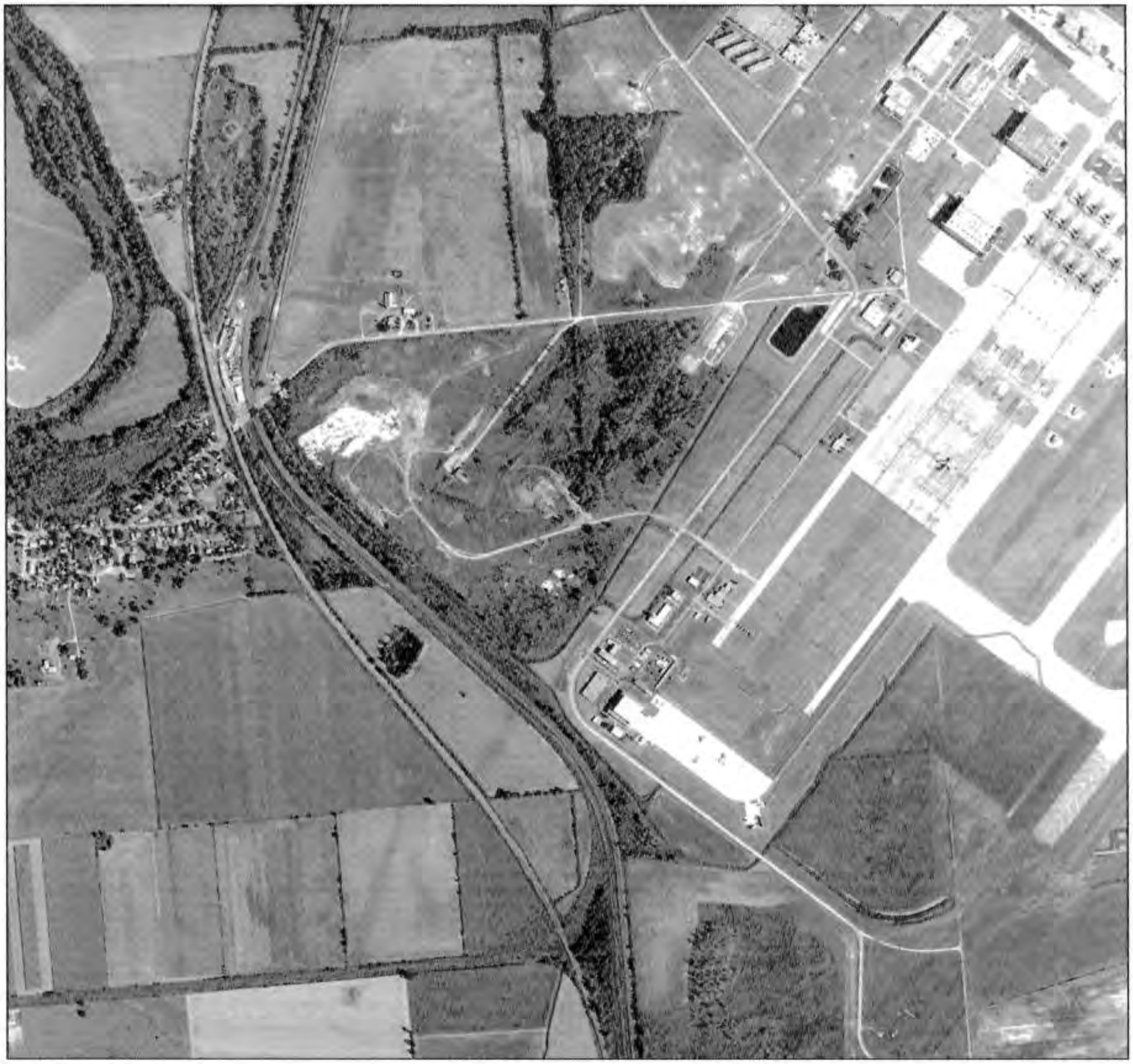
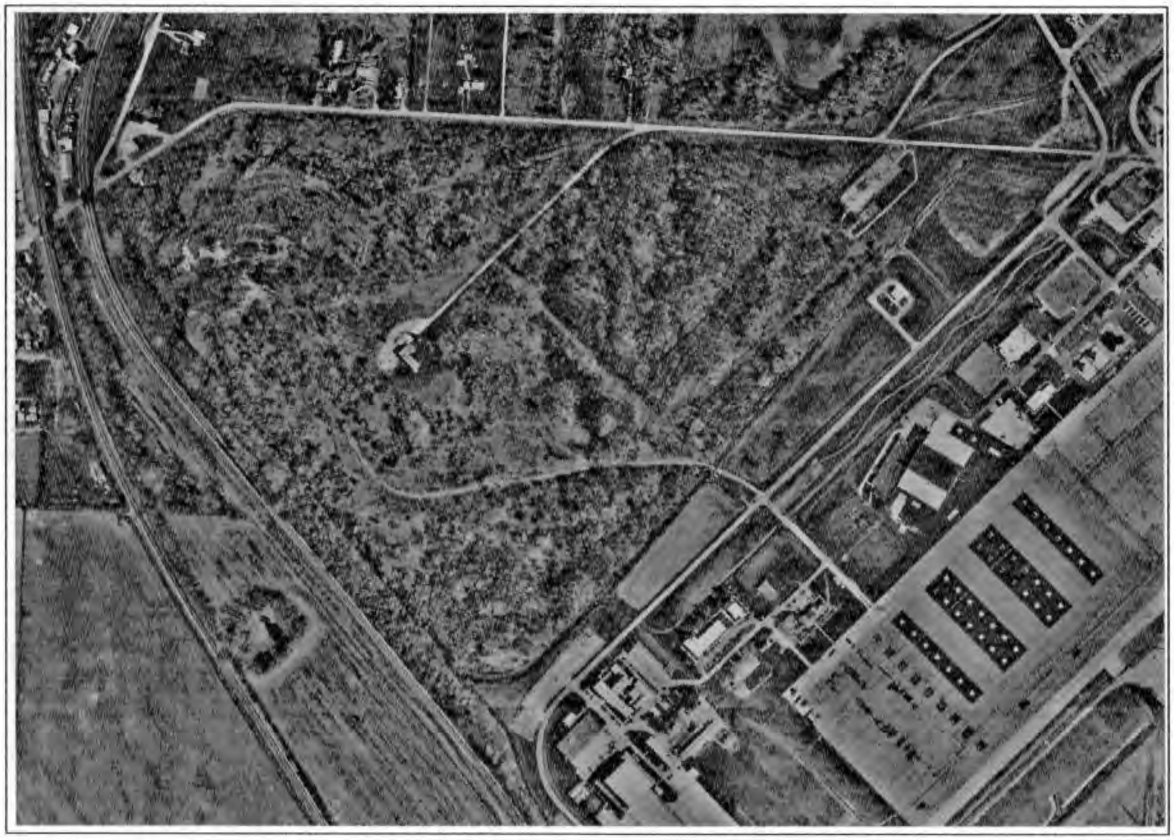


Photo from 1996

(credit unknown)

Photo from 2003
(credit unknown)



Appendix B1

Transmitter Property Delineation Report

GROUP ELLIS ENVIRONMENTAL GROUP, LC

414 SW 140th Terrace
Newberry, FL 32669-5400
Phone (352) 332-3888
Fax (352) 332-3222
ellisenv.com

November 10, 2005

Ms. Diana Bynum
Ohio EPA, DERR, CDO
3232 Alum Creek Dr.
Columbus, OH 43207

Re: **Transmitter Property Delineation Letter Report**
Former Lockbourne Air Force Base, FUDS Property No. G05OH0007

Dear Ms. Bynum:

This letter report represents activities and findings associated with transmitter property delineation trenching activities conducted during the Remedial Investigation at the Former Lockbourne Air Force Base Landfill. Figure 1, Transmitter Property Trenching Locations, and photographic documentation are supplied as attachments to this report.

Objectives for the transmitter property delineation included:

- Determination of the approximate extent of placed waste to evaluate the need for or feasibility of excavating and removing wastes in the vicinity of the transmitter facility
- Determination of the footprint of the area never used as a landfill

Following a site walkover by Ellis Environmental Group, LC (EEG), R.D. Zande & Associates surveyed and marked transmitter property corners on December 2, 2002. Utility lines were located and marked prior to initiation of trenching operations. Representatives from the United States Corps of Engineers (USACE), Ohio Environmental Protection Agency (OEPA), Columbus Regional Airport Authority (CRAA), Rickenbacker Air National Guard Base (RANGB), and EEG met at the site on December 3, 2002.

A total of seven test pits were excavated for the transmitter property delineation at three corners of the transmitter property and at one corner of CRAA/RANGB property (see Figure 1). Belasco Drilling Services Inc., of Columbus, Ohio, performed the trenching operations using a backhoe.

Trenching operations began at the **west corner of the transmitter property**. One trench, trending northeast-southwest, approximately 1.5 feet wide, 15 feet long, and 2 feet deep, was excavated northeast of the marked property corner. No evidence of landfill debris was observed. This trench was left open until OEPA arrived on location.

Operations then mobilized to the **south corner of the transmitter property**, where the second and third trenches were excavated. The first excavation, northwest of the south corner and trending northwest-southeast, was dug into a mound approximately 10 feet long, 10 feet wide, and 3 feet above grade. This mound appeared to be soil pushed off to the side during clearing of grading and apparently not a debris pile. A few tires and some concrete debris were at surface. The mound was leveled to natural grade, with no evidence of landfill trenching or disposal. The second excavation, northeast of the south corner and trending northeast-southwest, consisted of a trench approximately 1.5 feet wide, 15 feet long, and 2.5 feet deep. This trench revealed natural undisturbed clay, with tree roots at surface and no evidence of landfill debris. This trench was also left open pending arrival of OEPA representatives.

Prior to mobilizing to the east corner of the transmitter property, OEPA representatives arrived. All parties then agreed that one trench along each boundary was sufficient. All parties also agreed that previous trenching did not exhibit any evidence of landfill burial.

Two trenches were dug along the **east corner of the transmitter property**. The first trench, northwest of the east corner and trending northwest-southeast, was approximately 1.5 feet wide, 10 feet long, and 2 feet deep. This trench penetrated natural, undisturbed clay below topsoil. The second trench, southwest of the east corner and trending northeast-southwest, approximately 1.5 feet wide, 10 feet long, and 2 feet deep, also penetrated natural, undisturbed clay under topsoil. All parties agreed that there was no evidence of landfill activities.

The **north corner of the transmitter property** fell on the asphalt access road to the transmitter building. All parties concurred that burial would not be likely in this area. The USACE, OEPA, CRAA, and RANGB representatives then agreed that trenching for transmitter property delineation could be concluded, and all trenches were backfilled.

Operations were then mobilized to the **corner of CRAA/RANGB property**, located east-southeast of the east corner of the transmitter property. Two trenches were dug, one northeast of the property corner and one southeast of the corner. Both trenches were approximately 1.5 feet wide, 5 feet long, and 2 feet deep. Soil in both trenches appeared undisturbed, with no evidence of landfill trenching or disposal in these trenches. USACE, OEPA, CRAA, and RANGB representatives agreed that no evidence existed of trenching or disposal in these trenches, and all trenching operations were concluded.

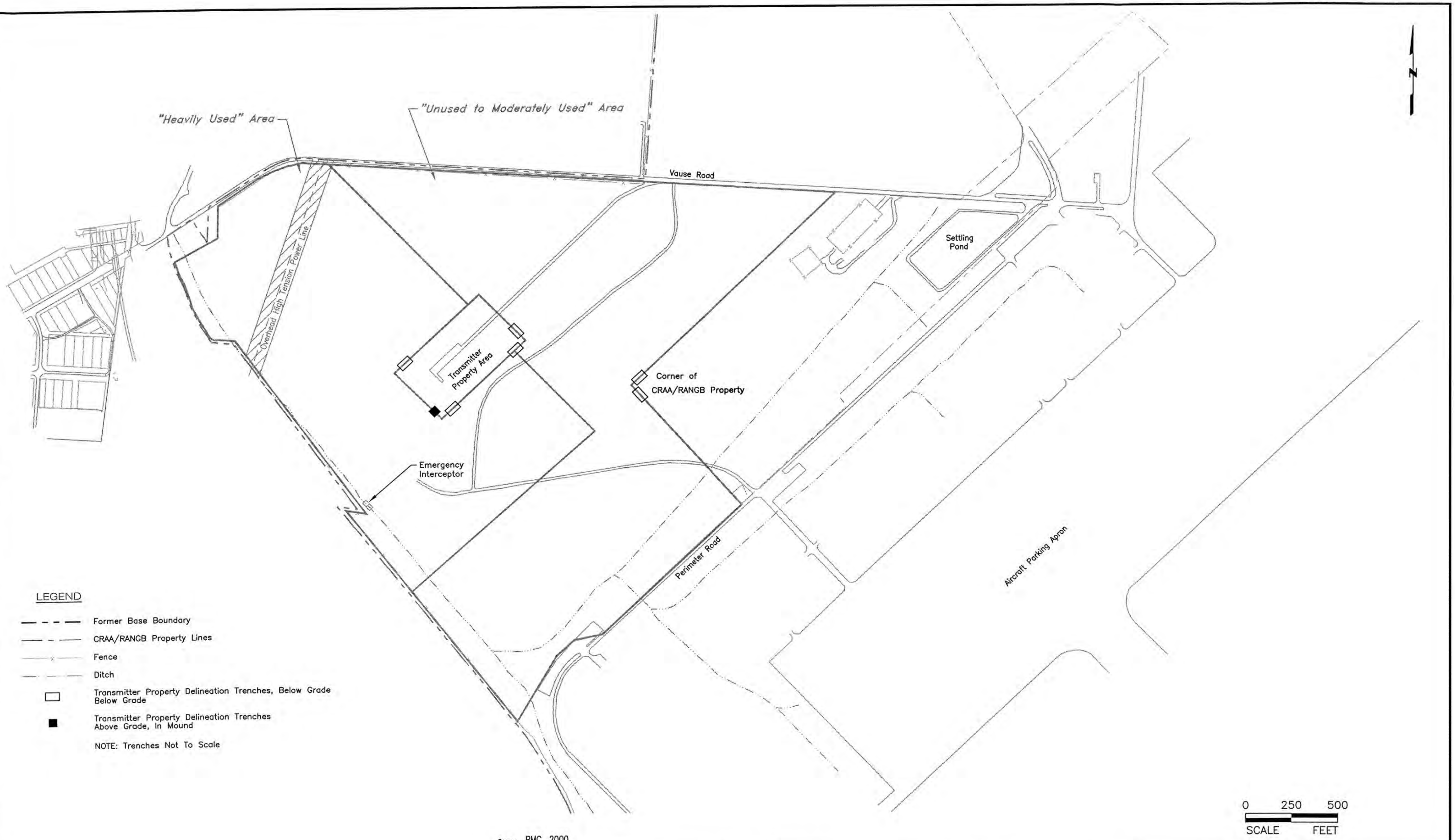
Transmitter property delineation trenching conducted at both the transmitter station area and at the corner of CRAA/RANGB property revealed no evidence landfill activities and determined the footprint of the transmitter property. This area was not used for landfill activities and should be excluded from remedial activities at the area designated as the Former Lockbourne Air Force Base Landfill.

Should you have any questions or comments, please do not hesitate to contact me.

Sincerely,

Mark Webster
Senior Geologist
Telephone (817) 514-1600
e-mail: Mark.Webster@ellisenv.com

Attachments



Source: PMC, 2000

ELLIS ENVIRONMENTAL GROUP, LC

Contract No. DACA27-98-D-0015		
Delivery Order No.: 0004	EEG No: 7005.501	
Document Date: November 2005		

Former
Lockbourne AFB Landfill
Lockbourne, Ohio

Client: US Army Corps of Engineers Louisville District

Figure No. 1

Transmitter Property Trenching Locations

Drawing: S:\PROJECTS\ …me\7005_501_Sept2005\Trench_Report_Figure_1.dwg Plotted by: rthomas Plot date: 11/9/05 … time: 11:03 am

Transmitter Property Delineation
Former Lockbourne Air Force Base Landfill RI

Photograph Log

Photo Number	Date	View Direction	Subject
1	12-03-02	Northeast	Single NE-SW trending trench, west corner of transmitter station area
2	12-03-02	Southwest	NE-SW trending trench, south corner of transmitter station area
3	12-03-02	Southwest	NE-SW trending trench, south corner of transmitter station area
4	12-03-02	Southwest	NW-SE trending trench, south corner of transmitter station area, mounded area
5	12-03-02	Northeast	NE-SW trending trench, east corner of transmitter station area
6	12-03-02	West	NE-SW trending trench, east corner of transmitter station area
7	12-03-02	Southeast	NW-SE trending trench, east corner of transmitter station area
8	12-03-02	Northeast	NE-SW trending trench, CRAA / RANGB property line

Photo 1
Single NE-SW trending trench, west corner of transmitter station area

Photo 2
NE-SW trending trench, south corner of transmitter station area

Photo 3
NE-SW trending trench, south corner of transmitter station area

Photo 4
NW-SE trending trench, south corner of transmitter station area, mounded area

Photo 5
NE-SW trending trench, east corner of transmitter station area

Photo 6
NE-SW trending trench, east corner of transmitter station area

Photo 7
NW-SE trending trench, east corner of transmitter station area

Photo 8
NE-SW trending trench, CRAA / RANGB property line

Appendix B2

Remedial Investigation Analytical Results

November 2003 Sampling Event VOC

VOLATILES BY GC/MS
USACE-LOCKBOURNE AFB
JOB# 222172

STL Chicago is part of Severn Trent Laboratories, Inc.

SAMPLE INFORMATION

Date: 12/11/2003

Job Number.: 222172
Customer...: Ellis Environmental Group, LC
Attn.......: Karen Hatfield

Project Number.........: 20002508
Customer Project ID....: USACE-LOCKBOURNE AFB
Project Description....: USACE-Lockbourne AFB

Laboratory Sample ID	Customer Sample ID	Sample Matrix	Date Sampled	Time Sampled	Date Received	Time Received
222172-1	LCKMW-15	Water	11/10/2003	14:20	11/11/2003	09:25
222172-2	DUP01	Water	11/10/2003	02:00	11/11/2003	09:25
222172-3	TRIP BLANK	Water	11/10/2003	15:00	11/11/2003	09:25

LABORATORY CHRONICLE

Job Number: 222172

Date: 12/11/2003

CUSTOMER: Ellis Environmental Group, LC PROJECT: USACE-LOCKBOURNE AFB ATTN: Karen Hatfield

Lab ID: 222172-1 Client ID: LCKMW-15 Date Recvd: 11/11/2003 Sample Date: 11/10/2003

METHOD	DESCRIPTION	RUN#	BATCH#	PREP BT #(S)	DATE/TIME ANALYZED		DILUTION
5030B	5030 25 mL Purge Prep	1	102284		11/20/2003	2242	
8260B	Volatile Organics	1	102291	102284	11/20/2003	2242	1.00000

Lab ID: 222172-2 Client ID: DUP01 Date Recvd: 11/11/2003 Sample Date: 11/10/2003

METHOD	DESCRIPTION	RUN#	BATCH#	PREP BT #(S)	DATE/TIME ANALYZED		DILUTION
5030B	5030 25 mL Purge Prep	1	102284		11/21/2003	0008	
8260B	Volatile Organics	1	102291	102284	11/21/2003	0008	1.00000

Lab ID: 222172-3 Client ID: TRIP BLANK Date Recvd: 11/11/2003 Sample Date: 11/10/2003

METHOD	DESCRIPTION	RUN#	BATCH#	PREP BT #(S)	DATE/TIME ANALYZED		DILUTION
5030B	5030 25 mL Purge Prep	1	102284		11/20/2003	2214	
8260B	Volatile Organics	1	102291	102284	11/20/2003	2214	1.00000

REPORT COMMENTS

1) All pages of this report are integral parts of the analytical data. Therefore, this report should be reproduced only in its entirety.
2) Soil, sediment and sludge sample results are reported on a "dry weight" basis except when analyzed for landfill disposal or incineration parameters. All other solid matrix samples are reported on an "as received" basis unless noted differently.
3) Reporting limits are adjusted for sample size used, dilutions and moisture content if applicable.
4) The test results for the noted analytical method(s) meet the requirements of NELAC. Lab Cert. ID# 100201
5) According to 40CFR Part 136.3, pH, Chlorine Residual and Dissolved Oxygen analyses are to be performed immediately after aqueous sample collection. When these parameters are not indicated as field (e.g. pH Field) they were not analyzed immediately, but as soon as possible on laboratory receipt.

Glossary of flags, qualifiers and abbreviations (any number of which may appear in the report)

Inorganic Qualifiers (Q-Column)

U	Analyte was not detected at or above the stated limit.
<	Not detected at or above the reporting limit.
J	Result is less than the RL, but greater than or equal to the method detection limit.
B	Result is less than the CRDL/RL, but greater than or equal to the IDL/MDL.
S	Result was determined by the Method of Standard Additions.
F	AFCEE: Result is less than the RL, but greater than or equal to the method detection limit.

Inorganic Flags (Flag Column)

^	ICV,CCV,ICB,CCB,ISA,ISB,CRI,CRA,MRL: Instrument related QC exceed the upper or lower control limits.
*	LCS, LCD, MD: Batch QC exceeds the upper or lower control limits.
+	MSA correlation coefficient is less than 0.995.
4	MS, MSD: The analyte present in the original sample is 4 times greater than the matrix spike concentration; therefore, control limits are not applicable.
E	SD: Serial dilution exceeds the control limits.
H	MB, EB1, EB2, EB3: Batch QC is greater than reporting limit or had a negative instrument reading lower than the absolute value of the reporting limit.
N	MS, MSD: Spike recovery exceeds the upper or lower control limits.
W	AS(GFAA) Post-digestion spike was outside 85-115% control limits.

Organic Qualifiers (Q - Column)

U	Analyte was not detected at or above the stated limit.
ND	Compound not detected.
J	Result is an estimated value below the reporting limit or a tentatively identified compound (TIC).
Q	Result was qualitatively confirmed, but not quantified.
C	Pesticide identification was confirmed by GC/MS.
Y	The chromatographic response resembles a typical fuel pattern.
Z	The chromatographic response does not resemble a typical fuel pattern.
E	Result exceeded calibration range, secondary dilution required.
F	AFCEE:Result is an estimated value below the reporting limit or a tentatively identified compound (TIC)

Organic Flags (Flags Column)

B	MB: Batch QC is greater than reporting limit.
*	LCS, LCD, ELC, ELD, CV, MS, MSD, Surrogate: Batch QC exceeds the upper or lower control limits.
^	EB1, EB2, EB3, MLE: Batch QC is greater than reporting Limit
A	Concentration exceeds the instrument calibration range
a	Concentration is below the method Reporting Limit (RL)
B	Compound was found in the blank and sample.
D	Surrogate or matrix spike recoveries were not obtained because the extract was diluted for analysis; also compounds analyzed at a dilution will be flagged with a D.
H	Alternate peak selection upon analytical review
I	Indicates the presence of an interfence, recovery is not calculated.
M	Manually integrated compound.
P	The lower of the two values is reported when the % difference between the results of two GC columns is

greater than 25%.

Abbreviations

AS	Post Digestion Spike (GFAA Samples - See Note 1 below)
Batch	Designation given to identify a specific extraction, digestion, preparation set, or analysis set
CAP	Capillary Column CCB Continuing Calibration Blank
CCV	Continuing Calibration Verification
CF	Confirmation analysis of original
C1	Confirmation analysis of A1 or D1
C2	Confirmation analysis of A2 or D2
C3	Confirmation analysis of A3 or D3
CRA	Low Level Standard Check - GFAA; Mercury
CRI	Low Level Standard Check - ICP
CV	Calibration Verification Standard
Dil Fac	Dilution Factor - Secondary dilution analysis
D1	Dilution 1
D2	Dilution 2
D3	Dilution 3
DLFac	Detection Limit Factor
DSH	Distilled Standard - High Level
DSL	Distilled Standard - Low Level
DSM	Distilled Standard - Medium Level
EB1	Extraction Blank 1
EB2	Extraction Blank 2
EB3	DI Blank
ELC	Method Extracted LCS
ELD	Method Extracted LCD
ICAL	Initial calibration
ICB	Initial Calibration Blank
ICV	Initial Calibration Verification
IDL	Instrument Detection Limit
ISA	Interference Check Sample A - ICAP
ISB	Interference Check Sample B - ICAP
Job No.	The first six digits of the sample ID which refers to a specific client, project and sample group
	Lab ID An 8 number unique laboratory identification
LCD	Laboratory Control Standard Duplicate
LCS	Laboratory Control Standard with reagent grade water or a matrix free from the analyte of interest
MB	Method Blank or (PB) Preparation Blank
MD	Method Duplicate
MDL	Method Detection Limit
MLE	Medium Level Extraction Blank
MRL	Method Reporting Limit Standard
MSA	Method of Standard Additions
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ND	Not Detected
PREPF	Preparation factor used by the Laboratory's Information Management System (LIMS)
PDS	Post Digestion Spike (ICAP)
RA	Re-analysis of original
A1	Re-analysis of D1
A2	Re-analysis of D2
A3	Re-analysis of D3
RD	Re-extraction of dilution
RE	Re-extraction of original
RC	Re-extraction Confirmation
RL	Reporting Limit
RPD	Relative Percent Difference of duplicate (unrounded) analyses
RRF	Relative Response Factor
RT	Retention Time

QUALITY ASSURANCE METHODS

REFERENCES AND NOTES

Report Date: 12/11/2003

RTW	Retention Time Window Sample ID A 9 digit number unique for each sample, the first six digits are referred as the Job number
SCB	Seeded Control Blank
SD	Serial Dilution (Calculated when sample concentration exceeds 50 times the MDL)
UCB	Unseeded Control Blank
SSV	Second Source Verification Standard
SLCS	Solid Laboratory Control Standard(LCS)
PHC	pH Calibration Check LCSP pH Laboratory Control Sample
LCDP	pH Laboratory Control Sample Duplicate
MDPH	pH Sample Duplicate
MDFP	Flashpoint Sample Duplicate
LCFP	Flashpoint LCS
G1	Gelex Check Standard Range 0-1
G2	Gelex Check Standard Range 1-10
G3	Gelex Check Standard Range 10-100
G4	Gelex Check Standard Range 100-1000

Note 1: The Post Spike Designation on Batch QC for GFAA is designated with an "S" added to the current abbreviation used. EX. LCS S=LCS Post Spike (GFAA); MSS=MS Post Spike (GFAA)

Note 2: The MD calculates an absolute difference (A) when the sample concentration is less than 5 times the reporting limit. The control limit is represented as +/- the RL.

CHAIN OF CUSTODY

SEVERN TRENT **STL**

STL Chicago
2417 Bond Street
University Park, IL 60466
Phone: 708-534-5200
Fax: 708-534-5211

Report To:
Contact: MIKE GEARHART
Company: ELLIS ENVIRONMENTAL
Address: 414 SW 140TH TERRACE
NEWBERRY, FL 32669
Phone: 352-332-3888
Fax: 352-332-3222
E-Mail: MICHAEL.GEARHART@ELLISENV.COM

Bill To:
Contact:
Company:
Address: SAME
Phone:
Fax:
PO#: Quote:

Shaded Areas For Internal Use Only 1 of 1

Lab Lot# 222172

Package Sealed [✓ Yes] No	**Samples Sealed** Yes [✓ No]
Received on Ice [✓ Yes] No	**Samples Intact** [✓ Yes] No
Temperature °C of Cooler (3.1) (3.8) (4.3) (4.9)	
Within Hold Time [✓ Yes] No	**Preserv. Indicated** [✓ Yes] No NA
pH Check OK [✓ Yes] No NA	**Res Cl₂ Check OK** Yes No [✓ NA]
Sample Labels and COC Agree [✓ Yes] No	COC not present

Sampler Name: MARK WEBSTER
Signature:
Project Name: LOCKBOURNE
Project Number: 7005.201
Project Location: LOCKBOURNE, OHIO
Date Required Hard Copy: __/__/__ Fax: __/__/__
Lab PM: NANCY McDONALD

							VOCs SW 8260B	SVOCs SW 8270C	TAL METALS SW6000/7000	PEST. / PCBs SW 8082 SW 8081	EXPLOSIVES SW 8330	**Additional Analyses / Remarks**
						Refrg #						
						# / Cont.	2	4	1	4	4	
						Volume	40mL	1L	1000mL	1L	1L	
						Preserv	1	6	3	6	6	
Laboratory ID	**MS-MSD**	**Client Sample ID**	**Sampling Date**	**Sampling Time**	**Matrix**	**Comp/Grab**						
1		LCKMW-15	11-10-02	1420	W	G	X	X	X	X	X	
	X	LCKMW-15 MS	11-10-02	1420	W	G	X	X	X	X	X	
	X	LCKMW-15 MSD	11-10-02	1420	W	G	X	X	X	X	X	
2	-	DUP01	11-10-02	0200	W	G	X	X	X	X	X	
3		TRIP BLANK	11-10-03	1500	W	G	X					
		TEMP BLANK	11-10-03	1500	W	G						

RELINQUISHED BY	COMPANY Ellis Environmental	DATE 11-10-03	TIME 18:00	RECEIVED BY	COMPANY STL	DATE 11/11/03	TIME 0925
RELINQUISHED BY	COMPANY	DATE	TIME	RECEIVED BY	COMPANY	DATE	TIME

Matrix Key
WW = Wastewater
W = Water
S = Soil
SL = Sludge
MS = Miscellaneous
OL = Oil
A = Air
SE = Sediment
SO = Solid
DS = Drum Solid
DL = Drum Liquid
L = Leachate
WI = Wipe
O = ____

Container Key
1. Plastic
2. VOA Vial
3. Sterile Plastic
4. Amber Glass
5. Widemouth Glass
6. Other ____

Preservative Key
1. HCl, Cool to 4°
2. H2SO4, Cool to 4°
3. HNO3, Cool to 4°
4. NaOH, Cool to 4°
5. NaOH/Zn, Cool to 4°
6. Cool to 4°
7. None

COMMENTS

Date Received 11 / 11 / 03
Courier: FX **Hand Delivered** ☐
Bill of Lading See attach

STL Chicago
Internal Sample Custody Transfer Record

Sample Lot#: 222172

Client: Ellis

Sample No.	Analysis	Relinquished by:	Received by:	Date	Time	Comments
1-3	8260		Cooke S	11/11/03	1215	
1&2	ORG			11/12/03	0808	
1-2	8330		J. Price	11/18/03	1900	
1-2	8330	J. Price		11/13/03	2000	
1&2	ORG			11/14/03	1120	

rpjsckl

Job Sample Receipt Checklist Report

V2

Job Number.: 222172 Location.: 57222 Check List Number.: 1 Description.:
Customer Job ID.....: Job Check List Date.: 12/10/2003
Project Number.: 20002508 Project Description.: USACE-Lockbourne AFB
Customer.......: Ellis Environmental Group, LC Contact.: Karen Hatfield
Date of the Report..: 12/10/2003
Project Manager.....: nsm

Questions ?	(Y/N)	Comments
Chain-of-Custody Present?.........................	Y	
Were samples dropped off at or picked up by STL?..	N	
Custody seal on shipping container?..............	Y	
...If "yes", custody seal intact?................	Y	
Custody seals on sample containers?..............	N	
...If "yes", custody seal intact?................		
Samples iced?..............................	Y	
Temperature of cooler acceptable? (4 deg C +/- 2).	Y	3.1,3.8,4.3,4.8
Samples received intact (good condition)?.........	Y	
Volatile samples acceptable? (no headspace).......	Y	
Correct containers used?.........................	Y	
Adequate sample volume provided?.................	Y	
Samples preserved correctly?.....................	Y	
Samples received within holding-time?............	Y	
Agreement between COC and sample labels?.........	Y	
Radioactivity at or below background levels?......	Y	
A Sample Discrepancy Report (SDR) was needed?.....	N	
If samples were shipped was there an air bill #?..	Y	
Sample Custodian Signature/Date..................	Y	

FedEx Express *USA Airbill* FedEx Tracking Number 841745725250

Form I.D. No. 0200

1 **From** [redacted]

Date

Sender's Name Phone

Company

Address Dept./Floor/Suite/Room

City State ZIP

222172

2 **Your Internal Billing Reference**

3 **To**

Recipient's Name Phone

Company

Address

To "HOLD" at FedEx location, print FedEx address. We cannot deliver to P.O. boxes or P.O. ZIP codes.

Address Dept./Floor/Suite/Room

City State ZIP

8417 4572 5250

4a Express Package Service *Packages up to 150 lbs.* Delivery commitment may be later in some are

☒ FedEx Priority Overnight Next business morning ☐ FedEx Standard Overnight Next business afternoon ☐ FedEx First Overnight Earliest next business morning delivery to select locations

☐ FedEx 2Day Second business day ☐ FedEx Express Saver Third business day

FedEx Envelope rate not available. Minimum charge: One-pound rate

4b Express Freight Service *Packages over 150 lbs.* Delivery commitment may be later in some are

☐ FedEx 1Day Freight* Next business day ☐ FedEx 2Day Freight Second business day ☐ FedEx 3Day Freight Third business day

* Call for Confirmation:

* Declared value limit $

5 Packaging

☐ FedEx Envelope* ☐ FedEx Pak* Includes FedEx Small Pak, FedEx Large Pak, and FedEx Sturdy Pak ☒ Other

6 Special Handling Include FedEx address in Section 3.

☐ SATURDAY Delivery Available only for FedEx Priority Overnight and FedEx 2Day to select ZIP codes ☐ HOLD Weekday at FedEx Location Not available for FedEx First Overnight ☐ HOLD Saturday at FedEx Location Available only for FedEx Priority Overnight and FedEx 2Day to select locations

Does this shipment contain dangerous goods? One box must be checked.

☒ No ☐ Yes As per attached Shipper's Declaration ☐ Yes Shipper's Declaration not required ☐ Dry Ice Dry Ice, 9, UN 1845 ___ x ___ kg

Dangerous Goods (including Dry Ice) cannot be shipped in FedEx packaging. ☐ Cargo Aircraft Only

7 Payment *Bill to:* Enter FedEx Acct. No. or Credit Card No. below. ☐ Obtain Recip. Acct. No.

☒ Sender Acct. No. in Section 1 will be billed. ☐ Recipient ☐ Third Party ☐ Credit Card ☐ Cash/Check

[redacted]

Total Packages	Total Weight	Total Declared Value†	Total Charges
1	53	$ .00	
			Credit Card Auth.

†Our liability is limited to $100 unless you declare a higher value. See back for details.

8 Release Signature *Sign to authorize delivery without obtaining signature.*

By signing you authorize us to deliver this shipment without obtaining a signature and agree to indemnify and hold us harmless from any resulting claims.

Questions? Visit our Web site at fedex.com

or call 1.800.Go.FedEx® 800.463.3339.

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446

FedEx Express *USA Airbill* FedEx Tracking Number 841745725238

Form I.D. No. 0200

1 **From** [redacted]

Date

Sender's Name Phone

Company

Address Dept./Floor/Suite/Room

222172

City State ZIP

2 **Your Internal Billing Reference**

3 **To**

Recipient's Name Phone

Company

Address

To "HOLD" at FedEx location, print FedEx address. We cannot deliver to P.O. boxes or P.O. ZIP codes.

Address Dept./Floor/Suite/Room

City State ZIP

8417 4572 5238

4a Express Package Service *Packages up to 150 lbs.* Delivery commitment may be later in some ar

☒ FedEx Priority Overnight Next business morning ☐ FedEx Standard Overnight Next business afternoon ☐ FedEx First Overnight Earliest next business morning delivery to select locations

☐ FedEx 2Day Second business day ☐ FedEx Express Saver Third business day

FedEx Envelope rate not available. Minimum charge: One-pound rate

4b Express Freight Service *Packages over 150 lbs.* Delivery commitment may be later in some ar

☐ FedEx 1Day Freight* Next business day ☐ FedEx 2Day Freight Second business day ☐ FedEx 3Day Freight Third business day

* Call for Confirmation:

* Declared value limit

5 Packaging

☐ FedEx Envelope* ☐ FedEx Pak* Includes FedEx Small Pak, FedEx Large Pak, and FedEx Sturdy Pak ☒ Other

6 Special Handling Include FedEx address in Section 3.

☐ SATURDAY Delivery Available only for FedEx Priority Overnight and FedEx 2Day to select ZIP codes ☐ HOLD Weekday at FedEx Location Not available for FedEx First Overnight ☐ HOLD Saturday at FedEx Location Available only for FedEx Priority Overnight and FedEx 2Day to select locations

Does this shipment contain dangerous goods? One box must be checked.

☒ No ☐ Yes As per attached Shipper's Declaration ☐ Yes Shipper's Declaration not required ☐ Dry Ice Dry Ice, 9, UN 1845 ___ x ___ kg

Dangerous Goods (including Dry Ice) cannot be shipped in FedEx packaging. ☐ Cargo Aircraft Only

7 Payment *Bill to:* Enter FedEx Acct. No. or Credit Card No. below. ☐ Obtain Recip. Acct. No.

☒ Sender Acct. No. in Section 1 will be billed. ☐ Recipient ☐ Third Party ☐ Credit Card ☐ Cash/Che

[redacted]

Total Packages	Total Weight	Total Declared Value†	Total Charge
	53	$ .00	
			Credit Card Auth.

†Our liability is limited to $100 unless you declare a higher value. See back for details.

8 Release Signature *Sign to authorize delivery without obtaining signature.*

By signing you authorize us to deliver this shipment without obtaining a signature and agree to indemnify and hold us harmless from any resulting claims.

Questions? Visit our Web site at fedex.com

or call 1.800.Go.FedEx® 800.463.3339.

10

446

FedEx Express *USA Airbill* FedEx Tracking Number 841745725249

1 From [redacted]

Date [illegible]

Sender's Name [illegible] Phone [illegible]

Company [illegible]

Address [illegible] Dept./Floor/Suite/Room

City [illegible] State FL ZIP 32667

2 Your Internal Billing Reference [illegible]

222172

3 To

Recipient's Name [illegible] Phone [illegible]

Company [illegible]

Address [illegible]

To "HOLD" at FedEx location, print FedEx address. We cannot deliver to P.O. boxes or P.O. ZIP codes.

Address Dept./Floor/Suite/Room

City [illegible] State FL ZIP [illegible]

8417 4572 5249

Form ID No. 0200

4a Express Package Service Packages up to 150 l

Delivery commitment may be later in some ar

☒ FedEx Priority Overnight Next business morning ☐ FedEx Standard Overnight Next business afternoon ☐ FedEx First Overnight Earliest next business morning delivery to select locations

☐ FedEx 2Day Second business day ☐ FedEx Express Saver Third business day

FedEx Envelope rate not available. Minimum charge: One-pound rate

4b Express Freight Service Packages over 150 l

Delivery commitment may be later in some ar

☐ FedEx 1Day Freight* Next business day ☐ FedEx 2Day Freight Second business day ☐ FedEx 3Day Freight Third business day

* Call for Confirmation:

* Declared value limit $

5 Packaging

☐ FedEx Envelope* ☐ FedEx Pak* Includes FedEx Small Pak, FedEx Large Pak, and FedEx Sturdy Pak ☒ Other

6 Special Handling Include FedEx address in Section 3.

☐ SATURDAY Delivery Available only for FedEx Priority Overnight and FedEx 2Day to select ZIP codes ☐ HOLD Weekday at FedEx Location Not available for FedEx First Overnight ☐ HOLD Saturday at FedEx Location Available only for FedEx Priority Overnight and FedEx 2Day to select locations

Does this shipment contain dangerous goods? One box must be checked.

☒ No ☐ Yes As per attached Shipper's Declaration ☐ Yes Shipper's Declaration not required ☐ Dry Ice Dry Ice, 9, UN 1845 ____ x ____

Dangerous Goods (including Dry Ice) cannot be shipped in FedEx packaging ☐ Cargo Aircraft Only

7 Payment *Bill to:* Enter FedEx Acct. No. or Credit Card No. below. ☐ Obtain Recip. Acct. No.

☒ Sender Acct. No. in Section 1 will be billed ☐ Recipient ☐ Third Party ☐ Credit Card ☐ Cash/Che

[redacted] [redacted]

Total Packages	Total Weight	Total Declared Value†	Total Charges
1	56	$ .00	

†Our liability is limited to $100 unless you declare a higher value. See back for details.

8 Release Signature Sign to authorize delivery without obtaining signature.

By signing you authorize us to deliver this shipment without obtaining a signature and agree to indemnify and hold us harmless from any resulting claims.

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FedEx Express *USA Airbill* FedEx Tracking Number 841745725227

1 From [redacted]

Date [illegible]

Sender's Name [illegible] Phone [illegible]

Company [illegible]

Address [illegible] Dept./Floor/Suite/Room

City [illegible] State FL ZIP [illegible]

222172

2 Your Internal Billing Reference [illegible]

3 To

Recipient's Name [illegible] Phone [illegible]

Company [illegible]

Address [illegible]

To "HOLD" at FedEx location, print FedEx address. We cannot deliver to P.O. boxes or P.O. ZIP codes.

Address Dept./Floor/Suite/Room

City [illegible] State [illegible] ZIP [illegible]

8417 4572 5227

Form ID No. 0200

4a Express Package Service Packages up to 150 lbs

Delivery commitment may be later in some areas

☒ FedEx Priority Overnight Next business morning ☐ FedEx Standard Overnight Next business afternoon ☐ FedEx First Overnight Earliest next business morning delivery to select locations

☐ FedEx 2Day Second business day ☐ FedEx Express Saver Third business day

FedEx Envelope rate not available. Minimum charge: One-pound rate

4b Express Freight Service Packages over 150 lbs

Delivery commitment may be later in some areas

☐ FedEx 1Day Freight* Next business day ☐ FedEx 2Day Freight Second business day ☐ FedEx 3Day Freight Third business day

* Call for Confirmation:

* Declared value limit $500

5 Packaging

☐ FedEx Envelope* ☐ FedEx Pak* Includes FedEx Small Pak, FedEx Large Pak, and FedEx Sturdy Pak ☒ Other

6 Special Handling Include FedEx address in Section 3.

☐ SATURDAY Delivery Available only for FedEx Priority Overnight and FedEx 2Day to select ZIP codes ☐ HOLD Weekday at FedEx Location Not available for FedEx First Overnight ☐ HOLD Saturday at FedEx Location Available only for FedEx Priority Overnight and FedEx 2Day to select locations

Does this shipment contain dangerous goods? One box must be checked.

☒ No ☐ Yes As per attached Shipper's Declaration ☐ Yes Shipper's Declaration not required ☐ Dry Ice Dry Ice, 9, UN 1845 ____ x ____

Dangerous Goods (including Dry Ice) cannot be shipped in FedEx packaging. ☐ Cargo Aircraft Only

7 Payment *Bill to:* Enter FedEx Acct. No. or Credit Card No. below. ☐ Obtain Recip. Acct. No.

☒ Sender Acct. No. in Section 1 will be billed ☐ Recipient ☐ Third Party ☐ Credit Card ☐ Cash/Chec

[redacted] [redacted]

Total Packages	Total Weight	Total Declared Value†	Total Charges
1	62	$ .00	

†Our liability is limited to $100 unless you declare a higher value. See back for details.

8 Release Signature Sign to authorize delivery without obtaining signature.

By signing you authorize us to deliver this shipment without obtaining a signature and agree to indemnify and hold us harmless from any resulting claims.

Questions? Visit our Web site at fedex.com or call 1.800.Go.FedEx® 800.463.3339.

1146

I. CASE NARRATIVE

Severn Trent Laboratories Chicago
GC/MS Case Narrative

Ellis Environmental Group
USACE-Lockbourne AFB
STL JOB# 222172
VOA DATA:

1. The water samples were analyzed within the 14-day hold time from the date of collection.

2. The Method Blank target compounds were below reporting limits.

3. The QC limits specified in the QAPP were used to evaluate QC acceptance. Dichlorodifluoromethane (58%) and Chloromethane (45%) were below the QC limits in the LCS for batch 102424. The ICAL spike had Carbon Disulfide (78%) spike recovery below the QAPP specified QC limits of (80-120) for 9S1016. All other spike recoveries were within the QAPP specified QC limits in the LCS sample and the ICAL Spike. The compounds that exceeded the control limits were not contaminants of concern.

4. Matrix Spike/Matrix Spike Duplicate analyses were performed on sample 1. The QC limits specified in the QAPP were used to evaluate QC acceptance. Chloromethane was below the QC limits in the MS for sample 1. All other spike recoveries were within the QAPP specified QC limits in the MS and MSD samples.

5. MRL verification standards were analyzed before and after the sample analysis in all of the tune batches. Dichlorodifluoromethane was outside of the QC limits in the MRL standard and Dichlorodifluoromethane and 2-Butanone were outside of the QC limits in the MRL2 standard for batch 102284. A low level detection limit check was analyzed and all compounds were detected. All other compounds were within the QAPP specified QC limits.

6. All of the samples had surrogate recoveries within the QAPP specified QC limits.

7. All samples were prepared using Method 5030 and analyzed following SW846 Method 8260B and 8000B. All of the calibration criteria are met per method or QAPP (for minimum R values for certain compounds). The low point in the initial calibration verifies the base reporting limits. The target compounds were quantitated using the initial calibration.

8. All manual integrations were preformed following the laboratory's Manual Integration Standard Operating Procedure (SOP). The reason for manual integration was documented, reviewed and included as part of the package.

9. All internal standard areas and retention times were within SOP acceptance limits as compared to the corresponding calibration verification standard.

10. The water samples were analyzed without dilution using a 25-ml purge volume.

John Nagel
GC/MS Dept

12-12-03
Date

Note Number : 45819 PROJECT
Date : 8/21/2003
Author : nsm
Subject : Revised Contaminants of Concern

Project Code....: 20002508 USACE-Lockbourne AFB

Location Code...: 57222
Job/Sales Order.:

Customer........: ELLISENVIR Ellis Environmental Group, LC
Contact Location: NEWBERR FL Newberry, FL
Contact.........: HATFIELD K Karen Hatfield

Invoice.........:

Batch...........:

Note For........:

GC/MS VOCs: Toluene, Xylene, Ethylbenzene, Benzene, MTBE, TCE, DCE, PCE.

GC/MS SVOCs: PAHs and Diethylphthalate.

13A

MANUAL INTEGRATION SUMMARY REPORT

Sample Name	Data File	Client ID	Compound
~~VSTD0.5~~	~~101603a_25ml9w.b/9i1016a.d~~		~~Tetrahydrofuran~~
VSTD0.5	101603a_25ml9w.b/9i1016a.d		Carbon tetrachloride
VSTD0.5	101603a_25ml9w.b/9i1016a.d		1,2-Dichloroethane
VSTD0.5	101603a_25ml9w.b/9i1016a.d		Dibromomethane
VSTD0.5	101603a_25ml9w.b/9i1016a.d		1,2-Dibromoethane
VSTD0.5	101603a_25ml9w.b/9i1016a.d		Bromoform
VSTD0.5	101603a_25ml9w.b/9i1016a.d		1,2-Dibromo-3-Chloropropane
VSTD001	101603a_25ml9w.b/9i1016b.d		2-Butanone
VSTD040	101603a_25ml9w.b/9i1016i.d		Pentafluorobenzene
ICAL SPIKE	101603a_25ml9w.b/9s1016.d		Chloroethane

Jm 121003

MANUAL INTEGRATION SUMMARY REPORT

Sample Name	Data File	Client ID	Compound
222172-1MSD	112003a.b/2172-01t.d		4-Methyl-2-pentanone
VSTD010	112003a.b/9c1120b.d	2	2-Butanone
MRL	112003a.b/9i1120.d		4-Methyl-2-pentanone
MRL	112003a.b/9i1120a.d		4-Methyl-2-pentanone
MRL	112003a.b/9i1120a.d		1,2-Dibromo-3-Chloropropane
DLCK CHECK	112003a.b/9i1120.d		Methyl-tert-Butyl Ether
DLCK CHECK	112003a.b/9i1120.d		2,2-Dichloropropane

12/10/03

II. QUALITY CONTROL SUMMARY

SURROGATE RECOVERIES REPORT

Job Number.: 222172 Report Date.: 12/09/2003

CUSTOMER: Ellis Environmental Group, LC PROJECT: USACE-LOCKBOURNE AFB ATTN: Karen Hatfield

Method........: Volatile Organics
Method Code...: 8260B
Test Matrix...: Water
Batch(s)......: 102291
Prep Batch..: 102284

Lab ID	DT	Sample ID	Date	12DCED	BRFLBE	DBRFLM	TOLD8
DLCK			11/21/2003	90	91	99	100
LCS			11/20/2003	89	90	97	97
MB			11/20/2003	92	91	100	101
MRL			11/20/2003	91	91	99	101
MRL2			11/21/2003	94	93	101	101
222172- 1		LCKMW-15	11/20/2003	89	90	96	100
222172- 1	MS	LCKMW-15	11/20/2003	93	93	99	100
222172- 1	MSD	LCKMW-15	11/20/2003	94	93	99	100
222172- 2		DUP01	11/21/2003	90	91	96	101
222172- 3		TRIP BLANK	11/20/2003	81	87	91	99

Test	Test Description	Limits
12DCED	1,2-Dichloroethane-d4 (surr)	50 - 150
BRFLBE	4-Bromofluorobenzene (surr)	50 - 150
DBRFLM	Dibromofluoromethane (surr)	50 - 150
TOLD8	Toluene-d8 (surr)	50 - 150

QUALITY CONTROL RESULTS

Job Number.: 222172

Report Date.: 12/09/2003

CUSTOMER: Ellis Environmental Group, LC PROJECT: USACE-LOCKBOURNE AFB ATTN: Karen Hatfield

QC Type	Description	Reag. Code	Lab ID	Dilution Factor	Date	Time
MS	Matrix Spike	V03K200SE	222172-1		11/20/2003	2311

Test Method........: 8260B
Method Description.: Volatile Organics

Equipment Code....: GCL9
Batch.............: 102291

Analyst...: jdn

Parameter/Test Description	Units	QC Result	QC Result	True Value	Orig. Value	QC Calc.	*	Limits	F
Dichlorodifluoromethane	ug/L	6.068		10.000	1.000 U	61	%	59-134	
Chloromethane	ug/L	5.039		10.000	1.000 U	50	%	58-135	*
Vinyl chloride	ug/L	8.534		10.000	1.000 U	85	%	73-134	
Bromomethane	ug/L	5.445		10.000	1.000 U	54	%	35-153	
Chloroethane	ug/L	9.880		10.000	1.000 U	99	%	72-129	
Trichlorofluoromethane	ug/L	9.291		10.000	1.000 U	93	%	68-133	
1,1-Dichloroethene	ug/L	9.317		10.000	1.000 U	93	%	75-125	
Carbon disulfide	ug/L	7.860		10.000	5.000 U	79	%	74-123	
Acetone	ug/L	8.745		10.000	5.000 U	87	%	51-157	
Methylene chloride	ug/L	9.738		10.000	1.000 U	97	%	69-118	
trans-1,2-Dichloroethene	ug/L	9.894		10.000	1.000 U	99	%	75-134	
Methyl-tert-butyl-ether (MTBE)	ug/L	9.389		10.000	1.000 U	94	%	59-129	
1,1-Dichloroethane	ug/L	10.259		10.000	1.000 U	103	%	75-133	
2,2-Dichloropropane	ug/L	10.374		10.000	1.000 U	104	%	62-134	
cis-1,2-Dichloroethene	ug/L	10.475		10.000	1.000 U	105	%	73-133	
2-Butanone (MEK)	ug/L	10.532		10.000	5.000 U	105	%	45-150	
Bromochloromethane	ug/L	8.946		10.000	1.000 U	89	%	75-127	
Chloroform	ug/L	10.346		10.000	1.000 U	103	%	74-127	
1,1,1-Trichloroethane	ug/L	9.963		10.000	1.000 U	100	%	70-127	
1,1-Dichloropropene	ug/L	10.028		10.000	1.000 U	100	%	75-135	
Carbon tetrachloride	ug/L	10.134		10.000	1.000 U	101	%	71-132	
Benzene	ug/L	10.122		10.000	1.000 U	101	%	75-126	
1,2-Dichloroethane	ug/L	9.455		10.000	1.000 U	95	%	67-132	
Trichloroethene	ug/L	10.442		10.000	1.000 U	104	%	67-128	
1,2-Dichloropropane	ug/L	10.226		10.000	1.000 U	102	%	75-127	
Dibromomethane	ug/L	9.841		10.000	1.000 U	98	%	76-132	
Bromodichloromethane	ug/L	10.686		10.000	1.000 U	107	%	70-130	
cis-1,3-Dichloropropene	ug/L	10.413		10.400	1.000 U	100	%	73-132	
4-Methyl-2-pentanone (MIBK)	ug/L	10.219		10.000	5.000 U	102	%	59-150	
Toluene	ug/L	10.200		10.000	1.000 U	102	%	75-125	
trans-1,3-Dichloropropene	ug/L	9.684		9.600	1.000 U	101	%	74-131	
1,1,2-Trichloroethane	ug/L	10.391		10.000	1.000 U	104	%	75-136	
Tetrachloroethene	ug/L	10.088		10.000	1.000 U	101	%	75-129	
1,3-Dichloropropane	ug/L	10.740		10.000	1.000 U	107	%	75-133	
2-Hexanone	ug/L	9.806		10.000	5.000 U	98	%	53-139	
Dibromochloromethane	ug/L	9.972		10.000	1.000 U	100	%	74-145	
1,2-Dibromoethane (EDB)	ug/L	9.891		10.000	1.000 U	99	%	75-127	
Chlorobenzene	ug/L	10.048		10.000	1.000 U	100	%	75-127	
1,1,1,2-Tetrachloroethane	ug/L	10.504		10.000	1.000 U	105	%	75-127	
Ethylbenzene	ug/L	10.584		10.000	1.000 U	106	%	75-120	
m&p-Xylenes	ug/L	20.778		20.000	2.000 U	104	%	75-122	
o-Xylene	ug/L	10.473		10.000	1.000 U	105	%	75-118	
Styrene	ug/L	10.945		10.000	1.000 U	109	%	75-130	
Bromoform	ug/L	9.003		10.000	1.000 U	90	%	72-136	
Isopropylbenzene	ug/L	10.098		10.000	1.000 U	101	%	75-126	
Bromobenzene	ug/L	10.215		10.000	1.000 U	102	%	74-123	
1,1,2,2-Tetrachloroethane	ug/L	10.059		10.000	1.000 U	101	%	68-129	
1,2,3-Trichloropropane	ug/L	10.353		10.000	1.000 U	104	%	65-139	
n-Propylbenzene	ug/L	11.003		10.000	1.000 U	110	%	75-127	
2-Chlorotoluene	ug/L	10.780		10.000	1.000 U	108	%	75-121	

* %=% REC, R=RPD, A=ABS Diff., D=% Diff.

Q U A L I T Y   C O N T R O L   R E S U L T S

Job Number.: 222172

Report Date.: 12/09/2003

CUSTOMER: Ellis Environmental Group, LC   PROJECT: USACE-LOCKBOURNE AFB   ATTN: Karen Hatfield

QC Type	Description	Reag. Code	Lab ID	Dilution Factor	Date	Time
MS	Matrix Spike	V03K20DSE	222172-1		11/20/2003	2311

Parameter/Test Description	Units	QC Result	QC Result	True Value	Orig. Value	QC Calc.	*	Limits	F
1,3,5-Trimethylbenzene	ug/L	10.949		10.000	1.000 U	109	%	75-121	
4-Chlorotoluene	ug/L	10.636		10.000	1.000 U	106	%	73-127	
tert-Butylbenzene	ug/L	10.937		10.000	1.000 U	109	%	75-125	
1,2,4-Trimethylbenzene	ug/L	11.517		10.000	1.000 U	115	%	75-123	
sec-Butylbenzene	ug/L	11.194		10.000	1.000 U	112	%	75-125	
p-Isopropyltoluene	ug/L	10.512		10.000	1.000 U	105	%	75-125	
n-Butylbenzene	ug/L	12.379		10.000	1.000 U	124	%	75-126	
1,2-Dibromo-3-chloropropane	ug/L	9.004		10.000	1.000 U	90	%	75-132	
1,2,3-Trichlorobenzene	ug/L	11.208		10.000	1.000 U	112	%	75-133	

* %=% REC, R=RPD, A=ABS Diff., D=% Diff.

QUALITY CONTROL RESULTS

Job Number.: 222172

Report Date.: 12/09/2003

CUSTOMER: Ellis Environmental Group, LC   PROJECT: USACE-LOCKBOURNE AFB   ATTN: Karen Hatfield

Test Method........: 8260B
Method Description.: Volatile Organics

Equipment Code....: GCL9
Batch.............: 102291

Analyst...: jdn

QC Type	Description	Reag. Code	Lab ID	Dilution Factor	Date	Time
MSD	Matrix Spike Duplicate	V03K20DSE	222172-1		11/20/2003	2340

Parameter/Test Description	Units	QC Result	QC Result	True Value	Orig. Value	QC Calc.	*	Limits	F
Dichlorodifluoromethane	ug/L	6.014	6.068	10.000	1.000 U	60 2	% R	59-134 30	
Chloromethane	ug/L	5.624	5.039	10.000	1.000 U	56 11	% R	58-135 30	*
Vinyl chloride	ug/L	8.459	8.534	10.000	1.000 U	85 0	% R	73-134 30	
Bromomethane	ug/L	5.997	5.445	10.000	1.000 U	60 11	% R	35-153 30	
Chloroethane	ug/L	9.991	9.880	10.000	1.000 U	100 1	% R	72-129 30	
Trichlorofluoromethane	ug/L	9.267	9.291	10.000	1.000 U	93 0	% R	68-133 30	
1,1-Dichloroethene	ug/L	8.903	9.317	10.000	1.000 U	89 4	% R	75-125 30	
Carbon disulfide	ug/L	7.539	7.860	10.000	5.000 U	75 5	% R	74-123 30	
Acetone	ug/L	11.679	8.745	10.000	5.000 U	117 29	% R	51-157 30	
Methylene chloride	ug/L	9.300	9.738	10.000	1.000 U	93 4	% R	69-118 30	
trans-1,2-Dichloroethene	ug/L	9.594	9.894	10.000	1.000 U	96 3	% R	75-134 30	
Methyl-tert-butyl-ether (MTBE)	ug/L	9.240	9.389	10.000	1.000 U	92 2	% R	59-129 30	
1,1-Dichloroethane	ug/L	9.842	10.259	10.000	1.000 U	98 5	% R	75-133 30	
2,2-Dichloropropane	ug/L	9.837	10.374	10.000	1.000 U	98 6	% R	62-134 30	
cis-1,2-Dichloroethene	ug/L	10.214	10.475	10.000	1.000 U	102 3	% R	73-133 30	
2-Butanone (MEK)	ug/L	9.916	10.532	10.000	5.000 U	99 6	% R	45-150 30	
Bromochloromethane	ug/L	8.494	8.946	10.000	1.000 U	85 5	% R	75-127 30	
Chloroform	ug/L	10.123	10.346	10.000	1.000 U	101 2	% R	74-127 30	
1,1,1-Trichloroethane	ug/L	9.588	9.963	10.000	1.000 U	96 4	% R	70-127 30	
1,1-Dichloropropene	ug/L	9.673	10.028	10.000	1.000 U	97 3	% R	75-135 30	
Carbon tetrachloride	ug/L	9.386	10.134	10.000	1.000 U	94 7	% R	71-132 30	
Benzene	ug/L	9.656	10.122	10.000	1.000 U	97 4	% R	75-126 30	
1,2-Dichloroethane	ug/L	9.528	9.455	10.000	1.000 U	95 0	% R	67-132 30	
Trichloroethene	ug/L	9.951	10.442	10.000	1.000 U	100 4	% R	67-128 30	
1,2-Dichloropropane	ug/L	9.907	10.226	10.000	1.000 U	99 3	% R	75-127 30	

* %=% REC, R=RPD, A=ABS Diff., D=% Diff.

QUALITY CONTROL RESULTS

Job Number.: 222172

Report Date.: 12/09/2003

CUSTOMER: Ellis Environmental Group, LC PROJECT: USACE-LOCKBOURNE AFB ATTN: Karen Hatfield

QC Type	Description	Reag. Code	Lab ID	Dilution Factor	Date	Time
MSD	Matrix Spike Duplicate	V03K200SE	222172-1		11/20/2003	2340

Parameter/Test Description	Units	QC Result	QC Result	True Value	Orig. Value	QC Calc.	*	Limits	F
Dibromomethane	ug/L	9.647	9.841	10.000	1.000 U	96 2	% R	76-132 30	
Bromodichloromethane	ug/L	10.475	10.686	10.000	1.000 U	105 2	% R	70-130 30	
cis-1,3-Dichloropropene	ug/L	10.082	10.413	10.400	1.000 U	97 3	% R	73-132 30	
4-Methyl-2-pentanone (MIBK)	ug/L	10.720	10.219	10.000	5.000 U	107 5	% R	59-150 30	
Toluene	ug/L	9.934	10.200	10.000	1.000 U	99 3	% R	75-125 30	
trans-1,3-Dichloropropene	ug/L	9.606	9.684	9.600	1.000 U	100 1	% R	74-131 30	
1,1,2-Trichloroethane	ug/L	10.238	10.391	10.000	1.000 U	102 2	% R	75-136 30	
Tetrachloroethene	ug/L	9.664	10.088	10.000	1.000 U	97 4	% R	75-129 30	
1,3-Dichloropropane	ug/L	10.517	10.740	10.000	1.000 U	105 2	% R	75-133 30	
2-Hexanone	ug/L	9.569	9.806	10.000	5.000 U	96 2	% R	53-139 30	
Dibromochloromethane	ug/L	9.797	9.972	10.000	1.000 U	98 2	% R	74-145 30	
1,2-Dibromoethane (EDB)	ug/L	9.812	9.891	10.000	1.000 U	98 1	% R	75-127 30	
Chlorobenzene	ug/L	9.747	10.048	10.000	1.000 U	97 3	% R	75-127 30	
1,1,1,2-Tetrachloroethane	ug/L	10.385	10.504	10.000	1.000 U	104 1	% R	75-127 30	
Ethylbenzene	ug/L	10.188	10.584	10.000	1.000 U	102 4	% R	75-120 30	
m&p-Xylenes	ug/L	20.360	20.778	20.000	2.000 U	102 2	% R	75-122 30	
o-Xylene	ug/L	10.225	10.473	10.000	1.000 U	102 3	% R	75-118 30	
Styrene	ug/L	10.676	10.945	10.000	1.000 U	107 2	% R	75-130 30	
Bromoform	ug/L	8.935	9.003	10.000	1.000 U	89 1	% R	72-136 30	
Isopropylbenzene	ug/L	9.813	10.098	10.000	1.000 U	98 3	% R	75-126 30	
Bromobenzene	ug/L	10.203	10.215	10.000	1.000 U	102 0	% R	74-123 30	
1,1,2,2-Tetrachloroethane	ug/L	9.997	10.059	10.000	1.000 U	100 1	% R	68-129 30	
1,2,3-Trichloropropane	ug/L	9.900	10.353	10.000	1.000 U	99 5	% R	65-139 30	
n-Propylbenzene	ug/L	10.680	11.003	10.000	1.000 U	107 3	% R	75-127 30	
2-Chlorotoluene	ug/L	10.387	10.780	10.000	1.000 U	104 4	% R	75-121 30	
1,3,5-Trimethylbenzene	ug/L	10.675	10.949	10.000	1.000 U	107 2	% R	75-121 30	
4-Chlorotoluene	ug/L	10.360	10.636	10.000	1.000 U	104 2	% R	73-127 30	

* %=% REC, R=RPD, A=ABS Diff., D=% Diff.

QUALITY CONTROL RESULTS

Job Number.: 222172

Report Date.: 12/09/2003

CUSTOMER: Ellis Environmental Group, LC PROJECT: USACE-LOCKBOURNE AFB ATTN: Karen Hatfield

QC Type	Description	Reag. Code	Lab ID	Dilution Factor	Date Time
MSD	Matrix Spike Duplicate	V03K200SE	222172-1		11/20/2003 2340

Parameter/Test Description	Units	QC Result	QC Result	True Value	Orig. Value	QC Calc.	*	Limits	F
tert-Butylbenzene	ug/L	10.565	10.937	10.000	1.000 U	106 3	% R	75-125 30	
1,2,4-Trimethylbenzene	ug/L	11.276	11.517	10.000	1.000 U	113 2	% R	75-123 30	
sec-Butylbenzene	ug/L	10.838	11.194	10.000	1.000 U	108 4	% R	75-125 30	
p-Isopropyltoluene	ug/L	10.156	10.512	10.000	1.000 U	102 3	% R	75-125 30	
n-Butylbenzene	ug/L	11.948	12.379	10.000	1.000 U	119 4	% R	75-126 30	
1,2-Dibromo-3-chloropropane	ug/L	8.962	9.004	10.000	1.000 U	90 0	% R	75-132 30	
1,2,3-Trichlorobenzene	ug/L	11.602	11.208	10.000	1.000 U	116 4	% R	75-133 30	

* %=% REC, R=RPD, A=ABS Diff., D=% Diff.

QUALITY CONTROL RESULTS

Job Number.: 222172

Report Date.: 12/09/2003

CUSTOMER: Ellis Environmental Group, LC PROJECT: USACE-LOCKBOURNE AFB ATTN: Karen Hatfield

QC Type	Description	Reag. Code	Lab ID	Dilution Factor	Date Time
LCS	Laboratory Control Sample	V03K20DBE	102284-022		11/20/2003 2102

Test Method........: 8260B
Method Description.: Volatile Organics
Equipment Code....: GCL9
Batch.............: 102291
Analyst...: jdn

Parameter/Test Description	Units	QC Result	QC Result	True Value	Orig. Value	QC Calc.	*	Limits	F
Dichlorodifluoromethane	ug/L	5.833		10.000	1.000 U	58	%	59-134	*
Chloromethane	ug/L	4.540		10.000	1.000 U	45	%	58-135	*
Vinyl chloride	ug/L	7.707		10.000	1.000 U	77	%	73-134	
Bromomethane	ug/L	4.743		10.000	1.000 U	47	%	35-153	
Chloroethane	ug/L	8.966		10.000	1.000 U	90	%	72-129	
Trichlorofluoromethane	ug/L	8.641		10.000	1.000 U	86	%	68-133	
1,1-Dichloroethene	ug/L	8.661		10.000	1.000 U	87	%	75-125	
Carbon disulfide	ug/L	7.361		10.000	5.000 U	74	%	74-123	
Acetone	ug/L	9.235		10.000	5.000 U	92	%	51-157	
Methylene chloride	ug/L	9.079		10.000	1.000 U	91	%	69-118	
trans-1,2-Dichloroethene	ug/L	9.343		10.000	1.000 U	93	%	75-134	
Methyl-tert-butyl-ether (MTBE)	ug/L	9.405		10.000	1.000 U	94	%	59-129	
1,1-Dichloroethane	ug/L	9.644		10.000	1.000 U	96	%	75-133	
2,2-Dichloropropane	ug/L	9.766		10.000	1.000 U	98	%	62-134	
cis-1,2-Dichloroethene	ug/L	9.877		10.000	1.000 U	99	%	73-133	
2-Butanone (MEK)	ug/L	10.685		10.000	5.000 U	107	%	45-150	
Bromochloromethane	ug/L	8.410		10.000	1.000 U	84	%	75-127	
Chloroform	ug/L	9.734		10.000	1.000 U	97	%	74-127	
1,1,1-Trichloroethane	ug/L	9.360		10.000	1.000 U	94	%	70-127	
1,1-Dichloropropene	ug/L	9.374		10.000	1.000 U	94	%	75-135	
Carbon tetrachloride	ug/L	9.049		10.000	1.000 U	90	%	71-132	
Benzene	ug/L	9.399		10.000	1.000 U	94	%	75-126	
1,2-Dichloroethane	ug/L	9.129		10.000	1.000 U	91	%	67-132	
Trichloroethene	ug/L	9.754		10.000	1.000 U	98	%	67-128	
1,2-Dichloropropane	ug/L	9.632		10.000	1.000 U	96	%	75-127	
Dibromomethane	ug/L	9.499		10.000	1.000 U	95	%	76-132	
Bromodichloromethane	ug/L	10.172		10.000	1.000 U	102	%	70-130	
cis-1,3-Dichloropropene	ug/L	10.000		10.400	1.000 U	96	%	73-132	
4-Methyl-2-pentanone (MIBK)	ug/L	9.354		10.000	5.000 U	94	%	59-150	
Toluene	ug/L	9.635		10.000	1.000 U	96	%	75-125	
trans-1,3-Dichloropropene	ug/L	9.193		9.600	1.000 U	96	%	74-131	
1,1,2-Trichloroethane	ug/L	9.959		10.000	1.000 U	100	%	75-136	
Tetrachloroethene	ug/L	9.489		10.000	1.000 U	95	%	75-129	
1,3-Dichloropropane	ug/L	10.299		10.000	1.000 U	103	%	75-133	
2-Hexanone	ug/L	10.516		10.000	5.000 U	105	%	53-139	
Dibromochloromethane	ug/L	9.557		10.000	1.000 U	96	%	74-145	
1,2-Dibromoethane (EDB)	ug/L	9.566		10.000	1.000 U	96	%	75-127	
Chlorobenzene	ug/L	9.522		10.000	1.000 U	95	%	75-127	
1,1,1,2-Tetrachloroethane	ug/L	10.098		10.000	1.000 U	101	%	75-127	
Ethylbenzene	ug/L	9.958		10.000	1.000 U	100	%	75-120	
m&p-Xylenes	ug/L	19.686		20.000	2.000 U	98	%	75-122	
o-Xylene	ug/L	9.850		10.000	1.000 U	99	%	75-118	
Styrene	ug/L	10.369		10.000	1.000 U	104	%	75-130	
Bromoform	ug/L	8.640		10.000	1.000 U	86	%	72-136	
Isopropylbenzene	ug/L	9.413		10.000	1.000 U	94	%	75-126	
Bromobenzene	ug/L	9.681		10.000	1.000 U	97	%	74-123	
1,1,2,2-Tetrachloroethane	ug/L	9.941		10.000	1.000 U	99	%	68-129	
1,2,3-Trichloropropane	ug/L	9.467		10.000	1.000 U	95	%	65-139	
n-Propylbenzene	ug/L	10.201		10.000	1.000 U	102	%	75-127	
2-Chlorotoluene	ug/L	9.964		10.000	1.000 U	100	%	75-121	

* %=% REC, R=RPD, A=ABS Diff., D=% Diff.

QUALITY CONTROL RESULTS

Job Number.: 222172

Report Date.: 12/09/2003

CUSTOMER: Ellis Environmental Group, LC PROJECT: USACE-LOCKBOURNE AFB ATTN: Karen Hatfield

QC Type	Description	Reag. Code	Lab ID	Dilution Factor	Date	Time
LCS	Laboratory Control Sample	V03K200SE	102284-022		11/20/2003	2102

Parameter/Test Description	Units	QC Result	QC Result	True Value	Orig. Value	QC Calc.	*	Limits	F
1,3,5-Trimethylbenzene	ug/L	10.144		10.000	1.000 U	101	%	75-121	
4-Chlorotoluene	ug/L	10.014		10.000	1.000 U	100	%	73-127	
tert-Butylbenzene	ug/L	10.094		10.000	1.000 U	101	%	75-125	
1,2,4-Trimethylbenzene	ug/L	10.712		10.000	1.000 U	107	%	75-123	
sec-Butylbenzene	ug/L	10.396		10.000	1.000 U	104	%	75-125	
p-Isopropyltoluene	ug/L	9.883		10.000	1.000 U	99	%	75-125	
n-Butylbenzene	ug/L	11.423		10.000	1.000 U	114	%	75-126	
1,2-Dibromo-3-chloropropane	ug/L	7.970		10.000	1.000 U	80	%	75-132	
1,2,3-Trichlorobenzene	ug/L	10.790		10.000	1.000 U	108	%	75-133	

* %=% REC, R=RPD, A=ABS Diff., D=% Diff.

RECOVERY REPORT

Client Name:
Sample Matrix: LIQUID
Lab Smp Id: ICAL SPIKE
Level: LOW
Data Type: MS DATA
SpikeList File: ical.spk
Sublist File: 02ICAL1.sub
Method File: /var/chem/gc19.i/101603a_25ml9w.b/25ml9w.m
Misc Info: ICAL SPIKE,1,22

Client SDG: 101603a
Fraction: VOA
Client Smp ID: ICAL SPIKE
Operator: EA
SampleType: BS
Quant Type: ISTD

SPIKE COMPOUND	CONC ADDED ug/L	CONC RECOVERED ug/L	% RECOVERED	QAPP LIMITS 80-120
1 Dichlorodifluorome	10.000	8.760	87.60	~~75-125~~
2 Chloromethane	10.000	9.272	92.72	~~75-125~~
3 Vinyl chloride	10.000	9.502	95.02	~~75-125~~
5 Bromomethane	10.000	9.777	97.77	~~75-125~~
6 Chloroethane	10.000	9.831	98.31	~~75-125~~
7 Trichlorofluoromet	10.000	10.618	106.18	~~75-125~~
12 1,1-Dichloroethene	10.000	8.750	87.50	~~75-125~~
19 Methylene chloride	10.000	8.931	89.31	~~75-125~~
21 trans-1,2-Dichloro	10.000	9.276	92.76	~~75-125~~
25 1,1-Dichloroethane	10.000	9.555	95.55	~~75-125~~
28 2,2-Dichloropropan	10.000	9.426	94.26	~~75-125~~
29 cis-1,2-Dichloroet	10.000	9.822	98.22	~~75-125~~
33 Bromochloromethane	10.000	9.343	93.43	~~75-125~~
36 Chloroform	10.000	9.684	96.84	~~75-125~~
39 1,1,1-Trichloroeth	10.000	9.823	98.23	~~75-125~~
43 1,1-Dichloropropen	10.000	9.239	92.39	~~75-125~~
42 Carbon tetrachlori	10.000	10.199	101.99	~~75-125~~
45 Benzene	10.000	9.579	95.79	~~75-125~~
47 1,2-Dichloroethane	10.000	9.691	96.91	~~75-125~~
52 Trichloroethene	10.000	9.971	99.71	~~75-125~~
54 1,2-Dichloropropan	10.000	9.709	97.09	~~75-125~~
56 Dibromomethane	10.000	10.033	100.33	~~75-125~~
58 Bromodichlorometha	10.000	10.655	106.55	~~75-125~~
61 cis-1,3-Dichloropr	10.400	10.397	99.97	~~75-125~~
64 Toluene	10.000	9.798	97.98	~~75-125~~
65 trans-1,3-Dichloro	9.600	9.951	103.66	~~75-125~~
68 1,1,2-Trichloroeth	10.000	9.971	99.71	~~75-125~~
69 Tetrachloroethene	10.000	9.967	99.67	~~75-125~~
70 1,3-Dichloropropan	10.000	10.424	104.24	~~75-125~~
72 Dibromochlorometha	10.000	10.307	103.07	~~75-125~~
73 1,2-Dibromoethane	10.000	10.017	100.17	~~75-125~~
76 Chlorobenzene	10.000	9.789	97.89	~~75-125~~
78 1,1,1,2-Tetrachlor	10.000	10.271	102.71	~~75-125~~

TF
12/12/03

SPIKE COMPOUND	CONC ADDED ug/L	CONC RECOVERED ug/L	% RECOVERED	QAPP LIMITS 80-120
77 Ethylbenzene	10.000	10.042	100.42	75-125
79 p.m-Xylene	20.000	20.101	100.50	75-125
80 o-Xylene	10.000	10.137	101.37	75-125
81 Styrene	10.000	10.620	106.20	75-125
82 Bromoform	10.000	9.596	95.96	75-125
83 Isopropylbenzene	10.000	9.513	95.13	75-125
88 1,1,2,2-Tetrachlor	10.000	9.854	98.54	75-125
87 Bromobenzene	10.000	10.055	100.55	75-125
90 1,2,3-Trichloropro	10.000	10.239	102.39	75-125
89 n-Propylbenzene	10.000	9.812	98.12	75-125
92 2-Chlorotoluene	10.000	9.803	98.03	75-125
93 1,3,5-Trimethylben	10.000	10.00	100.00	75-125
94 4-Chlorotoluene	10.000	10.230	102.30	75-125
95 tert-Butylbenzene	10.000	9.965	99.65	75-125
96 1,2,4-Trimethylben	10.000	10.442	104.42	75-125
98 sec-Butylbenzene	10.000	10.106	101.06	75-125
100 1,3-Dichlorobenzen	10.000	9.872	98.72	75-125
99 p-Isopropyltoluene	10.000	9.600	96.00	75-125
102 1,4-Dichlorobenzen	10.000	9.561	95.61	75-125
103 n-Butylbenzene	10.000	10.410	104.10	75-125
104 1,2-Dichlorobenzen	10.000	9.716	97.16	75-125
105 1,2-Dibromo-3-Chlo	10.000	10.288	102.88	75-125
107 1,2,4-Trichloroben	10.000	10.498	104.98	75-125
108 Hexachlorobutadien	10.000	11.220	112.20	75-125
109 Naphthalene	10.000	9.376	93.76	75-125
110 1,2,3-Trichloroben	10.000	10.289	102.89	75-125
13 Acetone	10.000	8.402	84.03	75-125
30 2-Butanone	10.000	8.978	89.78	75-125
15 Carbon Disulfide	10.000	7.812	78.13 *	75-125 *
57 2-Chloroethylviny	10.000	0.000	NA *	75-125
71 2-Hexanone	10.000	9.862	98.62	75-125
14 Iodomethane	10.000	0.000	NA *	75-125
62 4-Methyl-2-pentano	10.000	10.927	109.27	75-125
26 Vinyl Acetate	10.000	10.666	106.66	75-125
M 84 1,2-Dichloroethene	20.000	19.050	95.25	75-125
M 112 Xylene (total)	30.000	32.660	108.87	75-125
74 1-Chlorohexane	10.000	9.654	96.54	75-125
34 Tetrahydrofuran	10.000	9.011	90.11	75-125

TP 12/12/03

SURROGATE COMPOUND	CONC ADDED ug/L	CONC RECOVERED ug/L	% RECOVERED	LIMITS
$ 40 Dibromofluorometha	10.770	10.703	99.38	66-132
$ 46 1,2-Dichloroethane	10.770	10.728	99.61	61-131

SURROGATE COMPOUND	CONC ADDED ug/L	CONC RECOVERED ug/L	% RECOVERED	LIMITS
$ 63 Toluene-d8	10.770	10.898	101.18	78-128
$ 86 p-Bromofluorobenze	10.770	10.240	95.08	73-122

QUALITY CONTROL RESULTS

Job Number.: 222172

Report Date.: 12/09/2003

CUSTOMER: Ellis Environmental Group, LC   PROJECT: USACE-LOCKBOURNE AFB   ATTN: Karen Hatfield

QC Type	Description	Reag. Code	Lab ID	Dilution Factor	Date Time

Test Method........: 8260B
Method Description.: Volatile Organics
Equipment Code....: GCL9
Batch.............: 102291
Analyst...: jdn

MRL	Method Reporting Limit Standard	V03K200MA	102284-018		11/20/2003 2131

Parameter/Test Description	Units	QC Result	QC Result	True Value	Orig. Value	QC Calc.	*	Limits	F
Dichlorodifluoromethane	ug/L	2.792		2.000		140	%	70-130	*
Chloromethane	ug/L	1.797		2.000		90	%	70-130	
Vinyl chloride	ug/L	2.292		2.000		115	%	70-130	
Bromomethane	ug/L	1.799		2.000		90	%	70-130	
Chloroethane	ug/L	2.048		2.000		102	%	70-130	
Trichlorofluoromethane	ug/L	1.797		2.000		90	%	70-130	
1,1-Dichloroethene	ug/L	1.963		2.000		98	%	70-130	
Carbon disulfide	ug/L	3.908 J		4.000		98	%	70-130	
Acetone	ug/L	3.147 J		4.000		79	%	70-130	
Methylene chloride	ug/L	2.058		2.000		103	%	70-130	
trans-1,2-Dichloroethene	ug/L	1.984		2.000		99	%	70-130	
Methyl-tert-butyl-ether (MTBE)	ug/L	2.017		2.000		101	%	70-130	
1,1-Dichloroethane	ug/L	2.059		2.000		103	%	70-130	
2,2-Dichloropropane	ug/L	2.000		2.000		100	%	70-130	
cis-1,2-Dichloroethene	ug/L	2.068		2.000		103	%	70-130	
2-Butanone (MEK)	ug/L	5.072		4.000		127	%	70-130	
Bromochloromethane	ug/L	1.990		2.000		99	%	70-130	
Chloroform	ug/L	2.021		2.000		101	%	70-130	
1,1,1-Trichloroethane	ug/L	1.877		2.000		94	%	70-130	
1,1-Dichloropropene	ug/L	1.943		2.000		97	%	70-130	
Carbon tetrachloride	ug/L	1.746		2.000		87	%	70-130	
Benzene	ug/L	2.023		2.000		101	%	70-130	
1,2-Dichloroethane	ug/L	1.997		2.000		100	%	70-130	
Trichloroethene	ug/L	2.041		2.000		102	%	70-130	
1,2-Dichloropropane	ug/L	2.105		2.000		105	%	70-130	
Dibromomethane	ug/L	2.062		2.000		103	%	70-130	
Bromodichloromethane	ug/L	1.873		2.000		94	%	70-130	
cis-1,3-Dichloropropene	ug/L	1.833		2.000		92	%	70-130	
4-Methyl-2-pentanone (MIBK)	ug/L	4.221 J		4.000		106	%	70-130	
Toluene	ug/L	1.982		2.000		99	%	70-130	
trans-1,3-Dichloropropene	ug/L	1.743		2.000		87	%	70-130	
1,1,2-Trichloroethane	ug/L	1.959		2.000		98	%	70-130	
Tetrachloroethene	ug/L	1.903		2.000		95	%	70-130	
1,3-Dichloropropane	ug/L	2.039		2.000		102	%	70-130	
2-Hexanone	ug/L	4.914 J		4.000		123	%	70-130	
Dibromochloromethane	ug/L	1.740		2.000		87	%	70-130	
1,2-Dibromoethane (EDB)	ug/L	1.855		2.000		93	%	70-130	
Chlorobenzene	ug/L	1.962		2.000		98	%	70-130	
1,1,1,2-Tetrachloroethane	ug/L	1.990		2.000		99	%	70-130	
Ethylbenzene	ug/L	1.985		2.000		99	%	70-130	
m&p-Xylenes	ug/L	3.992		4.000		100	%	70-130	
o-Xylene	ug/L	1.972		2.000		99	%	70-130	
Styrene	ug/L	1.960		2.000		98	%	70-130	
Bromoform	ug/L	2.137		2.000		107	%	70-130	
Isopropylbenzene	ug/L	2.000		2.000		100	%	70-130	
Bromobenzene	ug/L	1.912		2.000		96	%	70-130	
1,1,2,2-Tetrachloroethane	ug/L	2.051		2.000		103	%	70-130	
1,2,3-Trichloropropane	ug/L	1.999		2.000		100	%	70-130	
n-Propylbenzene	ug/L	2.076		2.000		104	%	70-130	
2-Chlorotoluene	ug/L	2.069		2.000		103	%	70-130	

* %=% REC, R=RPD, A=ABS Diff., D=% Diff.

Q U A L I T Y   C O N T R O L   R E S U L T S

Job Number.: 222172

Report Date.: 12/09/2003

CUSTOMER: Ellis Environmental Group, LC   PROJECT: USACE-LOCKBOURNE AFB   ATTN: Karen Hatfield

QC Type	Description	Reag. Code	Lab ID	Dilution Factor	Date Time
MRL	Method Reporting Limit Standard	V03K20DMA	102284-018		11/20/2003 2131

Parameter/Test Description	Units	QC Result	QC Result	True Value	Orig. Value	QC Calc.	*	Limits	F
1,3,5-Trimethylbenzene	ug/L	2.068		2.000		103	%	70-130	
4-Chlorotoluene	ug/L	2.062		2.000		103	%	70-130	
tert-Butylbenzene	ug/L	2.038		2.000		102	%	70-130	
1,2,4-Trimethylbenzene	ug/L	2.112		2.000		106	%	70-130	
sec-Butylbenzene	ug/L	2.083		2.000		104	%	70-130	
p-Isopropyltoluene	ug/L	2.004		2.000		100	%	70-130	
n-Butylbenzene	ug/L	2.270		2.000		114	%	70-130	
1,2-Dibromo-3-chloropropane	ug/L	2.063		2.000		103	%	70-130	
1,2,3-Trichlorobenzene	ug/L	2.429		2.000		121	%	70-130	

* %=% REC, R=RPD, A=ABS Diff., D=% Diff.

QUALITY CONTROL RESULTS

Job Number.: 222172

Report Date.: 12/09/2003

CUSTOMER: Ellis Environmental Group, LC PROJECT: USACE-LOCKBOURNE AFB ATTN: Karen Hatfield

QC Type	Description	Reag. Code	Lab ID	Dilution Factor	Date Time

Test Method........: 8260B
Method Description.: Volatile Organics
Equipment Code....: GCL9
Batch.............: 102291
Analyst...: jdn

MRL2	Method Reporting Limit Standard	V03K200MA	102284-019		11/21/2003 0623

Parameter/Test Description	Units	QC Result		QC Result		True Value	Orig. Value	QC Calc.	*	Limits	F
Dichlorodifluoromethane	ug/L	2.842		2.792		2.000		142	%	70-130	*
Chloromethane	ug/L	1.810		1.797		2.000		91	%	70-130	
Vinyl chloride	ug/L	2.340		2.292		2.000		117	%	70-130	
Bromomethane	ug/L	1.578		1.799		2.000		79	%	70-130	
Chloroethane	ug/L	2.128		2.048		2.000		106	%	70-130	
Trichlorofluoromethane	ug/L	1.883		1.797		2.000		94	%	70-130	
1,1-Dichloroethene	ug/L	2.009		1.963		2.000		100	%	70-130	
Carbon disulfide	ug/L	3.972	J	3.908	J	4.000		99	%	70-130	
Acetone	ug/L	4.075	J	3.147	J	4.000		102	%	70-130	
Methylene chloride	ug/L	2.356		2.058		2.000		118	%	70-130	
trans-1,2-Dichloroethene	ug/L	2.034		1.984		2.000		102	%	70-130	
Methyl-tert-butyl-ether (MTBE)	ug/L	2.043		2.017		2.000		102	%	70-130	
1,1-Dichloroethane	ug/L	2.149		2.059		2.000		107	%	70-130	
2,2-Dichloropropane	ug/L	1.943		2.000		2.000		97	%	70-130	
cis-1,2-Dichloroethene	ug/L	2.057		2.068		2.000		103	%	70-130	
2-Butanone (MEK)	ug/L	5.397		5.072		4.000		135	%	70-130	*
Bromochloromethane	ug/L	2.066		1.990		2.000		103	%	70-130	
Chloroform	ug/L	2.032		2.021		2.000		102	%	70-130	
1,1,1-Trichloroethane	ug/L	1.935		1.877		2.000		97	%	70-130	
1,1-Dichloropropene	ug/L	2.048		1.943		2.000		102	%	70-130	
Carbon tetrachloride	ug/L	1.843		1.746		2.000		92	%	70-130	
Benzene	ug/L	2.029		2.023		2.000		101	%	70-130	
1,2-Dichloroethane	ug/L	2.037		1.997		2.000		102	%	70-130	
Trichloroethene	ug/L	1.982		2.041		2.000		99	%	70-130	
1,2-Dichloropropane	ug/L	2.053		2.105		2.000		103	%	70-130	
Dibromomethane	ug/L	2.092		2.062		2.000		105	%	70-130	
Bromodichloromethane	ug/L	1.886		1.873		2.000		94	%	70-130	
cis-1,3-Dichloropropene	ug/L	1.817		1.833		2.000		91	%	70-130	
4-Methyl-2-pentanone (MIBK)	ug/L	4.076	J	4.221	J	4.000		102	%	70-130	
Toluene	ug/L	2.001		1.982		2.000		100	%	70-130	
trans-1,3-Dichloropropene	ug/L	1.724		1.743		2.000		86	%	70-130	
1,1,2-Trichloroethane	ug/L	1.986		1.959		2.000		99	%	70-130	
Tetrachloroethene	ug/L	1.829		1.903		2.000		91	%	70-130	
1,3-Dichloropropane	ug/L	2.096		2.039		2.000		105	%	70-130	
2-Hexanone	ug/L	4.773	J	4.914	J	4.000		119	%	70-130	
Dibromochloromethane	ug/L	1.781		1.740		2.000		89	%	70-130	
1,2-Dibromoethane (EDB)	ug/L	1.842		1.855		2.000		92	%	70-130	
Chlorobenzene	ug/L	1.932		1.962		2.000		97	%	70-130	
1,1,1,2-Tetrachloroethane	ug/L	1.935		1.990		2.000		97	%	70-130	
Ethylbenzene	ug/L	1.942		1.985		2.000		97	%	70-130	
m&p-Xylenes	ug/L	3.924		3.992		4.000		98	%	70-130	
o-Xylene	ug/L	2.020		1.972		2.000		101	%	70-130	
Styrene	ug/L	1.915		1.960		2.000		96	%	70-130	
Bromoform	ug/L	2.072		2.137		2.000		104	%	70-130	
Isopropylbenzene	ug/L	1.912		2.000		2.000		96	%	70-130	
Bromobenzene	ug/L	1.933		1.912		2.000		97	%	70-130	
1,1,2,2-Tetrachloroethane	ug/L	1.979		2.051		2.000		99	%	70-130	
1,2,3-Trichloropropane	ug/L	1.872		1.999		2.000		94	%	70-130	
n-Propylbenzene	ug/L	2.021		2.076		2.000		101	%	70-130	
2-Chlorotoluene	ug/L	1.974		2.069		2.000		99	%	70-130	

* %=% REC, R=RPD, A=ABS Diff., D=% Diff.

QUALITY CONTROL RESULTS

Job Number.: 222172

Report Date.: 12/09/2003

CUSTOMER: Ellis Environmental Group, LC PROJECT: USACE-LOCKBOURNE AFB ATTN: Karen Hatfield

QC Type	Description	Reag. Code	Lab ID	Dilution Factor	Date	Time
MRL2	Method Reporting Limit Standard	V03K20DMA	102284-019		11/21/2003	0623

Parameter/Test Description	Units	QC Result	QC Result	True Value	Orig. Value	QC Calc.	*	Limits	F
1,3,5-Trimethylbenzene	ug/L	2.001	2.068	2.000		100	%	70-130	
4-Chlorotoluene	ug/L	2.051	2.062	2.000		103	%	70-130	
tert-Butylbenzene	ug/L	2.007	2.038	2.000		100	%	70-130	
1,2,4-Trimethylbenzene	ug/L	2.001	2.112	2.000		100	%	70-130	
sec-Butylbenzene	ug/L	2.020	2.083	2.000		101	%	70-130	
p-Isopropyltoluene	ug/L	1.938	2.004	2.000		97	%	70-130	
n-Butylbenzene	ug/L	2.134	2.270	2.000		107	%	70-130	
1,2-Dibromo-3-chloropropane	ug/L	2.047	2.063	2.000		102	%	70-130	
1,2,3-Trichlorobenzene	ug/L	2.190	2.429	2.000		109	%	70-130	

* %=% REC, R=RPD, A=ABS Diff., D=% Diff.

Q U A L I T Y   C O N T R O L   R E S U L T S

Job Number.: 222172

Report Date.: 12/09/2003

CUSTOMER: Ellis Environmental Group, LC   PROJECT: USACE-LOCKBOURNE AFB   ATTN: Karen Hatfield

QC Type	Description	Reag. Code	Lab ID	Dilution Factor	Date Time
DLCK	Detection Limit Check Standard	V03K20DLA	102284-020		11/21/2003 0651

Test Method........: 8260B
Method Description.: Volatile Organics

Equipment Code....: GCL9
Batch.............: 102291

Analyst...: jdn

Parameter/Test Description	Units	QC Result	QC Result	True Value	Orig. Value	QC Calc.	*	Limits	F
Dichlorodifluoromethane	ug/L	2.037		1.000		204	%	10-190	*
Chloromethane	ug/L	1.298		1.000		130	%	10-190	
Vinyl chloride	ug/L	1.453		1.000		145	%	10-190	
Bromomethane	ug/L	1.346		1.000		135	%	10-190	
Chloroethane	ug/L	1.167		1.000		117	%	10-190	
Trichlorofluoromethane	ug/L	1.045		1.000		104	%	10-190	
1,1-Dichloroethene	ug/L	1.101		1.000		110	%	10-190	
Carbon disulfide	ug/L	2.045 J		2.000		102	%	10-190	
Acetone	ug/L	1.205 J		2.000		60	%	10-190	
Methylene chloride	ug/L	1.168		1.000		117	%	10-190	
trans-1,2-Dichloroethene	ug/L	1.041		1.000		104	%	10-190	
Methyl-tert-butyl-ether (MTBE)	ug/L	1.087		1.000		109	%	10-190	
1,1-Dichloroethane	ug/L	1.070		1.000		107	%	10-190	
2,2-Dichloropropane	ug/L	0.992 J		1.000		99	%	10-190	
cis-1,2-Dichloroethene	ug/L	1.071		1.000		107	%	10-190	
2-Butanone (MEK)	ug/L	2.888 J		2.000		144	%	10-190	
Bromochloromethane	ug/L	1.044		1.000		104	%	10-190	
Chloroform	ug/L	1.056		1.000		106	%	10-190	
1,1,1-Trichloroethane	ug/L	1.044		1.000		104	%	10-190	
1,1-Dichloropropene	ug/L	1.100		1.000		110	%	10-190	
Carbon tetrachloride	ug/L	0.903 J		1.000		90	%	10-190	
Benzene	ug/L	1.038		1.000		104	%	10-190	
1,2-Dichloroethane	ug/L	1.005		1.000		100	%	10-190	
Trichloroethene	ug/L	1.028		1.000		103	%	10-190	
1,2-Dichloropropane	ug/L	1.057		1.000		106	%	10-190	
Dibromomethane	ug/L	1.032		1.000		103	%	10-190	
Bromodichloromethane	ug/L	0.933 J		1.000		93	%	10-190	
cis-1,3-Dichloropropene	ug/L	0.903 J		1.000		90	%	10-190	
4-Methyl-2-pentanone (MIBK)	ug/L	2.148 J		2.000		107	%	10-190	
Toluene	ug/L	1.018		1.000		102	%	10-190	
trans-1,3-Dichloropropene	ug/L	0.884 J		1.000		88	%	10-190	
1,1,2-Trichloroethane	ug/L	0.966 J		1.000		97	%	10-190	
Tetrachloroethene	ug/L	1.006		1.000		101	%	10-190	
1,3-Dichloropropane	ug/L	1.052		1.000		105	%	10-190	
2-Hexanone	ug/L	2.473 J		2.000		124	%	10-190	
Dibromochloromethane	ug/L	0.819 J		1.000		82	%	10-190	
1,2-Dibromoethane (EDB)	ug/L	0.968 J		1.000		97	%	10-190	
Chlorobenzene	ug/L	1.003		1.000		100	%	10-190	
1,1,1,2-Tetrachloroethane	ug/L	0.943 J		1.000		94	%	10-190	
Ethylbenzene	ug/L	1.050		1.000		105	%	10-190	
m&p-Xylenes	ug/L	2.047		2.000		102	%	10-190	
o-Xylene	ug/L	1.010		1.000		101	%	10-190	
Styrene	ug/L	0.981 J		1.000		98	%	10-190	
Bromoform	ug/L	1.360		1.000		136	%	10-190	
Isopropylbenzene	ug/L	1.018		1.000		102	%	10-190	
Bromobenzene	ug/L	0.985 J		1.000		98	%	10-190	
1,1,2,2-Tetrachloroethane	ug/L	0.961 J		1.000		96	%	10-190	
1,2,3-Trichloropropane	ug/L	1.057		1.000		106	%	10-190	
n-Propylbenzene	ug/L	1.049		1.000		105	%	10-190	
2-Chlorotoluene	ug/L	1.024		1.000		102	%	10-190	

* %=% REC, R=RPD, A=ABS Diff., D=% Diff.

QUALITY CONTROL RESULTS

Job Number.: 222172

Report Date.: 12/09/2003

CUSTOMER: Ellis Environmental Group, LC PROJECT: USACE-LOCKBOURNE AFB ATTN: Karen Hatfield

QC Type	Description	Reag. Code	Lab ID	Dilution Factor	Date	Time
DLCK	Detection Limit Check Standard	V03K200LA	102284-020		11/21/2003	0651

Parameter/Test Description	Units	QC Result	QC Result	True Value	Orig. Value	QC Calc.	*	Limits	F
1,3,5-Trimethylbenzene	ug/L	1.033		1.000		103	%	10-190	
4-Chlorotoluene	ug/L	1.039		1.000		104	%	10-190	
tert-Butylbenzene	ug/L	1.055		1.000		105	%	10-190	
1,2,4-Trimethylbenzene	ug/L	1.035		1.000		104	%	10-190	
sec-Butylbenzene	ug/L	1.041		1.000		104	%	10-190	
p-Isopropyltoluene	ug/L	1.015		1.000		101	%	10-190	
n-Butylbenzene	ug/L	1.136		1.000		114	%	10-190	
1,2-Dibromo-3-chloropropane	ug/L	0.773 J		1.000		77	%	10-190	
1,2,3-Trichlorobenzene	ug/L	1.136		1.000		114	%	10-190	

* %=% REC, R=RPD, A=ABS Diff., D=% Diff.

4A

VOLATILE METHOD BLANK SUMMARY

Lab Name: STL CHICAGO Contract:

Lab Code: Case No.: SAS No.: SDG No.: 222172

Lab File ID: 9M1120A Lab Sample ID: MB

Date Analyzed: 11/20/03 Time Analyzed: 2033

Matrix: (soil/water) WATER Level:(low/med) LOW

Instrument ID: GCL9

THIS METHOD BLANK APPLIES TO THE FOLLOWING SAMPLES, MS and MSD:

	EPA SAMPLE NO.	LAB SAMPLE ID	LAB FILE ID	TIME ANALYZED
01	102284BS	LCS	9S1120A	2102
02	MRL	MRL	9I1120	2131
03	TRIP BLANK	222172-3	2172-03	2214
04	LCKMW-15	222172-1	2172-01	2242
05	LCKMW-15MS	222172-1MS	2172-01S	2311
06	LCKMW-15MSD	222172-1MSD	2172-01T	2340
07	DUP01	222172-2	2172-02	0008
08	MRL	MRL	9I1120A	0623
09	DLCK CHECK	DLCK CHECK	9L1120	0651
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COMMENTS:

page 1 of 1

FORM IV VOA 1/87 Rev.

5A

VOLATILE ORGANIC GC/MS TUNING AND MASS
CALIBRATION - BROMOFLUOROBENZENE (BFB)

Lab Name: STL CHICAGO Contract:

Lab Code: Case No.: SAS No.: SDG No.: 25M9W_ICAL1

Lab File ID: 9B1016 BFB Injection Date: 10/16/03

Instrument ID: GCL9 BFB Injection Time: 1838

Matrix:(soil/water) WATER Level:(low/med) LOW Column:(pack/cap) CAP

m/e	ION ABUNDANCE CRITERIA	% RELATIVE ABUNDANCE
50	15.0 - 40.0% of mass 95	19.2
75	30.0 - 60.0% of mass 95	45.0
95	Base Peak, 100% relative abundance	100.0
96	5.0 - 9.0% of mass 95	5.7
173	Less than 2.0% of mass 174	0.2 (0.3)1
174	50.0 - 99.0% of mass 95	60.1
175	5.0 - 9.0% of mass 174	4.2 (7.1)1
176	Greater than 95.0%, but less than 101.0% of mass 174	58.1 (96.7)1
177	5.0 - 9.0% of mass 176	4.1 (7.0)2

1-Value is % of mass 174 2-Value is % of mass 176

THIS TUNE APPLIES TO THE FOLLOWING SAMPLES, MS, MSD, BLANKS, AND STANDARDS:

	EPA SAMPLE NO.	LAB SAMPLE ID	LAB FILE ID	DATE ANALYZED	TIME ANALYZED
01	VSTD0.5	VSTD0.5	9I1016A	10/16/03	1957
02	VSTD001	VSTD001	9I1016B	10/16/03	2026
03	VSTD002	VSTD002	9I1016C	10/16/03	2054
04	VSTD005	VSTD005	9I1016D	10/16/03	2123
05	VSTD008	VSTD008	9I1016E	10/16/03	2151
06	VSTD010	VSTD010	9I1016F	10/16/03	2220
07	VSTD014	VSTD014	9I1016G	10/16/03	2249
08	VSTD020	VSTD020	9I1016H	10/16/03	2318
09	VSTD040	VSTD040	9I1016I	10/16/03	2346
10	ICAL SPIKE	ICAL SPIKE	9S1016	10/17/03	0044
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22					

page 1 of 1

5A

VOLATILE ORGANIC GC/MS TUNING AND MASS CALIBRATION - BROMOFLUOROBENZENE (BFB)

Lab Name: STL CHICAGO Contract:

Lab Code: Case No.: SAS No.: SDG No.: 222172

Lab File ID: 9B1120A BFB Injection Date: 11/20/03

Instrument ID: GCL9 BFB Injection Time: 1939

Matrix:(soil/water) WATER Level:(low/med) LOW Column:(pack/cap) CAP

m/e	ION ABUNDANCE CRITERIA	% RELATIVE ABUNDANCE
50	15.0 - 40.0% of mass 95	16.0
75	30.0 - 60.0% of mass 95	43.2
95	Base Peak, 100% relative abundance	100.0
96	5.0 - 9.0% of mass 95	5.7
173	Less than 2.0% of mass 174	0.3 (0.5)1
174	50.0 - 99.0% of mass 95	61.7
175	5.0 - 9.0% of mass 174	4.2 (6.8)1
176	Greater than 95.0%, but less than 101.0% of mass 174	58.9 (95.6)1
177	5.0 - 9.0% of mass 176	3.8 (6.4)2

1-Value is % of mass 174 2-Value is % of mass 176

THIS TUNE APPLIES TO THE FOLLOWING SAMPLES, MS, MSD, BLANKS, AND STANDARDS:

	EPA SAMPLE NO.	LAB SAMPLE ID	LAB FILE ID	DATE ANALYZED	TIME ANALYZED
01	VSTD010	VSTD010	9C1120B	11/20/03	2004
02	102284	MB	9M1120A	11/20/03	2033
03	102284BS	LCS	9S1120A	11/20/03	2102
04	MRL	MRL	9I1120	11/20/03	2131
05	TRIP BLANK	222172-3	2172-03	11/20/03	2214
06	LCKMW-15	222172-1	2172-01	11/20/03	2242
07	LCKMW-15MS	222172-1MS	2172-01S	11/20/03	2311
08	LCKMW-15MSD	222172-1MSD	2172-01T	11/20/03	2340
09	DUP01	222172-2	2172-02	11/21/03	0008
10	MRL	MRL	9I1120A	11/21/03	0623
11	DLCK CHECK	DLCK CHECK	9L1120	11/21/03	0651
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8A
VOLATILE INTERNAL STANDARD AREA SUMMARY

Lab Name: STL CHICAGO Contract:

Lab Code: Case No.: SAS No.: SDG No.: 222172

Lab File ID (Standard): 9I1016F Date Analyzed: 10/16/03

Instrument ID: GCL9 Time Analyzed: 2220

Matrix:(soil/water) WATER Level:(low/med) LOW Column:(pack/cap) CAP

		IS1 AREA #	RT	IS2(DFB) AREA #	RT	IS3(CBZ) AREA #	RT
	12 HOUR STD	1652004	8.45	1567137	9.41	1006474	13.25
	UPPER LIMIT	3304008	8.95	3134274	9.91	2012948	13.75
	LOWER LIMIT	826002	7.95	783568	8.91	503237	12.75
	EPA SAMPLE NO.						
01	102284	1922548	8.45	1879215	9.41	1229812	13.24
02	102284BS	1986904	8.44	1960088	9.41	1230876	13.25
03	MRL	1946684	8.44	1904490	9.41	1213622	13.25
04	TRIP BLANK	1864793	8.43	1768181	9.39	1085789	13.24
05	LCKMW-15	1917799	8.45	1854535	9.41	1180649	13.25
06	LCKMW-15MS	1937512	8.45	1904623	9.41	1200412	13.24
07	LCKMW-15MSD	1933787	8.45	1908607	9.41	1204475	13.24
08	DUP01	1938801	8.45	1870866	9.41	1204878	13.24
09	MRL	1864223	8.44	1843297	9.41	1185535	13.23
10	DLCK CHECK	1889139	8.44	1864297	9.41	1196087	13.24
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22							

IS1 = Pentafluorobenzene
IS2 (DFB) = 1,4-Difluorobenzene
IS3 (CBZ) = Chlorobenzene-d5

UPPER LIMIT = +100%
of internal standard area.
LOWER LIMIT = - 50%
of internal standard area.

Column used to flag internal standard area values with an asterisk.

8A
VOLATILE INTERNAL STANDARD AREA SUMMARY

Lab Name: STL CHICAGO Contract:

Lab Code: Case No.: SAS No.: SDG No.: 222172

Lab File ID (Standard): 9I1016F Date Analyzed: 10/16/03

Instrument ID: GCL9 Time Analyzed: 2220

Matrix:(soil/water) WATER Level:(low/med) LOW Column:(pack/cap) CAP

		IS4(DCB) AREA #	RT	AREA #	RT	AREA #	RT
	12 HOUR STD	473202	16.30				
	UPPER LIMIT	946404	16.80				
	LOWER LIMIT	236601	15.80				
	EPA SAMPLE NO.						
01	102284	590563	16.29				
02	102284BS	592038	16.29				
03	MRL	570506	16.29				
04	TRIP BLANK	487409	16.28				
05	LCKMW-15	551820	16.29				
06	LCKMW-15MS	572444	16.29				
07	LCKMW-15MSD	573772	16.30				
08	DUP01	575348	16.29				
09	MRL	570079	16.28				
10	DLCK CHECK	576670	16.29				
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22							

IS4 (DCB) = 1,4-Dichlorobenzene-d4

UPPER LIMIT = +100%
of internal standard area.

Column used to flag internal standard area values with an asterisk.

page 2 of 2

III. SAMPLE DATA

L A B O R A T O R Y   T E S T   R E S U L T S

Job Number: 222172

Date:12/09/2003

CUSTOMER: Ellis Environmental Group, LC **PROJECT:** USACE-LOCKBOURNE AFB **ATTN:** Karen Hatfield

Customer Sample ID: LCKMW-15
Date Sampled......: 11/10/2003
Time Sampled......: 14:20
Sample Matrix.....: Water

Laboratory Sample ID: 222172-1
Date Received.......: 11/11/2003
Time Received.......: 09:25

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	Q	FLAGS	MDL	RL	DILUTION	UNITS	BATCH	DT	DATE/TIME	TECH
8260B	Volatile Organics											
	Dichlorodifluoromethane	1.0	U	*	0.14	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	Chloromethane	1.0	U	*	0.16	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	Vinyl chloride	1.0	U		0.18	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	Bromomethane	1.0	U		0.18	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	Chloroethane	1.0	U		0.21	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	Trichlorofluoromethane	1.0	U		0.22	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	1,1-Dichloroethene	1.0	U		0.19	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	Carbon disulfide	2.0	U		0.40	2.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	Acetone	10	U		1.5	10	1.00000	ug/L	102291		11/20/03 2242	jdn
	Methylene chloride	2.0	U		0.19	2.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	trans-1,2-Dichloroethene	1.0	U		0.21	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	Methyl-tert-butyl-ether (MTBE)	1.0	U		0.21	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	1,1-Dichloroethane	1.0	U		0.20	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	2,2-Dichloropropane	1.0	U		0.20	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	cis-1,2-Dichloroethene	1.0	U		0.21	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	2-Butanone (MEK)	10	U		1.7	10	1.00000	ug/L	102291		11/20/03 2242	jdn
	Bromochloromethane	1.0	U		0.19	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	Chloroform	1.0	U		0.23	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	1,1,1-Trichloroethane	1.0	U		0.22	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	1,1-Dichloropropene	1.0	U		0.24	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	Carbon tetrachloride	1.0	U		0.24	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	Benzene	1.0	U		0.20	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	1,2-Dichloroethane	1.0	U		0.25	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	Trichloroethene	1.0	U		0.21	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	1,2-Dichloropropane	1.0	U		0.22	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	Dibromomethane	1.0	U		0.26	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	Bromodichloromethane	1.0	U		0.23	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	cis-1,3-Dichloropropene	1.0	U		0.22	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn

* In Description = Dry Wgt.

LABORATORY TEST RESULTS

Job Number: 222172

Date:12/09/2003

CUSTOMER: Ellis Environmental Group, LC **PROJECT: USACE-LOCKBOURNE AFB** **ATTN: Karen Hatfield**

Customer Sample ID: LCKMW-15
Date Sampled......: 11/10/2003
Time Sampled......: 14:20
Sample Matrix.....: Water

Laboratory Sample ID: 222172-1
Date Received.......: 11/11/2003
Time Received.......: 09:25

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	Q	FLAGS	MDL	RL	DILUTION	UNITS	BATCH	DT	DATE/TIME	TECH
	4-Methyl-2-pentanone (MIBK)	10	U		0.92	10	1.00000	ug/L	102291		11/20/03 2242	jdn
	Toluene	1.0	U		0.21	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	trans-1,3-Dichloropropene	1.0	U		0.24	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	1,1,2-Trichloroethane	1.0	U		0.33	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	Tetrachloroethene	1.0	U		0.20	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	1,3-Dichloropropane	1.0	U		0.23	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	2-Hexanone	10	U		1.2	10	1.00000	ug/L	102291		11/20/03 2242	jdn
	Dibromochloromethane	1.0	U		0.23	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	1,2-Dibromoethane (EDB)	1.0	U		0.25	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	Chlorobenzene	1.0	U		0.22	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	1,1,1,2-Tetrachloroethane	1.0	U		0.21	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	Ethylbenzene	1.0	U		0.20	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	m&p-Xylenes	2.0	U		0.39	2.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	o-Xylene	1.0	U		0.21	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	Styrene	1.0	U		0.23	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	Bromoform	1.0	U		0.22	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	Isopropylbenzene	1.0	U		0.21	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	Bromobenzene	1.0	U		0.22	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	1,1,2,2-Tetrachloroethane	1.0	U		0.25	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	1,2,3-Trichloropropane	1.0	U		0.20	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	n-Propylbenzene	1.0	U		0.25	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	2-Chlorotoluene	1.0	U		0.22	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	1,3,5-Trimethylbenzene	1.0	U		0.20	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	4-Chlorotoluene	1.0	U		0.22	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	tert-Butylbenzene	1.0	U		0.21	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	1,2,4-Trimethylbenzene	1.0	U		0.20	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	sec-Butylbenzene	1.0	U		0.22	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	p-Isopropyltoluene	1.0	U		0.22	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	n-Butylbenzene	1.0	U		0.22	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn

* In Description = Dry Wgt.

LABORATORY TEST RESULTS

Job Number: 222172

Date:12/09/2003

CUSTOMER: Ellis Environmental Group, LC   PROJECT: USACE-LOCKBOURNE AFB   ATTN: Karen Hatfield

Customer Sample ID: LCKMW-15
Date Sampled......: 11/10/2003
Time Sampled......: 14:20
Sample Matrix.....: Water

Laboratory Sample ID: 222172-1
Date Received.......: 11/11/2003
Time Received.......: 09:25

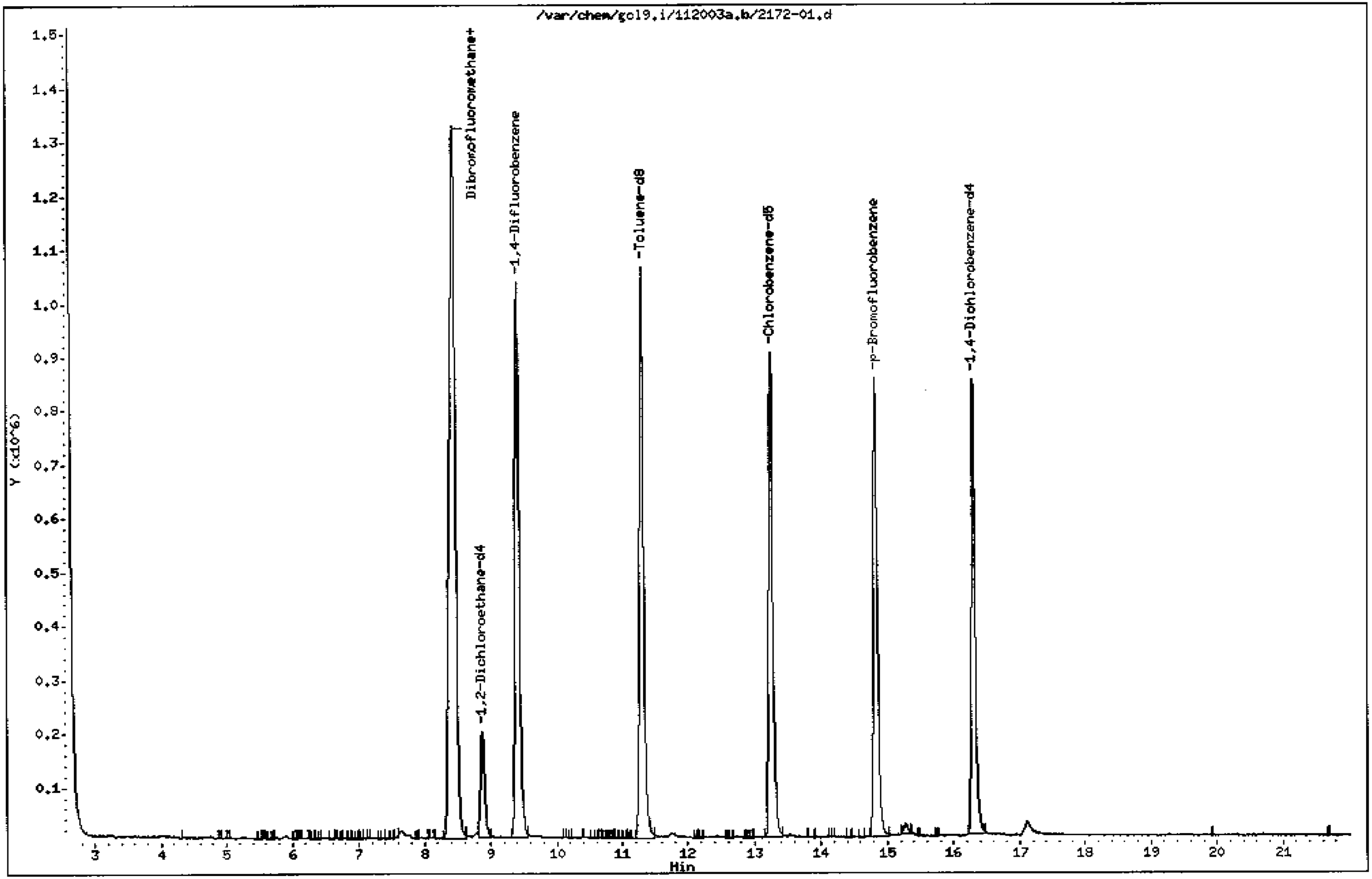
TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	Q	FLAGS	MDL	RL	DILUTION	UNITS	BATCH	DT	DATE/TIME	TECH
	1,2-Dibromo-3-chloropropane	2.0	U		0.46	2.0	1.00000	ug/L	102291		11/20/03 2242	jdn
	1,2,3-Trichlorobenzene	1.0	U		0.24	1.0	1.00000	ug/L	102291		11/20/03 2242	jdn

* In Description = Dry Wgt.

Data File: /var/chem/gc19.i/112003a.b/2172-01.d
Date : 20-NOV-2003 22:42
Client ID: LCKMW-15
Sample Info: 222172-001
Purge Volume: 25.0
Column phase: Cap

Instrument: gc19.i

Operator: DCT
Column diameter: 0.53



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                    VOLATILE REPORT SW846 METHOD 8260B WATERS
Data file : /var/chem/gc19.i/112003a.b/2172-01.d
Lab Smp Id: 222172-1                        Client Smp ID: LCKMW-15
Inj Date  : 20-NOV-2003 22:42
Operator  : DCT                             Inst ID: gc19.i
Smp Info  : 222172-001
Misc Info : 222172-1,1,7
Comment   :  HP 5972/ 5890 GC TEKMAR 3000/2016
Method    : /var/chem/gc19.i/112003a.b/25m19w.m
Meth Date : 09-Dec-2003 13:53 nagelj        Quant Type: ISTD
Cal Date  : 17-OCT-2003 04:31               Cal File: 9i1016o.d
Als bottle: 7
Dil Factor: 1.00000
Integrator: HP RTE                          Compound Sublist: Lockbourne.sub
Target Version:  3.50
Processing Host: manatee

Concentration Formula: Amt * DF * Uf * 1/Vo * CpndVariable

     Name          Value              Description
-------------- -------------- -----------------------
       DF         1.00000       Dilution Factor
       Uf        25.00000      ng unit correction factor
       Vo        25.00000      Sample Volume purged (mL)
Cpnd Variable                   Local Compound Variable

                                                                        CONCENTRATIONS
                                  QUANT SIG                           ON-COLUMN   FINAL
Compounds                           MASS      RT    EXP RT REL RT  RESPONSE ( ug/L)    ( ug/L)
=========================          ====      ==    ====== ======  ======== ========  ========
$  40 Dibromofluoromethane          113     8.394   8.386 (0.994)   772790 10.3453    10.345
*  41 Pentafluorobenzene            168     8.448   8.440 (1.000)  1917799 10.7700
$  46 1,2-Dichloroethane-d4          65     8.874   8.865 (0.943)   285780 9.63930     9.639
*  50 1,4-Difluorobenzene           114     9.407   9.399 (1.000)  1854535 10.7700
$  63 Toluene-d8                     98    11.306  11.298 (1.202)  1685252 10.7972    10.797
*  75 Chlorobenzene-d5              117    13.251  13.233 (1.000)  1180649 10.7700
$  86 p-Bromofluorobenzene           95    14.824  14.816 (1.119)   865228 9.68564     9.686
* 101 1,4-Dichlorobenzene-d4        152    16.290  16.281 (1.000)   551820 10.7700
```

12dc3

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LABORATORY TEST RESULTS

Job Number: 222172

Date:12/09/2003

CUSTOMER: Ellis Environmental Group, LC PROJECT: USACE-LOCKBOURNE AFB ATTN: Karen Hatfield

Customer Sample ID: DUP01
Date Sampled......: 11/10/2003
Time Sampled......: 02:00
Sample Matrix.....: Water

Laboratory Sample ID: 222172-2
Date Received.......: 11/11/2003
Time Received.......: 09:25

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	Q	FLAGS	MDL	RL	DILUTION	UNITS	BATCH	DT	DATE/TIME	TECH
8260B	Volatile Organics											
	Dichlorodifluoromethane	1.0	U	*	0.14	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	Chloromethane	1.0	U	*	0.16	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	Vinyl chloride	1.0	U		0.18	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	Bromomethane	1.0	U		0.18	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	Chloroethane	1.0	U		0.21	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	Trichlorofluoromethane	1.0	U		0.22	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	1,1-Dichloroethene	1.0	U		0.19	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	Carbon disulfide	2.0	U		0.40	2.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	Acetone	13			1.5	10	1.00000	ug/L	102291		11/21/03 0008	jdn
	Methylene chloride	2.0	U		0.19	2.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	trans-1,2-Dichloroethene	1.0	U		0.21	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	Methyl-tert-butyl-ether (MTBE)	1.0	U		0.21	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	1,1-Dichloroethane	1.0	U		0.20	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	2,2-Dichloropropane	1.0	U		0.20	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	cis-1,2-Dichloroethene	1.0	U		0.21	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	2-Butanone (MEK)	10	U		1.7	10	1.00000	ug/L	102291		11/21/03 0008	jdn
	Bromochloromethane	1.0	U		0.19	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	Chloroform	1.0	U		0.23	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	1,1,1-Trichloroethane	1.0	U		0.22	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	1,1-Dichloropropene	1.0	U		0.24	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	Carbon tetrachloride	1.0	U		0.24	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	Benzene	1.0	U		0.20	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	1,2-Dichloroethane	1.0	U		0.25	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	Trichloroethene	1.0	U		0.21	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	1,2-Dichloropropane	1.0	U		0.22	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	Dibromomethane	1.0	U		0.26	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	Bromodichloromethane	1.0	U		0.23	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	cis-1,3-Dichloropropene	1.0	U		0.22	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn

* In Description = Dry Wgt.

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L A B O R A T O R Y   T E S T   R E S U L T S

Job Number: 222172

Date:12/09/2003

CUSTOMER: Ellis Environmental Group, LC **PROJECT:** USACE-LOCKBOURNE AFB **ATTN:** Karen Hatfield

Customer Sample ID: DUP01
Date Sampled......: 11/10/2003
Time Sampled......: 02:00
Sample Matrix.....: Water

Laboratory Sample ID: 222172-2
Date Received.......: 11/11/2003
Time Received.......: 09:25

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	Q	FLAGS	MDL	RL	DILUTION	UNITS	BATCH	DT	DATE/TIME	TECH
	4-Methyl-2-pentanone (MIBK)	10	U		0.92	10	1.00000	ug/L	102291		11/21/03 0008	jdn
	Toluene	1.0	U		0.21	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	trans-1,3-Dichloropropene	1.0	U		0.24	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	1,1,2-Trichloroethane	1.0	U		0.33	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	Tetrachloroethene	1.0	U		0.20	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	1,3-Dichloropropane	1.0	U		0.23	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	2-Hexanone	10	U		1.2	10	1.00000	ug/L	102291		11/21/03 0008	jdn
	Dibromochloromethane	1.0	U		0.23	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	1,2-Dibromoethane (EDB)	1.0	U		0.25	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	Chlorobenzene	1.0	U		0.22	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	1,1,1,2-Tetrachloroethane	1.0	U		0.21	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	Ethylbenzene	1.0	U		0.20	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	m&p-Xylenes	2.0	U		0.39	2.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	o-Xylene	1.0	U		0.21	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	Styrene	1.0	U		0.23	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	Bromoform	1.0	U		0.22	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	Isopropylbenzene	1.0	U		0.21	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	Bromobenzene	1.0	U		0.22	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	1,1,2,2-Tetrachloroethane	1.0	U		0.25	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	1,2,3-Trichloropropane	1.0	U		0.20	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	n-Propylbenzene	1.0	U		0.25	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	2-Chlorotoluene	1.0	U		0.22	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	1,3,5-Trimethylbenzene	1.0	U		0.20	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	4-Chlorotoluene	1.0	U		0.22	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	tert-Butylbenzene	1.0	U		0.21	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	1,2,4-Trimethylbenzene	1.0	U		0.20	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	sec-Butylbenzene	1.0	U		0.22	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	p-Isopropyltoluene	1.0	U		0.22	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	n-Butylbenzene	1.0	U		0.22	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn

* In Description = Dry Wgt.

L A B O R A T O R Y   T E S T   R E S U L T S

Job Number: 222172

Date:12/09/2003

CUSTOMER: Ellis Environmental Group, LC   **PROJECT:** USACE-LOCKBOURNE AFB   **ATTN:** Karen Hatfield

Customer Sample ID: DUP01
Date Sampled......: 11/10/2003
Time Sampled......: 02:00
Sample Matrix.....: Water

Laboratory Sample ID: 222172-2
Date Received.......: 11/11/2003
Time Received.......: 09:25

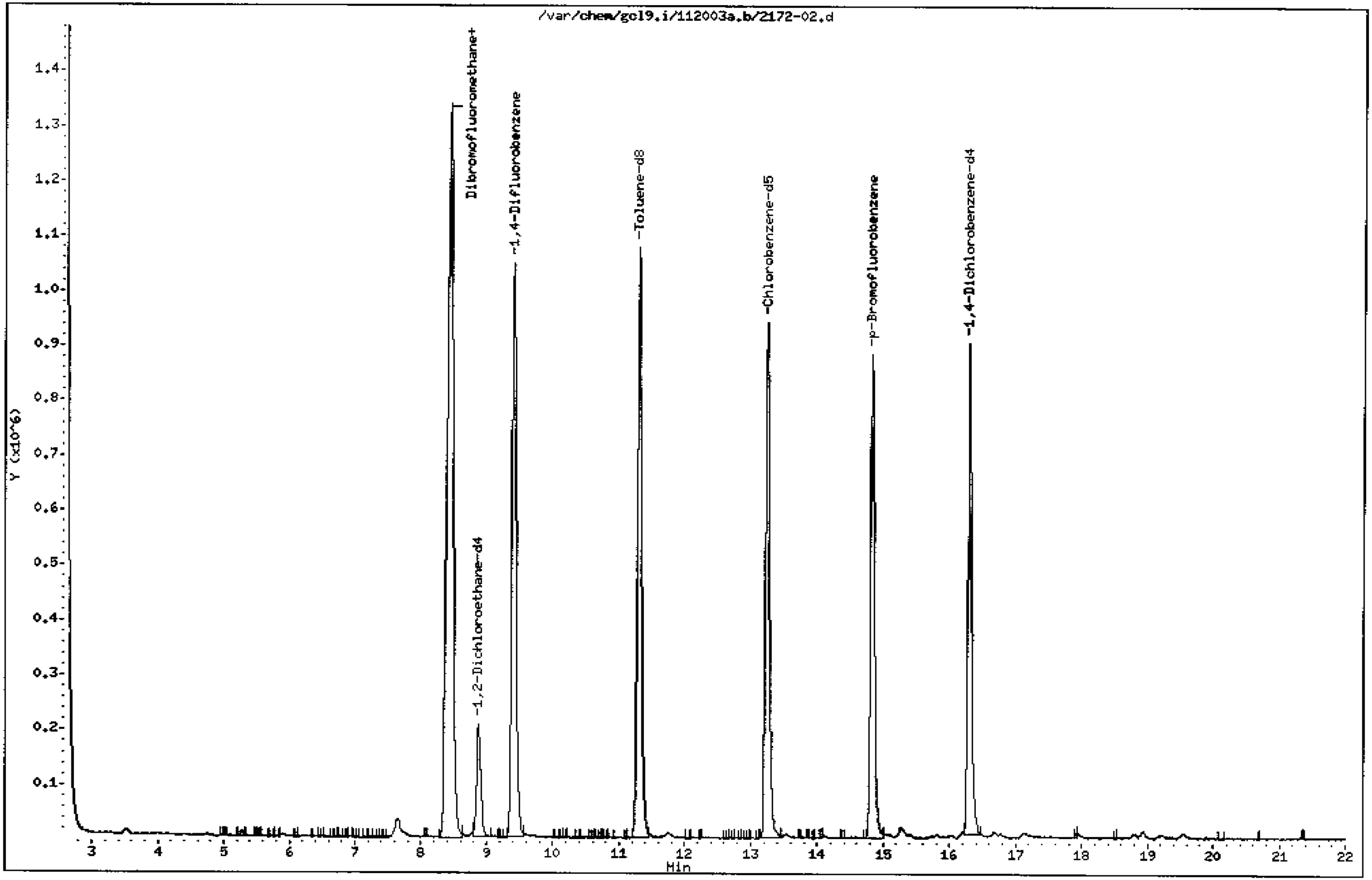
TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	Q	FLAGS	MDL	RL	DILUTION	UNITS	BATCH	DT	DATE/TIME	TECH
	1,2-Dibromo-3-chloropropane	2.0	U		0.46	2.0	1.00000	ug/L	102291		11/21/03 0008	jdn
	1,2,3-Trichlorobenzene	1.0	U		0.24	1.0	1.00000	ug/L	102291		11/21/03 0008	jdn

* In Description = Dry Wgt.

Data File: /var/chem/gcl9.i/112003a.b/2172-02.d
Date : 21-NOV-2003 00:08
Client ID: DUP01
Sample Info: 222172-002
Purge Volume: 25.0
Column phase: Cap

Instrument: gcl9.i

Operator: DCT
Column diameter: 0.53



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Data File: /var/chem/gc19.i/112003a.b/2172-02.d                    Page 1
Report Date: 09-Dec-2003 13:54



                    VOLATILE REPORT SW846 METHOD 8260B WATERS
Data file : /var/chem/gc19.i/112003a.b/2172-02.d
Lab Smp Id: 222172-2                         Client Smp ID: DUP01
Inj Date  : 21-NOV-2003 00:08
Operator  : DCT                              Inst ID: gc19.i
Smp Info  : 222172-002
Misc Info : 222172-2,1,10
Comment   :  HP 5972/  5890 GC TEKMAR 3000/2016
Method    : /var/chem/gc19.i/112003a.b/25ml9w.m
Meth Date : 09-Dec-2003 13:53 nagelj     Quant Type: ISTD
Cal Date  : 17-OCT-2003 04:31            Cal File: 9i1016o.d
Als bottle: 10
Dil Factor: 1.00000
Integrator: HP RTE                           Compound Sublist: Lockbourne.sub
Target Version:  3.50
Processing Host: manatee

Concentration Formula: Amt * DF * Uf * 1/Vo * CpndVariable

     Name         Value          Description
-------------- -------------  ----------------------
     DF          1.00000        Dilution Factor
     Uf         25.00000       ng unit correction factor
     Vo         25.00000       Sample Volume purged (mL)

Cpnd Variable                   Local Compound Variable
```

12-9-03

```
                                                                            CONCENTRATIONS
                                  QUANT SIG                                        ON-COLUMN   FINAL
Compounds                           MASS      RT    EXP RT REL RT    RESPONSE     ( ug/L)    ( ug/L)
==========================         ====     ==    ====== ======    ========     =======    =======
   13 Acetone                          43    5.276   5.257 (0.624)      30864     13.2284    13.228
$  40 Dibromofluoromethane            113    8.387   8.386 (0.992)     786145     10.4101    10.410
*  41 Pentafluorobenzene              168    8.451   8.440 (1.000)    1938801     10.7700
$  46 1,2-Dichloroethane-d4            65    8.876   8.865 (0.943)     291584     9.74921     9.749
*  50 1,4-Difluorobenzene             114    9.409   9.399 (1.000)    1870866     10.7700
$  63 Toluene-d8                       98   11.299  11.298 (1.201)    1718268     10.9126    10.912
*  75 Chlorobenzene-d5                117   13.244  13.233 (1.000)    1204878     10.7700
$  86 p-Bromofluorobenzene             95   14.826  14.816 (1.119)     891105     9.77472     9.775
* 101 1,4-Dichlorobenzene-d4          152   16.292  16.281 (1.000)     575348     10.7700
```

Data File: /var/chem/gcl9.i/112003a.b/2172-02.d

Date : 21-NOV-2003 00:08

Client ID: DUP01

Instrument: gcl9.i

Sample Info: 222172-002

Purge Volume: 25.0

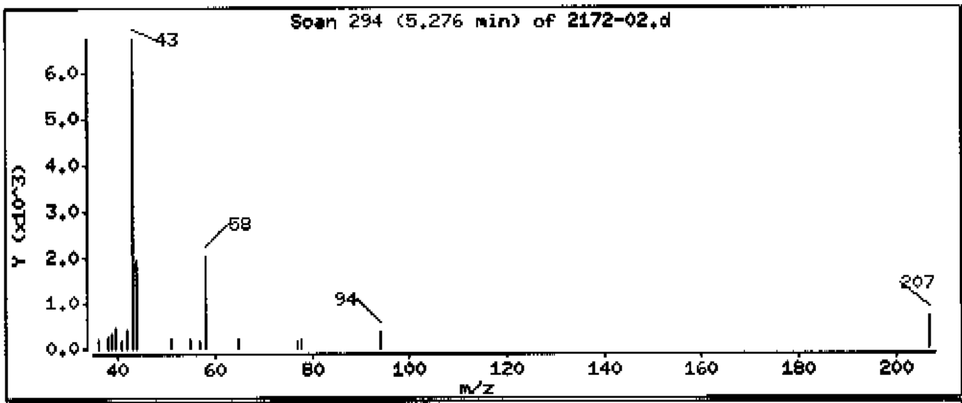
Operator: DCT

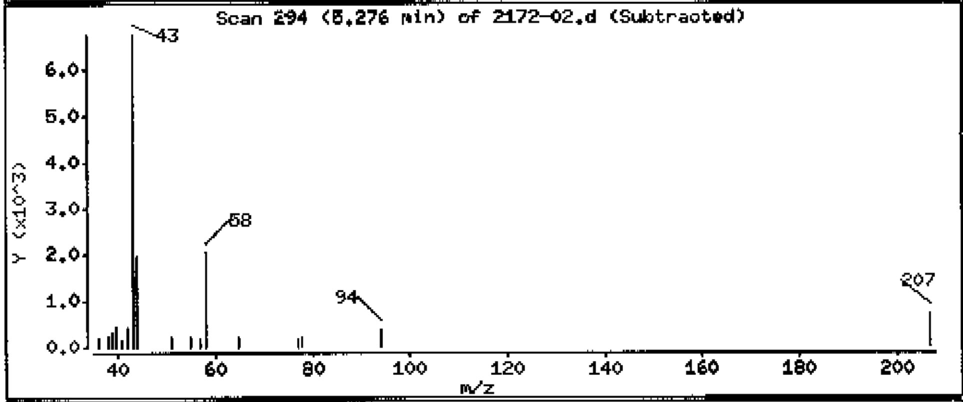
Column phase: Cap

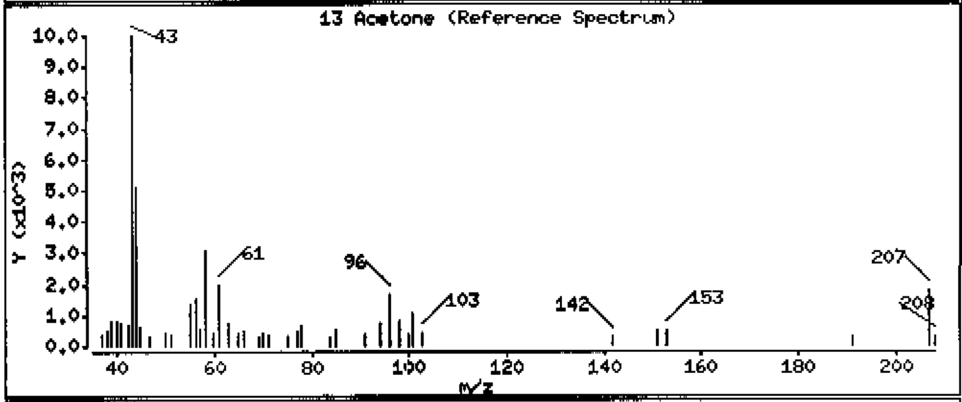
Column diameter: 0.53

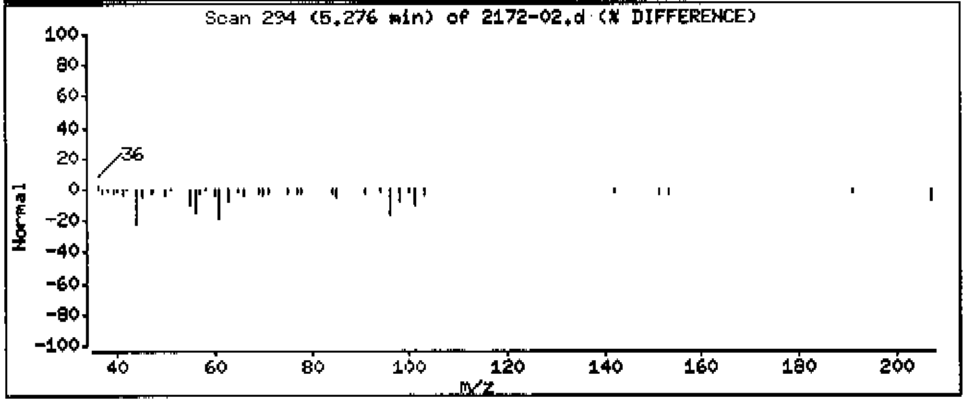
13 Acetone

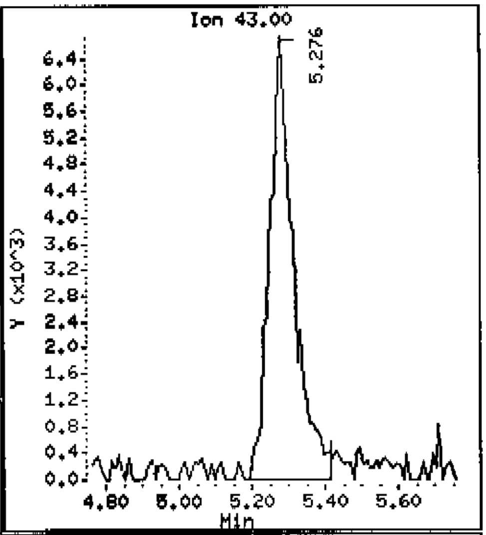
Concentration: 13.228 ug/L

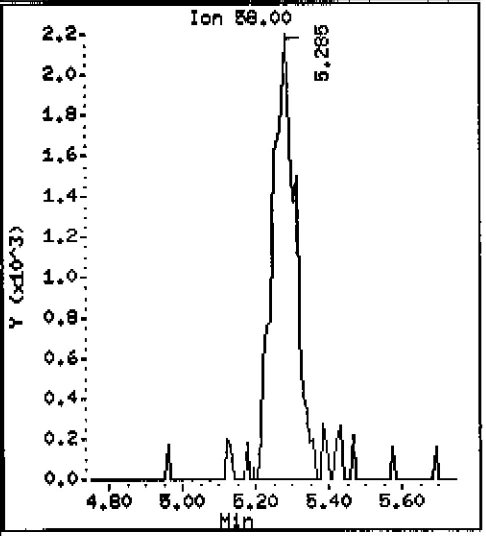












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L A B O R A T O R Y   T E S T   R E S U L T S

Job Number: 222172

Date:12/09/2003

CUSTOMER: Ellis Environmental Group, LC   **PROJECT:** USACE-LOCKBOURNE AFB   **ATTN:** Karen Hatfield

Customer Sample ID: TRIP BLANK
Date Sampled......: 11/10/2003
Time Sampled......: 15:00
Sample Matrix.....: Water

Laboratory Sample ID: 222172-3
Date Received.......: 11/11/2003
Time Received.......: 09:25

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	Q	FLAGS	MDL	RL	DILUTION	UNITS	BATCH	DT	DATE/TIME	TECH
8260B	Volatile Organics											
	Dichlorodifluoromethane	1.0	U	*	0.14	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	Chloromethane	1.0	U	*	0.16	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	Vinyl chloride	1.0	U		0.18	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	Bromomethane	1.0	U		0.18	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	Chloroethane	1.0	U		0.21	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	Trichlorofluoromethane	1.0	U		0.22	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	1,1-Dichloroethene	1.0	U		0.19	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	Carbon disulfide	2.0	U		0.40	2.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	Acetone	10	U		1.5	10	1.00000	ug/L	102291		11/20/03 2214	jdn
	Methylene chloride	2.0	U		0.19	2.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	trans-1,2-Dichloroethene	1.0	U		0.21	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	Methyl-tert-butyl-ether (MTBE)	1.0	U		0.21	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	1,1-Dichloroethane	1.0	U		0.20	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	2,2-Dichloropropane	1.0	U		0.20	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	cis-1,2-Dichloroethene	1.0	U		0.21	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	2-Butanone (MEK)	10	U		1.7	10	1.00000	ug/L	102291		11/20/03 2214	jdn
	Bromochloromethane	1.0	U		0.19	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	Chloroform	1.0	U		0.23	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	1,1,1-Trichloroethane	1.0	U		0.22	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	1,1-Dichloropropene	1.0	U		0.24	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	Carbon tetrachloride	1.0	U		0.24	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	Benzene	1.0	U		0.20	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	1,2-Dichloroethane	1.0	U		0.25	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	Trichloroethene	1.0	U		0.21	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	1,2-Dichloropropane	1.0	U		0.22	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	Dibromomethane	1.0	U		0.26	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	Bromodichloromethane	1.0	U		0.23	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	cis-1,3-Dichloropropene	1.0	U		0.22	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn

* In Description = Dry Wgt.

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LABORATORY TEST RESULTS

Job Number: 222172

Date:12/09/2003

CUSTOMER: Ellis Environmental Group, LC

PROJECT: USACE-LOCKBOURNE AFB

ATTN: Karen Hatfield

Customer Sample ID: TRIP BLANK
Date Sampled......: 11/10/2003
Time Sampled......: 15:00
Sample Matrix.....: Water

Laboratory Sample ID: 222172-3
Date Received.......: 11/11/2003
Time Received.......: 09:25

TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	Q	FLAGS	MDL	RL	DILUTION	UNITS	BATCH	DT	DATE/TIME	TECH
	4-Methyl-2-pentanone (MIBK)	10	U		0.92	10	1.00000	ug/L	102291		11/20/03 2214	jdn
	Toluene	1.0	U		0.21	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	trans-1,3-Dichloropropene	1.0	U		0.24	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	1,1,2-Trichloroethane	1.0	U		0.33	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	Tetrachloroethene	1.0	U		0.20	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	1,3-Dichloropropane	1.0	U		0.23	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	2-Hexanone	10	U		1.2	10	1.00000	ug/L	102291		11/20/03 2214	jdn
	Dibromochloromethane	1.0	U		0.23	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	1,2-Dibromoethane (EDB)	1.0	U		0.25	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	Chlorobenzene	1.0	U		0.22	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	1,1,1,2-Tetrachloroethane	1.0	U		0.21	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	Ethylbenzene	1.0	U		0.20	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	m&p-Xylenes	2.0	U		0.39	2.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	o-Xylene	1.0	U		0.21	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	Styrene	1.0	U		0.23	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	Bromoform	1.0	U		0.22	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	Isopropylbenzene	1.0	U		0.21	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	Bromobenzene	1.0	U		0.22	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	1,1,2,2-Tetrachloroethane	1.0	U		0.25	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	1,2,3-Trichloropropane	1.0	U		0.20	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	n-Propylbenzene	1.0	U		0.25	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	2-Chlorotoluene	1.0	U		0.22	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	1,3,5-Trimethylbenzene	1.0	U		0.20	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	4-Chlorotoluene	1.0	U		0.22	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	tert-Butylbenzene	1.0	U		0.21	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	1,2,4-Trimethylbenzene	1.0	U		0.20	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	sec-Butylbenzene	1.0	U		0.22	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	p-Isopropyltoluene	1.0	U		0.22	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	n-Butylbenzene	1.0	U		0.22	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn

* In Description = Dry Wgt.

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LABORATORY TEST RESULTS

Job Number: 222172

Date:12/09/2003

CUSTOMER: Ellis Environmental Group, LC **PROJECT:** USACE-LOCKBOURNE AFB **ATTN:** Karen Hatfield

Customer Sample ID: TRIP BLANK
Date Sampled......: 11/10/2003
Time Sampled......: 15:00
Sample Matrix.....: Water

Laboratory Sample ID: 222172-3
Date Received.......: 11/11/2003
Time Received.......: 09:25

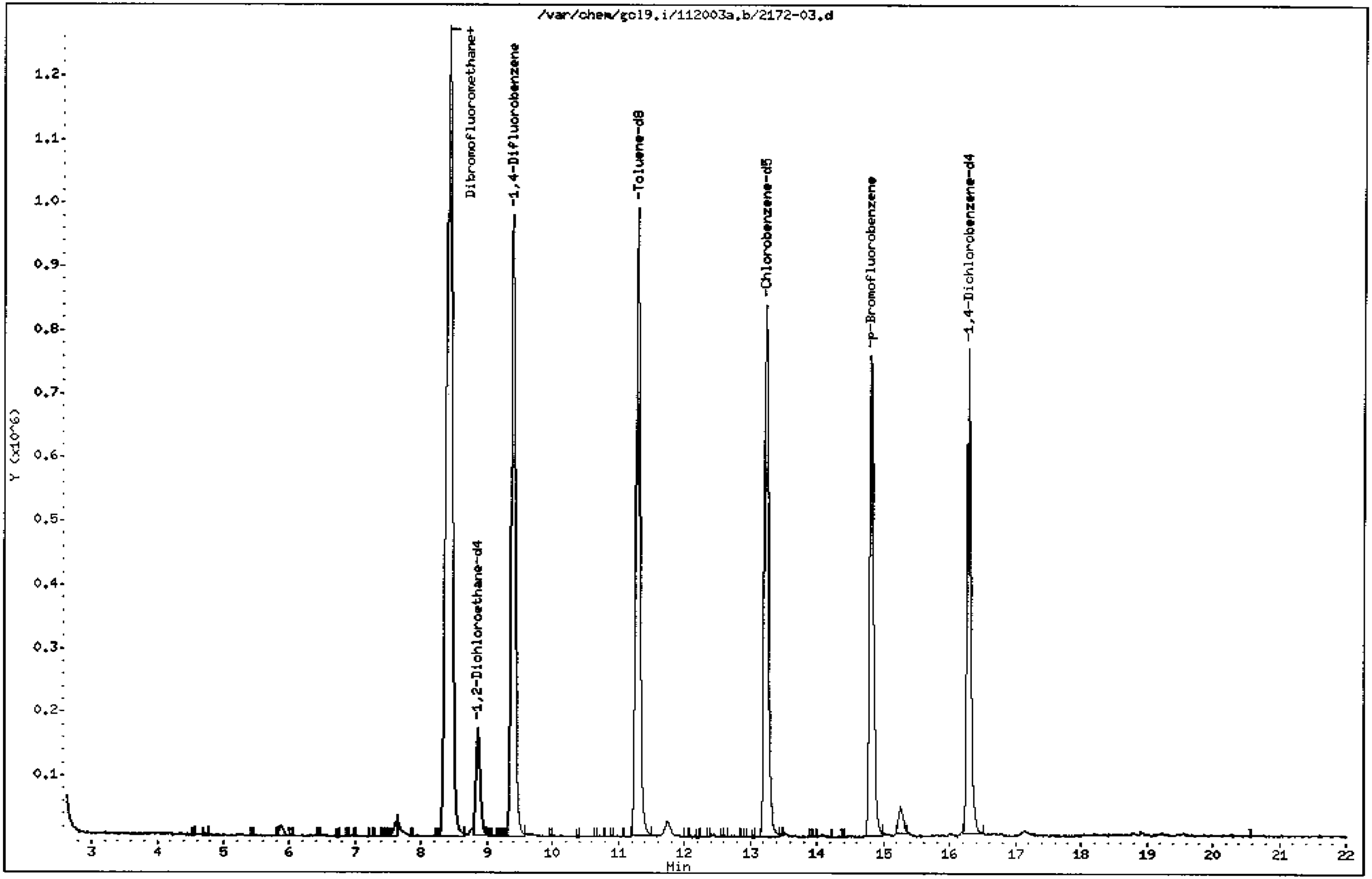
TEST METHOD	PARAMETER/TEST DESCRIPTION	SAMPLE RESULT	Q	FLAGS	MDL	RL	DILUTION	UNITS	BATCH	DT	DATE/TIME	TECH
	1,2-Dibromo-3-chloropropane	2.0	U		0.46	2.0	1.00000	ug/L	102291		11/20/03 2214	jdn
	1,2,3-Trichlorobenzene	1.0	U		0.24	1.0	1.00000	ug/L	102291		11/20/03 2214	jdn

* In Description = Dry Wgt.

Data File: /var/chem/gcl9.i/112003a.b/2172-03.d
Date : 20-NOV-2003 22:14
Client ID: TRIP BLANK
Sample Info: 222172-003
Purge Volume: 25.0
Column phase: Cap

Instrument: gcl9.i

Operator: DCT
Column diameter: 0.53



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                     VOLATILE REPORT SW846 METHOD 8260B WATERS
Data file : /var/chem/gc19.i/112003a.b/2172-03.d
Lab Smp Id: 222172-3                           Client Smp ID: TRIP BLANK
Inj Date  : 20-NOV-2003 22:14
Operator  : DCT                                Inst ID: gc19.i
Smp Info  : 222172-003
Misc Info : 222172-3,1,6
Comment   :  HP 5972/  5890 GC TEKMAR 3000/2016
Method    : /var/chem/gc19.i/112003a.b/25ml9w.m
Meth Date : 09-Dec-2003 13:53 nagelj           Quant Type: ISTD
Cal Date  : 17-OCT-2003 04:31                  Cal File: 9i1016o.d
Als bottle: 6
Dil Factor: 1.00000
Integrator: HP RTE                             Compound Sublist: Lockbourne.sub
Target Version:  3.50
Processing Host: manatee

Concentration Formula: Amt * DF * Uf * 1/Vo * CpndVariable

     Name          Value              Description
 -------------  -------------    ----------------------
      DF          1.00000          Dilution Factor
      Uf         25.00000        ng unit correction factor
      Vo         25.00000        Sample Volume purged (mL)
Cpnd Variable                      Local Compound Variable


                                                                            CONCENTRATIONS
                                   QUANT SIG                                  ON-COLUMN   FINAL
Compounds                            MASS       RT    EXP RT REL RT  RESPONSE  ( ug/L)   ( ug/L)
============================         ====       ==    ====== ======  ========  =======   =======
$  40 Dibromofluoromethane           113      8.379    8.386 (0.994)   716408  9.86314     9.863
*  41 Pentafluorobenzene             168      8.433    8.440 (1.000)  1864793  10.7700
$  46 1,2-Dichloroethane-d4           65      8.858    8.865 (0.943)   246323  8.71419     8.714
*  50 1,4-Difluorobenzene            114      9.392    9.399 (1.000)  1768181  10.7700
$  63 Toluene-d8                      98     11.291   11.298 (1.202)  1592355  10.7002    10.700
*  75 Chlorobenzene-d5               117     13.236   13.233 (1.000)  1085789  10.7700
$  86 p-Bromofluorobenzene            95     14.809   14.816 (1.119)   770089  9.37376     9.374
* 101 1,4-Dichlorobenzene-d4         152     16.283   16.281 (1.000)   487409  10.7700
```

12-9-03

IV. STANDARDS DATA

6A
VOLATILE ORGANICS INITIAL CALIBRATION DATA

Lab Name: STL CHICAGO Contract:

Lab Code: Case No.: SAS No.: SDG No.: 25M9W_ICAL1

Instrument ID: GCL9 Calibration Date(s): 10/16/03 10/17/03

Matrix:(soil/water) WATER Level:(low/med) LOW Column:(pack/cap) CAP

Min RRF for SPCC(#) = 0.300 (0.250 for Bromoform) Max %RSD for CCC(*) = 30.0%

LAB FILE ID: RRF1 =9i1016j.d RRF2 =9i1016k.d
RRF3 =9i1016l.d RRF4 =9i1016m.d RRF5 =9i1016n.d

COMPOUND	RRF1	RRF2	RRF3	RRF4	RRF5	RRF	% RSD
Dichlorodifluoromethane	0.231	0.203	0.196	0.194	0.525		
Chloromethane	0.225	0.183	0.181	0.165	0.269		
Vinyl chloride	0.244	0.236	0.238	0.230	0.338		
Bromomethane	0.222	0.146	0.160	0.163	0.215		
Chloroethane	0.188	0.166	0.168	0.166	0.210		
Trichlorofluoromethane	0.656	0.639	0.655	0.659	0.791		
2-Propanol							
1,1-Dichloroethene	0.345	0.306	0.316	0.313	0.323		
Acrolein		0.006	0.006	0.006	0.006		
Acetone		0.027	0.018	0.018	0.016		
Carbon Disulfide		0.893	0.951	0.893	0.934		
Iodomethane		0.187	0.285	0.371	0.386		
Acetonitrile		0.005	0.005	0.003	0.003		
3-Chloropropene		0.141	0.144	0.147	0.138		
Methylene chloride	0.314	0.248	0.234	0.216	0.218		
Trichlorotrifluoroethane	0.400	0.376	0.407	0.398	0.407		
Ethyl ether	0.086	0.076	0.079	0.080	0.073		
Methyl-tert-Butyl Ether	0.214	0.204	0.193	0.195	0.193		
trans-1,2-Dichloroethene	0.375	0.343	0.352	0.340	0.344		
Acrylonitrile		0.013	0.015	0.012	0.013		
1,2-Dichloroethene (total)	0.350	0.318	0.319	0.315	0.312		
1,1-Dichloroethane	0.595	0.565	0.597	0.587	0.593		
Vinyl Acetate		0.179	0.179	0.169	0.170		
2-Chloro-1,3-butadiene	0.484	0.507	0.509	0.513	0.488		
Ethyl Acetate	0.076	0.056	0.071	0.066	0.053		
cis-1,2-Dichloroethene	0.325	0.293	0.286	0.290	0.279		
2,2-Dichloropropane	0.548	0.540	0.531	0.548	0.547		
2-Butanone		0.030	0.018	0.023	0.020		
Propionitrile		0.005	0.005	0.004	0.004		
Bromochloromethane	0.096	0.099	0.098	0.103	0.102		
Chloroform	0.575	0.558	0.569	0.559	0.552		
Tetrahydrofuran	0.015	0.016	0.017	0.014	0.013		
1,1,1-Trichloroethane	0.599	0.584	0.592	0.597	0.591		
1,1-Dichloropropene	0.572	0.537	0.520	0.539	0.537		
Hexane	0.544	0.507	0.471	0.497	0.466		
Carbon tetrachloride	0.420	0.592	0.618	0.642	0.637		
Isobutanol		0.003	0.002	0.002	0.002		
Methacrylonitrile		0.035	0.028	0.036	0.030		

6A
VOLATILE ORGANICS INITIAL CALIBRATION DATA

Lab Name: STL CHICAGO Contract:

Lab Code: Case No.: SAS No.: SDG No.: 25M9W_ICAL1

Instrument ID: GCL9 Calibration Date(s): 10/16/03 10/17/03

Matrix:(soil/water) WATER Level:(low/med) LOW Column:(pack/cap) CAP

Min RRF for SPCC(#) = 0.300 (0.250 for Bromoform) Max %RSD for CCC(*) = 30.0%

LAB FILE ID: RRF1 =9i1016j.d RRF2 =9i1016k.d
RRF3 =9i1016l.d RRF4 =9i1016m.d RRF5 =9i1016n.d

COMPOUND	RRF1	RRF2	RRF3	RRF4	RRF5	RRF	% RSD
Benzene	0.963	0.869	0.890	0.872	0.878		
1,2-Dichloroethane	0.204	0.185	0.189	0.178	0.185		
Crotononitrile							
Trichloroethene	0.402	0.384	0.397	0.394	0.387		
1,2-Dichloropropane	0.306	0.284	0.285	0.287	0.288		
2-Chloroethylvinylether							
Methylmethacrylate		0.072	0.075	0.086	0.072		
n-Butanol		0.001	0.001	0.001	0.001		
Dibromomethane	0.131	0.124	0.121	0.136	0.134		
Bromodichloromethane	0.394	0.389	0.399	0.420	0.416		
Bis(chloromethyl)ether							
cis-1,3-Dichloropropene	0.318	0.304	0.324	0.324	0.321		
4-Methyl-2-pentanone		0.054	0.061	0.053	0.058		
2-Nitropropane		0.013	0.016	0.019	0.016		
Toluene	0.607	0.580	0.592	0.605	0.591		
trans-1,3-Dichloropropene	0.213	0.188	0.198	0.198	0.199		
Ethylmethacrylate		0.185	0.185	0.219	0.183		
1,1,2-Trichloroethane	0.124	0.112	0.118	0.120	0.115		
1,3-Dichloropropane	0.237	0.299	0.309	0.328	0.326		
Tetrachloroethene	0.822	0.740	0.764	0.789	0.752		
2-Hexanone		0.061	0.050	0.045	0.053		
Dibromochloromethane	0.315	0.313	0.330	0.349	0.356		
1,2-Dibromoethane	0.158	0.153	0.161	0.160	0.155		
1-Chlorohexane	0.504	0.496	0.487	0.515	0.503		
Chlorobenzene #	1.018	0.917	0.972	0.961	0.934		#
1,1,1,2-Tetrachloroethane	0.368	0.386	0.380	0.413	0.405		
Ethylbenzene	0.550	0.496	0.530	0.539	0.521		
p,m-Xylene	1.576	1.386	1.470	1.517	1.435		
Xylene (total)	1.372	1.250	1.297	1.339	1.284		
o-Xylene	1.372	1.250	1.297	1.339	1.284		
Styrene	0.835	0.757	0.809	0.818	0.827		
Bromoform	0.111	0.094	0.141	0.170	0.175		
Isopropylbenzene	4.347	3.970	4.161	4.194	4.146		
trans-1,4-Dichloro-2-butene		0.047	0.045	0.056	0.044		
1,1,2,2-Tetrachloroethane #	0.469	0.413	0.457	0.441	0.452		#
Bromobenzene	0.827	0.796	0.840	0.849	0.838		
1,2,3-Trichloropropane	0.098	0.101	0.100	0.105	0.100		
n-Propylbenzene	5.214	4.706	4.911	5.212	5.079		

6A
VOLATILE ORGANICS INITIAL CALIBRATION DATA

Lab Name: STL CHICAGO Contract:

Lab Code: Case No.: SAS No.: SDG No.: 25M9W_ICAL1

Instrument ID: GCL9 Calibration Date(s): 10/16/03 10/17/03

Matrix:(soil/water) WATER Level:(low/med) LOW Column:(pack/cap) CAP

Min RRF for SPCC(#) = 0.300 (0.250 for Bromoform) Max %RSD for CCC(*) = 30.0%

LAB FILE ID: RRF1 =9i1016j.d RRF2 =9i1016k.d
RRF3 =9i1016l.d RRF4 =9i1016m.d RRF5 =9i1016n.d

COMPOUND	RRF1	RRF2	RRF3	RRF4	RRF5	RRF	% RSD
2-Chlorotoluene	3.487	3.076	3.096	3.413	3.359		
1,3,5-Trimethylbenzene	2.901	2.734	2.842	3.009	2.979		
4-Chlorotoluene	2.851	2.846	2.803	3.125	3.070		
Pentachloroethane		0.230	0.243	0.305	0.251		
tert-Butylbenzene	3.258	3.008	3.117	3.276	3.238		
1,2,4-Trimethylbenzene	2.637	2.430	2.570	2.706	2.661		
sec-Butylbenzene	4.890	4.419	4.649	4.929	4.829		
1,3-Dichlorobenzene	1.642	1.529	1.528	1.554	1.510		
p-Isopropyltoluene	4.233	3.620	3.510	3.606	3.523		
1,4-Dichlorobenzene	1.924	1.604	1.666	1.617	1.600		
n-Butylbenzene	3.127	3.053	3.225	3.556	3.526		
1,2-Dichlorobenzene	1.302	1.126	1.130	1.135	1.141		
1,2-Dibromo-3-Chloropropane	0.102	0.096	0.077	0.062	0.071		
1,2,4-Trichlorobenzene	0.746	0.659	0.699	0.716	0.733		
Hexachlorobutadiene	0.909	0.834	0.849	1.060	1.055		
Naphthalene	0.280	0.245	0.370	0.380	0.429		
1,2,3-Trichlorobenzene	0.431	0.453	0.480	0.510	0.528		
tert-Butyl alcohol							
Heptane	0.707	0.690	0.670	0.688	0.663		
1,3,5-Trichlorobenzene	1.257	1.091	1.172	1.203	1.167		
Isopropyl ether	0.721	0.710	0.729	0.756	0.709		
1,3-Butadiene	0.184	0.191	0.180	0.178	0.168		
2-Methylnaphthalene							
Cyclohexanone		0.013	0.010	0.009	0.007		
Methyl acetate	0.105	0.076	0.063	0.050	0.051		
Cyclohexane	0.561	0.815	0.699	0.626	0.579		
Methyl cyclohexane	0.538	0.537	0.546	0.548	0.519		
Dichlorofluoromethane	0.736	0.814	0.840	0.849	0.806		
1,2-Dichloroethane-d4	0.159	0.170	0.161	0.166	0.193		
Toluene-d8	0.808	0.893	0.863	0.906	1.018		
p-Bromofluorobenzene	0.819	0.845	0.759	0.822	0.946		
Dibromofluoromethane	0.374	0.419	0.404	0.414	0.463		

6A
VOLATILE ORGANICS INITIAL CALIBRATION DATA

Lab Name: STL CHICAGO Contract:

Lab Code: Case No.: SAS No.: SDG No.: 25M9W_ICAL1

Instrument ID: GCL9 Calibration Date(s): 10/16/03 10/17/03

Matrix:(soil/water) WATER Level:(low/med) LOW Column:(pack/cap) CAP

Min $\overline{RRF}$ for SPCC(#) = 0.300 (0.250 for Bromoform) Max %RSD for CCC(*) = 30.0%

LAB FILE ID: RRF6 =9i1016o.d RRF7 =9i1016p.d
RRF8 =9i1016q.d RRF9 =9i1016r.d

COMPOUND	RRF6	RRF7	RRF8	RRF9		$\overline{RRF}$	% RSD
Dichlorodifluoromethane	0.478	0.506	0.523	0.503		0.373	1.0
Chloromethane	0.248	0.250	0.259	0.262		0.227	1.0
Vinyl chloride	0.307	0.320	0.338	0.327		0.286	1.0
Bromomethane	0.215	0.224	0.230	0.249		0.203	1.0
Chloroethane	0.194	0.199	0.209	0.204		0.189	9.6
Trichlorofluoromethane	0.738	0.766	0.795	0.778		0.720	9.2
2-Propanol							
1,1-Dichloroethene	0.331	0.333	0.335	0.340		0.327	4.1
Acrolein	0.006	0.006	0.006	0.006		0.006	5.4
Acetone	0.016	0.012	0.012	0.014		0.017	1.0
Carbon Disulfide	0.977	1.003	1.019	1.034		0.963	5.7
Iodomethane	0.436	0.426	0.452	0.482		0.378	1.0
Acetonitrile	0.003	0.003	0.003	0.003		0.004	26.6 <- [illegible]
3-Chloropropene	0.140	0.138	0.144	0.144		0.142	2.3
Methylene chloride	0.229	0.228	0.226	0.232		0.238	12.4
Trichlorotrifluoroethane	0.417	0.424	0.420	0.430		0.409	4.0
Ethyl ether	0.078	0.077	0.079	0.082		0.079	4.7
Methyl-tert-Butyl Ether	0.200	0.202	0.202	0.208		0.201	3.5
trans-1,2-Dichloroethene	0.352	0.352	0.356	0.364		0.353	3.1
Acrylonitrile	0.013	0.013	0.014	0.014		0.013	5.8
1,2-Dichloroethene (total)	0.324	0.324	0.325	0.333		0.324	3.5
1,1-Dichloroethane	0.615	0.612	0.619	0.628		0.601	3.2
Vinyl Acetate	0.171	0.184	0.185	0.195		0.179	5.0
2-Chloro-1,3-butadiene	0.506	0.512	0.527	0.530		0.508	3.0
Ethyl Acetate	0.057	0.061	0.059	0.044		0.060	1.0
cis-1,2-Dichloroethene	0.296	0.296	0.294	0.302		0.296	4.3
2,2-Dichloropropane	0.564	0.563	0.564	0.576		0.553	2.5
2-Butanone	0.019	0.019	0.018	0.020		0.021	1.0
Propionitrile	0.004	0.004	0.004	0.004		0.004	6.6
Bromochloromethane	0.107	0.108	0.110	0.113		0.104	5.6
Chloroform	0.585	0.576	0.577	0.592		0.571	2.3
Tetrahydrofuran	0.014	0.014	0.012	0.013		0.014	10.5
1,1,1-Trichloroethane	0.614	0.616	0.619	0.634		0.605	2.7
1,1-Dichloropropene	0.546	0.559	0.549	0.562		0.547	2.9
Hexane	0.479	0.484	0.504	0.486		0.493	4.8
Carbon tetrachloride	0.639	0.658	0.657	0.647		0.612	12.2
Isobutanol	0.002	0.002	0.002	0.002		0.002	1.0
Methacrylonitrile	0.030	0.029	0.030	0.031		0.031	9.7

page 4 of 6

6A
VOLATILE ORGANICS INITIAL CALIBRATION DATA

Lab Name: STL CHICAGO Contract:

Lab Code: Case No.: SAS No.: SDG No.: 25M9W_ICAL1

Instrument ID: GCL9 Calibration Date(s): 10/16/03 10/17/03

Matrix:(soil/water) WATER Level:(low/med) LOW Column:(pack/cap) CAP

Min RRF for SPCC(#) = 0.300 (0.250 for Bromoform) Max %RSD for CCC(*) = 30.0%

LAB FILE ID: RRF6 =9i1016o.d RRF7 =9i1016p.d
RRF8 =9i1016q.d RRF9 =9i1016r.d

COMPOUND	RRF6	RRF7	RRF8	RRF9		RRF	% RSD	
Benzene	0.909	0.901	0.894	0.895		0.897	3.1	
1,2-Dichloroethane	0.193	0.188	0.190	0.193		0.189	3.7	
Crotononitrile								*-
Trichloroethene	0.410	0.405	0.403	0.402		0.398	2.2	
1,2-Dichloropropane	0.303	0.297	0.297	0.300		0.294	2.8	
2-Chloroethylvinylether								*-
Methylmethacrylate	0.073	0.076	0.076	0.076		0.076	6.1	
n-Butanol	0.001	0.001	0.001	0.001		0.001	9.3	
Dibromomethane	0.146	0.143	0.142	0.146		0.136	6.8	
Bromodichloromethane	0.455	0.442	0.440	0.450		0.423	5.9	
Bis(chloromethyl)ether								*-
cis-1,3-Dichloropropene	0.349	0.342	0.338	0.346		0.330	4.6	
4-Methyl-2-pentanone	0.055	0.056	0.057	0.060		0.057	5.0	
2-Nitropropane	0.016	0.016	0.017	0.017		0.016	9.7	
Toluene	0.629	0.612	0.607	0.601		0.603	2.4	
trans-1,3-Dichloropropene	0.214	0.208	0.207	0.212		0.204	4.3	
Ethylmethacrylate	0.190	0.193	0.196	0.192		0.193	6.0	
1,1,2-Trichloroethane	0.126	0.124	0.122	0.128		0.121	4.5	
1,3-Dichloropropane	0.348	0.344	0.342	0.352		0.320	11.3	
Tetrachloroethene	0.783	0.785	0.780	0.786		0.778	3.1	
2-Hexanone	0.049	0.054	0.057	0.053		0.053	9.4	
Dibromochloromethane	0.392	0.386	0.387	0.402		0.359	9.5	
1,2-Dibromoethane	0.170	0.170	0.167	0.169		0.162	4.1	
1-Chlorohexane	0.523	0.532	0.525	0.539		0.514	3.4	
Chlorobenzene #	1.010	0.989	0.982	0.981		0.974	3.4#	
1,1,1,2-Tetrachloroethane	0.441	0.435	0.426	0.439		0.410	6.6	
Ethylbenzene	0.561	0.546	0.549	0.554		0.538	3.8	
p,m-Xylene	1.563	1.512	1.514	1.504		1.497	4.0	
Xylene (total)	1.389	1.362	1.361	1.373		1.336	3.6	
o-Xylene	1.389	1.362	1.361	1.373		1.336	3.6	
Styrene	0.889	0.874	0.881	0.880		0.841	5.2	
Bromoform	0.191	0.195	0.196	0.207		0.164	1.0	
Isopropylbenzene	4.440	4.305	4.240	4.384		4.243	3.4	
trans-1,4-Dichloro-2-butene	0.044	0.047	0.046	0.047		0.047	8.0	
1,1,2,2-Tetrachloroethane #	0.483	0.486	0.459	0.478		0.460	5.0#	
Bromobenzene	0.930	0.903	0.885	0.913		0.864	5.2	
1,2,3-Trichloropropane	0.109	0.108	0.109	0.110		0.104	4.3	
n-Propylbenzene	5.418	5.276	5.194	5.350		5.151	4.3	

page 5 of 6

6A
VOLATILE ORGANICS INITIAL CALIBRATION DATA

Lab Name: STL CHICAGO Contract:

Lab Code: Case No.: SAS No.: SDG No.: 25M9W_ICAL1

Instrument ID: GCL9 Calibration Date(s): 10/16/03 10/17/03

Matrix:(soil/water) WATER Level:(low/med) LOW Column:(pack/cap) CAP

Min RRF for SPCC(#) = 0.300 (0.250 for Bromoform) Max %RSD for CCC(*) = 30.0%

LAB FILE ID: RRF6 =9i1016o.d RRF7 =9i1016p.d
RRF8 =9i1016q.d RRF9 =9i1016r.d

COMPOUND	RRF6	RRF7	RRF8	RRF9		$\overline{RRF}$	% RSD
2-Chlorotoluene	3.587	3.473	3.476	3.498		3.385	5.3
1,3,5-Trimethylbenzene	3.178	3.095	3.057	3.154		2.994	4.9
4-Chlorotoluene	3.295	3.228	3.167	3.185		3.063	6.0
Pentachloroethane	0.258	0.266	0.272	0.262		0.261	8.6
tert-Butylbenzene	3.423	3.336	3.282	3.427		3.263	4.1
1,2,4-Trimethylbenzene	2.856	2.804	2.776	2.822		2.696	5.1
sec-Butylbenzene	5.073	4.970	4.804	5.083		4.850	4.3
1,3-Dichlorobenzene	1.603	1.567	1.557	1.586		1.564	2.6
p-Isopropyltoluene	3.686	3.641	3.504	3.653		3.664	6.1
1,4-Dichlorobenzene	1.649	1.703	1.637	1.663		1.674	5.9
n-Butylbenzene	3.639	3.703	3.471	3.647		3.438	7.0
1,2-Dichlorobenzene	1.199	1.192	1.175	1.188		1.176	4.7
1,2-Dibromo-3-Chloropropane	0.080	0.077	0.073	0.077		0.079	1.0
1,2,4-Trichlorobenzene	0.760	0.800	0.768	0.797		0.742	6.2
Hexachlorobutadiene	1.055	1.097	0.995	1.121		0.997	10.8
Naphthalene	0.442	0.504	0.473	0.473		0.400	1.0
1,2,3-Trichlorobenzene	0.552	0.569	0.554	0.565		0.516	9.9
tert-Butyl alcohol							
Heptane	0.685	0.691	0.709	0.684		0.687	2.2
1,3,5-Trichlorobenzene	1.201	1.248	1.294	1.244		1.208	5.0
Isopropyl ether	0.738	0.733	0.764	0.771		0.737	3.1
1,3-Butadiene	0.172	0.176	0.180	0.178		0.178	3.7
2-Methylnaphthalene							
Cyclohexanone	0.010	0.009	0.008	0.010		0.010	1.0
Methyl acetate	0.048	0.046	0.049	0.048		0.060	1.0
Cyclohexane	0.593	0.594	0.606	0.592		0.629	12.7
Methyl cyclohexane	0.536	0.546	0.562	0.553		0.543	2.3
Dichlorofluoromethane	0.824	0.872	0.871	0.854		0.830	5.1
1,2-Dichloroethane-d4	0.176	0.171	0.172	0.182		0.172	6.2
Toluene-d8	0.914	0.912	0.903	0.940		0.906	6.2
p-Bromofluorobenzene	0.764	0.772	0.794	0.812		0.815	7.1
Dibromofluoromethane	0.422	0.413	0.418	0.449		0.420	6.1

INITIAL CALIBRATION DATA

```
Start Cal Date   : 16-OCT-2003 19:57
End Cal Date     : 17-OCT-2003 05:58
Quant Method     : ISTD
Target Version   : 3.50
Integrator       : HP RTE
Method file      : /var/chem/gc19.i/101603a_25ml9w.b/25ml9w.m
Cal Date         : 17-Oct-2003 12:41 alikpata

Calibration File Names:
Level 1: /var/chem/gc19.i/101603a_25ml9w.b/9i1016j.d
Level 2: /var/chem/gc19.i/101603a_25ml9w.b/9i1016k.d
Level 3: /var/chem/gc19.i/101603a_25ml9w.b/9i1016l.d
Level 4: /var/chem/gc19.i/101603a_25ml9w.b/9i1016m.d
Level 5: /var/chem/gc19.i/101603a_25ml9w.b/9i1016n.d
Level 6: /var/chem/gc19.i/101603a_25ml9w.b/9i1016o.d
Level 7: /var/chem/gc19.i/101603a_25ml9w.b/9i1016p.d
Level 8: /var/chem/gc19.i/101603a_25ml9w.b/9i1016q.d
Level 9: /var/chem/gc19.i/101603a_25ml9w.b/9i1016r.d
```

Compound	0.5000 Level 1	1 Level 2	2 Level 3	5 Level 4	8 Level 5	10 Level 6	Curve	Coefficients b	m1	m2	%RSD or R^2
	14 Level 7	20 Level 8	40 Level 9								
1 Dichlorodifluoromethane	18335	31003	60416	147362	643681	733118					
	1080555	1568574	2987351				LINR	0.08621	0.52447		0.99374
2 Chloromethane	17819	27914	55627	125806	329696	380453					
	534075	775893	1557238				LINR	0.05710	0.26620		0.99797
3 Vinyl chloride	19319	36111	73150	175252	414507	471242					
	682765	1013360	1942723				LINR	0.04499	0.33371		0.99810
4 1,3-Butadiene	0.18449	0.19080	0.17959	0.17852	0.16819	0.17178					
	0.17618	0.17953	0.17830				AVRG		0.17860		3.68309
5 Bromomethane	17611	22296	49354	123903	263686	330038					
	479345	666671	1480933				LINR	0.09557	0.25183		0.99739

INITIAL CALIBRATION DATA

Start Cal Date : 16-OCT-2003 19:57
End Cal Date : 17-OCT-2003 05:58
Quant Method : ISTD
Target Version : 3.50
Integrator : HP RTE
Method file : /var/chem/gc19.i/101603a.25ml9w.b/25ml9w.m
Cal Date : 17-Oct-2003 12:41 alikpata

Compound	0.5000 Level 1	1 Level 2	2 Level 3	5 Level 4	8 Level 5	10 Level 6	Curve	Coefficients b	 m1	 m2	%RSD or R^2
	14 Level 7	20 Level 8	40 Level 9								
6 Chloroethane	0.18806	0.16589	0.16833	0.16652	0.21034	0.19363					
	0.19862	0.20881	0.20433				AVRG		0.18939		9.63290
7 Trichlorofluoromethane	0.65596	0.63896	0.65476	0.65881	0.79078	0.73821					
	0.75581	0.79493	0.77769				AVRG		0.71954		9.19888
8 Dichlorofluoromethane	0.73568	0.81424	0.83958	0.84878	0.80561	0.82448					
	0.87196	0.87074	0.85356				AVRG		0.82940		5.07730
9 Ethyl ether	0.08622	0.07554	0.07929	0.08013	0.07343	0.07775					
	0.07716	0.07941	0.08184				AVRG		0.07898		4.68753
10 Acrolein	+++++	0.00611	0.00654	0.00558	0.00553	0.00583					
	0.00570	0.00598	0.00608				AVRG		0.00593		5.40707
11 Trichlorotrifluoroethane	0.40026	0.37598	0.40690	0.39789	0.40743	0.41691					
	0.42374	0.41956	0.42972				AVRG		0.40871		3.97986
12 1,1-Dichloroethene	0.34520	0.30592	0.31645	0.31294	0.32333	0.33148					
	0.33342	0.33527	0.34041				AVRG		0.32716		4.05435
13 Acetone	+++++	8205	10938	13567	19138	24523					
	25185	35627	84064				QUAD	-0.39810	113	-649	0.99195
14 Iodomethane	+++++	56769	218170	565444	873896	1333161					
	1947854	2768326	4372767				LINR	0.23066	0.49205		0.99753

INITIAL CALIBRATION DATA

```
Start Cal Date    : 16-OCT-2003 19:57
End Cal Date      : 17-OCT-2003 05:58
Quant Method      : ISTD
Target Version    : 3.50
Integrator        : HP RTE
Method file       : /var/chem/gc19.i/101603a_25ml9w.b/25ml9w.m
Cal Date          : 17-Oct-2003 12:41 alikpata

 ________________________________________________________________________________________________________________________________________________________________
|                                     | 0.5000    | 1         | 2         | 5         | 8         | 10        |     |           Coefficients          | %RSD     |
| Compound                            | Level 1   | Level 2   | Level 3   | Level 4   | Level 5   | Level 6   |Curve|    b         m1          m2     | or R^2   |
|                                     |-----------|-----------|-----------|-----------|-----------|-----------|     |                                 |          |
|                                     | 14        | 20        | 40        |           |           |           |     |                                 |          |
|                                     | Level 7   | Level 8   | Level 9   |           |           |           |     |                                 |          |
|=====================================|===========|===========|===========|===========|===========|===========|=====|=================================|==========|
| 15 Carbon Disulfide                 |   +++++   |   0.89285|    0.95098|    0.89282|    0.93399|    0.97684|     |          |          |          |          |
|                                     |    1.00344|    1.01928|    1.03454|           |           |           |AVRG |          |   0.96309|          |   5.67961|
|-------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----|----------|----------|----------|----------|
| 16 3-Chloropropene                  |   +++++   |    0.14128|    0.14357|    0.14691|    0.13834|    0.14013|     |          |          |          |          |
|                                     |    0.13775|    0.14460|    0.14423|           |           |           |AVRG |          |   0.14210|          |   2.28414|
|-------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----|----------|----------|----------|----------|
| 17 Methyl acetate                   |       8081|      11472|      19290|      37903|      61486|      73044|     |          |          |          |          |
|                                     |      99196|     150406|     290899|           |           |           |LINR | -0.03866|    0.04742|          |   0.99929|
|-------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----|----------|----------|----------|----------|
| 18 Acetonitrile                     |   +++++   |    0.00532|    0.00509|    0.00316|    0.00298|    0.00299|     |          |          |          |          |
|                                     |    0.00314|    0.00331|    0.00318|           |           |           |AVRG |          |   0.00365|          |  26.56856|<-
|-------------------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----|----------|----------|----------|----------|
| 19 Methylene chloride               |    0.31351|    0.24816|    0.23360|    0.21630|    0.21854|    0.22867|     |          |          |          |          |
|                                     |    0.22825|    0.22657|    0.23218|           |           |           |AVRG |          |   0.23842|          |  12.42328|
| 20 Methyl-tert-Butyl Ether          |    0.21427|    0.20407|    0.19300|    0.19484|    0.19313|    0.20010|     |          |          |          |          |
|                                     |    0.20221|    0.20171|    0.20803|           |           |           |AVRG |          |   0.20126|          |   3.51821|
| 21 trans-1,2-Dichloroethene         |    0.37469|    0.34350|    0.35212|    0.34015|    0.34384|    0.35220|     |          |          |          |          |
|                                     |    0.35258|    0.35652|    0.36421|           |           |           |AVRG |          |   0.35331|          |   3.08163|
| 22 Acrylonitrile                    |   +++++   |    0.01333|    0.01496|    0.01241|    0.01285|    0.01317|     |          |          |          |          |
|                                     |    0.01316|    0.01355|    0.01403|           |           |           |AVRG |          |   0.01343|          |   5.80796|
| 23 Hexane                           |    0.54368|    0.50685|    0.47098|    0.49677|    0.46633|    0.47947|     |          |          |          |          |
|                                     |    0.48425|    0.50397|    0.48561|           |           |           |AVRG |          |   0.49310|          |   4.75912|
|_____________________________________|___________|___________|___________|___________|___________|___________|_____|__________|__________|__________|__________|
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INITIAL CALIBRATION DATA

Start Cal Date : 16-OCT-2003 19:57
End Cal Date : 17-OCT-2003 05:58
Quant Method : ISTD
Target Version : 3.50
Integrator : HP RTE
Method file : /var/chem/gc19.i/101603a.25ml9w.b/25ml9w.m
Cal Date : 17-Oct-2003 12:41 alikpata

Compound	0.5000 Level 1	1 Level 2	2 Level 3	5 Level 4	8 Level 5	10 Level 6	Curve	Coefficients b	m1	m2	%RSD or R^2
	14 Level 7	20 Level 8	40 Level 9								
24 Isopropyl ether	0.72083	0.71017	0.72914	0.75638	0.70909	0.73819					
	0.73281	0.76354	0.77095				AVRG		0.73679		3.06254
25 1,1-Dichloroethane	0.59485	0.56482	0.59731	0.58702	0.59274	0.61540					
	0.61241	0.61864	0.62777				AVRG		0.60122		3.21508
26 Vinyl Acetate	+++++	0.17884	0.17916	0.16899	0.16981	0.17104					
	0.18358	0.18501	0.19526				AVRG		0.17896		5.04127
27 2-Chloro-1,3-butadiene	0.48373	0.50736	0.50910	0.51346	0.48794	0.50644					
	0.51152	0.52738	0.52967				AVRG		0.50851		3.01483
28 2,2-Dichloropropane	0.54822	0.54034	0.53149	0.54826	0.54707	0.56357					
	0.56260	0.56357	0.57561				AVRG		0.55341		2.49777
29 cis-1,2-Dichloroethene	0.32489	0.29333	0.28651	0.29042	0.27947	0.29601					
	0.29593	0.29419	0.30204				AVRG		0.29586		4.26818
30 2-Butanone	+++++	9338	10916	17602	24482	28668					
	39777	54544	122003				LINR	0.02343	0.02021		0.99306
31 Ethyl Acetate	58660	84910	218753	501963	640244	872160					
	1305418	1804674	2676695				QUAD	0.69917	10.42965	6.90485	0.99241
32 Propionitrile	+++++	0.00478	0.00513	0.00414	0.00445	0.00450					
	0.00429	0.00454	0.00459				AVRG		0.00455		6.63647

INITIAL CALIBRATION DATA

Start Cal Date : 16-OCT-2003 19:57
End Cal Date : 17-OCT-2003 05:58
Quant Method : ISTD
Target Version : 3.50
Integrator : HP RTE
Method file : /var/chem/gc19.i/101603a.25ml9w.b/25ml9w.m
Cal Date : 17-Oct-2003 12:41 alikpata

Compound	0.5000 Level 1	1 Level 2	2 Level 3	5 Level 4	8 Level 5	10 Level 6	Curve	Coefficients b	m1	m2	%RSD or R^2
	14 Level 7	20 Level 8	40 Level 9								
33 Bromochloromethane	0.09579	0.09872	0.09771	0.10322	0.10208	0.10727					
	0.10838	0.10956	0.11265				AVRG		0.10393		5.63865
34 Tetrahydrofuran	0.01472	0.01605	0.01696	0.01383	0.01309	0.01397					
	0.01395	0.01233	0.01301				AVRG		0.01421		10.47497
35 Methacrylonitrile	+++++	0.03522	0.02791	0.03648	0.03060	0.03000					
	0.02907	0.02973	0.03068				AVRG		0.03121		9.65479
36 Chloroform	0.57488	0.55819	0.56939	0.55945	0.55248	0.58547					
	0.57597	0.57695	0.59225				AVRG		0.57167		2.29344
37 Crotononitrile	+++++	+++++	+++++	+++++	+++++	+++++					
	+++++	+++++	+++++				AVRG		0.000e+00		0.000e+00 <-
38 Cyclohexane	0.56094	0.81540	0.69936	0.62597	0.57862	0.59287					
	0.59375	0.60622	0.59163				AVRG		0.62942		12.72724
39 1,1,1-Trichloroethane	0.59943	0.58454	0.59152	0.59665	0.59130	0.61423					
	0.61647	0.61920	0.63427				AVRG		0.60529		2.71653
42 Carbon tetrachloride	0.42026	0.59245	0.61768	0.64170	0.63679	0.63887					
	0.65759	0.65691	0.64657				AVRG		0.61210		12.21107
43 1,1-Dichloropropene	0.57205	0.53673	0.51996	0.53941	0.53695	0.54603					
	0.55878	0.54934	0.56164				AVRG		0.54677		2.87863

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Method file : /var/chem/gc19.i/101603a.25ml9w.b/25ml9w.m
Cal Date : 17-Oct-2003 12:41 alikpata

Compound	0.5000 Level 1	1 Level 2	2 Level 3	5 Level 4	8 Level 5	10 Level 6	Curve	Coefficients b	Coefficients m1	Coefficients m2	%RSD or R^2
	14 Level 7	20 Level 8	40 Level 9								
44 Isobutanol	+++++	36870	66691	145158	170270	224734					
	330951	442812	620020				LINR	-9.12461	0.00173		0.99731
45 Benzene	0.96279	0.86868	0.89030	0.87238	0.87799	0.90950					
	0.90075	0.89396	0.89473				AVRG		0.89679		3.13606
47 1.2-Dichloroethane	0.20399	0.18540	0.18949	0.17799	0.18502	0.19260					
	0.18778	0.18965	0.19282				AVRG		0.18942		3.74577
48 Heptane	0.70709	0.69024	0.67005	0.68777	0.65334	0.68475					
	0.69088	0.70885	0.68381				AVRG		0.68742		2.16260
49 Bis(chloromethyl)ether	+++++	+++++	+++++	+++++	+++++	+++++					
	+++++	+++++	+++++				AVRG		0.000e+00		0.000e+00 <-
51 n-Butanol	+++++	0.00122	0.00097	0.00122	0.00101	0.00099					
	0.00104	0.00105	0.00102				AVRG		0.00106		9.29844 <-
52 Trichloroethene	0.40186	0.38350	0.39696	0.39378	0.38713	0.41030					
	0.40531	0.40332	0.40232				AVRG		0.39827		2.19817
53 Methyl cyclohexane	0.53860	0.53677	0.54637	0.54828	0.51862	0.53563					
	0.54642	0.56174	0.55322				AVRG		0.54285		2.26871
54 1.2-Dichloropropane	0.30604	0.28397	0.28489	0.28723	0.28769	0.30296					
	0.29726	0.29691	0.30031				AVRG		0.29414		2.82778

INITIAL CALIBRATION DATA

Start Cal Date : 16-OCT-2003 19:57
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Method file : /var/chem/gc19.i/101603a_25ml9w.b/25ml9w.m
Cal Date : 17-Oct-2003 12:41 alikpata

Compound	0.5000 Level 1 14 Level 7	1 Level 2 20 Level 8	2 Level 3 40 Level 9	5 Level 4	8 Level 5	10 Level 6	Curve	Coefficients b	Coefficients m1	Coefficients m2	%RSD or R^2
55 Methylmethacrylate	+++++	0.07250	0.07461	0.08631	0.07155	0.07323					
	0.07561	0.07611	0.07588				AVRG		0.07572		6.06200
56 Dibromomethane	0.13109	0.12356	0.12087	0.13577	0.13431	0.14577					
	0.14325	0.14198	0.14573				AVRG		0.13582		6.83128
57 2-Chloroethylvinylether	+++++	+++++	+++++	+++++	+++++	+++++					
	+++++	+++++	+++++				AVRG		0.000e+00		0.000e+00 <-
58 Bromodichloromethane	0.39448	0.38911	0.39929	0.41992	0.41628	0.45468					
	0.44158	0.44014	0.45011				AVRG		0.42285		5.88674
59 2-Nitropropane	+++++	0.01347	0.01553	0.01916	0.01584	0.01633					
	0.01653	0.01665	0.01667				AVRG		0.01627		9.66042
60 2-Propanol	+++++	+++++	+++++	+++++	+++++	+++++					
	+++++	+++++	+++++				AVRG		0.000e+00		0.000e+00 <-
61 cis-1,3-Dichloropropene	0.31778	0.30387	0.32400	0.32360	0.32106	0.34914					
	0.34241	0.33855	0.34583				AVRG		0.32958		4.59060
62 4-Methyl-2-pentanone	+++++	0.05440	0.06141	0.05308	0.05819	0.05478					
	0.05650	0.05746	0.05987				AVRG		0.05696		4.99450
64 Toluene	0.60695	0.57955	0.59243	0.60475	0.59083	0.62938					
	0.61179	0.60727	0.60098				AVRG		0.60256		2.36314

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Start Cal Date : 16-OCT-2003 19:57
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Integrator : HP RTE
Method file : /var/chem/gc19.i/101603a.25ml9w.b/25ml9w.m
Cal Date : 17-Oct-2003 12:41 alikpata

Compound	0.5000	1	2	5	8	10		Coefficients			%RSD
	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Curve	b	m1	m2	or R^2
	14 Level 7	20 Level 8	40 Level 9								
65 trans-1,3-Dichloropropene	0.21293	0.18809	0.19769	0.19847	0.19944	0.21358					
	0.20828	0.20697	0.21231				AVRG		0.20420		4.28234
66 Ethylmethacrylate	+++++	0.18482	0.18512	0.21906	0.18293	0.18976					
	0.19332	0.19571	0.19174				AVRG		0.19281		5.97390
67 tert-Butyl alcohol	+++++	+++++	+++++	+++++	+++++	+++++					
	+++++	+++++	+++++				AVRG		0.000e+00		0.000e+00 <-
68 1,1,2-Trichloroethane	0.12426	0.11179	0.11811	0.11977	0.11468	0.12657					
	0.12411	0.12247	0.12788				AVRG		0.12107		4.48147
69 Tetrachloroethene	0.82200	0.74009	0.76397	0.78882	0.75185	0.78280					
	0.78476	0.78016	0.78583				AVRG		0.77781		3.05114
70 1,3-Dichloropropane	0.23705	0.29934	0.30878	0.32846	0.32572	0.34784					
	0.34427	0.34182	0.35232				AVRG		0.32052		11.25578
71 2-Hexanone	+++++	0.06113	0.04973	0.04503	0.05296	0.04910					
	0.05414	0.05679	0.05341				AVRG		0.05279		9.36195
72 Dibromochloromethane	0.31526	0.32341	0.33052	0.34908	0.35581	0.39151					
	0.38623	0.38670	0.40252				AVRG		0.35900		9.53366
73 1,2-Dibromoethane	0.15852	0.15270	0.16068	0.16014	0.15543	0.16954					
	0.17025	0.16712	0.16942				AVRG		0.16264		4.06334

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Integrator : HP RTE
Method file : /var/chem/gc19.i/101603a_25ml9w.b/25ml9w.m
Cal Date : 17-Oct-2003 12:41 alikpata

Compound	0.5000 Level 1	1 Level 2	2 Level 3	5 Level 4	8 Level 5	10 Level 6	Curve	Coefficients b	 m1	 m2	%RSD or R^2
	14 Level 7	20 Level 8	40 Level 9								
74 1-Chlorohexane	0.50436	0.49591	0.48691	0.51519	0.50342	0.52331					
	0.53196	0.52529	0.53908				AVRG		0.51394		3.39333
76 Chlorobenzene	1.01839	0.91713	0.97247	0.96117	0.93441	1.01011					
	0.98913	0.98258	0.98119				AVRG		0.97406		3.36546
77 Ethylbenzene	0.55046	0.49592	0.52978	0.53895	0.52094	0.56108					
	0.54640	0.54943	0.55385				AVRG		0.53853		3.75332
78 1,1,1,2-Tetrachloroethane	0.36828	0.38654	0.37966	0.41275	0.40526	0.44150					
	0.43482	0.42650	0.43874				AVRG		0.41045		6.64213
79 p,m-Xylene	1.57641	1.38555	1.46988	1.51715	1.43466	1.56270					
	1.51170	1.51372	1.50369				AVRG		1.49727		3.99409
80 o-Xylene	1.37156	1.24954	1.29688	1.33945	1.28450	1.38917					
	1.36157	1.36097	1.37277				AVRG		1.33627		3.58792
81 Styrene	0.83516	0.75716	0.80867	0.81837	0.82687	0.88918					
	0.87442	0.88135	0.88009				AVRG		0.84125		5.21799
82 Bromoform	5267	8804	26296	78087	129434	178237					
	255203	359016	754464				LINR	0.07395	0.20922		0.99920 <-
83 Isopropylbenzene	4.34690	3.96952	4.16083	4.19416	4.14595	4.43982					
	4.30493	4.24002	4.38398				AVRG		4.24290		3.40120

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Method file : /var/chem/gc19.i/101603a.25ml9w.b/25ml9w.m
Cal Date : 17-Oct-2003 12:41 alikpata

	Compound	0.5000 Level 1 14 Level 7	1 Level 2 20 Level 8	2 Level 3 40 Level 9	5 Level 4	8 Level 5	10 Level 6	Curve	Coefficients b	Coefficients m1	Coefficients m2	%RSD or R^2	
M	84 1,2-Dichloroethene (total)	0.34979	0.31842	0.31932	0.31529	0.31166	0.32410						
		0.32426	0.32535	0.33313				AVRG		0.32459		3.49315	
	85 Cyclohexanone	+++++	47132	90508	152771	178717	345648						
		470614	579508	1080920				QUAD	-6.21395	143	-18.81524	0.99021	<-
	87 Bromobenzene	0.82665	0.79597	0.84011	0.84882	0.83786	0.93037						
		0.90283	0.88512	0.91319				AVRG		0.86455		5.21836	
	88 1,1,2,2-Tetrachloroethane	0.46893	0.41337	0.45687	0.44116	0.45229	0.48349						
		0.48556	0.45950	0.47845				AVRG		0.45996		4.99551	
	89 n-Propylbenzene	5.21455	4.70556	4.91140	5.21228	5.07919	5.41759						
		5.27589	5.19388	5.34985				AVRG		5.15113		4.32366	
	90 1,2,3-Trichloropropane	0.09856	0.10073	0.10049	0.10533	0.10034	0.10879						
		0.10776	0.10892	0.10963				AVRG		0.10451		4.25850	
	91 trans-1,4-Dichloro-2-butene	+++++	0.04702	0.04507	0.05558	0.04442	0.04357						
		0.04733	0.04560	0.04691				AVRG		0.04694		7.96605	
	92 2-Chlorotoluene	3.48660	3.07638	3.09642	3.41295	3.35895	3.58720						
		3.47268	3.47575	3.49832				AVRG		3.38503		5.32530	
	93 1,3,5-Trimethylbenzene	2.90093	2.73357	2.84181	3.00861	2.97948	3.17754						
		3.09480	3.05706	3.15421				AVRG		2.99422		4.91921	

INITIAL CALIBRATION DATA

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Quant Method : ISTD
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Method file : /var/chem/gc19.i/101603a.25ml9w.b/25ml9w.m
Cal Date : 17-Oct-2003 12:41 alikpata

Compound	0.5000 Level 1	1 Level 2	2 Level 3	5 Level 4	8 Level 5	10 Level 6	Curve	Coefficients b	 m1	 m2	%RSD or R^2
	14 Level 7	20 Level 8	40 Level 9								
94 4-Chlorotoluene	2.85074	2.84642	2.80285	3.12514	3.07055	3.29527					
	3.22799	3.16714	3.18518				AVRG		3.06347		6.00235
95 tert-Butylbenzene	3.25804	3.00815	3.11675	3.27574	3.23857	3.42307					
	3.33581	3.28163	3.42672				AVRG		3.26272		4.12905
96 1,2,4-Trimethylbenzene	2.63722	2.43001	2.57031	2.70632	2.66141	2.85627					
	2.80443	2.77551	2.82171				AVRG		2.69591		5.09398
97 Pentachloroethane	+++++	0.22970	0.24342	0.30541	0.25125	0.25849					
	0.26599	0.27192	0.26160				AVRG		0.26097		8.57640
98 sec-Butylbenzene	4.88964	4.41875	4.64882	4.92861	4.82877	5.07292					
	4.96985	4.80416	5.08341				AVRG		4.84944		4.34565
99 p-Isopropyltoluene	4.23339	3.61983	3.50994	3.60659	3.52293	3.68558					
	3.64095	3.50441	3.65295				AVRG		3.66406		6.10023
100 1,3-Dichlorobenzene	1.64163	1.52945	1.52785	1.55427	1.51045	1.60316					
	1.56708	1.55695	1.58563				AVRG		1.56405		2.63126
102 1,4-Dichlorobenzene	1.92357	1.60426	1.66619	1.61688	1.59990	1.64908					
	1.70298	1.63681	1.66263				AVRG		1.67359		5.93522
103 n-Butylbenzene	3.12705	3.05316	3.22539	3.55597	3.52639	3.63899					
	3.70339	3.47092	3.64733				AVRG		3.43873		7.02947

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Cal Date : 17-Oct-2003 12:41 alikpata

Compound	0.5000 Level 1	1 Level 2	2 Level 3	5 Level 4	8 Level 5	10 Level 6	Curve	Coefficients b	m1	m2	%RSD or R^2
	14 Level 7	20 Level 8	40 Level 9								
104 1,2-Dichlorobenzene	1.30233	1.12632	1.12990	1.13481	1.14087	1.19948					
	1.19219	1.17537	1.18807				AVRG		1.17659		4.69751
105 1,2-Dibromo-3-Chloropropane	2182	4192	6732	13463	24991	34939					
	47786	64578	132604				LINR	0.01836	0.07713		0.99835
106 1,3,5-Trichlorobenzene	1.25730	1.09111	1.17236	1.20286	1.16728	1.20063					
	1.24783	1.29387	1.24430				AVRG		1.20862		5.01387
107 1,2,4-Trichlorobenzene	0.74623	0.65871	0.69912	0.71552	0.73271	0.75981					
	0.80030	0.76759	0.79672				AVRG		0.74186		6.20378
108 Hexachlorobutadiene	0.90899	0.83366	0.84934	1.06034	1.05507	1.05523					
	1.09693	0.99476	1.12093				AVRG		0.99725		10.77390
109 Naphthalene	5984	10703	32345	82420	149942	194397					
	313750	416043	810737				LINR	0.04611	0.48220		0.99841
110 1,2,3-Trichlorobenzene	0.43111	0.45280	0.48028	0.50951	0.52798	0.55249					
	0.56934	0.55404	0.56543				AVRG		0.51589		9.86727
111 2-Methylnaphthalene	+++++	+++++	+++++	+++++	+++++	+++++					
	+++++	+++++	+++++				AVRG		0.000e+00		0.000e+00 <-
M 112 Xylene (total)	1.37156	1.24954	1.29688	1.33945	1.28450	1.38917					
	1.36157	1.36097	1.37277				AVRG		1.33627		3.58792

INITIAL CALIBRATION DATA

Start Cal Date : 16-OCT-2003 19:57
End Cal Date : 17-OCT-2003 05:58
Quant Method : ISTD
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Integrator : HP RTE
Method file : /var/chem/gc19.i/101603a.25ml9w.b/25ml9w.m
Cal Date : 17-Oct-2003 12:41 alikpata

Compound	0.5000 Level 1 14 Level 7	1 Level 2 20 Level 8	2 Level 3 40 Level 9	5 Level 4	8 Level 5	10 Level 6	Curve	Coefficients b	Coefficients m1	Coefficients m2	%RSD or R^2
$ 40 Dibromofluoromethane	0.37374 0.41305	0.41916 0.41799	0.40354 0.44886	0.41436	0.46312	0.42166	AVRG		0.41950		6.07068
$ 46 1,2-Dichloroethane-d4	0.15890 0.17088	0.16978 0.17159	0.16113 0.18221	0.16615	0.19334	0.17558	AVRG		0.17217		6.16941
$ 63 Toluene-d8	0.80767 0.91215	0.89277 0.90300	0.86344 0.94011	0.90631	1.01856	0.91387	AVRG		0.90643		6.24028
$ 86 p-Bromofluorobenzene	0.81948 0.77155	0.84534 0.79412	0.75692 0.81220	0.82210	0.94656	0.76371	AVRG		0.81489		7.05023

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                      INITIAL CALIBRATION DATA
Start Cal Date   : 16-OCT-2003 19:57
End Cal Date     : 17-OCT-2003 05:58
Quant Method     : ISTD
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Integrator       : HP RTE
Method file      : /var/chem/gc19.i/101603a.25ml9w.b/25ml9w.m
Cal Date         : 17-Oct-2003 12:41 alikpata

|Average %RSD Results.                          |
|===============================================|
|Calculated Average %RSD = 8.11827850           |
|Maximun Average %RSD    =         15           |
|* Passed Average %RSD Test.                    |
|_______________________________________________|

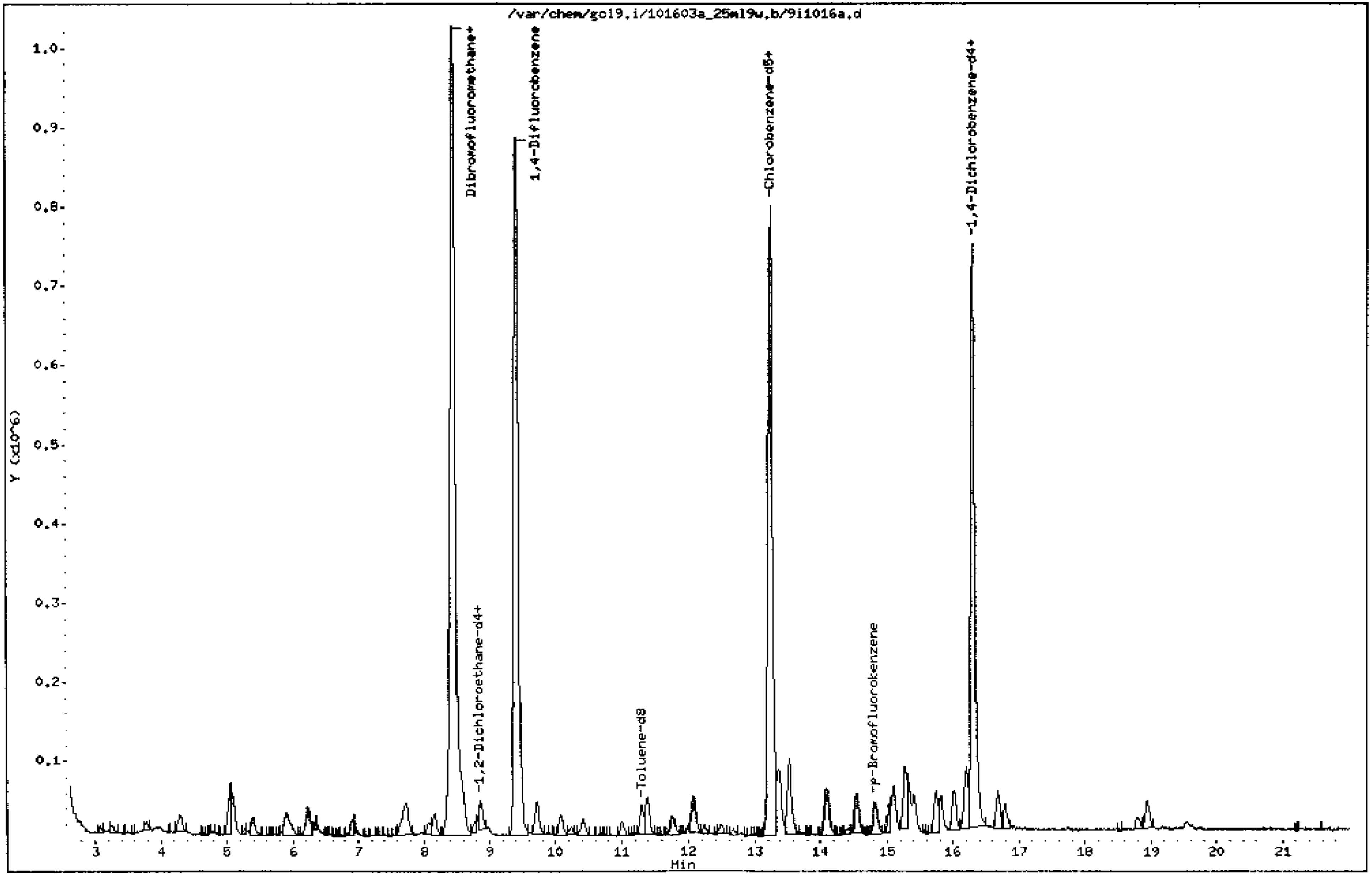
| Curve    | Formula                             | Units        |
|==========|=====================================|==============|
| Averaged | Amt = Rsp/m1                        |  Response    |
| Linear   | Amt = b + Rsp/m1                    |  Response    |
| Quad     | Amt = b + m1*Rsp + m2*Rsp^2         |  Response    |
|__________|_____________________________________|______________|
```

Data File: /var/chem/gc19.i/101603a_25ml9w.b/9i1016a.d
Date : 16-OCT-2003 19:57
Client ID: VSTD0.5
Sample Info: VSTD0.5
Purge Volume: 25.0
Column phase: Cap

Instrument: gc19.i

Operator: EA
Column diameter: 0.53

77



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                      VOLATILE REPORT SW846 METHOD 8260B WATERS
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Inj Date    : 16-OCT-2003 19:57
Operator    : EA                                 Inst ID: gc19.i
Smp Info    : VSTD0.5
Misc Info   : VSTD0.5,1,12
Comment     :  HP 5972 / 5890 GC TEKMAR 3000/2016
Method      : /var/chem/gc19.i/101603a_25ml9w.b/25ml9w.m
Meth Date   : 30-Oct-2003 17:16 manzanol        Quant Type: ISTD
Cal Date    : 17-OCT-2003 02:06                  Cal File: 9i1016j.d
Als bottle: 12                                   Calibration Sample, Level: 1
Dil Factor: 1.00000
Integrator: HP RTE                               Compound Sublist: 02ICAL1.sub
Target Version:  3.50
Processing Host: manatee

Concentration Formula: Amt * DF * Uf * 1/Vo * CpndVariable

     Name          Value             Description
 -------------  ---------------  -----------------------
      DF         1.00000          Dilution Factor
      Uf        25.00000         ng unit correction factor
      Vo        25.00000         Sample Volume purged (mL)

Cpnd Variable                     Local Compound Variable


                                                                              AMOUNTS
                                QUANT SIG                                 CAL-AMT    ON-COL
Compounds                         MASS       RT    EXP RT REL RT  RESPONSE  ( ug/L)   ( ug/L)
---------------------------      ----       --    ------ ------  --------  -------   -------
    1 Dichlorodifluoromethane      85      2.788   2.788 (0.330)    18335   0.50000    1.149
    2 Chloromethane                50      3.086   3.086 (0.365)    17819   0.50000    1.037
    3 Vinyl chloride               62      3.267   3.267 (0.387)    19319   0.50000    0.8496
    5 Bromomethane                 94      3.783   3.783 (0.448)    17611   0.50000    1.470
    6 Chloroethane                 64      3.955   3.955 (0.468)    14909   0.50000    0.4965(a)
    7 Trichlorofluoromethane      101      4.280   4.280 (0.507)    52002   0.50000    0.4558(a)
   11 Trichlorotrifluoroethane    101      5.049   5.049 (0.598)    31731   0.50000    0.4896(a)
   12 1,1-Dichloroethene           96      5.094   5.094 (0.603)    27366   0.50000    0.5276
   19 Methylene chloride           84      5.890   5.890 (0.697)    24854   0.50000    0.6575
   20 Methyl-tert-Butyl Ether      73      6.215   6.215 (0.736)    16987   0.50000    0.5323
   21 trans-1,2-Dichloroethene     96      6.234   6.234 (0.738)    29704   0.50000    0.5302
   25 1,1-Dichloroethane           63      6.912   6.912 (0.818)    47158   0.50000    0.4947(a)
   29 cis-1,2-Dichloroethene       96      7.744   7.744 (0.916)    25756   0.50000    0.5490
   28 2,2-Dichloropropane          77      7.699   7.699 (0.911)    43461   0.50000    0.4953(a)
   33 Bromochloromethane          128      8.069   8.069 (0.955)     7594   0.50000    0.4608(a)
```

10/20/03

```
                                                                                  AMOUNTS
                                    QUANT SIG                                          CAL-AMT    ON-COL
Compounds                              MASS        RT     EXP RT REL RT    RESPONSE    ( ug/L)    ( ug/L)
============================           ====        ==     ====== ======    ========    =======    =======
   36 Chloroform                         83     8.169   8.169 (0.967)     45575    0.50000     0.5028
$  40 Dibromofluoromethane              113     8.386   8.386 (0.992)     29629    0.50000     0.4455(a)
*  41 Pentafluorobenzene                168     8.449   8.449 (1.000)   1707621    10.7700
   39 1,1,1-Trichloroethane              97     8.368   8.368 (0.990)     47521    0.50000     0.4952(a)
   43 1,1-Dichloropropene                75     8.594   8.594 (1.017)     45350    0.50000     0.5231
   42 Carbon tetrachloride              117     8.540   8.540 (0.908)     31433    0.50000     0.3433(aM)
$  46 1,2-Dichloroethane-d4              65     8.874   8.874 (0.943)     11885    0.50000     0.4615(a)
   45 Benzene                            78     8.856   8.856 (0.941)     72011    0.50000     0.5368
   47 1,2-Dichloroethane                 62     8.983   8.983 (0.955)     15257    0.50000     0.5385(M)
*  50 1,4-Difluorobenzene               114     9.408   9.408 (1.000)   1611058    10.7700
   52 Trichloroethene                   130     9.725   9.725 (1.034)     30057    0.50000     0.5045
   54 1,2-Dichloropropane                63    10.068  10.068 (1.070)     22890    0.50000     0.5202
   56 Dibromomethane                     93    10.222  10.222 (1.087)      9805    0.50000     0.4826(aM)
   58 Bromodichloromethane               83    10.412  10.412 (1.107)     29505    0.50000     0.4665(a)
   61 cis-1,3-Dichloropropene            75    11.009  11.009 (1.170)     23768    0.50000     0.4821(a)
$  63 Toluene-d8                         98    11.298  11.298 (1.201)     60409    0.50000     0.4455(a)
   64 Toluene                            92    11.380  11.380 (1.210)     45396    0.50000     0.5036
   65 trans-1,3-Dichloropropene          75    11.750  11.750 (1.249)     15926    0.50000     0.5214
   68 1,1,2-Trichloroethane              97    11.995  11.995 (1.420)      9851    0.50000     0.5132
   70 1,3-Dichloropropane                76    12.230  12.230 (0.924)     11263    0.50000     0.3697(a)
   69 Tetrachloroethene                 166    12.085  12.085 (0.913)     39056    0.50000     0.5284(H)
   72 Dibromochloromethane              129    12.492  12.492 (0.943)     14979    0.50000     0.4391(a)
   73 1,2-Dibromoethane                 107    12.664  12.664 (1.346)     11856    0.50000     0.4873(aM)
   74 1-Chlorohexane                     91    13.188  13.188 (1.561)     39984    0.50000     0.4907(a)
*  75 Chlorobenzene-d5                  117    13.243  13.243 (1.000)   1023433    10.7700
   76 Chlorobenzene                     112    13.279  13.279 (1.003)     48387    0.50000     0.5228
   78 1,1,1,2-Tetrachloroethane         131    13.387  13.387 (1.011)     17498    0.50000     0.4486(a)
   77 Ethylbenzene                      106    13.369  13.369 (1.010)     26154    0.50000     0.5111
   79 p,m-Xylene                         91    13.541  13.541 (1.023)    149800    1.00000      1.053
   80 o-Xylene                           91    14.084  14.084 (1.063)     65167    0.50000     0.5132
   81 Styrene                           104    14.111  14.111 (1.066)     39681    0.50000     0.4964(a)
   82 Bromoform                         173    14.409  14.409 (1.088)      5267    0.50000      1.061(M)
   83 Isopropylbenzene                  105    14.545  14.545 (0.892)     92754    0.50000     0.5122
$  86 p-Bromofluorobenzene               95    14.825  14.825 (1.119)     38936    0.50000     0.5028
   88 1,1,2,2-Tetrachloroethane          83    15.033  15.033 (0.922)     10006    0.50000     0.5098
   87 Bromobenzene                      156    15.033  15.033 (0.922)     17639    0.50000     0.4781(a)
   90 1,2,3-Trichloropropane            110    15.115  15.115 (0.927)      2103    0.50000     0.4715(a)
   89 n-Propylbenzene                    91    15.106  15.106 (0.927)    111268    0.50000     0.5062
   92 2-Chlorotoluene                    91    15.259  15.259 (0.936)     74397    0.50000     0.5150
   93 1,3,5-Trimethylbenzene            105    15.332  15.332 (0.941)     61900    0.50000     0.4844(a)
   94 4-Chlorotoluene                    91    15.413  15.413 (0.946)     60829    0.50000     0.4653(a)
M  84 1,2-Dichloroethene (total)         96                               55460    1.00000      1.078
   95 tert-Butylbenzene                 119    15.739  15.739 (0.966)     69520    0.50000     0.4993(a)
   96 1,2,4-Trimethylbenzene            105    15.820  15.820 (0.971)     56273    0.50000     0.4891(a)
   98 sec-Butylbenzene                  105    16.010  16.010 (0.982)    104335    0.50000     0.5041
  100 1,3-Dichlorobenzene               146    16.218  16.218 (0.995)     35029    0.50000     0.5248
   99 p-Isopropyltoluene                119    16.182  16.182 (0.993)     90332    0.50000     0.5777
```

```
                                                                                 AMOUNTS
                                    QUANT SIG                                   CAL-AMT    ON-COL
Compounds                             MASS      RT     EXP RT REL RT  RESPONSE  ( ug/L)    ( ug/L)
==================================    ====      ==     ====== ======  ========  =======    =======
* 101 1,4-Dichlorobenzene-d4          152     16.299  16.299 (1.000)   459620   10.7700
  102 1,4-Dichlorobenzene             146     16.336  16.336 (1.002)    41045   0.50000    0.5747
  103 n-Butylbenzene                   91     16.679  16.679 (1.023)    66725   0.50000    0.4547(a)
  104 1,2-Dichlorobenzene             146     16.788  16.788 (1.030)    27789   0.50000    0.5534
  105 1,2-Dibromo-3-Chloropropane      75     17.764  17.764 (1.090)     2182   0.50000    0.8606(M)
  107 1,2,4-Trichlorobenzene          180     18.786  18.786 (1.153)    15923   0.50000    0.5029
  108 Hexachlorobutadiene             225     18.940  18.940 (1.162)    19396   0.50000    0.4557(a)
  109 Naphthalene                     128     19.184  19.184 (1.177)     5984   0.50000    0.7874
  110 1,2,3-Trichlorobenzene          180     19.528  19.528 (1.198)     9199   0.50000    0.4178(a)
M 112 Xylene (total)                   91                              214967   0.50000     1.693
```

QC Flag Legend

a - Target compound detected but, quantitated amount
    Below Limit Of Quantitation(BLOQ).
M - Compound response manually integrated.
H - Operator selected an alternate compound hit.

Data File Name: 9i1016a.d
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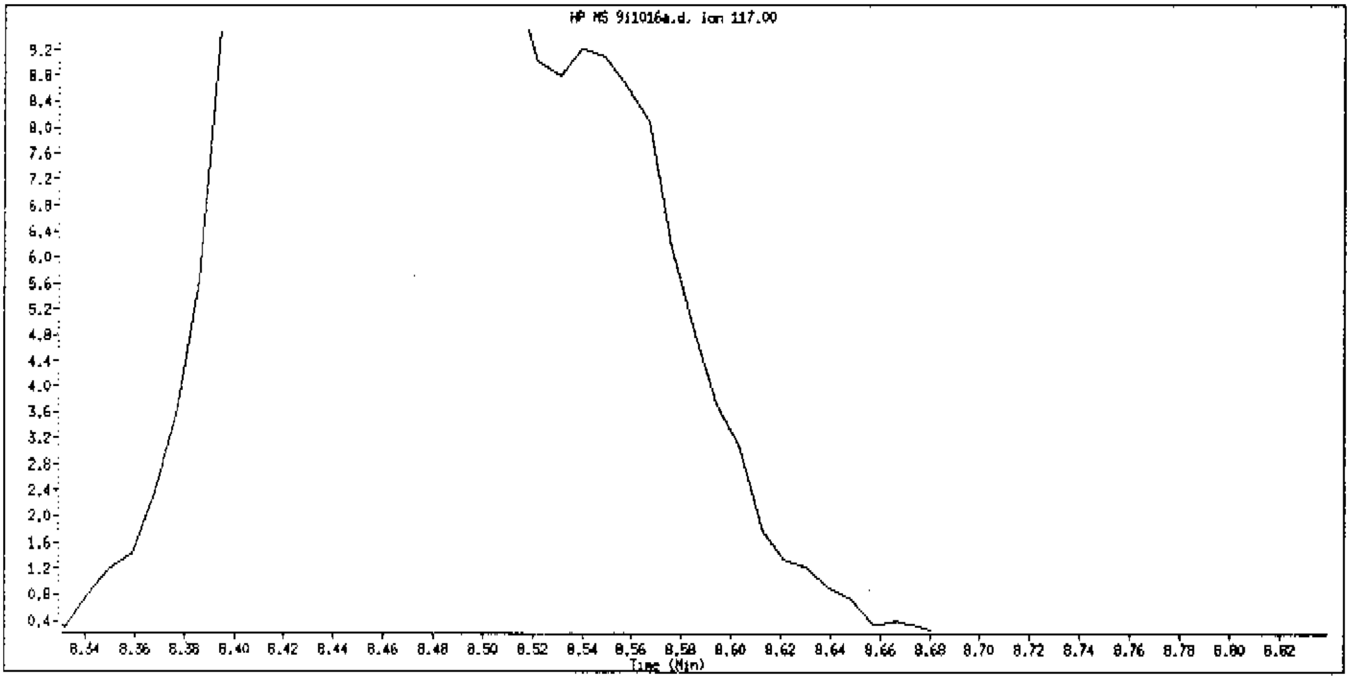
Instrument ID: gc19.i
Client ID: VSTD0.5
Compound Name: Carbon tetrachloride
CAS #: 56-23-5
Report Date: 10/30/2003



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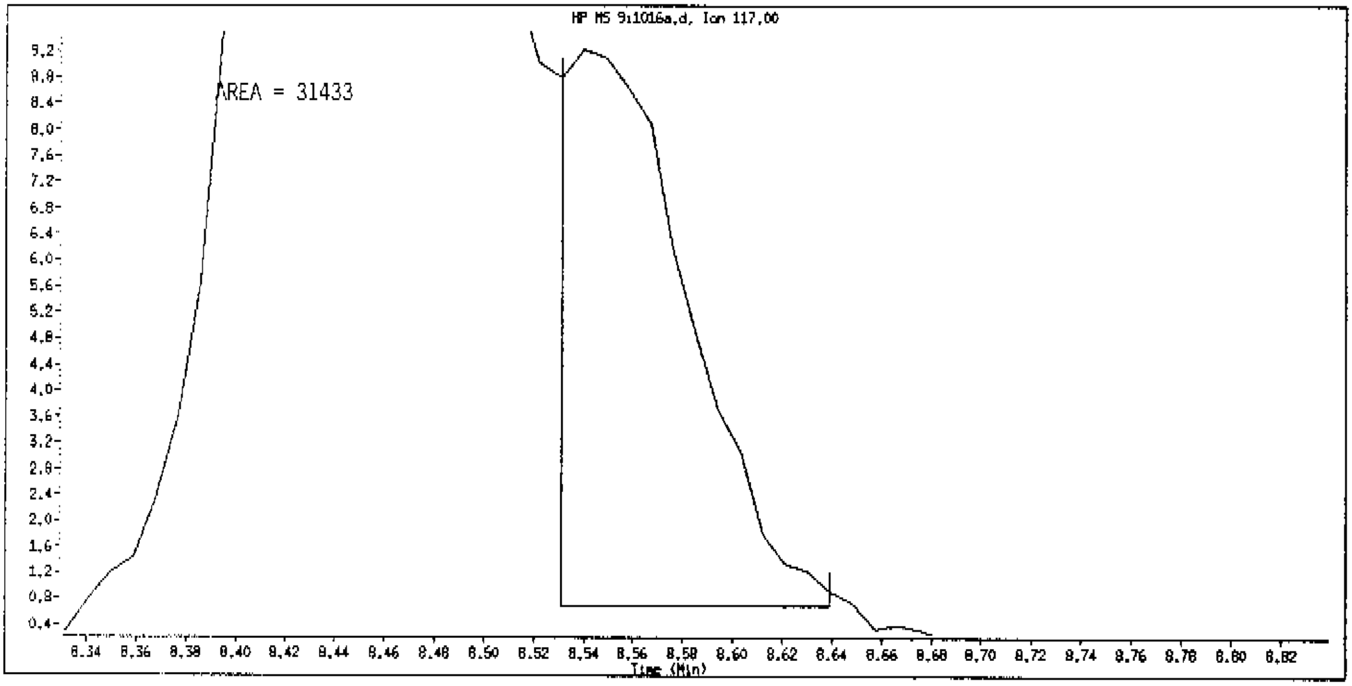

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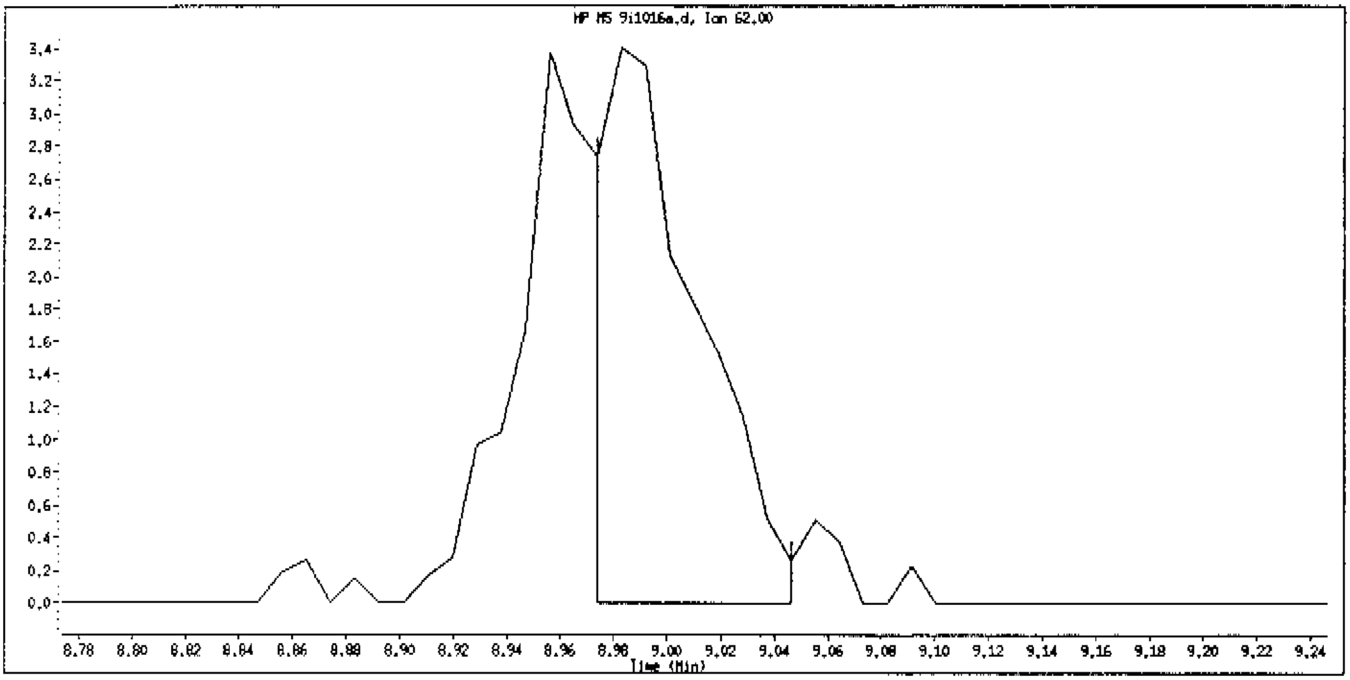
Manually Integrated By: manzanol
Manual Integration Reason: MI Peak missed

3/31 12.05

10/30/03

Data File Name: 9i1016a.d
Inj. Date and Time: 16-OCT-2003 19:57
Instrument ID: gc19.i
Client ID: VSTD0.5
Compound Name: 1.2-Dichloroethane
CAS #: 107-06-2
Report Date: 10/30/2003



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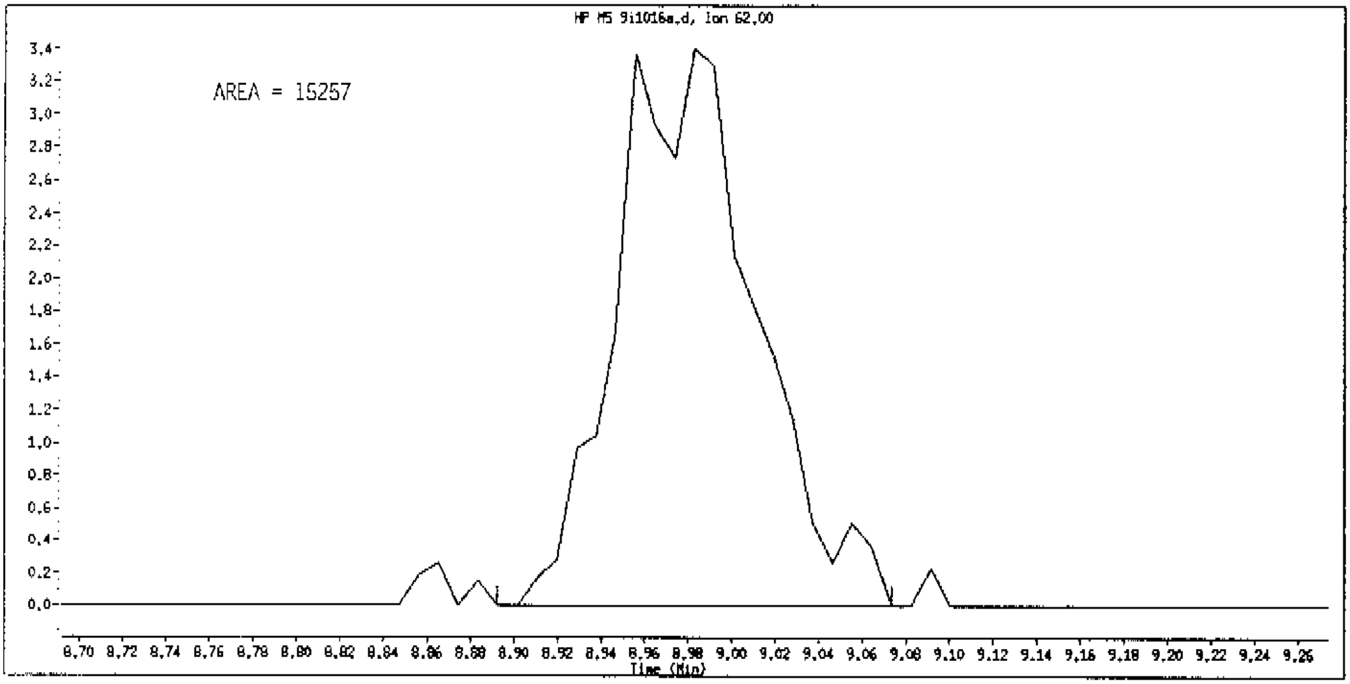

Manual Integration

Manually Integrated By: manzanol
Manual Integration Reason: MS Misintegration of peak by the Data System

12/2/03

10/30/03

Data File Name: 9i1016a.d
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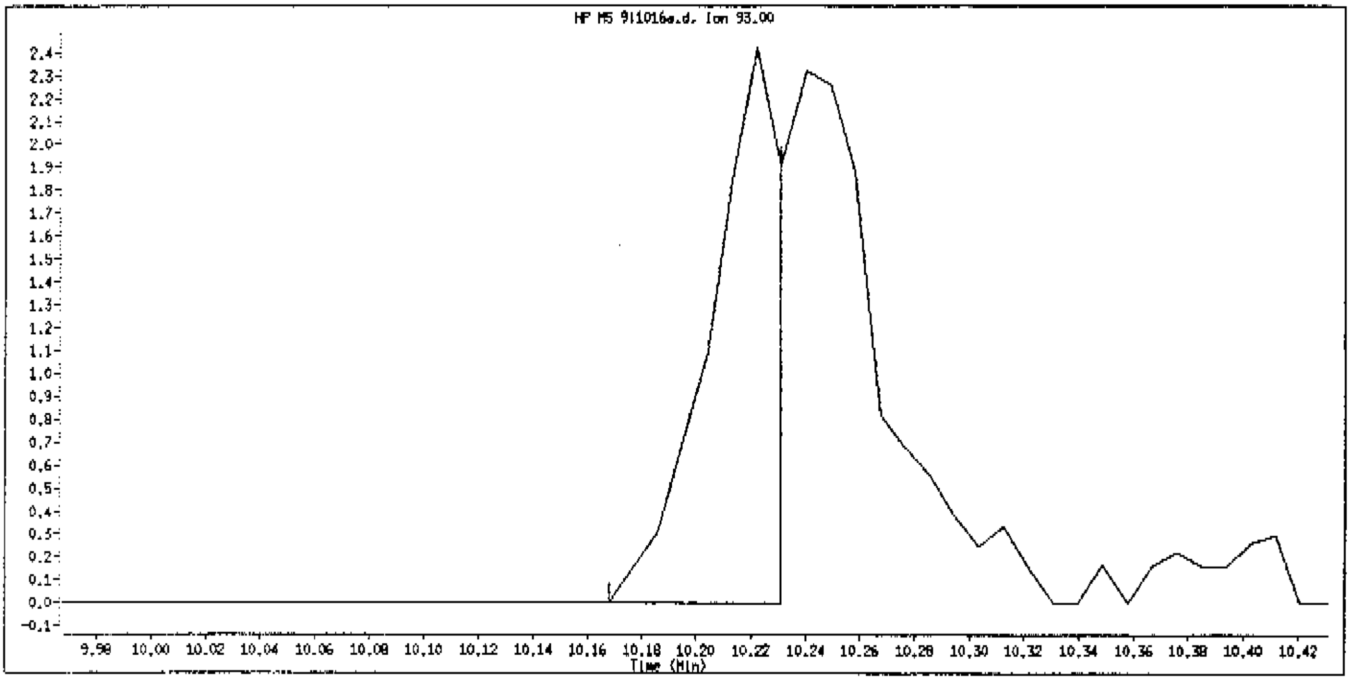
Instrument ID: gc19.i
Client ID: VSTD0.5
Compound Name: Dibromomethane
CAS #: 74-95-3
Report Date: 10/30/2003



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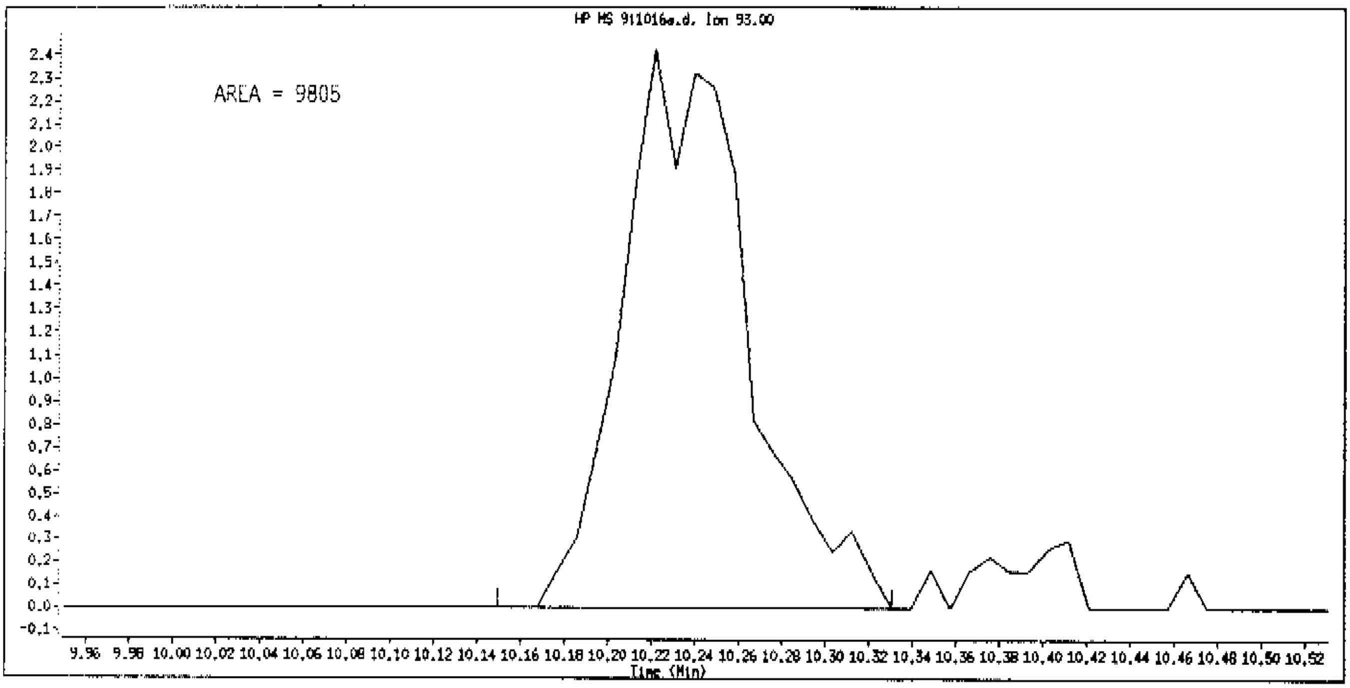

Manual Integration

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Manual Integration Reason: M5 Misintegration of peak by the Data System

10/30/03

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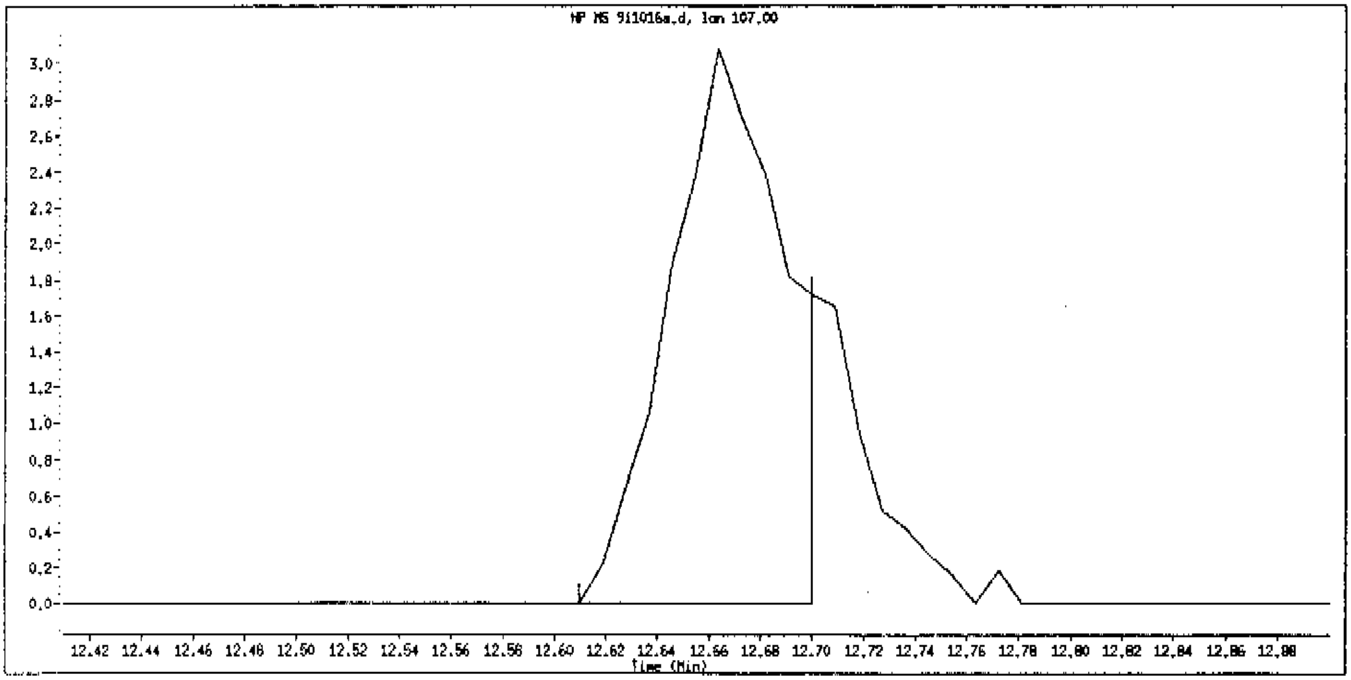
Report Date: 10/30/2003



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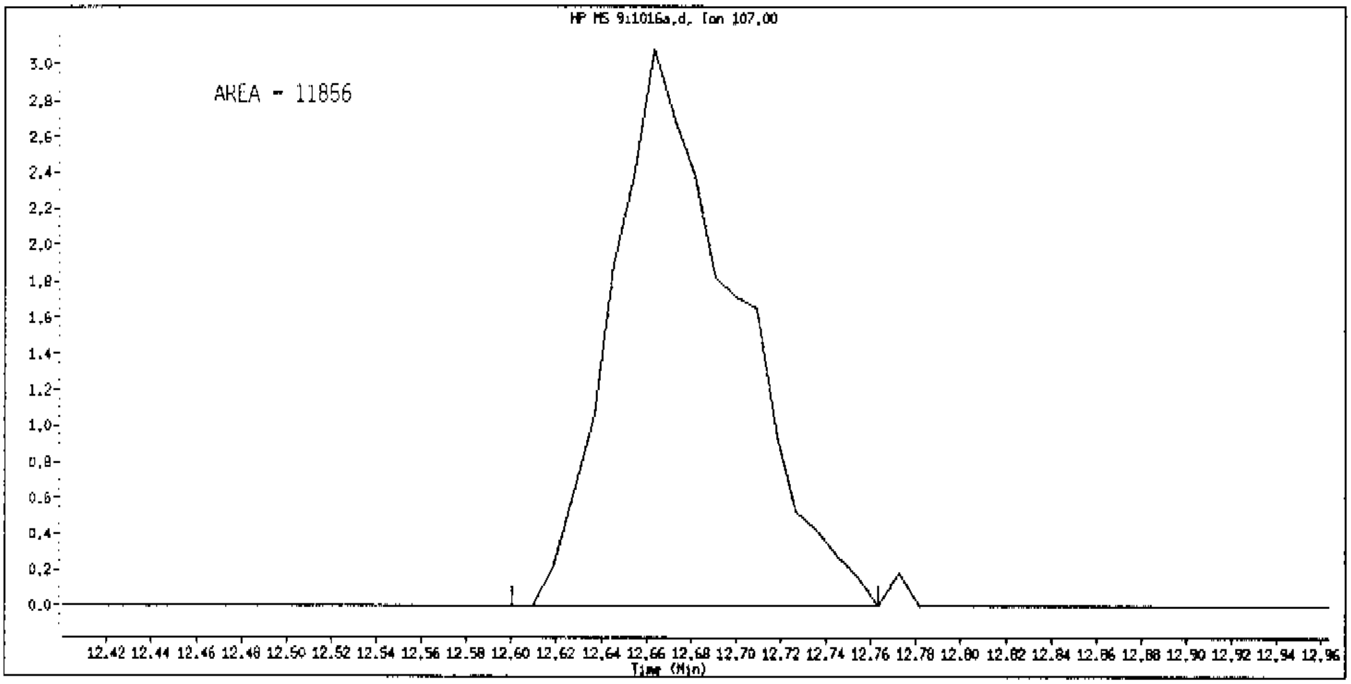

Manual Integration

Manually Integrated By: manzanol
Manual Integration Reason: M5 Misintegration of peak by the Data System

CMG 12/3/03

L 12/30/03

Data File Name: 9i1016a.d
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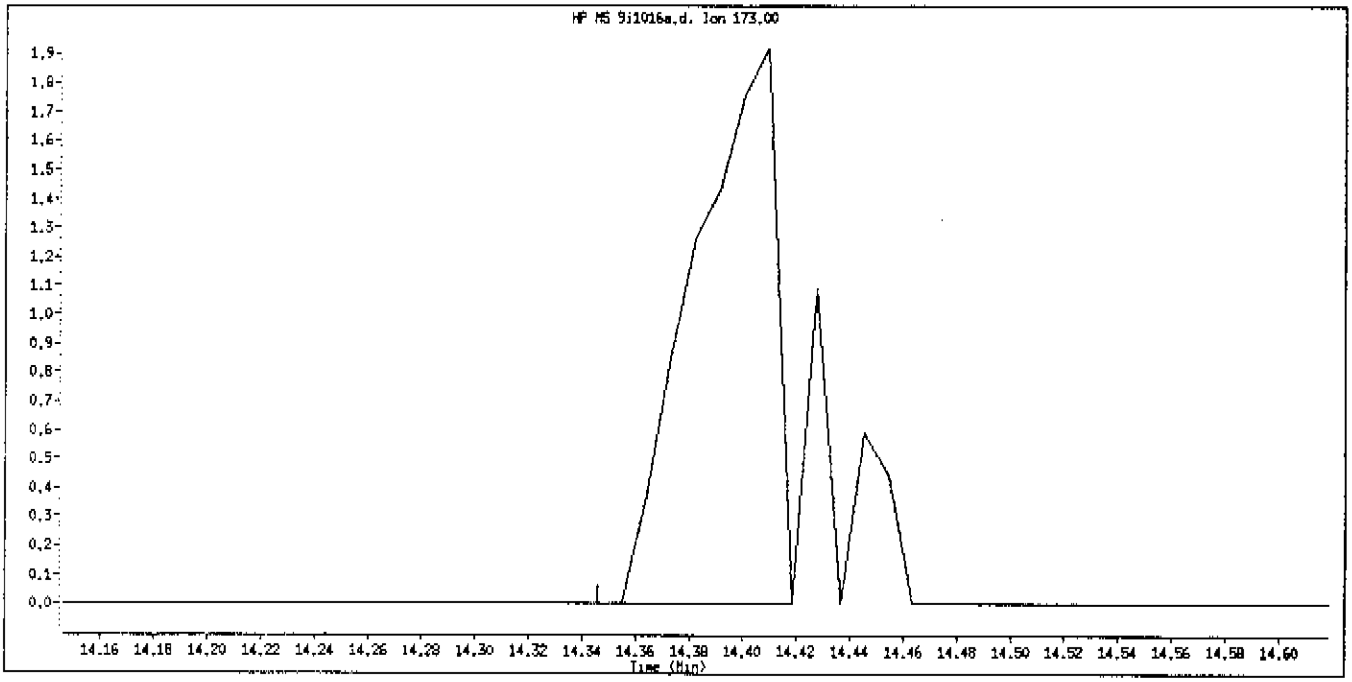
Client ID: VSTD0.5
Compound Name: Bromoform
CAS #: 75-25-2
Report Date: 10/30/2003



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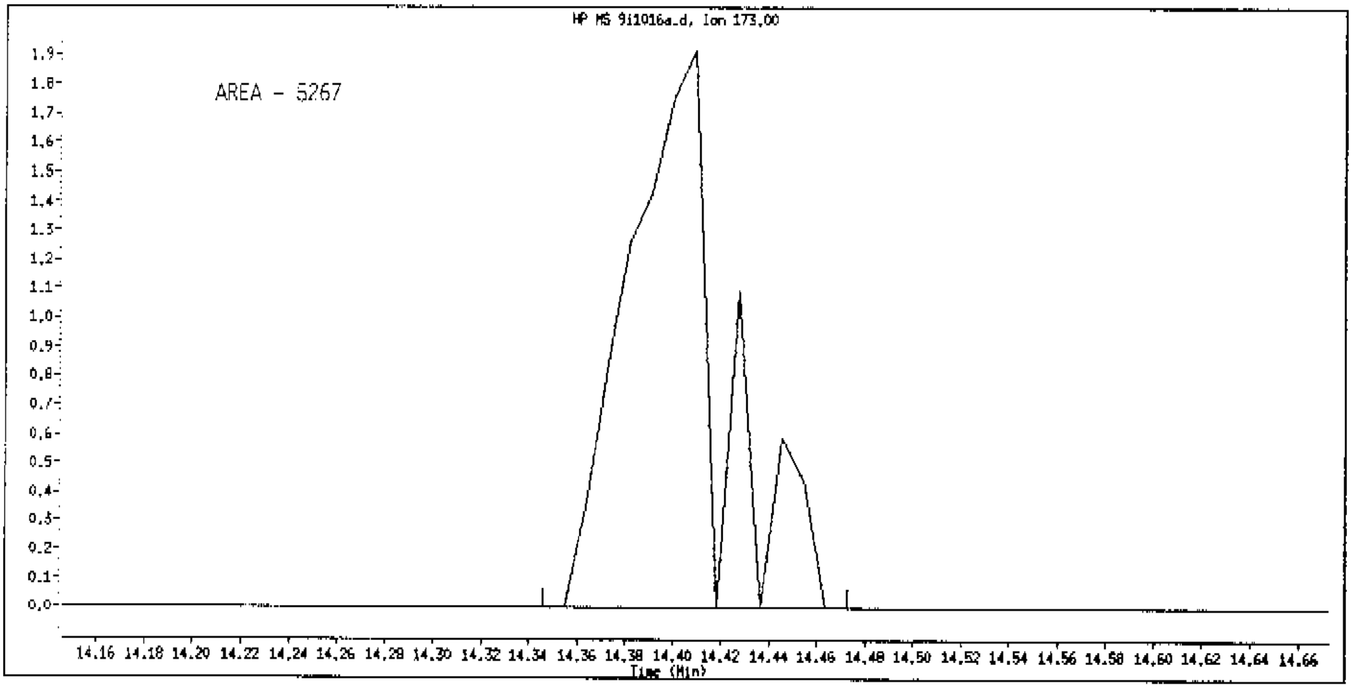

Manual Integration

Manually Integrated By: manzanol
Manual Integration Reason: M5 Misintegration of peak by the Data System

10/30/03

What's Inside?

This fact sheet describes the environmental investigations and proposed cleanup action at the Former Lockbourne Air Force Base Landfill, near Lockbourne in Columbus, Ohio.

You are invited to a public meeting...

... to learn more about the Proposed Plan for the former landfill. The U.S. Army Corps of Engineers, and the Ohio Environmental Protection Agency will be there to listen to your comments.

When: *Thursday April 28, 2011*
7:30 to 9:30 p.m.

Where: *Hamilton Township Community Center*
6400 Lockbourne Road
Lockbourne, OH 43137
(614) 491-3963

If you have questions about the meeting or need specialized assistance to participate, please contact Brooks Evens at Andrew.B.Evens@usace.army.mil or (502) 315-6335 before April 22, 2011.

U.S. Army Corps of Engineers
CELRL–PAO
P.O. Box 59
Louisville, KY 40201-0059

Place
Stamp
Here

ES022211123212MKE

Former Lockbourne Air Force Base Landfill

Columbus, Ohio
April 2011

U.S. ARMY CORPS OF ENGINEERS **Building Strong ®**

The U.S. Army Corps of Engineers (USACE) invites the public to review and comment on the proposed cleanup of the former Lockbourne Air Force Base (AFB) Landfill. The Proposed Plan, which describes the recommended cleanup actions, will be available for public review and comment from April 21 through May 21, 2011, and will be discussed at a public meeting on April 28, 2011.

Site Description

The former Lockbourne Air Force Base (AFB) Landfill was used for waste disposal from approximately 1951 until 1979. Waste products included general trash from base housing and office buildings, construction and demolition debris, and lime sludge from the base water treatment plant. The landfill might also have received pesticides and herbicides, ammunition, airplane parts, and hazardous materials.

The Department of Defense (DoD) later transferred the property to the Rickenbacker Port Authority, which is now the Columbus Regional Airport Authority. As a result, the landfill is considered a Formerly Used Defense Site (FUDS).

The site is located northwest of the Rickenbacker International Airport and Rickenbacker Air National Guard Base, and to the east of the village of Lockbourne. It is bordered by Vause Road to the north, Tank Truck Road to the southeast, and railroad tracks to the southwest. Big Walnut Creek is located approximately 0.75 mile west of the site.

Project History

DoD is responsible for evaluating and cleaning up DoD-generated environmental contamination at FUDS properties. The U.S. Army oversees the FUDS program for DoD. USACE manages the evaluation and cleanup of these properties.

USACE is the lead agency for environmental investigations at the former Lockbourne AFB Landfill site. The Ohio Environmental Protection Agency (Ohio EPA) provides regulatory oversight.

A series of investigations were conducted at the former landfill site. Site media, such as soil, groundwater, surface water, sediment, landfill seeps, and landfill gas were sampled and analyzed for chemicals potentially associated with landfill activities. This data was used to assess risks and to develop the proposed cleanup action.

The site was divided into two investigation areas, Area of Concern (AOC) 1 and AOC 2 (see Figure 1). AOC 1 is approximately 105 acres and occupies the western half of the parcel where waste disposal occurred. AOC 2 is approximately 40 acres and is located on the eastern side of the site. Although, there is scattered debris at AOC 2, no buried waste was found.

Key findings of the investigations include:

- Contaminants associated with waste materials in the landfill are primarily transported away from the site through surface runoff and soil erosion during heavy rainstorms.
- Exposure to contaminants in soil at the site could pose risks to human health and wildlife.
- Exposure to contaminants in groundwater could pose human health risks. However, contaminants are not likely to migrate far from the site in groundwater because there is limited groundwater movement. Also, most of the contaminants do not dissolve easily in water and have a tendency to bind strongly to soil, which also limits their movement away from the site.

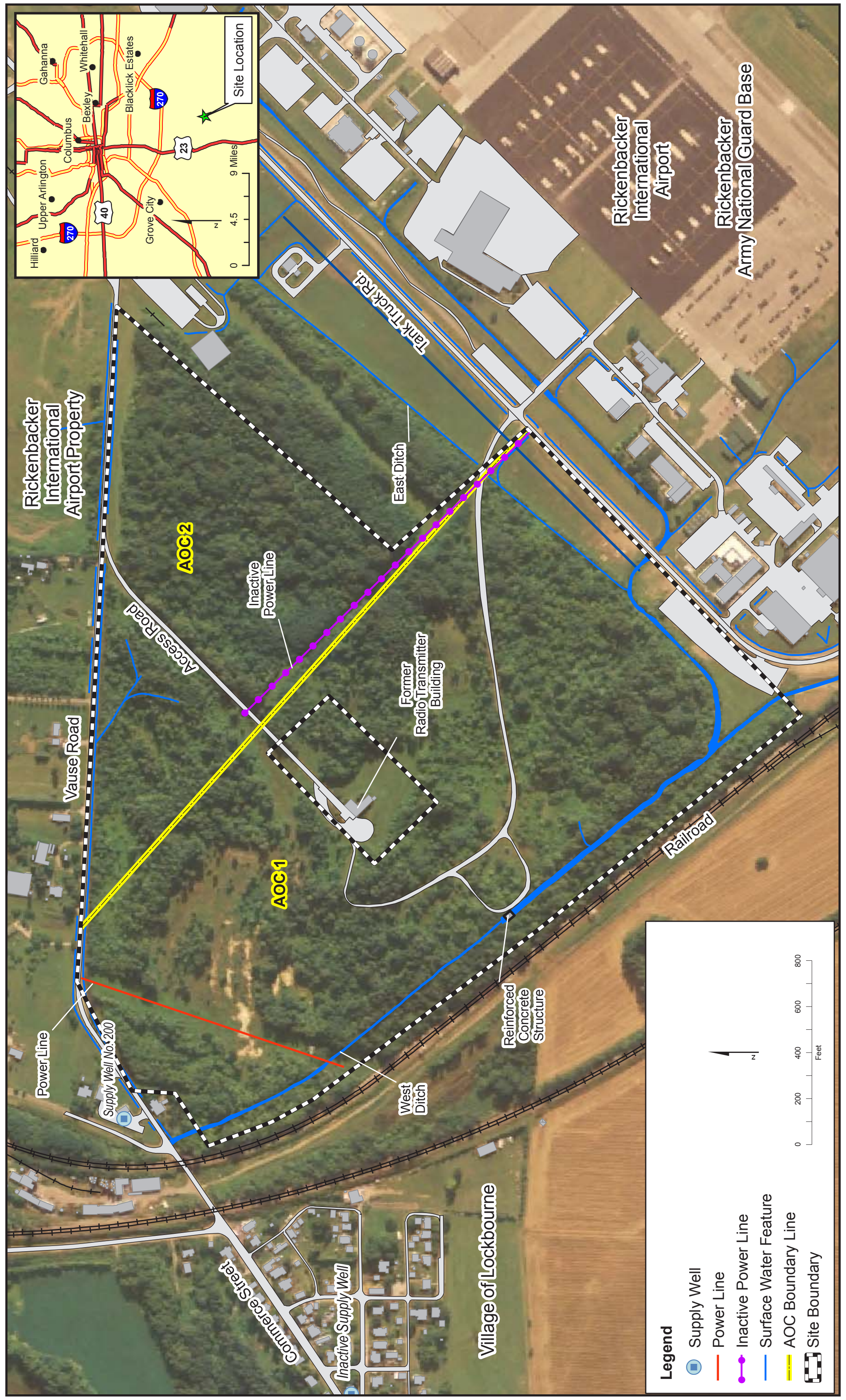

Figure 1 – Site Location and Features

- Groundwater at the site is not used for drinking water. The village of Lockbourne receives drinking water from the Columbus municipal water system, although some residents still use private wells.

Proposed Plan

USACE investigated the DoD-generated environmental contamination at the former Lockbourne AFB Landfill and is proposing to clean up the site.

The Proposed Plan describes the assessment of human health and ecological risks, cleanup alternatives evaluated, and the reasons for the proposed remedy. The proposed remedy includes the tasks below:

- The waste would be consolidated into one smaller area within AOC 1.
- Soil cover and vegetated topsoil would be placed over the area containing waste to minimize exposure to the waste and associated contamination.
- Long-term management activities would include additional sampling and inspections to evaluate protectiveness of the remedy after implementation.
- Institutional controls would be placed on the property to limit land and groundwater use and prevent intrusive activities on the landfill cover to minimize risk of exposure.

The other two cleanup alternatives evaluated included 1) no action and 2) construction of a compacted clay cap with long-term management activities and institutional controls.

Public Involvement

The public is encouraged to review and comment on the Proposed Plan. The 30-day public comment period is April 21 until May 21, 2011.

USACE, in coordination with Ohio EPA, will make its final decision after reviewing and considering comments submitted during the 30-day public comment period. All Proposed Plan comments received during the public comment period will be summarized, and responses will be provided in the Responsiveness Summary section of the Decision Document, which will present the selected cleanup action.

A soil cover is placed over a landfill to minimize exposure to waste and migration of contaminated surface soil via surface water runoff.

The Proposed Plan and supporting documents are available for public review at:

Columbus Metropolitan Library, Southeast Branch
3980 South Hamilton Road
Groveport, OH 43125
(614) 645-2275

Hours: Monday – Friday 9 a.m. to 9 p.m.
Friday – Saturday 9 a.m. to 6 p.m.
Sunday – 1 p.m. to 5 p.m.

The Proposed Plan and information used to recommend the preferred cleanup alternative is also available online at: http://bit.ly/LockbourneAFB.

Written comments should be mailed (postmarked) by May 21, 2011, to:

Brooks Evens
U.S. Army Corps of Engineers
CELRL-ED-E-E
P.O. Box 59
Louisville, KY 40201-0059
Andrew.B.Evens@usace.army.mil

Final Remedial Design

Former Lockbourne Air Force Base Landfill
Columbus, Ohio

FUDS Property Number G05 OH0007
Project Number G05 OH000703

Prepared for:

US Army Corps of Engineers
Louisville District

Contract Number W91236-07-D-0012
Delivery Order Number CY01

April 2012

STATEMENT OF TECHNICAL REVIEW

Former Lockbourne Air Force Base Landfill

Final Remedial Design

The CH2M HILL Team has completed the technical review of the submittal of the Former Lockbourne Air Force Base Landfill Final Remedial Design. Notice is hereby given that an independent technical review has been conducted that is appropriate to the level of risk and complexity inherent in the project. During the independent technical review, compliance with established policy principles and procedures, utilizing justified and valid assumptions, was verified. This included review of assumptions; methods, procedures and material used in analyses; the appropriateness of data used and level of data obtained; and reasonableness of the results including whether the product meets the customer's needs consistent with the law and existing USACE policy.

Technical Reviewer	Signature	Date of Review
Colleen Reilly	Colleen Reilly	22 April 2012

Project Manager	ITR Leader
Tiffany Swoveland Chapman	Colleen Reilly
	Colleen Reilly

Final Remedial Design

Former Lockbourne Air Force Base Landfill

FUDS Property Number G05 OH0007
Project Number G05 OH000703

Prepared for

U.S. Army Corps of Engineers
Louisville District
Contract Number W91236-07-D-0012
Delivery Order Number CY01

April 2012

STATE OF OHIO
SCOTT G.
HUTSELL
ENGINEER
No. 72855
LICENSED PROFESSIONAL ENGINEER

Scott Hutsell

Preface

This remedial design presents the details for conducting the remedial action for the former Lockbourne Air Force Base Landfill, Columbus, Franklin County, Ohio. The report was prepared by CH2MHILL in accordance with U.S. Army Corps of Engineer Contract No. W91236-07-D-0012 under Delivery Order No. CY01. This document comprises a basis of design, construction schedule, design calculations, design drawings, technical specifications, cost estimate, draft construction quality assurance/quality control plan, green and sustainable remediation report, compliance plan, and the long-term management strategy.

Basis of Design

Remedial Design: Former Lockbourne Air Force Base Landfill

FUDS Property Number G05 OH0007
Project Number G05 OH000703

Prepared for

U.S. Army Corps of Engineers
Louisville District
Contract Number W91236-07-D-0012
Delivery Order Number CY01

April 2012

Contents

Appendices

Tables

Acronyms and Abbreviations

AASHSTO	American Association of State Highway and Transportation Officials
AEP	American Electric Power
AFB	Air Force Base
AOC	Area of Concern
ARARs	Applicable or Relevant and Appropriate Requirement
ASTM	American Society for Testing and Materials
BOD	basis of design
bgs	below ground surface
BMPs	best management practice
CFR	Code of Federal Regulations
COCs	constituents of concern
DoD	Department of Defense
ESC	erosion and sediment control
GSR	green and sustainable remediation
HDPE	high density polyethylene
IDA	intermediate depth aquifer
K	hydraulic conductivity
LTM	long-term management
OAC	Ohio Administrative Code
Ohio EPA	Ohio Environmental Protection Agency
PCBs	polychlorinated biphenyls
PVC	polyvinyl chloride
QA/QC	quality assurance/quality control
RCRA	Resource Conservation and Recovery Act
RD	remedial design
UWBZ	upper water-bearing zone
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency

SECTION 1

Introduction

This basis of design (BOD) presents the remedial design (RD) elements and design criteria for the selected remedy at Area of Concern (AOC) 1 and AOC 2 at the former Lockbourne Air Force Base (AFB) Landfill in Columbus, Franklin County, east of the village of Lockbourne, Ohio. The Department of Defense (DoD) used the site to dispose of waste from the former AFB. The Decision Document (CH2M HILL 2012) identifies the remedy for the site.

1.1 Purpose and Scope

The U.S. Army Corps of Engineers (USACE), in coordination with the Ohio Environmental Protection Agency (Ohio EPA), chose a remedy for both AOCs in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act, as amended in 1986 by the Superfund Amendments and Reauthorization Act, and the National Oil and Hazardous Substances Pollution Contingency Plan. The selected remedy for AOC 1 is the presumptive remedy for landfills. The containment presumptive remedy consists of waste consolidation, construction of a soil cover, long-term management (LTM), and institutional controls. The selected remedy for AOC 2 is implementation of an institutional control that will be implemented through the conveyance of an environmental covenant.

The purpose of this report is to present the RD elements for the selected remedies, which are presented in Section 3. These elements include a summary of the project background, site characteristics, and landfill cover performance standards; RD components, such as description, remedial action construction schedule (Appendix A), design calculations (Appendix B), design drawings (Appendix C), technical specifications (Appendix D), cost estimate (Appendix E), Construction Quality Assurance/Quality Control (QA/QC) Plan (Appendix F); Green and Sustainable Remediation (GSR) Report (Appendix G); and the preliminary framework of the LTM strategy (Appendix H). The cost estimate was prepared for the USACE and is not provided because of remedial action procurement activities.

1.2 Schedule for Landfill Cover Construction

The USACE plans to complete remedial construction procurement activities based on available funding. Remedial action construction will commence after procurement and planning activities are complete. Appendix A contains an example construction schedule with the general construction tasks anticipated for this type of project. The construction start date shown in the schedule is based on the anticipated award date of the remedial action contract.

SECTION 2

Project Background

The site was used to dispose of wastes generated at the former Lockbourne AFB from 1951 to 1979. The types of waste disposed of included general trash from base housing and other administrative buildings, construction and demolition debris, and lime sludge from the base water treatment plant. The landfill may also have received pesticides and herbicides, ammunition, airplane parts, and hazardous materials. Wastes reportedly were buried in trenches up to 10 feet below ground surface (bgs) and on the ground surface (Law Engineering and Environmental Services 1995; CH2M HILL 2009; 2011a).

Between 1986 and 2011, investigations were conducted to evaluate environmental contamination. During the investigations, landfill gas, soil, sediment, surface water, seep, and groundwater samples were collected. Some investigations included taking geophysical measurements and digging test pits to determine extent of buried waste at the site. As a result of the investigations, contaminants such as polynuclear aromatic hydrocarbons, semivolatile organic compounds, polychlorinated biphenyls (PCBs), dioxins/furans, and metals were determined to be constituents of concern (COCs) in soil, surface water, sediment, or groundwater.

The site is divided into two investigation areas (Sheet 3 of the design drawings). AOC 1 covers roughly 105 acres on the western half of the site where waste disposal occurred. AOC 2 covers roughly 40 acres on the eastern side of the site. Although there is scattered inert debris at AOC 2 (for example, construction and demolition debris), historical investigations indicate AOC 2 was not used for waste disposal. However, because of the shift in boundary between AOC 1 and AOC 2, there is an incidental amount of waste in AOC 2 that will be addressed under AOC 1. The waste in AOC 2 will be gathered and placed in the landfill at AOC 1.

2.1 Existing Site Conditions

This section describes current site features, including topography, drainage, geology, hydrogeology, wetlands, climate, and groundwater and surface water use.

2.1.1 Site Topography

The site is located in the Central Lowland Province, which is characterized by low relief and elevation, in the western half of Ohio. The Central Lowland Province consists of the Lake Plain and Till Plains physiographic sections. The site lies within the Till Plains section of the Central Lowland Province. The Till Plains are extensive areas with a flat to slightly undulating terrain (National Cooperative Soil Survey 1980).

Scrub and old field vegetation occur in the northwestern corner of the site and in small areas in the southern half. The land surface is uneven, with land elevation ranging from 700 to 735 feet above mean sea level. Water sometimes collects in the low areas after rainfall.

2.1.2 Drainage

Surface water from the site drains to a man-made perimeter ditch along the eastern and western boundaries of the site and ultimately to Big Walnut Creek. Big Walnut Creek lies 0.75 mile (at its closest point) west of the site. The part of the drainage ditch southeast of the site is referred to as the East Ditch, the part to the southwest as the West Ditch. The West Ditch contains a reinforced concrete structure formerly used by the Lockbourne AFB as a flow control structure for surface water runoff (Engineering Science 1992).

The greater Columbus area lies in the center of the state and in the drainage area of the Ohio River. The site is within the Scioto River watershed. The Scioto and Olentangy rivers flow through the city. The elevation of the City of Columbus averages 833 feet above mean sea level, and the average elevation of the site is 725 feet.

2.1.3 Geology

The site is characterized by roughly 200 feet of Pleistocene glacial drift that fills a preglacial bedrock valley (Noble and Korsok 1995). Shales of the Ohio and Olentangy formations and limestones of the Columbus and Delaware formations underlie the area. The shale and limestone bedrock are Devonian Age. The surficial tills are mainly associated with ground moraine. Alluvial deposits are found in association with Walnut Creek and Big Walnut Creek. The soils near the site consist of medium-textured glacial till and glacial outwash, mainly derived from limestone and dolomite. The site is underlain by an upper silty clay from the ground surface to depths ranging from approximately 55 feet to more than 80 feet bgs. Sand and gravel deposits occur below the silty clay, followed by a clay unit at a depth of roughly 130 feet bgs. Shale and limestone bedrock generally are encountered at 200 feet bgs.

The U.S. Department of Agriculture–Soil Conservation Service has described the soils near the site as being of the Crosby series and the Kokomo series (National Cooperative Soil Survey 1980). The Crosby series consists of deep, somewhat poorly drained, slowly permeable soils formed in high-lime glacial till on uplands at a slope ranging from 0 to 6 percent. The Kokomo series consists of deep, very poorly drained, moderately slowly permeable soils formed in high-lime Wisconsin Age glacial till on uplands at a slope ranging from 0 to 2 percent.

2.1.4 Hydrogeology

The hydrogeologic setting of the site is characterized by the presence of three water-bearing zones each separated by relatively impermeable clay. The *Phase II Site Investigation Report* designates them as the upper water-bearing zone (UWBZ), intermediate depth aquifer (IDA), and the deep sand aquifer (Program Management Company 2000).

UWBZ groundwater exists at depths ranging from 4 to 16 feet bgs in interbedded sand lenses of the upper silty clay unit. Groundwater flow within the UWBZ is generally toward the west-southwest with a horizontal gradient of 0.0075 foot per foot. The potentiometric surface for the UWBZ is presented in the LTM strategy (Appendix H, Figure 2). The hydraulic conductivity values (K) derived from slug testing of the shallow wells range from 1 to 28 feet per day. Based on review of previous documents and topography, the UWBZ likely discharges to the East and West Ditches and to Big Walnut Creek. A gray clay layer appears to be laterally continuous throughout the site where its thickness is more than 20 feet and is believed to be an effective aquitard (a zone within the earth that restricts the flow of groundwater from one aquifer to another) between the shallow water-bearing zone and the lower water-bearing zones.

The IDA is present in the sand and gravel deposits at an estimated depth of 50 to 130 feet bgs and is considered a confined water-bearing zone. The groundwater flow in the IDA is generally toward the west-southwest with a horizontal gradient of 0.004 foot per foot. The potentiometric surface for the IDA is presented in the LTM strategy (Appendix H, Figure 3).The K values derived from slug testing of the IDA wells range from 0.5 to 18 feet per day. The K values derived from vertical and horizontal falling head permeability testing conducted in the laboratory on IDA groundwater samples range from 0.0001 to 0.1 foot per day. The IDA discharge points will be evaluated as part of long-term management. A silt and clay unit roughly 130 feet bgs separates the IDA from the deep sand aquifer (Engineering Science 1992).

2.1.5 Wetlands

Five wetlands and two water bodies are present at the site (CH2M HILL 2011b). Table 2-1 summarizes the characteristics for each wetland. The two water bodies are the East Ditch and the West Ditch. Sheet 3 of the design drawings shows the general locations and limits of wetlands and water bodies identified in May 2011. It is anticipated that one or more wetlands may be impacted by remedial action construction activities; therefore, actual wetland boundaries will be surveyed and staked before construction can begin. Coordination with USACE and Ohio EPA will be required if the proposed remediation will affect wetlands or water bodies. Also, measures will be implemented to limit wetland impacts as much as practicable. Wetland disturbance must meet the substantive provisions of applicable or relevant and appropriate water quality requirements such as those in Sections 401 and 404 of the Clean Water Act.

TABLE 2-1
Wetlands within the Site
Former Lockbourne AFB Landfill Basis of Design

Wetland	Feature ID	Latitude/ Longitude	Cowardin Classification[a]	Wetland Area	ORAM Score	Ohio EPA Wetland Category[b]	General Condition	Hydrological Connection
1	A	39.8113/ 82.959	PF01	7.86	48.5	2	Successional woodland	Connected to Big Walnut Creek by a roadside ditch
2	C	39.80962/ 82.9557	PF01	3.36	50.5	2	Successional woodland	Isolated
3	D	39.81043/ 82.95421	PF01	0.22	41	2	Successional woodland	Isolated
4	E	39.81062/ 82.95725	PF01/PSS1	0.79	41.5	2	Successional woodland, scrub	Connected to Wetland A by culvert, then to Big Walnut Creek by a roadside ditch
5	F	39.81128/ 82.9554	PF01	0.38	42	2	Successional woodland	Isolated

[a] PFO1 = palustrine forested, deciduous; PSS = palustrine scrub-shrub.
[b] Based on ORAM score, in accordance with Ohio EPA (2000).

2.1.6 Climate

The greater Columbus area lies in an area of dynamic weather. Cold air masses from central and northwest Canada frequently invade the region. Tropical Gulf masses often reach central Ohio during the summer, and to a much lesser extent in the fall and winter. Rivers and creeks provide variations in the microclimate of the area, contributing to the formation of shallow ground fog at daybreak in the summer and fall. Average temperatures range from 20°F in January to 85°F in July (CH2MHILL 2010).

Ohio Department of Natural Resources has summarized estimates of groundwater recharge rates in different basins (Dumouchelle and Schiefer 2002). Statewide, these recharge rates range from 3 to 16 inches per year with a median rate of 6 inches. Data for the Big Walnut Creek basin indicate that precipitation is roughly 37 inches per year, but the low-permeability soils in the area suggest that groundwater recharge is 4 to 5 inches per year (Dumouchelle and Schiefer 2002).

2.1.7 Groundwater and Surface Water Use

The ground and surface waters at the former Lockbourne AFB landfill are not used for drinking water. Most village of Lockbourne residents receive drinking water from the Columbus municipal water system. The city of Columbus uses surface water from the Scioto River, Big Walnut Creek, and Hoover and Alum Creek reservoirs for its supply, along with groundwater from the South Wellfield area in southeast Franklin County.

The South Wellfield area is 2.5 to 4 miles north and northwest or upstream of the site adjacent to Big Walnut Creek and the Scioto River. The South Wellfield wells used by the city, draw water from glacial sands and gravels and indirectly nearby surface water. Being upstream and to the north and northwest of the site, the wells are not, nor are they expected to be, within groundwater flow paths from the site. The South Wellfield wells reportedly draw water from 68 to 109 feet bgs in sands and gravels in the heterogeneous glacial deposits characteristic of the area (House et al. 2008). These screened depths may be similar to those of the IDA near the landfill, but water-bearing zones within glacial outwash deposits are likely not contiguous throughout this part of Franklin County because of considerable heterogeneity. The shale bedrock beneath the unconsolidated glacial deposits is not considered to be water bearing and does not provide significant recharge to the unconsolidated deposits, as does the limestone bedrock terrain farther to the west in Franklin County.

Although most residents are connected to the municipal water system, some residents in the village of Lockbourne reportedly obtain drinking and irrigation water from private wells. A public health assessment conducted by the Agency for Toxic Substances and Disease Registry (2000) reported that private production wells, at that time, were still used by some homeowners for drinking water. In 1996, seven residences were identified as having private production wells, with five drawing from the UWBZ and two from the IDA. The report states that Ohio EPA collected and analyzed groundwater samples from the five wells believed to be screened in the UWBZ and that they met state and federal drinking water standards (Waters 1996).

2.2 Previous Site Studies

This section presents conclusions taken from previous investigations relevant to the RD. A full presentation of these studies can be found in the Remedial Investigation Report (CH2M HILL 2010) and in the Test Pit and Soil Sampling Results for the Former Lockbourne Air Force Base Landfill Site Investigation (CH2M HILL 2011a).

2.2.1 Supplemental Site Investigation (2011)

Soils from the onsite borrow source area were deemed suitable for use as landfill cover soils based on geotechnical testing. Concentrations of COCs in soil may exceed industrial/commercial use levels; therefore some borrow source material may not be suitable cover material. Verification sampling will be conducted during the remedial action to demonstrate that COCs in onsite soils meet acceptable limits for use as landfill cover material.

Waste encountered in the east bank of the West Ditch consists primarily of construction and demolition debris with some lime and fly ash. The maximum depth of waste encountered there was 12 feet bgs.

Waste delineation activities provided additional information regarding the horizontal and vertical extent of waste in the waste excavation areas as shown in the design drawings. The horizontal and vertical extent of waste excavation areas were modified based on test pit information collected during the investigation.

The 2011 supplemental investigation memorandum is provided as Appendix J.

2.2.2 Additional Site Investigation (2008)

The following observations and conclusions were made during additional site investigation (CH2M HILL 2009):

- Waste encountered during trenching included municipal solid waste, construction and demolition debris, lime sludge, and black material that was similar in appearance to coal ash. Sheet 4 of the design drawings shows the test pits advanced during the 2008 investigation.
- The data generated during the electromagnetic survey were consistent with results expected for trench-and-fill landfill techniques and correlated with previous electromagnetic surveys of the site.
- Twenty temporary landfill gas monitoring points were installed at the site. Two rounds of methane sampling were conducted. Landfill gas measurements indicated that methane concentrations were below 1.25 percent. The threshold level for methane is 5 percent at or within the facility boundary and 1.25 percent in occupied structures per Ohio EPA. There are, however, no occupied structures onsite.

3. Summary of Selected Remedy and Performance Standards

SECTION 3

Summary of Selected Remedy and Performance Standards

This section provides details of the selected remedy and the regulatory and RD performance standards that govern the RD.

3.1 Selected Remedy

At AOC 1, the selected remedy is the containment presumptive remedy, which consists of waste consolidation, construction of a soil cover, LTM, and institutional controls, defined as Alternative 3 in the Final Focused Feasibility Study Report (CH2M HILL 2011c). Institutional controls will be implemented through the conveyance of an environmental covenant. Appendix H contains the strategy/preliminary framework for the LTM program.

The following activities will be conducted to implement the selected remedy for AOC 1:

- Installing temporary soil and erosion control for construction activities.
- Clearing and grubbing vegetation within the consolidation, cover, and staging area limits, as needed.
- Excavating and consolidating waste from the site to the proposed landfill area cover area.
- Conducting verification sampling.
- Grading of the landfill surface in preparation for the soil cover.
- Installing vents in the landfill cover to prevent accumulation of landfill gases.
- Installing the perimeter seep prevention trench.
- Constructing a soil cover consisting of a 24-inch compacted soil layer, overlain by 6 inches of topsoil, defined as material suitable for establishing and supporting the vegetation selected for the cover. In this RD report, the topsoil material is referred to as "topsoil (plantable soil)."
- Installing surface water drainage swales, sediment traps, sediment basins, and other ancillary items.
- Restoring waste excavation and onsite borrow source areas.
- Installing a perimeter fence around the landfill.
- Implementing LTM activities.

- Implementing institutional controls through an environmental covenant that will restrict the future use of AOC 1 in a manner to prevent exposure to onsite groundwater, intrusive activities, and contact with waste.

At AOC 2, the selected remedy is an institutional control that will be implemented through the conveyance of an environmental covenant, defined as Alternative 2 in the Final Focused Feasibility Study Report (CH2M HILL 2011c), to restrict exposure to groundwater.

3.2 Remedial Design Performance Standards

Although the Decision Document (CH2MHILL 2012) selected the site applicable or relevant and appropriate requirement (ARARs), the RD references various regulations as guidance. The Compliance Plan (Section 7) identifies which RD criteria are ARARs, waivers, and guidance.

3.2.1 Landfill Cover

The landfill cover was designed to meet the Ohio EPA rules that were in place when the landfill ceased operation in 1979 (Ohio Administrative Code [OAC] 3745-27-10, effective July 29, 1976). The rules (1976 rules) were clarified by the Ohio EPA in two guidance documents: "Measureable Criteria for Questionable Pre-1990 Landfill Caps," Ohio EPA Guidance no. 0123 (March 27, 1995) and "Measureable Criteria for Questionable Pre-1990 Landfill Caps," Ohio EPA Guidance no. 0251 (March 24, 1995). The 1976 rules allow the minimum slope for the soil cover to be 1 percent. However, this design includes 5 percent slopes with a minimum allowable slope of 2.5 percent. The 24-inch soil cover will serve both as a barrier layer and vegetative layer described in the 1976 rules. In accordance with the above referenced guidance, the soil cover will have a maximum hydraulic conductivity of 1×10^{-6} centimeters per second as measured in the laboratory from samples collected in accordance with American Society for Testing and Materials (ASTM) D1556. (Field permeability of 1×10^{-5} centimeters per second as measured by either Boutwell or Single Double Ring Infiltrometer testing is also allowed.) The topsoil (plantable soil) will be seeded with a standard landfill grass mix on the cover area and with native grass species over other disturbed areas.

In addition to Ohio EPA guidance, the cover was designed to address potential risk to human health and the environment as presented in the Decision Document (CH2MHILL 2012).

3.2.2 Surface Water Management

3.2.2.1 During Construction

Stormwater management during construction was designed using the State of Ohio Storm Water Program OAC 3745-39, which states that with land disturbance greater than 10 acres, temporary sediment controls are required. Design guidance in the State of Ohio's *Rainwater and Land Development Manual* was used for sediment basin and sediment trap sizing.

Construction stormwater general permits require that a Stormwater Pollution Prevention Plan be developed to control pollutant sources. The remedial action contractor will be responsible for meeting the substantive requirements of the permit since this project is a

Comprehensive Environmental Response, Compensation, and Liability Act action. The contractor will develop the stormwater pollution prevention plan. A combination of erosion control practices will be used at the site throughout construction, as described in Section 4.

3.2.2.2 Post-Construction

Drainage swales will meet standard federal regulations for landfill surface water management (40 Code of Federal Regulations [CFR] 258.26 Run-on/runoff control systems), which requires control of the 24-hour duration 25-year return period storm.

Post-construction stormwater management was designed using the State of Ohio Storm Water Program, OAC 3745-39, which states that best management practices will include permanent vegetation and riprap-lined channels to control erosion. According to the general permit, if the project does not increase the amount of impervious area, no post-construction detention is required. The project does not include paving of pervious areas, and so no permanent detention was included.

3.2.3 Groundwater Monitoring

The LTM strategy is included in Appendix H for demonstration purposes. The strategy will be updated after initial groundwater data have been collected as part of the remedial action. The initial groundwater sampling event will be described in a Sampling and Analysis Plan as part of the Remedial Action Work Plan. USACE will conduct the initial groundwater sampling event prior to remedial action construction to establish the groundwater monitoring program and to prepare the LTM Plan. The LTM Plan will be completed in accordance with Ohio EPA Guidance no. 0117, "Ground Water Monitoring Requirements for Closed Facilities" (May 9, 2005) following initial sampling and analysis.

3.2.4 Landfill Gas Monitoring

Landfill gas monitoring is addressed in the LTM strategy. It was designed using field measurements of gas generation recorded during the 2008 site investigation (CH2M HILL 2009) and the site-specific gas generation calculations in Appendix B.1.

3.2.5 Institutional Controls

Institutional controls are addressed in the LTM strategy. They will be implemented through environmental covenants that will restrict the future use of AOC 1 in a manner to prevent exposure to onsite groundwater, intrusive activities, and contact with waste. At AOC 2, institutional controls will be implemented through an environmental covenant to restrict exposure to groundwater. The landowner, the Columbus Regional Airport Authority, is agreeable to placing industrial/commercial use restrictions for AOC 1 and AOC 2.

SECTION 4

Basis of Design

This section presents the components of the remedial action and documents the engineering analyses, calculations, and evaluations made to construct the landfill cover and maximize its long-term integrity.

4.1 Work Planning

The contractor will prepare a Remedial Action Work Plan and other planning documents as needed to implement the RD, including a Health and Safety Plan (including an air monitoring plan), Sampling and Analysis Plan, Stormwater Pollution Prevention Plan, LTM Plan, and QA/QC Plan. A preliminary version of the QA/QC Plan is included as an appendix to this report. The contractor will revise the draft QA/QC Plan with project-specific information. The contractor will prepare a Sampling and Analysis Plan that will present the approach to conduct initial groundwater sampling and determine the following:

- Onsite borrow source material is suitable (site human health COC concentrations below USEPA soil screening levels for industrial/commercial land use or USACE-approved background levels) for use as select fill, cover material, and or topsoil (plantable soil)
- Offsite borrow source material is suitable (concentrations of semivolatile organic compounds, volatile organic compounds, pesticides, PCBs, and target analyte list metals below USEPA soil screening levels for residential land use or USACE-approved background levels) for use as select fill, cover material, and or topsoil (plantable soil)
- Onsite soil outside the proposed cover area have site human health COC concentrations below USEPA soil screening levels for industrial/commercial land use or USACE-approved background levels

The plan also will outline data quality objectives, analytical methodologies, reporting limits, QA/QC activities pertaining to sampling analysis, laboratory requirements, and data assessment activities of the groundwater and verification sampling programs. The contractor will develop the LTM strategy after initial sampling is conducted.

4.2 Mobilization

Contractor mobilization will consist of the following as needed:

- Constructing temporary facilities, such as construction trailer, utilities, staging area, security fencing, and equipment decontamination facilities
- Delivering equipment
- Placing erosion and sediment control (ESC) features for staging areas if needed, such as silt fencing (site ESC measures are described below)

Equipment is expected to be transported by road. The temporary utilities will be active during construction of the cover.

4.3 Site Layout, Access, and Security

4.3.1 Site Layout and Access

The soil cover extends over 23.3 acres. Sheet 5 of the design drawings (Appendix C) shows the limits of the proposed cover area. Waste consolidation will occur as shown on Sheets 7, 8, 9, and 10 of the design drawings.

The access roads that extend from the Columbus Regional Airport Authority property to the site will remain. Temporary access roads will be added during construction to address transport of excavated waste materials and borrow source material across the site. A permanent access road will be constructed near the southern boundary of the former radio transmitter station property with a double swinging gate for access to the landfill after closure (Sheet 15 of the design drawings). No additional access roads are proposed for access to monitoring wells and passive gas vents. Access to these features may be gained by driving or walking over the established vegetated final cover.

4.3.2 Site Security

To prevent damage to the cover from vandalism or trespassing, temporary and permanent perimeter fencing and a gate will be installed as shown on Sheet 15 of the design drawings. During construction, the access gate located on Vause Road will be repaired and augmented so that it may be closed and secured during the remedial action. A temporary fence or concrete barriers will be installed on either side of the access gate so that vehicle traffic cannot bypass the gate. Temporary fencing may be required around waste excavation and borrow areas and will be addressed by the contractor in the Remedial Action Work Plan.

Permanent signage and fencing will be included along the perimeter of the waste consolidation boundary as shown on Sheet 15 of the design drawings.

4.4 Site Preparation

Site preparation consists of collecting current topographic elevations; locating underground utilities; and clearing and grubbing in accordance with the technical specifications in Appendix D.

4.4.1 Survey

An existing topographic survey of the ground surface prior to excavation and a topographic survey after excavation will be completed for preparation of record drawings.

4.4.2 Utility Locate

The contractor is responsible for locating the utilities onsite before excavation, using the Ohio Utilities Protection Service (call 8-1-1 or 1-800-362-2764) and other resources.

4.4.3 Monitoring Well Abandonment

Monitoring wells within the clearing and grubbing limits will be abandoned in accordance with the *Technical Guidance Manual for Ground Water Investigations* (Ohio EPA 1999 et seq.).

4.4.4 Clearing and Grubbing

Clearing and grubbing consist of removing debris, trees, shrubs, and brush; removing or grinding of stumps and roots; and felling and removing of dead trees, partially dead trees and limbs, and trees and limbs that pose a hazard to workers. Debris will be disposed of under the landfill cover. Grubbed material will be mulched onsite and either placed on the surface to reduce erosion until vegetation is established or reduced to fine particles and mixed with topsoil (plantable soil). Excess mulch may be placed in the landfill. The area to be cleared and grubbed covers 69 acres.

Soil that meets the geotechnical and analytical requirements for topsoil (plantable soil) within AOC 1 can be stockpiled by the contractor for reuse in accordance with the technical specifications.

4.5 Construction Surface Water Management

This section describes the ESC measures to be used during remedial action construction to manage surface water. ESC will be performed in three phases: clearing and grubbing and the construction of initial ESC measures; excavating the Waste Excavation Areas; and establishing final grade and permanent restoration. Appendix B.6 presents surface water calculations used to support the RD.

4.5.1 Erosion and Sediment Control Measures

Runoff will be routed from disturbed areas to sediment basins or sediment traps through the use of temporary diversions and permanent swales. The sediment basins and traps will provide sediment control by collecting surface water runoff from uncontaminated areas and allowing that water to pool and sediments to settle out. See Section 4.8 for requirements for contact water management.

Once vegetation is established on the final grade, the basins will be modified to route water to rock-lined channels, as shown on Sheet 15 of the design drawings. Channels will be lined with rock for long-term erosion control.

4.5.1.1 Sediment Barriers

Silt fences will be used to impede the flow and to provide for solids removal to reduce the transport of the sediment. These controls will be placed along the contours on long slopes and at the perimeters of the disturbance area, in places where temporary diversion berms cannot be used. Sheets 6 and 8 of the design drawings show the conceptual locations of silt fences. Silt fences will be maintained until site restoration is complete or until grading measures have removed the need for silt fence.

4.5.1.2 Geotextile Fabric

The construction entrance will consist of stabilized stone underlain with a geotextile fabric at the construction site entrance. This will reduce the amount of soil removed from the construction site.

4.5.1.3 Temporary Diversion Berms

Temporary diversion berms, consisting of a ditch and a berm, will intercept and route sediment-laden water to a sediment basin. Seeding and mulching should be utilized on slopes less than 3 percent and erosion matting for slopes greater than 3 percent.

4.5.1.4 Sediment Traps

Two sediment traps will be used along the eastern edge of the cleared and grubbed area. The temporary diversion berms will convey runoff from disturbed areas to the sediment traps, where sediment will settle or filter out before the water is discharged offsite. A limit of 280 nephelometric turbidity units cannot be exceeded during construction on storm water effluents per pending (as of April 2012) USEPA guidelines and must be monitored during construction. A discussion on sampling methods and frequencies must be included in the Remedial Action Work Plan. Sedimentation basins are currently designed per State of Ohio requirements including 48-hour drawdown, 1,800 cubic feet per acre of drainage area, and 1,000 cubic feet of sediment storage per acre of drainage area.

4.5.1.5 Sediment Basins

Four sediment basins will treat runoff from the disturbed area. Like sediment traps but larger, sediment basins treat water by removing sediment before water is discharged offsite. A limit of 280 nephelometric turbidity units cannot be exceeded during construction on storm water effluents per pending (as of April 2012) USEPA guidelines and must be monitored during construction. A discussion on sampling methods and frequencies must be included in the Remedial Action Work Plan. Sedimentation basins are currently designed per State of Ohio requirements including 48-hour drawdown, 1,800 cubic feet per acre of drainage area, and 1,000 cubic feet of sediment storage per acre of drainage area.

4.5.2 Erosion and Sediment Control Inspections During Construction

During construction, ESC measures will be inspected weekly and within 24 hours of a storm of 0.25 inch of rain in a 24-hour period. An inspection report will document the names and titles of personnel making the inspection, date of inspection, the scope of the inspection, observations relating to the effectiveness of controls, and procedures to fix deficiencies, dates that repairs were completed, and repairs.

4.5.3 Erosion and Sediment Control Maintenance During Construction

ESC measures will be maintained in working order to minimize the potential for erosion. Required maintenance identified in inspection reports will be completed as soon as practicable. Sediment barriers, such as silt fences, will be replaced as needed or as identified in weekly inspection reports. If results of an inspection (as outlined in the Surface Water Pollution Prevention Plan) completed during the remedial action indicate that erosion controls are insufficient, additional controls will be installed. Indications that controls are insufficient may include, but are not limited to, observations of sediment accumulation or water turbidity downstream of control structures, recurrence of ground surface damage, appearance of eroded surfaces, or damage to controls. Maintenance procedures for insufficient controls identified during inspections are covered in the Surface Water Pollution Prevention Plan.

4.5.3.1 Water Application

Multiple sources of water (East and West Ditches, sediment basins, fire hydrants in the surrounding area) can to provide water for dust control. The contractor will consider green and sustainable methods for dust control (GSR Report [Appendix G]).

4.5.3.2 Vegetation Application

The contractor will complete weekly inspections to check placement/establishment of seed, fertilizer, or mulch from the topsoil (plantable soil). The soil to be seeded will be prepared and seeded as required by the technical specifications. Seeded surfaces will be inspected following storms that result in measurable quantities of rainfall (for example, 0.25 inch of rain in a 24-hour period). Maintenance will include application of lime and fertilizer when soil testing confirms the need. At least 1 year from the time of planting, and at least 85 to 90 percent growth density (as measured during visual inspection by USACE), is required for the seeding to be considered established.

4.5.3.3 Silt Fence

Inspections will be done to ensure that the integrity of barriers is maintained and to quantify the sediment accumulation behind barriers after each storm. Sediment will be removed by shovel or mechanical excavators when accumulation approaches 50 percent of the height of the barrier. Damaged controls (through removal of sediments or from degradation by weather and storms) will be removed and replaced as necessary.

4.5.3.4 Drainage Channels

Maintenance of drainage channels, both grass- and rock-lined, will consist of routine inspection to ensure that vegetation is not damaged, stones are not dislodged, and scouring of supporting materials has not occurred.

4.5.3.5 Sediment Basins and Traps

Sediment basins and traps will be inspected weekly and after measurable rainfall (for example, 0.25 inch of rain in a 24-hour period). The sediment storage area will be cleaned out when sediment has filled the storage depth. Sediment traps will be reshaped to the original configuration. Sediment traps and basins are shown on Sheets 11 and 12 of the design drawings. Details for each basin are shown on Sheets 20 and 22 of the design drawings.

4.6 Current Landfill Conditions

Waste materials, vegetation, and topography vary over the current landfill and the area proposed for waste consolidation.

Waste material in northern part of the landfill was placed in trenches up to 10 feet bgs, but most waste was observed in the top 4 feet. Municipal solid waste, lime sludge, black ash, and construction and demolition debris were observed during test pit installation. The average thickness of the waste layer is about 4 feet. The terrain consists of ridges and valleys 5 to 10 feet in width. The difference in elevation between the ridges and the valleys averages roughly 3 feet. Lime sludge was seen on the surface of at least half of the area. Vegetation cannot grow on the surface where lime sludge is present. The access point in the northern area is a rough, grass covered path, underlain with construction and demolitions debris wide enough for a vehicle to enter.

In the southern part of the landfill, waste reportedly was placed in mounds and then at a later date covered with soil. Municipal solid waste, construction and demolition debris, and black ash were observed during test pit installation. Most of the area was inaccessible during previous investigations because of the dense vegetation. The depth of waste varies from ground surface to 8 feet bgs.

4.7 Volume of Waste

Sheet 5 of the design drawings shows the limits of the proposed cover area. The cover will encompass 23.3 acres in AOC 1. Based on historic records, aerial photography, electromagnetic surveys, and previous test pit investigations, the northern area of AOC 1 contains the most in-place waste and the most municipal solid waste. Waste outside the proposed landfill perimeter will be excavated and consolidated within the cover limits.

The horizontal limit of waste was defined using the farthest extent of electromagnetic survey detections, which were verified through test pit excavations. Where electromagnetic survey detections did not show waste but test pits encountering waste had been advanced in the field, the horizontal limit of waste was determined based on topography and field observations. The depth of waste in the waste excavation areas were determined based on depth to waste information from test pit installation activities (CH2M HILL 2009; 2011a). In areas where the bottom of waste was not encountered, the depth of waste was estimated by adding 1 foot to the maximum test pit depth achieved. The volume of waste to be excavated and placed within the proposed cover area is 153,263 cubic yards. Waste Excavation Areas 1 through 6 are shown on Sheets 7, 8, and 9 of the design drawings and are further discussed below.

Soil removed during clearing and grubbing is not accounted for in the volume of waste quantity. The voids created in the cover area during clearing and grubbing are considered negligible and will be offset by swell in materials from Waste Excavation Areas. Appendix B.2 contains calculations estimating waste consolidation volumes.

4.7.1 Waste Excavation Area 1

Waste Excavation Area 1 contains lime sludge, black ash, and construction and demolition debris. On average, the waste extends to 3 to 5 feet bgs, but in places it is as deep as 8 feet. The waste material is mostly covered by soil and vegetation. The terrain is generally flat with mounds of waste material. Waste Excavation Area 1 is estimated to contain 54,720 cubic yards of waste.

4.7.2 Waste Excavation Area 2

Waste Excavation Area 2 contains municipal solid waste, black ash, and construction and demolition debris. On average, the waste extends to about 3 feet bgs, but in places it is as deep as 6 feet. When the base runway was upgraded, concrete spoil was placed in the area. The municipal solid waste appears to be isolated to a small area in the eastern part of the excavation area. Waste Excavation Area 2 is estimated to contain 42,460 cubic yards of waste.

4.7.3 Waste Excavation Area 3

The waste material in Waste Excavation Area 3 includes construction and demolition debris. On average the waste extended to 4.5 feet bgs. The area contains pieces of concrete larger than 4 feet across by 6 inches thick and 4 feet long. Debris includes parking curbs and other construction and demolition debris. The demolition debris seems to consist mostly of concrete with little metal or wood. The area is partially covered in trees averaging about 1 foot in diameter. Waste Excavation Area 3 is estimated to contain 11,532 cubic yards of waste.

Buried construction and demolition debris extends into the former radio transmitter station property (Sheet 4 of the design drawings). That debris will not be consolidated under the landfill cover, because the area is not part of the Lockbourne AFB Landfill FUDS property and is not eligible for restoration by the FUDS program. The boundary of the former radio transmitter station property will be surveyed and staked before construction to prevent encroachment during excavation work.

Part of Waste Excavation Area 3 extends into AOC 2 (Sheet 4 of the design drawings). The waste extending into AOC 2 will be excavated and consolidated under the landfill cover.

Excavation in Waste Excavation Area 3 may extend into the wetland along the northern boundary of the proposed cover area (Sheet 8 of the design drawings). The wetland boundary will be surveyed and staked before construction begins. If waste excavation is necessary in the wetland, measures will be implemented to limit wetland impacts as much as practicable. Section 8 includes information on addressing wetland impacts.

4.7.4 Waste Excavation Area 4

Waste Excavation Area 4 contains construction and demolition debris and municipal solid waste. On average the waste extends to 4 feet bgs; the maximum depth observed was 7 feet. Several test pits were installed north of a berm along what appeared to be an old road. Waste Excavation Area 4 is estimated to contain 6,568 cubic yards of waste.

Waste Excavation Area 4 extends into a wetland. Based upon the estimated limits of the area (Sheet 8 of the design drawings), 0.34 acre of wetlands will be disturbed during the remedial action. The wetland boundary will be surveyed and staked before construction begins. Section 8 includes information addressing wetland impacts. Measures will be implemented to limit wetland impacts as much as practicable.

4.7.5 Waste Excavation Area 5

Waste Excavation Area 5 consists primarily of construction and demolition debris, lime sludge, and black fill. Lime sludge was observed on the surface, but most of the area is covered in grass or low brush. Waste Excavation Area 5 is estimated to contain 19,368 cubic yards of waste.

The American Electric Power (AEP) transmission line is located along the western edge of Waste Excavation Area 5 (Sheet 5 of the design drawings). There is a 50-foot easement in either direction perpendicular to the centermost transmission line. Construction cannot occur within 40 feet of the power line tower. Appendix I specifies the AEP restrictions.

4.7.6 Waste Excavation Area 6

Construction and demolition debris encountered along the crest of the east bank of the West Ditch extends to depths of 10 to 12 feet bgs. Surficial waste appears to have rolled down the slope of the West Ditch. Waste Excavation Area 6 is estimated to contain 18,615 cubic yards of waste. Upstream of Waste Excavation Area 6, the West Ditch contains a reinforced concrete structure (Sheet 3 of the design drawings) formerly used by Lockbourne AFB as a flow control structure for surface water runoff. The structure acts as a dam pool and influences roughly 3,050 linear feet of the stream. In order to restore West Ditch to natural flow conditions (as agreed to by the Columbus Regional Airport Authority through previous surface water permitting actions with Ohio EPA), the concrete structure will be removed. Debris from the structure will be consolidated under the proposed cover or disposed of offsite. Surficial waste materials encountered in the bank near the structure will be placed under the cover.

Excess sediments that have accumulated behind the concrete structure will be removed, sampled, analyzed, and disposed of in accordance with state and federal regulations. The contractor will prepare a Demolition Plan detailing the demolition of the concrete structure, bank restoration, and sampling and disposal strategies for the sediments.

4.8 Contact Water Management

The contractor must manage contact water during construction. The contractor will prepare a Contact Water Management Plan before beginning construction, as outlined in the technical specifications. The contact water management will include best management practices (BMPs) including minimization of the area of waste exposed at one time and the elimination of mingling contact and surface water runoff. Specific management practices will be included in the Remedial Action Work Plan. The contractor will provide for collection, sampling, and analysis of contact water. Treatment, transport, and disposal also may be necessary.

4.9 Waste Consolidation and Backfill

4.9.1 Waste Consolidation

An estimated 160,374 cubic yards of waste has been identified for consolidation under the proposed cover from Waste Excavation Areas 1 through 6, as shown on Sheets 7, 8, and 9 of the design drawings. Large objects shall be buried at least 5 feet minimum from the proposed top of subgrade surface to allow for bridging and to minimize localized settlement.

The proposed top of waste grading shown on Sheet 10 of the design drawings allows for the consolidation of 155,500 cubic yards; therefore, the final slopes are expected to be greater than 5 percent. Sheet 18 of the design drawings lists control points for the top of waste, top of 24-inch cover, and the top of topsoil (plantable soil). The control points may be modified during construction based on the actual waste placed within the cover area. The cover slopes currently are designed at 5 percent; the minimum slope will not be less than 2.5 percent or greater than 4H:1V. The contractor will be required to verify the slope stability of the final grading determined for the proposed cover.

If drums or hazardous wastes are encountered during the waste consolidation effort, hazards associated with the excavation of drums or hazardous waste will be determined before offsite disposal. Hazardous wastes or drums will be evaluated in accordance with the technical specifications (Appendix D).

4.9.2 Soil Sampling

Onsite and offsite borrow source material will be sampled to demonstrate that the material will meet material requirements presented in the technical specifications (Appendix D).

Onsite borrow source material meeting the geotechnical requirements will be sampled for human health COCs, as appropriate, to meet the site reuse requirements. Human health COCs include polynuclear aromatic hydrocarbons (benz[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, dibenzo[a,h]anthracene, and indeno[1,2,3-cd]pyrene), PCB-1248, and lead. Concentrations of the human health COCs are required to be below USEPA soil screening levels for industrial/commercial land use or USACE-approved background levels for use as onsite borrow source material.

Offsite borrow source material meeting the geotechnical requirements will be sampled for semivolatile organic compounds, volatile organic compounds, pesticides, PCBs, and target analyte list metals. Concentrations of these analytes must be below the USEPA soil screening levels for residential land use or USACE-approved background levels.

4.9.3 Select Fill

Select fill is soil used for backfill of waste excavation areas or general site grading. The onsite borrow source identified on Sheet 12 of the design drawings will provide 37,468 cubic yards of select fill to restore Waste Excavation Areas 3, 4, and 5 to the grades shown on Sheets 15 of the design drawings. Parts of Waste Excavation Areas 1 and 2, along with parts of the proposed borrow source area, will be regraded to promote surface water drainage and eliminate ponding. Further detail on select fill requirements is presented in the QA/QC Plan (Appendix F) and the technical specifications (Appendix D).

4.9.4 Landfill Cover Section

Soil excavated from the onsite borrow area will be used for the landfill cover as described below. The reuse of onsite materials will depend on verification sampling (demonstration of COC concentrations below industrial/commercial land use or background criteria) conducted as part of the remedial action. Appendix B.2 contains soil balance volume calculations. Excavation 5 feet deep in a source area of 16.5 acres will yield 133,100 cubic yards of soil, enough soil to meet the fill and cover material requirements listed below. If borrow material onsite is not suitable in sufficient quantities, material will be hauled in from offsite after verification sampling to demonstrate that chemical concentrations are below residential land use or background criteria. Borrow soils excavated from elevations beneath the UWBZ may require additional dewatering by the contractor.

4.9.4.1 Top of Waste

The subgrade for the landfill cover will consist of excavated waste consolidated from areas outside of the cover limits. The material will be placed and compacted and act as fill material to achieve the top of waste grades before placement of the soil cover.

The top of waste will be graded in preparation for cover construction. The upper 1 foot of the waste surface will consist of waste material no greater than 6 inches in size. Select fill may be used to create a suitable surface for construction of the landfill cover. Large waste debris encountered during waste excavation or through demolition of the concrete structure must be broken and reduced in size before placement under the landfill cover. Large debris must be placed at least 2 feet below the final top of waste surface. Compaction will be measured by proof-rolling, as provided in the technical specifications (Appendix D).

4.9.4.2 Compacted Soil Cover

The compacted soil cover is the 24-inch barrier and 6-inch vegetative layer (described below). The onsite borrow source area identified on Sheet 12 of the design drawings will provide the 69,244 cubic yards of soil needed for the 24-inch cover layer. Cover material requirements are discussed below and in the technical specifications.

The soil cover will consist of 24 inches of compacted soil cover. The cover layer will be of a low permeability material that stores moisture to help support vegetative growth and acts as a barrier layer to reduce vertical percolation of precipitation into the waste. The compacted soil cover will be placed and compacted as four 6-inch lifts. The soil cover must be compacted to achieve at least 95 percent compaction of a standard Proctor (ASTM D698) at optimum moisture content and achieve a field permeability of 1×10^{-5} centimeters per second or a laboratory permeability of 1×10^{-6} centimeters per second of Shelby tube samples. Further detail on soil cover requirements is presented in the QA/QC Plan (Appendix F) and the technical specifications (Appendix D).

4.9.4.3 Topsoil (Plantable Soil)

Topsoil (plantable soil) is defined as material suitable for establishing and supporting the vegetation selected for the cover. In this RD, the topsoil material is referred to as “topsoil (plantable soil).” To complete the 6-inch topsoil layer, 21,164 cubic yards of soil will be needed. Topsoil (plantable soil) material requirements are discussed below and in the technical specifications (Appendix D).

Topsoil (plantable soil) will consist of 6 inches of soil with pH in the range of 6.0 to 7.5. If suitable soils are not present onsite in sufficient quantity, they will need to be imported from offsite. If the topsoil (plantable soil) onsite is not within the pH range of 6.0 to 7.5, the contractor can perform additional testing to determine if soils outside of the range can be used with the seeding requirements in the technical specifications (Appendix D).

The topsoil (plantable soil) layer will be placed with low ground-pressure equipment and compacted lightly, as required for access and stability and to support vegetation. The uppermost 2 inches of the layer will be scarified to provide a base for seeding and treated with limestone and fertilizer, as necessary. Further details of topsoil (plantable soil) requirements are presented in the QA/QC Plan (Appendix E) and technical specifications (Appendix D).

4.10 Cover System Design

4.10.1 Slope Stability

Slope stability was calculated to show that the landfill cover grades will have a factor of safety against a sliding failure of at least 1.5 for the static condition. The standard of practice is to provide a factor of safety of 1.0 against dynamic failure. A critical cross section was used for both static and dynamic stability of drained and undrained materials.

4.10.1.1 Methods of Analysis

Slope stability was analyzed using Rocscience's program SLIDE, version 6.0. SLIDE analyzes the stability of slip surfaces using vertical slice limit equilibrium methods (such as Bishop, Janbu, Spencer). Individual slip surfaces were analyzed, and search methods were applied to locate the critical slip surface for the given slope. The site was analyzed for rotational (circular) and translational block failures using Bishop's and Janbu's methods. These methods are based on the principle of limiting equilibrium. That is, the method calculates shear strengths that would be required to just maintain equilibrium and then computes a factor of safety by dividing the available shear strength by the shear strength required to maintain stability. Critical surface search routing is used to determine the least stable failure surface. SLIDE iterates through a large number of potential failure surfaces and calculates the factor of safety of each surface. The lowest factor of safety is reported.

4.10.1.2 Selection of Engineering Parameters

The critical engineering parameters for slope stability analysis of the site are the shear strengths of the soils comprising the east bank of the West Ditch. Triaxial testing was completed on remolded samples during the supplemental test pit investigation (CH2M HILL 2011a). Table 4-1 lists the engineering parameters used in the slope stability analysis. Both the current design slopes of 5 percent and the maximum allowable cover slope of 4H:1V were analyzed in the analysis. The contractor shall verify the slope stability of the final grading for the proposed cover during the remedial action. Appendix B.3 contains further details on references and source data.

4.10.1.3 Results

The east bank of the West Ditch was selected as the critical cross section for slope stability analysis because of its steep 2H:1V slope and the presence of a short 4H:1V slope in the final grading. Waste located along the crest of the east bank of the West Ditch to depths of 10 to 12 feet (Waste Excavation Area 6) will be consolidated under the landfill cover. After excavation, a 30-foot-wide bench will exist at the crest of the slope. Appendix B.3 contains the slope stability analysis. The results of the analysis (Table 4-2) show a static condition factor of safety for both rotational and translational block methods exceeded the required 1.5 in addition to exceeding the required 1.0 factor of safety for dynamic conditions.

4.10.2 Settlement

Settlement was calculated for the overall impact of the consolidated waste on the landfill subgrade. Overall elastic settlement and primary and secondary consolidation settlement were evaluated. Waste mass settlement was estimated based on typical expected settlement values for the waste types encountered in the Waste Consolidation Areas. In this case, consolidation settlement will govern as the conservative case for analysis.

TABLE 4-1
Summary of Material Properties for Slope Stability Analysis
Former Lockbourne AFB Landfill Basis of Design

	Cover Material			**Base Material**		
	Top Soil[a]	Cover Soil[b]	Waste[a]	Upper In Situ Clay Soil[b]	Upper Water Bearing Zone[a]	Lower In Situ Clay Soil[a]
Density γ_d (pounds per cubic foot) (dry)	75	100	80	100	100	100
Density, γ_s (pounds per cubic foot) (saturated)	85	105	85	105	110	105
Thickness (ft) (or as shown)	0.5	2	Varies	Varies	Varies	Varies
Drained Friction Angle (degrees)	30	24	26	24	30	24
Drained Cohesion (pounds per square foot)	25	225	150	225	0	225
Undrained Friction Angle (degrees)	30	0	26	0	30	0
Undrained Cohesion (pounds per square foot)	25	600	150	800	0	Varies based on depth

[a] Estimated based on references presented in the calculation in Appendix B.3 for two locations of the landfill cover; the highest and lowest consolidated waste fill heights.

[b] Laboratory test results presented in the calculation in Appendix B.3.

TABLE 4-2
Summary of Results for Slope Stability Analysis
Former Lockbourne AFB Landfill Basis of Design

Final Cover Stability, East Bank of West Ditch Scenario	Rotational		Rotational, Dynamic		Minimum Factor of Safety Required	Minimum Factor of Safety Required, Dynamic
	Bishop	Janbu	Bishop	Janbu		
5% Rotational, Drained	1.99	1.77	1.72	1.56	1.5	1.0
5% Rotational, Undrained	2.41	2.39	2.14	2.10		
4H:1V Rotational, Drained	1.91	1.81	1.68	1.59		
4H:1V Rotational, Undrained	1.59	1.51	1.29	1.22		
	Block		**Block, Dynamic**			
5% Block, Drained	2.52	2.47	2.08	2.01	1.5	1.0
5% Block, Undrained	3.70	3.60	2.97	2.88		
4H:1V Block, Drained	1.94	1.84	1.51	1.43		
4H:1V Block. Undrained	1.89	1.80	1.51	1.43		

4.10.2.1 Selection of Engineering Parameters

The critical engineering parameters for settlement analysis are the unit weight of the waste materials, cover soils and in situ soils, consolidation parameters, including the preconsolidation pressure, compression index, and recompression index for the subsurface soils, and the depth to incompressible rock. The material properties listed in Table 4-3 were used to estimate total settlement.

TABLE 4-3
Universal Soil Loss Equation Values
Former Lockbourne AFB Landfill Basis of Design

Activity	C	P	K	R
Closure with permanent vegetation, 95 to 100% cover	0.007	1	0.375	125

Source: Estimating Load Reduction for Agriculture and Urban BMPs Revised Soil Loss Equation Erosion Prediction Ohio. http://ohiodnr.com

4.10.2.2 Method of Analysis

Overall settlement of the in situ soils under the load of the waste fill in the area of the proposed limit of waste consolidation was calculated using primary and secondary consolidation estimates. Clay soils were assumed to exist for the full depth, from the ground surface of the new elevation of the West Ditch crest to bedrock. Settlement was evaluated to determine whether differential settlements, due to the addition of waste as a surcharge load to the existing topography, would cause ponding on the final cover slopes. The settlement of the consolidated waste mass itself and the waste mass below grade was estimated using published settlement rates over time for landfills. It was assumed that the below grade waste would settle 6 percent of its total thickness under the load of the consolidated waste. It was then assumed that 10 percent of the consolidated waste mass depth itself would settle. Per the references listed in the calculation, settlement of pure municipal solid waste after closure is expected to be between 4 and 6 percent. Because the composition of the waste is unclear, the larger estimated thickness and settlement values were used.

4.10.2.3 Results

The results of the analysis resulted in a maximum settlement under the highest waste filled area of 2.43 feet. The estimated maximum grade change on the final cover system due to foundation consolidation settlement is 0.05 percent, with a 0.50 percent grade change due to the settlement of the waste mass after waste consolidation and regrading. At a maximum, this will reduce the proposed 5 percent slope to 4.5 percent. The decrease in the final cover slope will not have a significant impact on final cover drainage. Appendix B.4 contains the settlement calculations.

4.10.3 Soil Cover Loss

The final slope of the cover is designed to be 5 percent. Cover soil erosion can occur as a result of detachment and movement of soil particles due to raindrop impact and surface runoff.

4.10.3.1 Selection of Engineering Parameters and Method of Analysis

The potential for soil erosion from the final slopes was analyzed using the Universal Soil Loss Equation. The equation predicts average annual soil loss as the product of six quantifiable factors.

$$A = (R)\ (C)\ (K)\ (LS)\ (P)$$

where

A = computed soil loss in tons/acre/year
R = rainfall energy factor (for Franklin County)
C = cropping management factor
K = soil erodibility factor (based on soil types)
LS = slope/length/topographic factor (calculated from design berm spacing and configuration)
P = erosion control practice factor

4.10.3.2 Results

Computations for the 5 percent slopes were made to assess the potential for erosion during construction and throughout post-closure, after vegetation has been established. The analyses presented in Appendix B.5 confirmed that the finished slopes will have an average annual soil loss of 0.97 ton per acre, less than 2 tons per acre per year recommended in *Design and Construction of Covers for Solid Waste Landfills* (U.S. Environmental Protection Agency [USEPA] 600/2-79-165, August 1979). Soil loss during construction was calculated for the area with the steepest and longest slopes on the west side of the landfill. That area is estimated to experience soil loss of 5 tons per acre per year during construction.

4.11 Passive Vents

Gas generation estimates were calculated using the USEPA's LandGEM Landfill Gas Emission Model, version 3.02. LandGEM is based on a first order decomposition rate equation for quantifying emissions of landfilled municipal solid waste. Based on visual assessment of waste during previous investigations, it was assumed that 10 to 20 percent of the waste present at the site is municipal solid waste (organic fraction). LandGEM was used to estimate the total emission from the municipal solid waste fraction of the waste, as other wastes encountered at the site do not generate gas. The model computed that 5 to 10 standard cubic feet per minute of gas is generated (as of 2011). The level of methane in units of standard cubic feet per minute was not detected above the reporting limit in 2011. Appendix B.1 contains details of the LandGEM modeling.

Even though levels of methane are calculated and field verified as negligible through measurements taken in 2008 (CH2M HILL 2009), passive gas vents will be constructed in the landfill cover to accommodate gas migration. Gas vent locations are shown on Sheet 16 of the design drawings. The vents are spaced at roughly one per acre across the surface of the landfill. Each vent will consist of 4-inch polyvinyl chloride (PVC) schedule 80 riser pipes that will penetrate the final cover system and vent gas directly to the atmosphere. Below the cover soils, the vent will extend into a 12- by 12- by 6-inch gravel collection trench with an 8-ounce-per-square-yard geotextile placed on top of the gravel prior to cover soil placement. The riser pipe will be connected into a tee with two 5-foot schedule 80 slotted collection pipes (all PVC) running in the center of the gravel collection layer. Details of a typical gas vent are presented on Sheet 20 of the design drawings.

Passive gas vents and trenches will be constructed before and concurrently with placement of the 24-inch cover soil so as not to damage the cover system.

4.12 Seep Prevention Trench

A seep prevention trench located along the cover perimeter within the waste mass will prevent migration of seeps through the landfill cover to outside the landfill. The trench will be filled with the clean, crushed American Association of State Highway and Transportation Officials (AASHSTO) #57 stone and sloped at 1 percent toward manholes around the perimeter of the landfill. The trench will be wrapped with an 8-ounce-per-square-yard geotextile to prevent migration of fines from the surrounding soils and waste material into the trench. The 48-inch high-density polyethylene (HDPE) access manholes will allow a vacuum truck or similar equipment to pump out water if seeps are observed around the toe of the cover or as needed during LTM. A continuous perforated pipe will be installed around the landfill in the seep prevention trench and drainage, and a 4-inch sampling port for water level measurements and inspections will be provided in each manhole lid. Sheets 15 and 20 of the design drawings show the details of the seep prevention trench.

Based on the average daily flow rates estimated by the Hydrologic Evaluation of Landfill Performance model (Appendix B.7), it is anticipated that the waste mass may become saturated in the long term. Since water may accumulate in the manholes, the LTM Plan will include water level measurements of the manholes during cover inspection events, but at least annually.

4.13 Post-Construction Surface Water Management

Peak flow rates for runoff of surface water from the site were calculated using the Soil Conservation Service curve number method. Runoff rates for drainage swales were calculated using methodology found in 40 CFR 258 landfill requirements for the 24-hour duration 25-year return period storm. Runoff rates and sizing for temporary sediment basins outlet control were calculated using guidance taken from the State of Ohio Storm Water Program OAC 3745-39. Appendix B.6 contains the calculations for surface water runoff.

The contractor must manage contact water—water that has been in contact, however briefly, with waste present in excavations or as part of the consolidated waste mass—during construction, as discussed above.

4.13.1 Erosion and Sediment Control Measures

4.13.1.1 Temporary Cover

As sections of the cover are completed to final grade, temporary mulching or erosion blankets will be used to stabilize the soil surface until vegetation can be established. The cover will shield the surface from erosion by rainfall. Erosion blankets will be used to stabilize areas with slopes steeper than 3H to 1V until vegetation can be established. Stabilization reduces the formation of rills and gullies on slopes, thus minimizing soil loss.

4.13.1.2 Permanent Vegetative Cover

Permanent vegetative cover will be used on soil surfaces, which are at final grade. Soils will be seeded with a native seed mixture, depending on the temperature at time of planting. Details regarding vegetative cover are provided in Section 4.15 and in the technical specifications (Appendix D).

4.13.2 Surface Water Management

Surface water runoff from the northwest side of landfill (along the power line easement) will be conveyed within a grassed swale along the landfill perimeter and through overland sheet flow, as shown on Sheet 14 of the design drawings. Runoff will then flow through the grassed-lined swale, across part of the AEP easement, and finally through the rock-lined channel for release to the West Ditch. Grading in this part of the easement will be 1 to 2 feet below grade to convey water from the northeastern part of the landfill to the West Ditch (CH2M HILL 2011d).

Runoff from the northeast side of the landfill will be conveyed through a grassed swale along the landfill perimeter and discharged to an overland flow path that conveys surface water to wetlands on the northeastern part of the site. A sediment basin will be temporarily used to settle sediment from construction activities. Sheet 11 of the design drawings shows the details of drainage flows to and from the sediment basin. The sediment basin will be removed after construction and stabilization of the landfill cover. Runoff will be conveyed through grassed swales to existing topography that conveys water to the wetlands.

Surface water from Waste Excavation Area 5 along the west side of the landfill will be routed through temporary diversion berms during construction and drain to sediment basins. The basins will drain to one of two rock-lined trapezoidal channels that discharge into the West Ditch. Runoff will be over the landfill cap to the 30-foot-wide grassed ledge created along the West Ditch after excavation of the waste material. Water will then flow north or south along the ledge to a rock-lined trapezoidal channel that discharges to the West Ditch.

Surface water from the east and southeast side of the landfill will be conveyed in a grassed swale along the perimeter of the north and east parts of the landfill before discharge into the West Ditch. During construction, runoff from the waste excavation areas south of the landfill will drain to a swale and be conveyed in a rock-lined trapezoidal channel before discharge to the West Ditch.

Runoff from the east side of the borrow source area and waste excavation areas will be directed to drainage channels before being discharged off the east perimeter of the site. Waste excavation areas will be reshaped to continue to promote drainage to the east, whereas the borrow source areas will be regraded to promote drainage to the west. Areas draining to the east will drain overland off the site. Areas draining to the west will drain to grassed swales and rock-lined channels before discharging to the West Ditch.

Surface water from the south borrow source area will be directed to the West Ditch in a rock-lined trapezoidal channel. Depending upon final grading, the same rock channel will be used following construction to drain runoff to the West Ditch.

Excavation along the east bank of the West Ditch will occur down to elevation 720 feet to accommodate landfill cover construction. The 720-foot excavation elevation is about 20 feet above the normal surface water flow elevation in the West Ditch. The elevation of the crest of west bank in this section of the West Ditch is at approximately 713 feet in elevation. During flood events, water may rise in the West Ditch and overflow the west bank of the West Ditch. Since the east bank is approximately 7 feet higher than the west bank, the landfill cover will be unaffected by flooding that might occur along the West Ditch.

4.13.3 Post-Construction Erosion and Sediment Control Inspections

Inspections of ESC measures described in Section 4.13.2 are discussed in the LTM strategy provided in Appendix H.

4.13.4 Post-Construction Erosion and Sediment Control Maintenance

ESC measures will be maintained in working order to minimize the potential for erosion. Required maintenance identified in inspection reports will be completed as soon as practicable. If inspection reveals that controls are insufficient, additional controls will be installed. ESC measures will be maintained and inspected by the contractor for a minimum of one year beyond completion of punch list items or until suitable vegetation is established as determined by the USACE.

4.14 Post-Construction Survey

A topographic survey will be conducted following cover implementation to verify drainage requirements and payment quantities. The post-construction survey shall include items necessary to document the as-built condition of the remedial action; this may include but is not limited to drainage features, landfill waste limits, cover limits, cover grades, borrow areas, monitoring wells, and gas vents.

4.15 Site Restoration

Following completion of cover placement, the topsoil (plantable soil) will be seeded with a standard landfill grass mix on the landfill cover and with native grass species over other areas disturbed during construction. Vegetation will be stabilized using the lime, fertilizer, and seeding mixes and application rates in the technical specifications. If the cover system is placed at a time when application of the permanent seed mixtures is not possible, alternative stabilization measures, such as temporary seed mixes or mulching, will be employed in accordance with the technical specifications (Appendix D).

4.16 Reporting

A construction completion report will be prepared to document construction activities and present design variances.

4.17 Demobilization

As part of demobilization, the contractor will remove equipment, excess material, construction facilities, and ESCs. Street cleaning may need to be completed before and during demobilization.

4.18 Institutional Controls

USACE will implement institutional controls as environmental covenants in coordination with Columbus Regional Airport Authority.

4.19 Long-Term Management

LTM consists of groundwater monitoring, landfill gas monitoring, inspections, and maintenance. LTM will begin once construction is complete, as defined by completion of the landfill cover, establishment of vegetation, and initial groundwater sampling with COC analysis. LTM activities will assess potential offsite migration of the COCs in groundwater; monitor that landfill gas does not pose an explosion hazard; and ensure that the landfill cover prevents contact with the waste and reduces surface water infiltration. The groundwater monitoring program will evaluate the continued attenuation of COCs in groundwater and assess the need for additional corrective action to ensure protection of public health and welfare. The general procedures and LTM Strategy for inspection and monitoring, described in Appendix H, are included for demonstration purposes. The guidelines should be developed and presented in the LTM Plan to reflect actual inspection procedures and sampling. The LTM Plan will be finalized following cover implementation and initial groundwater sampling and analysis.

SECTION 5

Construction Documents

5.1 Design Drawings

The design drawings (Appendix C) include the following sheets:

Sheet No.	Title
1	Title Sheet, Vicinity and Location Maps, and Index to Drawings
2	Abbreviations, Designations, and Civil Legend
3	Existing Site Plan
4	Limits of Waste from Previous Investigations
5	Construction Overview
6	Phase One Erosion and Sediment Control Plan
7	Waste Excavation Grading Plans and Sections (1 of 3)
8	Waste Excavation Grading Plans and Sections (2 of 3)
9	Waste Excavation Grading Plans and Sections (3 of 3)
10	Top of Waste Grading Plan
11	Phase Two Erosion and Sediment Control Plan
12	Borrow Excavation Grading Plan and Sections
13	Top of 24” Cover Soil Grading Plan
14	Phase Three Erosion and Sediment Control Plan
15	Final Grading Plan and Site Restoration
16	Passive Gas Vent Layout Plan
17	Site Sections
18	Construction Staking Tables (1 of 2)
19	Construction Staking Tables (2 of 2)
20	Details
21	Details
22	Standard Details

5.2 Technical Specifications

The technical specifications (Appendix D) include the following:

DIVISION 01—GENERAL REQUIREMENTS

01 11 00	Summary of Work*
01 14 00	Work Restrictions*
01 20 00.00 20	Price and Payment Procedures*
01 22 00.00 10	Measurement and Payment*
01 26 00	Contract Modification Procedures*
01 31 13	Project Coordination
01 31 19	Project Meetings
01 32 01.00 10	Project Schedule
01 33 00	Submittal Procedures*
01 35 29.13	Safety and Emergency Response Procedures for Contaminated Sites*
01 50 00	Temporary Construction Facilities and Controls
01 51 00	Field Engineering/Surveying
01 57 20.00 10	Environmental Protection
01 57 21.00	Contact Water Management
01 57 23	Temporary Stormwater Pollution Control
01 61 00	Common Product Requirements

* Requirements related to this specification will be detailed in the contractor's base contract and task order for the project.

DIVISION 02—EXISTING CONDITIONS

02 32 00	Subsurface Drilling, Sampling, and Testing
02 56 14	Cover Soil Layer
02 61 00	Consolidation of Waste Material
02 66 00	Select Fill and Topsoil (Plantable Soil) for Landfill Cover
02 81 00	Transportation and Disposal of Hazardous Materials

DIVISION 31—EARTHWORK

31 00 00	Earthwork
31 11 00	Clearing and Grubbing

DIVISION 32—EXTERIOR IMPROVEMENTS

32 31 13	Chain Link Fences and Gates
32 92 19	Seeding

DIVISION 33—UTILITIES

33 05 11	High Density Poly-Ethylene and Polyvinyl Chloride Pipe
33 24 13	Groundwater Monitoring Wells

SECTION 6

Green and Sustainable Design Elements

This section discusses the overall GSR approach to the project. GSR was considered and incorporated as appropriate throughout the RD process. Appendix G presents the GSR Report for the site. GSR can be defined as follows:

> The practice of considering all environmental effects of remedy implementation and incorporating options to maximize net environmental benefit of cleanup actions. (DoD memorandum, "Consideration of Green and Sustainable Remediation Practices in the Defense Environmental Restoration Program," August 10, 2009)

Further, GSR practices are those that do the following:

- Minimize total energy use and maximize use of renewable energy.
- Minimize air pollutants and greenhouse gas emissions.
- Minimize water use and impacts to water resources.
- Reduce, reuse, and recycle material and waste.
- Protect land and ecosystems.

These GSR practices can be considered at two levels or phases in a project such as this. The first phase is at the strategic level, when the overall RD approach is developed. This was done in developing the Final Focused Feasibility Study Report (CH2M HILL 2011c) and the Decision Document (CH2MHILL 2012). These generally are big picture considerations involving the general remedial approach and net impacts on the environment. The second phase is at the RD level. These practices typically are more detailed as to the specifics of how the remedial action is implemented, constructed, operated, and monitored.

The development of GSR elements for the project was guided by several BMPs developed by USACE for the project (Appendix G). In addition, USACE has a draft guidance document on incorporating GSR and a list of 64 BMPs. The USEPA's BMPs cover mostly RD-level GSR elements, whereas USACE's cover both strategic level and RD-level GSR elements (USEPA 2009).

The BMPs were reviewed, then narrowed down to those that are applicable and those that are cost-effective and implementable for the site. The practical BMPs have been incorporated into the RD, as discussed in the following section.

6.1 Strategic Level GSR Elements

Although not specifically defined as GSR elements in the focused feasibility study and the Decision Document, the following GSR elements were incorporated into the RD:

- Select a soil cover comparable to a Resource Conservation and Recovery Act (RCRA) type of cap. The proposed final cover will meet an equivalent performance standard as a RCRA cap, but using onsite materials for the soil cover.

- Balance future land use considerations by allowing for multiple reuse options.
- Balance the dimensions of the cover versus the area to be excavated, thus maximizing reuse of the site for industrial/commercial purposes.
- Complete site restoration activities quickly, such as seeding and other erosion control items.

6.2 Remedial Design Level GSR Elements

The following RD-level GSR elements have been incorporated into the RD package:

- Propose a cut and fill borrow source onsite for cover soil, select fill, and topsoil (plantable soil) materials.
- Use native species for revegetation.
- Quickly and efficiently implement seeding and erosion restoration items at the end of the construction so as to limit erosion impacts.
- Remove the West Ditch reinforced concrete structure, reducing the need for two construction efforts at the same site and thus minimizing the use of equipment and resources.
- Consolidate the reinforced concrete structure debris under the landfill cover, minimizing waste generation requiring offsite disposal.
- Minimize dust during construction activities by spraying water or by laying biodegradable mats, tarps, or materials.
- Select and place rock-lined channel protection at the outlets of swales and pipes.

The following GSR language is included in the technical specifications.

- Employ sustainable practices to the maximum extent practicable during performance of the work. Sustainability practices to be used in performing the work may include the following:
  - Minimize vehicle miles driven including mobilization mileage, crew travel mileage, equipment and materials delivery mileage (bulk shipments), and maintenance/ repair mileage.
  - Limit vehicle idling.
  - Use alternative fuels for equipment and vehicles.
  - Use vehicles meeting new USEPA clean diesel standards, or upgrade to new emissions controls (such as diesel oxidation catalysts, diesel particulate filters, and closed crankcase ventilation filtration systems) to reduce particulate matter, carbon monoxide, and nitrogen oxides in exhaust.
  - Minimize packaging waste.
  - Recycle packaging waste.

  - Use recycled or recycled-content material (such as paper towels, trash bags or plastic sheeting, or materials packaging) as applicable.
  - Reuse materials where applicable.
  - Use local resources and materials, including local sources of water for dust suppression.
  - Use reasonable measures to minimize and suppress fugitive emissions of dust, vapors, and other site materials during site work.
- Complete an evaluation of Occupational Safety & Health Administration's Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120/29 CFR 1926.65) applicability, to support efficient resource use.

6.3 Green and Sustainable Remediation Report

The following items were included as recommendations in the final GSR report:

1. Evaluate the pros and cons of complete versus partial removal of the West Ditch concrete structure.

   Response—Partial removal was considered in the 60 percent remedial design submittal. However, complete removal is now planned because of potential stability problems with leaving part of the structure behind.

2. Determine if there are technical issues that would preclude leaving stumps in place in the area that will be covered.

   Response—Potential for development of preferential pathways and for additional differential settlement is increased if stumps are left within the footprint of the landfill. Therefore, areas of disturbance will be grubbed in accordance with the technical specifications (Appendix D).

3. Evaluate the idea to dig out an area to allow pooling of surface water for use during construction.

   Response—Temporary ponds (sediment basins) are incorporated into the RD for sediment control, but the ponded water is not proposed for reuse in the RD. The contractor can consider the East or West Ditch as a water source for dust control.

4. Perform a detailed technical and feasibility evaluation to maximize potential use of mulch generated by vegetation clearing for other aspects of the remedial action construction.

   Response—The reuse of onsite soils and mulch as the basis for creation of topsoil (plantable soil) for the cover will be evaluated by the contractor and used if deemed suitable. Importation of topsoil (plantable soil) is proposed if onsite soils are not deemed suitable.

5. Evaluate use of Hydrosleeves for groundwater sampling to eliminate/reduce purge water.

Response—The method of groundwater sampling will be established after groundwater data have been collected as part of LTM. Hydrosleeves will be evaluated as a potential sampling method during development of the final LTM Plan.

6. Evaluate potential alternatives for dust control.

   Response—The contractor will choose means and methods for dust control. Language has been added to the technical specifications encouraging the use of green and sustainable methods for dust control during the remedial action.

SECTION 7

Compliance Plan

Table 7-1 summarizes the ARARs for the site. Waivers are being applied to ARARs 1, 2, and 4 (as listed in Table 7-1). As noted, the landfill cover was designed to meet the Ohio EPA rules in place when the landfill ceased operation in 1979. The 1976 rules were clarified by the Ohio EPA in two guidance documents: “Measureable Criteria for Questionable Pre-1990 Landfill Caps” (Guidance no. 0123, March 27, 1995); and “Measureable Criteria for Questionable Pre-1990 Landfill Caps” (Guidance no. 0251, March 24, 1995). Table 7-2 indicates where in the BOD document each ARAR is addressed and incorporated into the RD. Table 7-3 indicates other regulations that were referenced and used for further guidance in the RD, but the regulations or guidance documents listed are not ARARs.

TABLE 7-1
Summary of ARARs
Former Lockbourne AFB Landfill Basis of Design

	ARARs	Description of Regulation	Comments
1	OAC 3745-27-08 Construction Specifications for Sanitary Landfills	Specifies the minimum requirements for soil and clay layers, granular drainage layer, geosynthetics, leachate management system, gas monitoring system, etc. Describes minimum standards for construction requirements for sanitary landfill facilities.	In coordination with Ohio EPA, USACE will be applying a waiver to this ARAR.
2	OAC 3745-27-10 Groundwater monitoring program for a sanitary landfill facility	Requires groundwater monitoring program for all sanitary landfill facilities. Requires that the system consist of a sufficient number of wells that are located so that samples indicate both upgradient (background) and downgradient water samples. Details minimum requirements that the system must be designed to meet. Details sampling and analysis procedures. Specifies procedures for assessment and correction of contamination.	In coordination with Ohio EPA, USACE will be applying a waiver to this ARAR.
3	OAC 3745-27-13 (H) Sections 7 and 8 Disturbances Where Hazardous or Solid Waste Facility was Operated	Describes substantive limitations on any proposed filling, grading, excavating, building, drilling, or mining on land where a hazardous waste facility or solid waste facility was operated and how the activities will be accomplished.	
4	OAC 3745-27-11 (G) and (H) Final Closure of Sanitary Landfill Facilities	Requires closure of a landfill in a manner which minimizes the need for post-closure maintenance and minimizes post-closure formation and release of leachate and explosive gases to air, soil, groundwater, or surface water. Specifies acceptable cap design; barrier layer, granular drainage layer, soil and vegetative layer. Provides for use of comparable materials to those specified with approval of Director.	In coordination with Ohio EPA, USACE will be applying a waiver to this ARAR.
5	OAC 3745-17-08 (B) Restriction of emission of fugitive dust	Requires reasonably available control measures to prevent fugitive dust from becoming airborne.	
6	40 CFR 230.10 Guidelines for Specification of Disposal Sites for Dredged or Fill Material	Requires appropriate and practicable steps are taken that minimize potential adverse impacts of the discharge of dredged or fill material on the aquatic ecosystem.	

TABLE 7-2
ARAR Compliance Evaluation Matrix
Former Lockbourne AFB Landfill Basis of Design

	ARARs	**Description of Regulation**	**Location and Description of Compliance Discussion**
1	OAC 3745-27-08 Construction Specifications for Sanitary Landfills	Specifies the minimum requirements for the soil and clay layers, granular drainage layer, geosynthetics, leachate management system, gas monitoring system, etc. Describes minimum standards for construction requirements for sanitary landfill facilities.	Specific requirements of this ARAR are waived. Equivalent standards of performance related to this ARAR are shown in the BOD throughout Sections 3 and 4, technical specifications and QA/QC Plan.
2	OAC 3745-27-10 Groundwater monitoring program for a sanitary landfill facility	Requires groundwater monitoring program for all sanitary landfill facilities. Requires that the system consist of a sufficient number of wells that are located so that samples indicate both upgradient (background) and downgradient water samples. Details minimum requirements that the system must be designed to meet. Details sampling and analysis procedures. Specifies procedures for assessment and correction of contamination.	Specific requirements of this ARAR are waived. Equivalent standards of performance related to this ARAR are shown in the BOD Section 3.2.3, design drawings and LTM Strategy.
3	OAC 3745-27-13 (H) Sections 7 and 8 Disturbances Where Hazardous or Solid Waste Facility was Operated	Describes substantive limitations on any proposed filling, grading, excavating, building, drilling, or mining on land where a hazardous waste facility or solid waste facility was operated and how the activities will be accomplished.	RD considerations related to this ARAR are shown in the BOD Section 4.9 and 4.10, technical specifications and OA/QC Plan.
4	OAC 3745-27-11 (G) and (H) Final Closure of Sanitary Landfill Facilities	Requires closure of a landfill in a manner which minimizes the need for post-closure maintenance and minimizes post-closure formation and release of leachate and explosive gases to air, soil, groundwater, or surface water. Specifies acceptable cap design; barrier layer, granular drainage layer, soil and vegetative layer. Provides for use of comparable materials to those specified with approval of Director.	Specific requirements of this ARAR are waived. Equivalent standards of performance related to this ARAR are shown in the BOD Section 3.2, technical specifications and QA/QC Plan.
5	OAC 3745-17-08 (B) Restriction of emission of fugitive dust	Does not allow anyone to cause or permit any fugitive dust source to be operated; or any materials to be handled, transported, or stored; or a building or its appurtenances or a road to be used, constructed, altered, repaired, or demolished without taking or installing reasonably available control measures to prevent fugitive dust from becoming airborne.	RD considerations related to this ARAR are shown in the technical specifications and QA/QC Plan.
6	40 CFR 230.10 Guidelines for Specification of Disposal Sites for Dredged or Fill Material	Requires appropriate and practicable steps are taken that minimize potential adverse impacts of the discharge of dredged or fill material on the aquatic ecosystem.	RD considerations related to this ARAR are included in the BOD, Section 8.2.3.4.

TABLE 7-3
RD Guidance Evaluation Matrix
Former Lockbourne AFB Landfill Basis of Design Report

	Other Regulations or Guidance	**Description of Regulation**	**Location and Description of Guidance Discussion**
1	OAC 3745-27-08 Construction Specifications for Sanitary Landfills	Describes minimum standards for construction requirements for sanitary landfill facilities.	BOD Section 4.9 through 4.13, technical specifications, and QA/QC Plan.
	OAC 3745-27-08 (D)(1) Survey marks	Specifies minimum requirements for permanent survey marks.	Technical specifications.
	OAC 3745-27-08 (D)(2) Surface water control structures	Specifies minimum requirements for surface water run-on and runoff control structures.	BOD Section 3.2, 4.5 and 4.13, technical specifications, and QA/QC Plan.
2	OAC 3745-27-08 (D)(20) Gas Collection System	Specifies minimum requirements for gas collection system	BOD Section 2.6 and design drawings.
	OAC 3745-27-08 (C)(7) Design for the Stability of Engineered Components	Specifies minimum requirements for factors of safety of landfill slopes.	BOD Section 4.10 and design drawings.
3	OAC 3745-27-10 Ground water monitoring program for a sanitary landfill facility	Requires that the system consist of a sufficient number of wells located so that samples indicate both upgradient (background) and downgradient water samples. Details minimum requirements that the system must be designed to meet. Details sampling and analysis procedures. Specifies procedures for assessment and correction of contamination.	BOD Section 3.2 and LTM Strategy.
4	OAC 3745-27-11 (G) and (H) Final Closure of Sanitary Landfill Facilities	Requires closure of a landfill in a manner that minimizes the need for post-closure maintenance and minimizes post-closure formation and release of leachate and explosive gases to air, soil, groundwater, or surface water. Specifies acceptable cap design; barrier layer, granular drainage layer, soil and vegetative layer. Provides for use of comparable materials to those specified with approval of Director.	BOD Section 3.2 and 4.0, technical specifications, design drawings, and LTM Strategy.
	OAC 3745-27-11 (G) Composite cap system	Specifies minimum requirements for a composite cap system.	Not applicable.
	OAC 3745-27-11 (H)(2) Surface water control structures	Installation of the required surface water control structures including permanent ditches to control run-on, runoff, and sediment ponds, as shown in the final closure/post-closure plan, and as necessary, grade all land surfaces to prevent ponding of water where solid waste has been placed and institute measures to control erosion.	BOD Section 3.2, 4.5, 4.13, Technical Specifications, and design drawings.
	OAC 3745-27-11 (H)(3) Groundwater monitoring system	Specifies requirements for design and installation a ground water monitoring system in accordance with rule 3745-27-10.	BOD Section 3.2 and LTM Strategy.

TABLE 7-3
RD Guidance Evaluation Matrix
Former Lockbourne AFB Landfill Basis of Design Report

	Other Regulations or Guidance	**Description of Regulation**	**Location and Description of Guidance Discussion**
	OAC 3745-27-11 (H)(5) Plat and deed	Specifies requirements for recordation on the plat and deed to the sanitary landfill facility property, or on some other instrument which is normally examined during title search, that will in perpetuity notify any potential purchaser of the property, a notation describing the affected acreage, and the exact location, depth, volume, and nature of solid waste deposited in the units of the sanitary landfill facility.	Not applicable to the RD.
	OAC 3745-27-11 (H)(7) Access	Upon ceasing acceptance of waste in all units of the sanitary landfill facility, the owner or operator must block, by locked gates, fencing, or other sturdy obstacles, all entrances and access roads to the sanitary landfill facility to prevent unauthorized access during the final closure and post-closure period.	Design drawings.
5	OAC 3745-17-08 (B) Restriction of emission of fugitive dust	Does not allow anyone to cause or permit any fugitive dust source to be operated; or any materials to be handled, transported, or stored; or a building or its appurtenances or a road to be used, constructed, altered, repaired, or demolished without taking or installing reasonably available control measures to prevent fugitive dust from becoming airborne.	Technical specifications. Dust needs to be controlled only during cover construction, as the site is no longer operational.
	OEPA Division of Solid and Infectious Waste Management: Guidance #0123 Standards for Current Construction of a 1976 Cap System, March 27, 1995 (Cross References: Measurable Criteria for Questionable Pre-1990 Landfill Caps, 3/24/95)	Establishes criteria for materials, construction, and testing specifications for building a new cap that meets the requirements of the 1976 rules, or rebuilding an old cap that failed to meet the 1976 rules.	BOD Section 3.2 and 4.9, technical specifications, QA/QC Plan, and design drawings.
	OAC 3745-27-10 Closure of Sanitary Landfills	Closure of sanitary landfills in accordance with the 1976 rules and associated guidance documents (#0123, #251).	BOD Section 3.2, throughout BOD Section 4, technical specifications, QA/QC Plan, and design drawings.
	OEPA Division of Solid and Infectious Waste Management Guidance #251 (#111) Measurable Criteria for Questionable Pre-1990 Landfill Caps	Interprets OAC Rule 3745-27-09(F) [effective 7/29/76] to establish measurable criteria in the area of grain size for old cap material. The criteria herein should be used when the quality of an old cap [pre-4/1/90] is questionable and testing is necessary to determine if it satisfies the 1976 rules. It should not be used as a document which initiates testing of all old caps at existing landfills.	BOD Section 3.2 and throughout BOD Section 4, technical specifications, QA/QC Plan, and design drawings.

TABLE 7-3
RD Guidance Evaluation Matrix
Former Lockbourne AFB Landfill Basis of Design Report

Other Regulations or Guidance	**Description of Regulation**	**Location and Description of Guidance Discussion**
OAC 3745-27-12- (E)(5)(a) Explosive Gas migration for a sanitary landfill facility	LFG threshold limits: 100% of the lower explosive limit (5% methane) at or within the facility boundary. 25% of the lower explosive limit (1.25% methane) in occupied structures. Note: no occupied structures onsite.	BOD Section 2.6.
Ohio EPA Guidance #0117, “Ground Water Monitoring Requirements for Closed Facilities” dated May 9, 2005.	Provide guidance for implementation of groundwater monitoring as part of the LTM Plan.	BOD Section 3.2 and the LTM Strategy.
State of Ohio Rainwater and Land Development Manual for sediment basin and sediment trap sizing.	Sediment basin and sediment trap sizing criteria.	BOD Section 4.5 and 4.13 and design drawings.
40 CFR 258 for drainage swale sizing	Surface water channel sizing criteria.	BOD Section 4.5 and 4.13 design drawings.
US EPA 600/2-79-165 “Design and Construction of Covers for Solid Waste Landfills” August 1979	Annual soil loss less than 2 tons/acre/year.	BOD Section 4.10

8. Remedial Action Construction Plan

SECTION 8

Remedial Action Construction Plan

This section describes the Remedial Action Construction Plan and presents the anticipated schedule for cover construction. The RD package contains the following major remedial activities:

- Preconstruction activities, including planning and surveying.
- Mobilization activities, including setup of project trailers, preparation of equipment and material laydown areas, temporary utility hookups, and setup of health and safety controls
- Site preparation activities, including installation and placement of ESC measures, clearing and grubbing, and abandonment of select monitoring wells
- Waste excavation and consolidation
- Soil sampling
- Site grading, backfill, and cover installation
- Seeps prevention trench installation
- Passive gas vents installation
- Site restoration
- Monitoring well installation and groundwater sampling
- Post-construction survey
- Reporting
- Demobilization

8.1 Schedule

Appendix A contains the proposed construction schedule.

8.2 Preconstruction Activities

8.2.1 Planning

A preconstruction field conference will be held during startup after selection of the contractor and subcontractors and before construction commences. The preconstruction conference will be used to accomplish the following:

- Define the roles and responsibilities of the parties involved.
- Define the construction schedule.

- Coordinate remedial activities with project stakeholders.
- Review the work area limits and safety protocols.
- Review equipment and material lay down requirements.
- Review traffic routing for hauling of materials and equipment.
- Define utility requirements during the remedial construction.
- Conduct a site reconnaissance.
- Define verification sampling.
- Review reinforced concrete structure removal plan.
- Review site security.

This phase of the project may be used to review methods for documenting and reporting QA/QC inspection data and for distributing and storing documents and reports. The preconstruction conference will be documented in meeting minutes that list attendees and describe items discussed, clarifications made, and instructions issued.

Contractor submittals will be reviewed including the:

- Remedial Action Work Plan (includes Sampling and Analysis Plan)
- Construction Health and Safety Plan
- QA/QC Plan (contractor will update the plan presented in Appendix F)
- Construction Site Plan (including security, waste management, and materials handling)
- Traffic Control Plan
- Contact Water Management Plan
- Sampling and Analysis Plan (applies to excavation, borrow and during monitoring well installation)
- Stormwater Pollution Prevention Plan (includes ESC measures)

These documents must be approved by USACE and finalized before construction begins.

8.2.2 Utility Locate

The contractor is responsible for locating the utilities on the site before excavation, using the Ohio Utilities Protection Service (call 8-1-1 or 1-800-362-2764) and other resources. Before implementing intrusive activities within each area to be covered, underground utilities will be located and marked. The contractor will be responsible for repairs if utilities are damaged.

8.2.3 Surveying

8.2.3.1 Topographic

An as-built survey, depicting grade elevations before construction of the soil cover system, will be conducted in accordance with the requirements described in the technical specifications.

8.2.3.2 Former Radio Transmitter Station Property

Waste Excavation Area 3 is adjacent to the former radio transmitter station property (Sheet 5 of the design drawings). The waste that extends into the former radio transmitter station property will not be excavated and consolidated under the landfill cover, because the site is not eligible for restoration under the FUDS program. The boundary of the transmitter station property will be surveyed and staked before construction to prevent encroachment during excavation work; control points for the property line are provided in the design drawings (Sheet 6 and 19).

8.2.3.3 American Electric Power Transmission Tower and Easement

The AEP transmission line is located in the middle of the eastern part of Waste Excavation Area 5 as shown on Sheet 5 of the design drawings. There is a 50-foot easement in either direction perpendicular to the centermost transmission line. Construction activities cannot occur within 40 feet of the transmission tower. Appendix I specifies the AEP restrictions.

8.2.3.4 Wetlands and Water Bodies

The northern part of the borrow source area and Waste Excavation Area 3 are located near the wetlands identified in 2011. Waste Excavation Area 4 includes excavation in a wetland identified in 2011. Additional wetland areas may be present. The wetland determination will occur in coordination with USACE and Ohio EPA prior to construction.

Following the wetland and water body determination, the boundaries will be surveyed and staked before construction begins. When waste must be excavated within the wetland, the excavation limits will be surveyed and staked. Measures will be implemented to limit wetland impacts as much as practicable. Wetland disturbance must meet the substantive provisions of applicable or relevant and appropriate water quality requirements such as those in Sections 401 and 404 of the Clean Water Act.

8.3 Mobilization

In mobilizing for construction, the contractor will make arrangements with utility service companies for temporary services, including light, power, telephone, sanitary facilities, and water. The contractor will provide a field trailer office and prepare approved equipment and material laydown areas in accordance with the technical specifications. Health and safety controls will be identified and implemented in accordance with the construction documents.

8.4 Site Preparation

Site preparation will begin with the installation of ESC measures, as depicted on the design drawings. These measures may include placement of silt fencing downgradient of disturbed work areas, installation of temporary and permanent stormwater management features in the project area, and stabilizing the construction entrances. Once the ESC measures are in place, construction can commence within the work area limits. Clearing and grubbing must occur as outlined in the technical specifications and design drawings. Certain areas on the site pose limitations regarding intrusive activities, as noted above. Monitoring wells will be abandoned.

8.5 Waste Excavation and Consolidation

The subgrade for the landfill cover will be made up of excavated waste consolidated from areas outside the cover limits. The material will be placed and compacted and act as fill to achieve top of waste grades before placing the compacted soil cover.

The top of waste will be graded in preparation for cover construction. The upper 1 foot of the waste surface will consist of materials with a particle size no greater than 6 inches. Select fill may be used to create a suitable surface for constructing the landfill cover.

8.6 Soil Sampling

Onsite soil will be sampled for suitability for reuse as select fill, cover material, or topsoil (plantable soil) and to evaluate COC concentrations in soil that will remain in place outside the landfill cover areas. If an offsite borrow source is needed, offsite soil will be sampled for suitability for reuse as select fill, cover material, or topsoil (plantable soil).

8.7 Site Grading and Backfill

Site grading and backfill will include waste excavation and consolidation and borrow source excavation in preparation for cover installation.

8.8 Soil Cover Construction

The cover will include the following components:

- 24 inches of compacted soil cover with a laboratory hydraulic conductivity of less than 1×10^{-6} cm/s
- 6 inches of topsoil (plantable soil) having an organic and nutrient content sufficient to support permanent, healthy, native vegetative growth

8.9 Seep Prevention Trench

A seep prevention trench will be installed along the cover perimeter within the waste mass to prevent migration of liquid (seeps) through the landfill and landfill cover to areas beyond the landfill cover boundary. The trench will be filled with the clean, crushed AASHSTO #57 stone and sloped at 1 percent toward manholes around the perimeter of the landfill. The trench will be wrapped with an 8-ounce-per-square-yard geotextile to prevent migration of fines from the surrounding soils and waste material into the trench. The 48-inch HDPE access manholes allow a vacuum truck or similar equipment to pump out water if seeps are observed around the toe of the cover. A continuous perforated pipe will be installed around the landfill in the seep prevention trench with a 4-inch sampling port for water level measurements. Inspections will be provided in each manhole lid. Sheets 15 and 20 of the design drawings show the details of the seep prevention trench.

8.10 Passive Gas Vents

Passive gas vents will be constructed in the landfill cover to facilitate gas migration. Proposed gas vent locations are shown on Sheet 16 of the design drawings. The gas vents are spaced at approximately one per acre across the surface of the landfill.

8.11 Site Restoration

8.11.1 Waste Excavation and Borrow Source Area

Borrow areas are to be graded in accordance with the design drawings and to be seeded in the same fashion as the soil cover. No topsoil (plantable soil) is required in the borrow source area.

8.11.2 Soil Cover

Following completion of cover placement, the topsoil (plantable soil) will be seeded with a standard landfill grass mix on the cover area and with native grass species over other areas disturbed during construction. Vegetation will be stabilized using the lime, fertilizer, and seeding mixes and application rates as specified in the technical specifications. If cover system placement is completed at a time when application of the permanent seed mixture is not permissible, alternative stabilization measures, such as temporary seed mixes or mulching, will be employed in accordance with the technical specifications.

8.11.3 Wetlands and Water Bodies

Before the remedial action can be implemented, coordination with USACE and Ohio EPA must occur because the proposed remedial action will affect wetlands and water bodies (CH2M HILL 2011b). Based upon the excavation area shown on Sheet 8 of the design drawings and observed wetlands in 2011, 0.34 acre of wetlands will be disturbed during the remedial action. The actual acreage disturbed may differ based on the actual wetland and water body determinations and actual waste extents encountered during excavation. The contractor will be responsible for determining restoration or mitigation requirements with the USACE, Huntington District depending on the extent of wetland and water body impacts.

8.12 Monitoring Well Installation and Groundwater Sampling

Groundwater sampling and analysis will be conducted to evaluate potential receptors and develop the LTM groundwater monitoring program. The proposed groundwater sampling will be presented in the Remedial Action Work Pan, specifically the Sampling and Analysis Plan. Following groundwater sampling, the LTM Plan will be finalized. However, the LTM Plan will continually be reviewed and revised, as appropriate as part of the five-year reviews.

8.13 Post-Construction Survey and Reporting

Following completion of the construction, a construction completion report will be prepared to document construction activities and will include as-built drawings and design variances.

The construction completion report must be certified by a professional engineer registered in the State of Ohio.

8.14 Demobilization

Upon completion of construction activities associated with the controlled fill placement and cover system construction in each area, the contractor will conduct a final inspection of the cover system with USACE. During the inspection, a punch list will be developed to document work elements that must be repaired, restored, or corrected before project closeout.

General site cleanup will occur at this time. Temporary ESCs will be checked and left in place for those areas of the site in which full vegetative stabilization has not been established. Final completion of the project will not occur until adequate vegetation is established.

9. Cost Estimate

SECTION 9

Cost Estimate

Appendix E contains a Class II estimate, accurate within -15 to +20 percent of the actual cost. The cost estimate [provided to USACE only] is for federal government use only and is on file at the USACE, Louisville District offices. The estimate was prepared using the following methods:

- Comparison with similar work performed by contractors, with labor, equipment and material adjustments based on observed or perceived site conditions, RD, and information provided by local engineers/facility operators
- Historical labor costs for engineering, construction management, etc. based on CH2M HILL experience

The engineer's estimate is only an estimate of construction costs for budgeting purposes. The estimate is limited to conditions current at its issuance. It is not a guaranty of actual price or cost. Uncertain market conditions such as local labor or contractor availability, wages, other work, material market fluctuations, price escalations, force majeure events, and developing bidding conditions may affect the accuracy of the estimate. CH2M HILL is not responsible for cost or contractual variances from the estimate.

SECTION 10

Quality Assurance / Quality Control

The Construction QA/QC Plan (Appendix F) establishes the guidelines and requirements used to meet client objectives and achieve applicable standards. The object of the plan is to document requirements, procedures and methodology for QA/QC during construction of the remedial action.

SECTION 11

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FINAL REPORT

Decision Document for AOCs 17/18/19/103, Former Lockbourne Air Force Base, Ohio

FUDS Property Number G05OH007
Project Number 33

Prepared for

U.S. Army Corps of Engineers
Louisville District

Contract Number W912PP-09-D-0016
Delivery Order Number CY01

July 2017

Contents

Appendixes

Tables

Figures

Acronyms and Abbreviations

μg/L	micrograms per liter
$\mu g/m^3$	micrograms per cubic meter
AFB	Air Force Base
AOC	area of concern
AR	Administrative Record
ARAR	applicable or relevant and appropriate requirement
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act of 1980
CFR	Code of Federal Regulations
COC	contaminant of concern
CRAA	Columbus Regional Airport Authority
CVOC	chlorinated volatile organic compound
DCE	dichloroethene
DERP	Defense Environmental Restoration Program
DoD	Department of Defense
ELCR	excess lifetime cancer risk
ERA	ecological risk assessment
FUDS	Formerly Used Defense Site
GSR	green and sustainable remediation
HHRA	human health risk assessment
HVAC	heating, ventilation, and air conditioning
IR	Information Repository
MCL	maximum contaminant level
NCP	National Oil and Hazardous Substances Pollution Contingency Plan 1990
O&M	operations and maintenance
Ohio EPA	Ohio Environmental Protection Agency
OSWER	Office of Solid Waste and Emergency Response
RAO	remedial action objective
RG	remediation goal
RI	remedial investigation
RIA	Rickenbacker International Airport
RPA	Rickenbacker Port Authority
SARA	Superfund Amendments and Reauthorization Act of 1986

SSD	subslab depressurization
SVE	soil vapor extraction
TCE	trichloroethene
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
UWBZ	upper water-bearing zone
VI	vapor intrusion

SECTION 1

Declaration

1.1 Site Name and Location

This Decision Document was prepared for areas of concern (AOCs) 17, 18, 19, and 103 at the former Lockbourne Air Force Base (AFB) in Columbus, Ohio (Figure 1-1). The AOCs are identified as Formerly Used Defense Site (FUDS) Property Number G05OH0007, Project Number 33.

Former Lockbourne AFB was constructed and activated in 1942 and consisted of approximately 4,378 acres. The former Lockbourne AFB was used as a training base by elements of the Department of Defense (DoD) from 1942 to 1945. It came under control of the Strategic Air Command in 1951 and became a Tactical Air Command Base in 1965. In 1974, the facility was renamed Rickenbacker AFB, and was realigned in April 1980. The former Lockbourne AFB is located east of Interstate 71 in Franklin and Pickaway Counties (Figure 1-1) and is now occupied primarily by the Columbus Regional Airport Authority (CRAA) and various retail and service businesses. Portions of the property to the west of AOCs 17, 18, 19, and 103 are occupied by the 121st Air Refueling Wing of the Ohio Air National Guard, the Ohio Army National Guard, and a U.S. Naval Reserve Center. Most of the area south and southeast of the former Lockbourne AFB is rural or agricultural. Residential and commercial/industrial areas border the north side of the former AFB, and the village of Lockbourne is to the west. A corridor of railroad tracks is immediately to the southwest.

The AOCs are part of the Rickenbacker International Airport (RIA), an active joint civil-military airport used primarily as a cargo airport for the City of Columbus and some passenger charter carriers. The airport features parallel 12,000-foot runways and 500,000 square feet of cargo terminal space. The Ohio Air National Guard's 121st Air Refueling Wing operates out of the airport and occupies an area west of the AOCs and northwest of the runways. The RIA lies within the city limits of metropolitan Columbus, Ohio. Most of the airport complex lies in Franklin County, with a small part to the south in Pickaway County.

The AOCs are located on property owned by the CRAA. The AOCs are part of a larger parcel of the former Lockbourne AFB that was declared excess and conveyed in April 1984 to the Rickenbacker Port Authority (RPA), predecessor to CRAA. The Ohio Army National Guard and U.S. Naval Reserves did not operate at the AOCs. Any use of the AOCs by the Ohio Air National Guard was for storage of deicing supplies and equipment. The AOCs are adjacent to a broad tarmac that covers an area roughly 1,000 by 2,000 feet. AOC 17 (0.52 acre) and AOC 103 (0.02 acre) are grass and pavement covered. CRAA uses the building at AOC 18 (0.77 acre) for light aircraft maintenance, including refueling and deicing, and the building at AOC 19 (0.02 acre) for a passenger terminal.

1.2 Statement of Basis and Purpose

DoD is the lead agency at FUDS properties when executing a DoD response action associated with DoD hazards. The United States Army Corps of Engineers (USACE) is the lead agency for response action execution on behalf of DoD. USACE selected the remedial action decisions, which are sealing and monitoring for AOC 18 and no action for AOCs 17, 19, and 103. This Decision Document, a legal document, presents the selected remedy for AOC 18 (Sealing and Monitoring) and AOCs 17, 19, and 103 (No Action) and was prepared in accordance with *A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Section Decision Documents* (United States Environmental Protection Agency [USEPA] 1999) and with the USACE FUDS program policy found in Engineering Regulation 200-3-1 (USACE 2004). USACE selected the remedial action decisions in accordance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended by the

Superfund Amendments and Reauthorization Act (SARA), and Section 300.430(f) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 Code of Federal Regulations [CFR], Part 300). The decisions are based on information contained in the Administrative Record (AR) file for AOCs 17, 18, 19, and 103. USACE–Louisville District maintains the AR file, and it is available online at http://www.lrl.usace.army.mil/Missions/Environmental/Lockbourne-Air-Force-Base/. The Information Repository (IR) is located at the Columbus Metropolitan Library, Southeast Branch, and in the AR file online, at the website noted above. The Ohio Environmental Protection Agency (EPA) has not provided concurrence with the selected remedial action decisions for AOCs 17, 18, 19, and 103.

1.3 Description of Selected Remedy

At AOCs 17, 19, and 103, no action for protection of human health and the environment is warranted because potential risks are within the acceptable range as specified in the NCP [40 CFR Section 300.430(e)(2)(i)(A)(2-5)] for current and reasonably foreseeable future land use.

At AOC 18, trichloroethene (TCE) was identified as a contaminant of concern (COC) in soil gas due to potential migration of TCE from subslab vapor beneath the Fixed Base Operations Building to indoor air via vapor intrusion (VI). Because U.S. Air Force Technical Orders and Manuals specified the use of TCE and the U.S. Air Force was known to use TCE in operations such as those conducted at AOC 18, the release of TCE is attributable to DoD. To address these potential risks to human health at AOC 18, the selected remedy is sealing and monitoring, defined as Alternative 2 in the *Feasibility Study Report* (CH2M 2016). While no current risks were identified for AOC 18, the selected remedy addresses the potential for unacceptable risk from a future commercial/industrial worker exposure to TCE in indoor air within the Fixed Base Operations Building (Former Base Engineer’s Maintenance and Inspection Building, or Aircraft Maintenance Building [Building 532]). Specifically, the remedy for AOC 18 consists of:

- *Sealing*. Sealing consists of sealing vapor entry points, if any, within the Fixed Base Operations Building. Potential vapor entry points will be identified for sealing, and a visual inspection of the entire building will be conducted to identify cracks, building joints, and other building features that could be potential vapor entry points. A portable gas detector will also be used to identify vapor entry points. Subsequent sealing of vapor entry points will be performed using elastomeric compounds and insulating foam sealants to reduce or prevent TCE from being transported through these vapor entry points. Long-term monitoring and maintenance of the seals will be required. However, this approach will address the potentially largest points of vapor entry and thereby mitigate the pathway between elevated subslab soil gas concentrations of TCE and potential future VI into indoor air.
- *Monitoring*. Monitoring consists of routine collection of subslab soil gas and indoor air samples to evaluate how indoor air and subslab soil gas TCE concentrations change over time within the Fixed Base Operations Building. The sampling approach, methods, frequency, and decision logic for changes in monitoring will be developed as part of the remedial design and a monitoring plan. The objectives of the monitoring program are to (1) verify that TCE concentrations in indoor air do not increase to concentrations above the remediation goal (RG) and (2) evaluate how subslab soil gas concentrations of TCE and degradation products change over time. If TCE is observed above the RG, contingency measures (such as a subslab depressurization system) may be implemented. The details of the monitoring program, such as the precise number of subslab soil gas and indoor air samples to be collected, analytical suite and screening criteria, and contingency measures and triggers, will be provided in the monitoring plan, which is part of the remedial design phase of the CERCLA process.

1.4 Statutory Determinations

Based on investigation results and the human health risk assessment (HHRA), there are no noncarcinogenic hazards exceeding USEPA's threshold hazard index (HI) of 1 or excess lifetime cancer risks (ELCRs) above USEPA's acceptable ELCR range of 1×10^{-4} to 1×10^{-6} for current/future commercial/industrial worker or construction worker exposures to surface soil, total soil, or groundwater. Therefore, the No Action remedial action decision for AOCs 17, 19, and 103 is protective of human health and the environment. Consequently, no applicable or relevant and appropriate requirements (ARARs) were identified, and the statutory determinations for treatment under CERCLA Section 121 are not necessary.

The selected remedy for Fixed Base Operations Building (AOC 18) is protective of human health and the environment and satisfies the statutory requirements of CERCLA §121(b). The selected remedy complies with ARARs, is cost-effective, and uses permanent solutions. The remedy does not satisfy the statutory preference for treatment as a principal element. The remedy was chosen because it reduces future potential unacceptable risk from exposure to TCE for future commercial/industrial workers in indoor air within the Fixed Base Operations Building and is protective of human health and the environment.

Statutory reviews will be conducted for AOC 18 every 5 years after initiating the remedial action to document whether the remedy remains protective of public health, welfare, and the environment. In accordance with Section 121 of CERCLA, as amended in 1986 by SARA, 5-year reviews will be completed as long as hazardous substances, pollutants, or contaminants remain at AOC 18 above levels that allow for unlimited use and unrestricted exposure.

1.5 Authorizing Signatures

AOCs 17, 18, 19, and 103 are located in Franklin County, Ohio, and were transferred from DoD control prior to October 17, 1986. Therefore, the AOCs meet the definition of a FUDS property. This Decision Document presents the selected remedies for AOCs 17, 18, 19, and 103. The USACE is the lead agency for response action execution on behalf of DoD under the Defense Environmental Restoration Program (DERP) and has developed this Decision Document consistent with CERCLA, as amended, and the NCP. The Proposed Plan was available for a 33-day public comment period (January 20, 2017, through February 22, 2017). Comments from the CRAA were received during the public comment period (Appendix A). No comments were received during the public meeting held on January 26, 2017, at 7:30 pm (Appendix B).

This Decision Document will be incorporated into the AR file for AOCs 17, 18, 19, and 103, which is available for public review in the AR file online at http://www.lrl.usace.army.mil/Missions/Environmental/Lockbourne-Air-Force-Base/. In addition, a copy will be placed in the IR located at the Columbus Metropolitan Library, Southeast Branch. A notice of availability of the Decision Document will be published in a local newspaper as required under the NCP.

This Decision Document, selecting Sealing and Monitoring for the Fixed Base Operations Building (AOC 18) as the remediation action decision and selecting No Action for AOCs 17, 19, and 103 as the remedial action decision, is approved by the undersigned, pursuant to Memorandum CEMP-CED, July 29, 2016, Subject: Redelegation of Assignment of Mission Execution Functions Associated with Department of Defense Lead Agent Responsibilities for Formerly Used Defense Sites program, and to Engineer Regulation 200-3-1, FUDS Program Policy.

Approved:

DALE.DAVID.FRANCIS.JR.1230598602

Digitally signed by DALE.DAVID.FRANCIS.JR.1230598602
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USA, cn=DALE.DAVID.FRANCIS.JR.1230598602
Date: 2017.09.19 17:05:27 -04'00'

David F. Dale, SES, PE, PMP Date
Programs Director
Great Lakes and Ohio River Division

SECTION 2

Decision Summary

2.1 Site Name, Location, and Description

This Decision Document was prepared for AOCs 17, 18, 19, and 103 at the former Lockbourne AFB in Columbus, Ohio (Figure 1-1). The AOCs are identified as FUDS Property Number G05OH0007, Project Number 33.

Former Lockbourne AFB covers 4,378 acres and is located east of Interstate 71 in Franklin and Pickaway Counties (Figure 1-1) and is now occupied primarily by CRAA and various retail and service businesses. Portions of the property to the west of AOCs 17, 18, 19, and 103 are occupied by the 121st Air Refueling Wing of the Ohio Air National Guard, the Ohio Army National Guard, and a U.S. Naval Reserve Center. Most of the area south and southeast of the former Lockbourne AFB is rural or agricultural. Residential and commercial/industrial areas border the north side of the former AFB, and the village of Lockbourne is to the west. A corridor of railroad tracks is immediately to the southwest.

The AOCs are part of RIA, an active joint civil-military airport used primarily as a cargo airport for the City of Columbus and some passenger charter carriers. The airport features parallel 12,000-foot runways and 500,000 square feet of cargo terminal space. The Ohio Air National Guard’s 121st Air Refueling Wing occupies an area west of the AOCs and northwest of the runways and operates out of the airport. The RIA lies within the city limits of metropolitan Columbus, Ohio. Most of the airport complex lies in Franklin County, with a small part to the south in Pickaway County.

The AOCs are located on property owned by the CRAA (Figure 2-1). The AOCs are part of a larger parcel of the former Lockbourne AFB that was declared excess and conveyed in April 1984 to the RPA, predecessor to CRAA. The Ohio Army National Guard and U.S. Naval Reserves did not operate at the AOCs. Any use of the AOCs by the Ohio Air National Guard was for storage of deicing supplies and equipment. The AOCs are adjacent to a broad tarmac that covers an area roughly 1,000 by 2,000 feet. AOC 17 (0.52 acre) and AOC 103 (0.02 acre) are grass and pavement covered. CRAA uses the building at AOC 18 (0.77 acre) for light aircraft maintenance, including refueling and deicing, and the building at AOC 19 (0.02 acre) for a passenger terminal.

2.2 FUDS Program Summary

A FUDS is a real property that was owned by, leased to, or otherwise possessed by the United States under DoD jurisdiction and transferred from DoD control before October 17, 1986. In accordance with DERP legislation (10 USC 2701 et. seq.), the Secretary of Defense is authorized to carry out response actions with respect to releases of hazardous substances from active installations and FUDS. The DERP/FUDS program follows the remedial process outlined by CERCLA, as amended by SARA, and the NCP. The USACE is the lead agency for response actions on behalf of DoD for purposes of implementing the FUDS program in Ohio for the DoD and works in coordination with Ohio EPA.

The Decision Document for the AOCs was prepared in accordance with FUDS Program Policy, Engineer Regulation 200-3-1 (USACE 2004), and DERP *Management Manual 4715.20* (DoD 2012), which are consistent with the NCP and Section 120 of CERCLA, as amended by SARA.

2.3 Site History and Enforcement Activities

Lockbourne AFB began as the Northwest Training Center of Army Air Corps in 1942. It was renamed Lockbourne AFB in 1948 and designated Rickenbacker AFB in 1974. In 1980, the base was transferred to the Ohio Air National Guard and renamed the Rickenbacker Air National Guard Base. In 1984, part of the property was transferred to the RPA, and the RIA was established. In 2003, RPA merged with the Columbus Airport Authority, forming the CRAA, which now owns and operates the RIA.

The following AOCs that compose this DD are located on property owned by the CRAA. The central machine shop area of the former AFB comprised the Base Engineer's Shop (former Building 530, AOC 17), Base Engineer's Maintenance and Inspection Building (Building 532, AOC 18), Engine Cleaning Building (former Building 535, AOC 19), and Battery Maintenance Facility (former Building 531, AOC 103) (Figure 2-2). Operations at the four buildings likely involved the use of solvents and cleaners (DPRA Incorporated [DPRA] 2010).

The AOCs are part of a larger parcel of the former Lockbourne AFB that was declared excess and conveyed in April 1984 to the RPA, predecessor to CRAA. Portions of the property to the west of AOCs 17, 18, 19, and 103 are occupied by the Ohio Air National Guard's 121st Air Refueling Wing, the Ohio Army National Guard, and a Naval Reserve Center. The Ohio Army National Guard and U.S. Naval Reserves did not operate at the AOCs. Any use of the AOCs by the Ohio Army National Guard was for storage of deicing supplies and equipment.

Of the four facilities, only the building at AOC 18 (Building 532, the Former Base Engineer's Maintenance and Inspection Building) remains. It is now known as the Fixed Base Operations Building or hangar. The building may have been used briefly by the Ohio Air National Guard for storage of deicing supplies and equipment, has been occupied by the RPA, Southern Air Transport (a private aircraft supply and maintenance company), and Lane Aviation (also a private aircraft supply and maintenance company), and is occupied currently by the CRAA and its tenants, which include Rickenbacker Aviation. With the exception of the Ohio Air National Guard, these other entities historically used Building 532 for aircraft maintenance, refueling, and deicing (DPRA 2010). Although TCE may have been used by occupants of AOC 18 after transfer of the property in 1984, there is no documentation that a release of chlorinated volatile organic compounds (CVOCs) occurred during their times of use. Products used for aircraft maintenance, refueling, and deicing (such as motor oils, lubricants, cleaning/custodial equipment, fuels, and fuel system icing inhibitors) do not contain chlorinated ethenes. A base-wide environmental baseline survey documented hazardous material (paint, grease, deicing fluids, aircraft cleaning fluids, and dry cleaning solvent) storage at Building 532 between 1988 and 1991, when the building was occupied by the RPA (DPRA 2010). At that time, there was also a self-contained parts washer, which contained solvents, in the building. There are no records that solvents for the parts washer were stored at the property. Maintaining the solvent inventory, draining and disposing of spent solvent, and filling the parts washer with new solvent appears to have been controlled by an offsite third-party commercial vendor; therefore, there is insufficient evidence of a post-DoD release of TCE at this time. Based on information from the CRAA, the RPA also used oils, custodial/cleaning equipment, urea (granular pavement deicer), and diesel and gasoline fuels. There are no other historical chemical inventories available for the AOCs. Since late 2012, the CRAA has used the building to provide customer service for aviation users who are based at RIA or who visit RIA. Services include sale of fuel, food catering, aircraft storage, pilot briefing, and similar activities. CRAA does not perform maintenance (is not certified) on aircraft in this hangar, though light maintenance can be done by aircraft owners themselves, including such activities as topping of fluids. Regulated aircraft maintenance must be done by Federal Aviation Administration–certified mechanics.

Former Buildings 530, 535, and 531 were demolished before the Phase I site investigation was conducted (before 1999). There is no documentation to state that the buildings were used by the U.S. Navy Reserves or the Ohio Army National Guard, though the Ohio Air National Guard may have used former Building 531 for storage. The RIA passenger charter terminal was constructed over part of the footprint of AOC 19 after the Phase I site investigation (after 2001); see Figure 2-2. During building construction, a passive vapor control system was installed beneath the terminal building footprint as a precautionary measure. The vapor control system consists of a vapor barrier (installed to block the potential entry of vapors into the building) and a passive venting system (installed to divert subslab vapors to the outdoor air through an exhaust stack west of the terminal building).

Several environmental investigations have been conducted at the former Lockbourne AFB. Information from the environmental investigations conducted at AOCs 17, 18, 19, and 103 can be found in the following documents:

- *Final Site Investigation of 21 Areas of Concern, Former Lockbourne Air Force Base, Columbus, Ohio* (Shaw 2006)
- *Final Phase II Site Inspection Report for Former Lockbourne Air Force Base AOCs 17/18/19/103, 49, and 94* (FUDS Site No. G05OH0007), Columbus, Franklin County, Ohio (GEO Consultants 2011)
- *Remedial Investigation, AOCs 17/18/19/103, Former Lockbourne Air Force Base, Ohio* (CH2M 2015)

No federal or state enforcement actions, lawsuits, or other pending actions apply to the AOCs.

2.4 Community Participation

Public involvement for the former Lockbourne AFB began in the early 1990s, specifically for the environmental cleanup program at the adjacent Rickenbacker Air National Guard Base. The U.S. Air Force established the Rickenbacker Restoration Advisory Board in January 1994 and in 1995 prepared the Community Relations Plan for the Rickenbacker Air National Guard Base (Air Force Center for Environmental Excellence 1995). Until 2002, the board met quarterly to update the public on the current progress at the environmental cleanup sites at the Rickenbacker Air National Guard Base and former Lockbourne AFB. The focus of the board was the cleanup of sites on Rickenbacker Air National Guard Base, but other USACE sites sometimes were discussed during the board’s public meetings.

In March 2011, USACE published a Public Involvement Plan for the former Lockbourne AFB landfill, AOCs 1 and 2. In July 2012, USACE published an addendum to the Public Involvement Plan for the Indoor Firing Range, AOC 75. USACE developed a Public Involvement Plan in October 2012 to guide public involvement activities associated with the investigation of AOCs 17, 18, 19, 94, and 103. As USACE conducts other environmental evaluations at the former Lockbourne AFB, public involvement will be evaluated and plans will be developed, as appropriate. Additionally, USACE has regularly issued informational materials (fact sheets) to the community since 2012 and maintained a mailing list of community members interested in receiving updates.

A 33-day public comment period (January 20, 2017, through February 22, 2017) on the Proposed Plan was solicited through a notice placed in the *Southeast Messenger* newspaper on January 15, 2016. The Proposed Plan (USACE 2017) was made available to the public on January 20, 2017. Comments were received during the public comment period and are provided in the Responsiveness Summary of this Decision Document. The AR file, which contains this Decision Document, Proposed Plan, and supporting documentation such as the remedial investigation (RI) and feasibility study reports, is maintained by the USACE–Louisville District office in the AR file online at http://www.lrl.usace.army.mil/Missions/Environmental/Lockbourne-Air-Force-Base/. The IR is located at the Columbus Metropolitan Library on Southeast Branch located at 3980 S. Hamilton Road in Groveport, Ohio.

A public meeting was held at the Hamilton Township Community Center at 6400 Lockbourne Road, in Lockbourne, Ohio on Thursday, January 26, 2017, at 7:30 p.m. At the meeting, representatives of USACE were available to answer questions from the community about the AOCs and the remedial alternatives. No community members attended the meeting and therefore there were no comments received during the meeting. The Responsiveness Summary (Section 3) of a Decision Document includes stakeholder concerns and preferences regarding the remedial alternatives and explains how those concerns were addressed and the preferences were factored into the remedy selection process. Comments were received from CRAA during the public comment period, which are addressed in Section 3, Responsiveness Summary. A transcript of the public meeting is available in the AR file, the IR, and Appendix B of this document.

2.5 Scope and Role of Remedial Action

The USACE serves as DoD's executing agent for cleanup of FUDS properties nationwide. The USACE–Louisville District is responsible for the environmental restoration program at the AOCs 17, 18, 19, and 103 at the former Lockbourne AFB in Columbus, Ohio. This Decision Document addresses the selected final response for AOCs 17, 18, 19, and 103 only. The final responses consist of the following:

- Sealing and monitoring for the Fixed Base Operations Building at AOC 18
- No further action for AOCs 17, 19, and 103

The anticipated sequence of activities to implement the sealing and monitoring for the Fixed Base Operations Building is:

1. Identifying and sealing obvious vapor entry points
2. Sampling and analyzing soil gas from existing subslab probes
3. Sampling and analyzing indoor air

2.6 Site Characteristics

The area that includes AOCs 17, 18, 19, and 103 is covered by pavement, small areas of mowed grass, and two buildings. The AOCs range in size from approximately 0.02 acre to 0.77 acre. An active taxiway of the RIA lies to the south of the AOCs. Asphalt parking lots are north and east of the AOCs. Stormwater from paved areas is directed toward and captured by storm sewers but may also run off into the grassy areas within the AOCs and infiltrate before reaching storm sewers. No streams, wetlands, or open water areas are present. Topography within this area is relatively flat, and surveys of sampling points showed elevations ranging from 733 to 737 feet above mean sea level.

The sections below briefly summarize the building characteristics, geology, hydrogeology, groundwater use, and nature and extent of contamination at AOCs 17, 18, 19, and 103.

2.6.1 Building Characteristics

Two buildings are present within the AOCs: the Fixed Base Operations Building, or hangar, at AOC 18 and a passenger terminal at AOC 19.

A building survey was conducted at the Fixed Base Operations Building (AOC 18) in July 2013 as part of the subslab soil gas sampling. An airplane hangar occupies most of the building as a large open space, or clear span. Offices and storage areas are located on two floors along the northern and southern sides of the building. The second-floor rooms were unoccupied during the building survey. The first-floor office rooms typically have standard doors, whereas the storage rooms have bay doors. Chemicals are stored in a northwest storage room, a northeast storage room, a southern break room, the hangar clear span, and a cleaning storage area. The break room has a fume hood that was used by a previous tenant and is no longer in service. Outdoor air may enter the building at doors and windows. There are two large hangar doors on both the east and west ends of the building for airplane and aircraft service vehicle entry. Exterior doors routinely left open and gaps observed along the bay doors are sources of outdoor air into the building. The floor, or foundation, of the Fixed Base Operations Building is concrete slab on grade. The slab had a measured thickness of 7 inches during the RI soil gas probe installations. The slab is covered by tile or carpeting in most office areas along the northern and southern sides of the building. Sealed expansion joints are present across the clear span of the maintenance area. However, two unsealed expansion joints were observed adjacent to the eastern and western interior walls of the building. Cracks in the concrete floor were observed within the clear span area, the southern break room, and a few storage rooms to the north; a greater number of floor cracks was observed in the western half of the building. Six floor drains were identified within the center of the clear span, whereas one floor drain each was observed in the break room, the men's restroom, and the women's restroom. The Fixed Base Operations Building includes a multizone heating, ventilation, and air conditioning (HVAC) system. Information obtained from the CRAA indicates that there are five HVAC zones. A radiant heat system, which draws indoor air out through an exhaust system, was installed in early 2014 for the clear span area of the airport hangar. The main furnace does not have an exterior intake. The offices on the northern and southern sides of the building have heat pumps with fresh-air connections. There are also five air conditioning units along the northern and southern sides of the building.

The passenger terminal at AOC 19 was constructed by the CRAA after disposition of the property by DoD. During building construction, a passive vapor control system was installed beneath the passenger terminal building footprint at AOC 19 as a precautionary measure; therefore a building survey was not performed. The vapor control system consists of a vapor barrier (installed to block the potential entry of vapors into the building) and a passive venting system (installed to divert subslab vapors to the outdoor air through an exhaust stack west of the terminal building).

2.6.2 Geology and Hydrogeology

The shallow geology consists of an upper till layer overlying a lower gray till layer. Based on soil boring logs, the shallow geology beneath the AOCs consists mainly of silty clay, sandy clay, and clayey silt, often with trace sand and/or gravel, and with alternating degrees of hardness. The lower gray till was described as a hard silty clay or clayey silt and was encountered between 12 and 15 feet below ground surface (bgs).

Groundwater present within the upper till layer is known as the upper water-bearing zone (UWBZ). The water table typically is encountered 4 to 10 feet bgs. The UWBZ is separated from the underlying intermediate depth aquifer by the lower gray till, which is considered an effective aquitard because of its low hydraulic conductivity and lateral continuity (International Technology Corporation 1998). Based on site-specific slug test data, hydraulic conductivity values for the UWBZ range between 4.0×10^{-5} and 6.8×10^{-4} centimeters per second. Hydraulic conductivities as low as 10^{-7} centimeters per second have been reported for the clays and silts in the UWBZ at the former Lockbourne AFB (International Technology Corporation 1998). Groundwater in the UWBZ generally flows east-southeast at an estimated groundwater velocity of 0.01 foot per day (4 feet per year).

2.6.3 Groundwater Use

Groundwater in the UWBZ at these AOCs is too shallow to be used for a public water system well (per Ohio Administrative Code 3745-9-05) or private system well (per Ohio Administrative Code 3701-28-10) and is documented to have low well yield. Further, the deeper sand and gravel aquifer would provide greater yield (Schmidt 1993). The RIA receives water from the City of Columbus Parsons Avenue Water Plant, which utilizes groundwater from the south well field area in southeast Franklin County. The RI identified 28 wells within 0.5 mile, most of which were test wells drilled on the former AFB. No wells within 0.5 mile draw water for potable supply from the contaminated UWBZ.

2.6.4 Nature and Extent of Chemicals of Concern

Soil, groundwater, subslab vapor, and indoor/outdoor air samples have been collected at AOCs 17, 18, 19, and 103 as part of environmental investigations (Section 2.3).

Risk evaluations were conducted to assess potentially unacceptable risks to human health and the environment from exposure to the potential contaminants of concern. Based on the HHRA and ecological risk assessment (ERA) summarized in Sections 2.6.5 and 2.6.6, the nature and extent of the identified COCs are summarized in this section. TCE is identified as a COC in soil gas for its potential to migrate from subslab vapor to indoor air via VI under the current and most likely future land use (commercial/industrial) and pose unacceptable risks to human health in indoor air. TCE was identified as a COC in soil gas under the unlikely residential land use for the potential to migrate to indoor air at concentrations that may pose unacceptable risks to human health. Based on a Level 1 Scoping ERA, habitat assessment, and visual ecological receptor survey summarized in Section 2.6.6, no ecological COCs were identified based on the ERA.

As part of the RI, six subslab soil gas samples and six indoor air samples were collected within the Fixed Base Operations Building. Subslab soil gas samples were collocated with indoor air samples, except for 18SV04 (subslab soil gas) and 18IA04 (indoor air). An exterior soil gas sample was collected adjacent to the eastern side of the passenger terminal, and vapor samples were collected from the exhaust stack that vents vapors from the passenger terminal's passive vapor extraction system (Figure 2-3). Outdoor air samples were collected from an upwind location and adjacent to an exterior air intake on the south side of the Fixed Base Operations Building.

TCE was detected in subslab soil gas above the commercial VI screening level of 30 $\mu g/m^3$ in six subslab soil gas samples collected beneath the Fixed Base Operations Building. The highest concentration was observed at sample 18SV04, located along the western edge of the hangar area (Figure 2-3); TCE was detected at 99,400 micrograms per cubic meter ($\mu g/m^3$). TCE concentrations were also observed in the southeast corner of the building, beneath an employee break room (18SV06). There were no TCE exceedances of the commercial/industrial VI screening level from the soil gas samples collected adjacent to the passenger terminal or at the exhaust stack vapor sample. Although TCE was detected in indoor air samples, with a highest concentration of 0.275 $\mu g/m^3$ at Sample 18IA03, concentrations were very low and did not exceed commercial/industrial indoor air screening level. Therefore, no current excessive risks from exposure to vapors in indoor air were identified.

TCE in soil and groundwater may be a potential source of COCs in soil gas. TCE was detected in vadose zone soil samples west and northeast of the Fixed Base Operations Building (Figure 2-4). The highest concentration was at soil boring 103SB01 at an approximate concentration of 1.1 milligrams per kilogram. TCE was detected in groundwater east of former Building 535 (AOC 19; current passenger terminal location), surrounding and beneath AOC 18 (Fixed Base Operations Building), and extending towards the northeast the area of former Building 531 (AOC 103) (Figure 2-5). The TCE plume extends to the bottom of the UWBZ (approximately 12 feet bgs) and has an estimated area of 46,800 square feet. The highest concentrations of TCE were detected at temporary point 18GG303 (64 $\mu g/L$), adjacent to the western side of the hangar, and at monitoring well 106MW06 (65 $\mu g/L$), at AOC 103. Monitored natural attenuation indicator data provide evidence of reductive dechlorination in groundwater. The mildly oxidizing conditions of the water-bearing zone may facilitate aerobic biodegradation processes, such as oxidation and cometabolism, and limit plume migration. As a result of these natural attenuation processes, the groundwater plume is stable and possibly shrinking (CH2M 2015).

2.6.5 Human Health Risk Assessment Summary

An HHRA was conducted to assess the potential risks from exposure to chemicals in groundwater, soil, soil gas, and indoor air in accordance with USEPA's Office of Solid Waste and Emergency Response (OSWER) Directive 9355.0-30 and the preamble to the NCP (55 *Federal Register* 8666-01, 52, March 8, 1990). The assessment evaluated the current and most likely future commercial/industrial use and a hypothetical future residential use. Assessment of a future residential use was evaluated for comparative purposes only, in accordance with FUDS policy. Specifically, FUDS projects are directed to compare the costs of long-term remedial action operation and maintenance (O&M) against the costs of a remedial action completion using residential-use remediation goals.

2.6.5.1 Commercial/Industrial Use (Most Likely Future Use)

For the AOCs, the reasonably foreseeable future land use is the same as its present use (part of the CRAA, an active joint civil-military airport). This is consistent with USEPA's "Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions" (OSWER Directive 9355.0-30), which states the following:

> ...the NCP also states that "the assumption of future residential land use may not be justifiable if the probability that the site will support residential use in the future is small." Sites that are surrounded by operating industrial facilities can be assumed to remain as industrial area unless there is an indication that this is not appropriate. Other land uses, such as recreational or agricultural, may be used, if appropriate.

Therefore, the HHRA evaluated potential human health risks associated with exposure to soil through ingestion, dermal contact, and/or inhalation, groundwater through dermal contact and/or inhalation, soil gas through inhalation of ambient air, and indoor air for commercial/industrial use through inhalation of indoor air.

The conclusions of the HHRA were that there are no noncarcinogenic hazards exceeding USEPA's threshold HI of 1 or ELCRs above USEPA's acceptable ELCR range of 1×10^{-4} to 1×10^{-6} for current/future commercial/industrial worker or construction worker exposures to surface soil, total soil, or groundwater. Current commercial/industrial worker exposures to indoor air concentrations of CVOCs at the Fixed Base Operations Building are below USEPA's acceptable threshold. However, estimated indoor air concentrations of TCE at the Fixed Base Operations Building may pose noncarcinogenic hazards above the USEPA threshold for future commercial/industrial workers due to elevated TCE concentrations in subslab soil gas. Potential ELCRs are within USEPA's target range. There is a high degree of uncertainty in the potential future indoor air risk estimates due to the potential variability in the building operation parameters used in modeling VI in the Fixed Base Operations Building (an old airplane hangar with large doors that are frequently opened and tall ceilings). Uncertainties are related to assumptions made in the risk estimates. Although it is theoretically possible that this approach leads to the underestimation of potential risk, the use of numerous upper-bound assumptions almost certainly results in overestimates of potential risk. Any individual's potential exposure and subsequent potential risk are influenced by their individual exposure and toxicity parameters and will vary on a case-by-case basis. Despite inevitable uncertainties associated with the steps used to estimate potential risks, the use of numerous health-protective assumptions will most likely lead to an overestimate of potential risk associated with Site exposures (CH2M 2015).

Also, indoor air concentrations may increase or decrease in the future due to various reasons, including the following:

- Subslab concentrations of TCE above screening levels (that is, TCE in subslab soil gas may serve as a source for indoor air VI)
- Changes in building use, condition, or operation (that is, alterations to the building to facilitate other uses may alter subslab-to-indoor air flow rates or additional cracks in the building slab may increase subslab gas migration into the building)
- Changes in the HVAC system or its operation (that is, changes to the HVAC system or its operations may affect airflow in the building)
- Seasonal variation (that is, changes in outdoor temperature and pressure may alter subslab-to-indoor air flow rates)

As a result, potential future inhalation exposures to TCE in indoor air (via VI) may pose noncarcinogenic hazards above USEPA's threshold of 1 for future commercial/industrial workers at the Fixed Base

Operations Building. The potential ELCR from VI is within USEPA's target risk range of 10^{-4} to 10^{-6} [40 CFR Section 300.420(e)(2)(i)(A)(2-5)]. A summary of ELCRs and HIs is provided in Table 2-1.

2.6.5.2 Residential Use (Hypothetical Future Use)

Although commercial/industrial use is currently dictated by the property deed and the most likely future use of the property, a HHRA was conducted to assess the unlikely future residential use of the property. Potable use of site groundwater was not evaluated since site groundwater from the UWBZ will not be used as a potable water source in the future.

The HHRA approach and results for the future hypothetical residential scenario are summarized below:

- Indoor air (passenger terminal)—exhaust stack vapor data were collected from the passenger terminal's vapor extraction system and evaluated for potential risks to future hypothetical residents. No COCs for indoor air at the passenger terminal were identified.
- Indoor air (Fixed Base Operations Building)—subslab soil gas data collected from the Fixed Base Operations Building were evaluated for potential risks to future hypothetical residents. The cumulative ELCR and HI estimates from two chemicals detected in subslab soil gas exceeded USEPA's target risk range and noncancer threshold for future residents. One COC (TCE) for indoor air at the Fixed Base Operations Building was identified for the future hypothetical residents.
- Soil direct contact—soil data collected from the AOCs were screened for direct contact exposure and evaluated for potential risks to future hypothetical residents. No AOC-related COCs for soil direct contact were identified.
- Groundwater potable use—because groundwater from the UWBZ will not be used as a potable water source in the future because of low well yield and current regulations regarding potable well construction, as described in Section 2.6.3. No AOC-related COCs for groundwater potable use were identified.

A summary of ELCRs and HIs is provided in Table 2-1.

2.6.6 Ecological Risk Assessment Summary

A Level I Scoping ERA (GEO Consultants 2011) was conducted to summarize the site history and ecological setting in terms of the habitats and biota known or likely to be present, and determine if there are significant ecological resources present within the AOCs, as defined in guidance published by the Ohio EPA (2008). The scoping level ERA is equivalent to the problem formulation, the first step in the ERA process (USEPA 1997). Prior to the visit, a literature search was performed. The Ohio Department of Natural Resources showed no records of rare or endangered species within a 1-mile radius of the AOCs. During the visit, no unique areas, geological features, populations of bird or mammal species inhabiting an area during breeding or nonbreeding seasons, champion trees, forests, or wildlife areas were noted. No streams, wetlands, or open water areas or trees were identified at the AOCs. It was therefore concluded that no habitat for federally listed species in the area exists. In addition, coordination with the U.S. Fish and Wildlife Service was conducted through a web-based evaluation. A "no effect" determination was made because the AOCs are located within developed areas and are not adjacent to native tree and shrub habitat for federally listed species. The AOCs consist primarily of pavement, two buildings, and small areas of mowed grass. The area is disturbed regularly, and the surrounding area is heavily developed. Therefore, the Level I Scoping ERA concluded that no further ecological investigation of the AOCs was warranted.

A habitat assessment and visual ecological receptor survey were conducted at the AOCs during the RI. As noted, the AOCs range in size from approximately 0.02 acre to 0.77 acre. No aquatic features, sensitive habitats, wetlands, or threatened or endangered species were identified during the survey or within a 0.5-mile radius of the AOCs. The sparse habitat within the AOCs likely would be used for intermittent foraging for birds and possibly small mammals. However, the habitat is not of sufficient size and lacks sufficient cover to support large local populations. The assessment confirmed the conclusion of the Level I Scoping ERA that habitat for federally listed species in the area does not exist.

2.7 Current and Potential Future Site and Resource Uses

The property deed (instrument number 198404170072568) specifies that the property occupied by AOCs 17, 18, 19, and 103 is to be used as an airport (Recorder's Office, Franklin County, Ohio; http://recorder.franklincountyohio.gov/). Therefore, the current and most likely future use of the property will be for commercial/industrial purposes. Based on information from the Mid-Ohio Regional Planning Commission, land use within the 0.5-mile radial area includes "airport operation, government, and warehouse." No residential use was identified. Roughly 90 percent of the land within 0.5 mile of the AOCs is within the CRAA property boundary. Since RIA is operational, it contributes to the ambient conditions through commercial/industrial activities, automobile parking and roads, and airplane runway use. Commercial/industrial business operations inside and outside the CRAA property include packaging facilities, distribution (food products, mattresses, and mobile equipment), air cargo logistics and transportation, flight support, and aircraft maintenance. There is also a hotel on the airport property. The government is present at the airport in the form of the Ohio Air National Guard, Ohio Army National Guard, and U.S. Naval Reserve Center. The Ohio Army National Guard and U.S. Naval Reserves do not operate at the AOCs.

2.8 Remedial Action Objective

Remedial action objectives (RAOs) are RGs specific to contaminants, exposure pathways, media, or operable units for protecting human health and the environment. The identified risks can be associated with current or potential future exposures. RAOs should be as specific as possible but not so specific that the range of alternatives that can be developed is unduly limited. Objectives aimed at protecting human health and the environment should specify (1) COCs, (2) exposure routes and receptors, (3) media, and (4) an acceptable contaminant level or range of levels for each exposure route (USEPA 1988).

The RAO for AOC 18 is to prevent future unacceptable risk from exposure to TCE, for future commercial/industrial workers at concentrations above 8.8 $\mu g/m^3$ in indoor air within the Fixed Base Operations Building. The RG, identified as 8.8 $\mu g/m^3$ in indoor air within the Fixed Base Operations Building as part of the RAO, is based on the Ohio EPA's Voluntary Action Program and provides generic standards for commercial/industrial indoor air due to VI from environmental media in Ohio Administrative Code (OAC) 3745-300-08(D)(2).

RAOs were not developed for AOCs 17, 19, and 103 since no remedial action is necessary because there are no unacceptable human health or ecological risks identified.

2.9 Description of Alternatives

The following remedial alternatives were developed to address the potential for unacceptable risk from a future commercial/industrial worker exposure to TCE in indoor air within the Fixed Base Operations Building (AOC 18). DoD will not be responsible for investigating or addressing VI concerns in future buildings constructed, erected, or located at AOC 18; however, DoD will provide notice of potential VI risks as required in DERP Management Manual 4715.20, Enclosure 3 (DoD 2012).

Four remedial alternatives were developed for AOC 18: Alternative 1—No Action; Alternative 2—Sealing and Monitoring; Alternative 3—Active Subslab Depressurization; and Alternative 4—Enhanced

Biodegradation and Soil Vapor Extraction. The major components of the remedial alternatives are defined below.

No remedial alternatives were developed for AOCs 17, 19, and 103 since there were no human health or ecological risks identified.

2.9.1 Alternative 1—No Action

Alternative 1 consists of taking no action. The NCP requires that a No Action alternative be retained as a baseline for comparison to the other alternatives. No action would leave affected soil gas in place and would exclude monitoring potential future impacts to indoor air. No mechanisms would be in place to prevent or control exposure to contaminants or to monitor whether indoor air concentrations increase over time. Lack of active cleanup or controls may allow users to be exposed to contaminants in indoor air if concentrations increase over time due to:

- Changes in the Fixed Base Operations Building use, condition, or operation (that is, other uses, alterations, or deterioration may alter subslab-to-indoor air soil gas migration)
- Changes in the Fixed Base Operations Building's HVAC system (that is, systems may affect airflow and pressure in the building)
- Seasonal variation (that is, changes in outdoor temperature and pressure may alter subslab-to-indoor air soil vapor migration at the Fixed Base Operations Building)

There are no capital or O&M costs for Alternative 1—No Action.

2.9.2 Alternative 2—Sealing and Monitoring

Alternative 2 consists of sealing of vapor entry points, if any, and routine collection of subslab soil gas and indoor air samples to evaluate how indoor air and subslab soil gas TCE concentrations change over time within the Fixed Base Operations Building. Alternative 2 is consistent with the current and likely future commercial/industrial use of the Fixed Base Operations Building (AOC 18), based on the property deed.

The conceptual design for this alternative is described below only for cost estimating and environmental impact assessment, which are evaluated under the comparative analyses. The conceptual design for this alternative as described below may vary from the final design, which would be developed during the remedial design phase and address site conditions at the time of the design. Sealing and monitoring for the existing building would be conducted under Alternative 2 and are described in the following subsections.

2.9.2.1 Sealing

Prior to initiating monitoring, potential vapor entry points would be identified for sealing. A visual inspection of the entire building would be conducted to identify cracks, building joints, and other building features that could be potential vapor entry points. A portable gas detector would also be used to identify vapor entry points. Subsequent sealing of vapor entry points could be performed using elastomeric compounds and insulating foam sealants to reduce or prevent TCE from being transported through these vapor entry points. Attempting to identify and seal every potential entry point can be impracticable, and long-term monitoring and maintenance of the seals would be required.

2.9.2.2 Monitoring

Concentrations of TCE and its degradation products would be monitored in subslab soil gas and indoor air through the collection of subslab soil gas and indoor air samples in the Fixed Base Operations Building and visual inspections of the building would be conducted to identify cracks, building joints, and other building features that could be potential vapor entry points. The subslab soil gas samples would be collected from the existing subslab soil gas probes. Degradation products include 1,1-dichloroethene (DCE) and vinyl chloride. If TCE is observed above the RG, contingency measures (such as a subslab depressurization system [as described in Section 2.9.3]) may be implemented.

The specific plan for sampling (for example how to sample, where to sample, and when to sample, contingency measures and triggers) will be developed in the O&M plan that is part of the remedial design phase of the CERCLA process. The specific plan will be developed by USACE in coordination with Ohio EPA and CRAA. The objectives of the monitoring program would be as follows:

- Verify that TCE concentrations in indoor air do not increase to concentrations above the RG
- Evaluate how subslab soil gas concentrations of TCE and degradation products change over time; these data would be used for a variety of reasons, such as monitoring for possible increases in reductive degradation daughter products and justifying the termination of indoor air monitoring if subslab soil gas concentrations were to attenuate over time

Periodic monitoring through the life span of the building is not warranted if subslab soil gas concentrations were to attenuate over time, and sampling and evaluation demonstrates the remedy has met the RAO. Reduction or elimination of the monitoring will be based on multiple lines of evidence, which may include subslab soil gas and indoor and outdoor air sampling data and building characteristics.

DoD will not be responsible for investigating or addressing VI concerns in future buildings constructed, erected, or located at AOC 18; however, DoD will provide notice of potential VI risks as required in DERP Management Manual 4715.20, Enclosure 3 (DoD 2012).

2.9.2.3 Major Components and Cost

The major components of Alternative 2 include the following:

- Identifying, sealing, and inspecting obvious vapor entry points
- Sampling and analyzing soil gas from existing subslab probes
- Sampling and analyzing indoor air

The estimated costs[1] for Alternative 2 are:

- 2016 capital cost: $200,000
- Lifetime O&M present value cost: $385,000
- Lifetime total present-worth capital and O&M cost: $585,000

2.9.3 Alternative 3—Active Subslab Depressurization

Alternative 3 consists of the actions described in Alternative 2 and an active subslab depressurization (SSD) at the Fixed Base Operations Building.

2.9.3.1 Subslab Depressurization

An active SSD would be accomplished using powered mitigation fans or blowers applying negative pressure on the subslab to create a subslab negative pressure field and to extract vapors within the targeted subslab area. Subslab vapors would then be piped to an exterior vent located above the building roofline. The SSD design would be developed during the remedial design phase and address the Fixed Base Operations Building conditions at the time of the design. Alternative 3 is consistent with the

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[1] Cost accuracy ranges from -30% to +50%.

current and likely future commercial/industrial use of Fixed Base Operations Building (AOC 18), based on the property deed.

Sealing, as described under Alternative 2, would result in active subslab depressurization being more effective because it would reduce short-circuiting between the subslab environment and the occupied space (resulting in a loss of applied vacuum).

2.9.3.2 Monitoring

The effectiveness of this alternative would be monitored through collection of field parameters (vacuum, flow, differential pressure measurements). Subslab soil gas and indoor air samples would be collected and visual inspections of the building would be conducted to identify cracks, building joints, and other building features that could be potential vapor entry points. The subslab soil gas samples would be collected from the existing subslab soil gas probes. The specific plan for sampling (for example how to sample, where to sample, and when to sample) will be developed in the O&M plan that is part of the remedial design phase of the CERCLA process. The specific plan will be developed by USACE in coordination with Ohio EPA and CRAA.

Periodic monitoring through the life span of the building is not warranted if subslab soil gas concentrations were to attenuate over time and sampling and evaluation demonstrates the remedy has met the RAO.

DoD will not be responsible for investigating or addressing VI concerns in future buildings constructed, erected, or located at AOC 18; however, DoD will provide notice of potential VI risks as required in DERP Management Manual 4715.20, Enclosure 3 (DoD 2012).

2.9.3.3 Major Components and Costs

Major components of the alternative include the following:

- Designing the mitigation system
- Identifying, sealing, and inspecting obvious vapor entry points
- Installing an active subslab depressurization system
- Performing O&M activities
- Sampling and analyzing indoor air and subslab soil gas

The estimated costs[2] for Alternative 3 are:

- 2016 capital cost: $831,000
- Lifetime O&M present value cost: $1,915,000
- Lifetime total present-worth capital and O&M cost: $2,746,000

2.9.4 Alternative 4—Enhanced Biodegradation and Soil Vapor Extraction

Under Alternative 4, TCE in soil and groundwater would be treated or removed to reduce the contaminant mass that is the potential source of vapors to subslab gas and subsequently to indoor air at the Fixed Base Operations Building. Soil and groundwater treatment would shorten the remediation timeframe and the need for extended long-term monitoring, maintenance, and reviews. A building inspection and portable gas detector would also be used to identify vapor entry points, and building sealing would be implemented in a manner similar to Alternative 2, for added protection during the remedial action. Alternative 4 is consistent with the current and likely future commercial/industrial use

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[2] Cost accuracy ranges from -30% to +50%.

of the Fixed Base Operations Building (AOC 18), based on the property deed. Alternative 4 satisfies the CERCLA preference for treatment since this alternative treats the potential source of COCs in soil gas and provides long-term monitoring and maintenance until unlimited use and unrestricted exposure is met.

2.9.4.1 Enhanced Biodegradation

Groundwater would be treated in situ with a suitable substrate to enhance biological reductive dechlorination. The groundwater data collected during the RI suggest that biological reductive dechlorination is already occurring. The substrate injection would accelerate that process within the UWBZ. The introduced substrate serves multiple purposes, such as depleting competing electron acceptors to create strongly reducing conditions and providing an electron donor source for reductive dechlorination. Because reductive dechlorination is most effective at neutral or near-neutral pH, a buffering agent may be introduced if the aquifer’s natural buffering capacity is low. The substrate would be selected in the remedial design phase.

It is assumed that enhanced biodegradation would be conducted over a zone with COC concentrations above their maximum contaminant levels (MCLs) in groundwater. However, the target treatment zone would be further refined during the design phase and consider additional VI data. TCE was identified as a COC under the residential use scenario. The MCL is 5 µg/L. Enhanced biodegradation may result in the production of reductive degradation products (such as cis-1,2-DCE, vinyl chloride, and methylene chloride). If these degradation products were to accumulate in soil gas at concentrations that could pose potential unacceptable risks, then future injections would be conducted to address those chemicals in groundwater as well. Following are MCLs for reductive degradation products:

- cis-1,2-DCE = 70 µg/L
- trans-1,2-DCE = 100 µg/L
- 1,1-DCE = 7 µg/L
- Vinyl chloride = 2 µg/L
- Methylene chloride = 5 µg/L

It is assumed that enhanced biodegradation substrate delivery would be completed through high-pressure direct-push technology rod injection and that fracture-specific technologies would not be required. However, some fracturing of the subsurface media may occur during the injection process. Because of the high clay and silt content of the UWBZ, only a 5-foot radius of influence is assumed. Injection wells are not recommended because the Fixed Base Operations Building may still be operational during the injections, and wells throughout the building would likely hinder the property owner’s activities.

It was assumed that four additional injections would be conducted at 1-year intervals (for a total of five injections over the remedial action). Additional biostimulation and bioaugmentation injections are included to address the production of reductive degradation products, which may create potential future VI risks, due to enhanced biodegradation and to meet remedial goals in a timely manner. Additional injections would also facilitate mixing in the aquifer, which may be beneficial given the slow groundwater flow rate at AOC 18. The latter injections may be offset from the initial injection transects to achieve a greater distribution of the substrate. Performance monitoring data would be used to confirm the need for additional injections, which may be needed given the clay and silt geology.

2.9.4.2 Soil Vapor Extraction System

Reductive degradation products (such as cis-1,2-DCE, vinyl chloride, and methylene chloride) might be produced during the degradation process described in Section 2.9.4.1. Methane, which is a possible degradation product of the reducing reactions, can also be a potential concern. Since these chemicals are also volatile, their potential impacts on VI would be addressed through in situ removal using soil vapor extraction (SVE). The SVE system would help remove these degradation products from the vadose zone and provide additional protection. The biodegradation and SVE system design would be developed during the remedial design phase and address site conditions at the time of the design.

2.9.4.3 Monitoring

Performance monitoring of the enhanced bioremediation injections would be conducted to evaluate the effectiveness of the treatment technology. The specific plan for sampling (for example how to sample, where to sample, and when to sample) will be developed in the O&M plan that is part of the remedial design phase of the CERCLA process. The specific plan will be developed by USACE in coordination with Ohio EPA and CRAA. During the remedy implementation, the O&M plan would be reviewed periodically and optimized as needed to reflect changes in site conditions and the fate and transport of the COCs at AOC 18.

Soil gas and air sampling would also be conducted to monitor the performance of the remedy. Details will be provided in the USACE-prepared monitoring plan noted above. Subslab soil gas and air monitoring would be conducted following the injections to document whether soil gas concentrations had attenuated following treatment. If the building is no longer present during the remedial action, then soil gas concentrations would also be used to estimate indoor air concentrations, to assess whether concentrations had decreased below residential RGs.

DoD will not be responsible for investigating or addressing VI concerns in future buildings constructed, erected, or located at AOC 18; however, DoD will provide notice of potential VI risks as required in DERP Management Manual 4715.20, Enclosure 3 (DoD 2012).

2.9.4.4 Major Components and Costs

Major components of the alternative include the following:

- Installing three new soil gas monitoring points for refinement of high COC concentrations in soil gas
- Performing baseline soil gas sampling and analysis
- Installing horizontal vapor extraction system over a zone with residual vadose zone contamination to remove contaminants from soil and soil gas
- Injecting enhanced bioremediation substrate over the target treatment zone to create reducing conditions and an electron-donor supply
- Injecting microbial culture to further enhance degradation rates and prevent accumulation of daughter products
- Installing four new monitoring wells for performance monitoring
- Performing baseline and quarterly sampling and analysis of existing and/or new monitoring wells
- Performing sampling and analysis of indoor air and soil gas for performance monitoring

The estimated costs[3] for Alternative 4 are:

- 2016 capital cost: $1,815,000
- Lifetime O&M present value cost: $3,598,000
- Lifetime total present-worth capital and O&M cost: $5,413,000

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[3] Cost accuracy ranges from -30% to +50%.

2.10 Comparative Analysis of Alternatives

CERCLA uses nine criteria to evaluate remedial alternatives individually and comparatively to help select a preferred alternative. They are classified as threshold, balancing, and modifying criteria.

Threshold criteria are standards that an alternative must meet for it to be eligible for selection as a remedial action. Threshold criteria are:

- Overall protection of human health and the environment
- Compliance with ARARs (Table 2-2)

Balancing criteria weigh the tradeoffs among alternatives. They represent the standards upon which the detailed evaluation and comparative analysis of alternatives are based. In general, a high rating on one balancing criterion can offset a low rating on another. Five of the nine criteria are balancing criteria:

- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume through treatment
- Short-term effectiveness
- Implementability
- Cost

Modifying criteria consider the concerns of state regulators and the local community's acceptance of a proposed remedial action. Modifying criteria are:

- State/support agency acceptance
- Community acceptance

This section summarizes how well each alternative satisfies each evaluation criterion and indicates how it compares to the other alternatives under consideration. Table 2-3 evaluates each alternative with respect to the criteria listed above for AOC 18.

Additionally, a decision analysis tool, which weights the NCP criteria, was used to create graphical representations of the alternatives (except No Action) against the NCP criteria to facilitate the analysis (CH2M 2016). In general, NCP criteria that were considered to be the most important for identifying the differences between the alternatives were weighted high; these include long-term effectiveness and permanence, short-term effectiveness, and implementability. Because the alternatives must meet the threshold criteria, the overall protection of human health and the environment and compliance with ARARs criteria were not weighted. Sustainability, or green and sustainable remediation (GSR), is considered because it is part of the short-term effectiveness criteria evaluation (Appendix C). Figure 2-6 presents a graphical representation of the overall alternative rankings. Figure 2-7 presents a graphical representation of the balancing criteria ranking for each alternative to reflect its increased level of detail.

GSR practices in accordance with DERP Management Manual 4715.20, Enclosure 3, Section 6(d) (DoD 2012) were incorporated into this Decision Document. The GSR memorandum (Appendix C) was developed to present GSR activities evaluated and implemented as part of this reporting phase. The memorandum in Appendix C will be updated during the remedial design and remedial action phases, as applicable. The GSR practices employ the following strategies throughout the remedial process:

- Use natural resources and energy efficiently
- Reduce negative impacts on the environment
- Minimize or eliminate pollution at its source

- Reduce waste to the greatest extent possible

Based on the comparison of alternatives using the NCP criteria, all alternatives except Alternative 1 would provide future protection of human health and the environment and are expected to comply with ARARs (Table 2-2). The HHRA did not identify current risks to human health under the current land use. Alternative 4 is considered to have the greatest long-term effectiveness, permanence, and reduction of toxicity, mobility, and volume through treatment because of the alternatives, it actively treats the largest area. Alternative 3 would provide only limited active treatment within the targeted subslab area, whereas Alternative 2 would include no active treatment. Alternative 4 is considered to have the lowest short-term effectiveness and implementability. Alternative 4 would be highly disruptive to the airport. Alternative 3 would have the largest quantitative environmental footprint but limited impacts to airport operations compared to Alternative 4. In comparison, Alternative 2 would result in minimal disruptions to the airport and have a small environmental footprint. Costs are highest for Alternative 4, followed by Alternative 3, due to capital installation costs and long-term O&M.

Based on the alternatives scoring process and decision analysis, Alternative 2 provides the best overall balance of the seven criteria considered. Alternative 2 would meet the RAO by sealing vapor entry points and monitoring TCE concentrations in indoor air. Monitoring would allow for trends to be identified, prior to exceedances of the RG.

2.11 Principle Threat Waste

The NCP expects treatment to be used to address principal threat wastes to the extent practicable to reduce their toxicity, mobility, or volume. “Principal threat wastes” refers to source materials that are highly toxic or highly mobile. As defined by USEPA, contaminated groundwater generally is not considered a principal threat waste. No highly toxic contaminants are present at AOC 18, as the highest concentrations of TCE detected in vadose zone soils was approximately 1.1 milligrams per kilogram. Therefore, no principal threat waste is present at AOC 18.

2.12 Selected Remedy

The selected remedy for the Fixed Base Operations Building (AOC 18) is Alternative 2—Sealing and Monitoring.

2.12.1 Summary of the Rationale for the Selected Remedy

Based on information currently available, USACE expects that the selected remedy will satisfy the RAO by verifying that TCE concentrations do not exceed RG target levels, will reduce the potential VI of TCE in indoor air within the Fixed Base Operations Building, and will best satisfy the statutory requirements of CERCLA §121(b): (1) be protective of human health and the environment, (2) comply with ARARs, (3) be cost effective, and (4) use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable for AOC 18. The GSR evaluation results indicate that Alternative 2 has the lowest environmental footprint compared to the other alternatives. The selected remedy also meets the threshold criteria and provides the best balance of tradeoffs among the other alternatives with respect to the balancing and modifying criteria and GSR practices.

2.12.2 Description of Selected Remedy

At AOCs 17, 19, and 103, no action for protection of human health and the environment is warranted because potential risks are within the acceptable range as specified in the NCP [40 CFR Section 300.430(e)(2)(i)(A)(2-5)] for current and reasonably foreseeable future land use.

At AOC 18, TCE was identified as a COC in soil gas due to potential migration of TCE from subslab vapor beneath the Fixed Base Operations Building to indoor air via VI. To address these potential risks to human health at AOC 18, the selected remedy is Sealing and Monitoring, defined as Alternative 2 in the *Feasibility Study Report* (CH2M 2016). While no current risks were identified for AOC 18, the selected remedy addresses the potential for unacceptable risk from a future commercial/industrial worker exposure to TCE in indoor air within the Fixed Base Operations Building. Specifically, the remedy for AOC 18 consists of:

- *Sealing*. Sealing consists of sealing vapor entry points, if any, within the Fixed Base Operations Building. Potential vapor entry points will be identified for sealing, and a visual inspection of the entire building will be conducted to identify cracks, building joints, and other building features that could be potential vapor entry points. A portable gas detector will also be used to identify vapor entry points. Subsequent sealing of vapor entry points will be performed using elastomeric compounds and insulating foam sealants to reduce or prevent TCE from being transported through these vapor entry points. Long-term monitoring and maintenance of the seals will be required. However, this approach will address the most obvious and potentially largest points of vapor entry and thereby mitigate the pathway between elevated soil subslab concentrations of TCE and potential future VI into indoor air.
- *Monitoring*. Monitoring consists of routine collection of subslab soil gas and indoor air samples to evaluate how indoor air and subslab soil gas TCE concentrations change over time within the Fixed Base Operations Building. The sampling approach, methods, frequency, and decision logic for changes in monitoring will be developed as part of the remedial design and a monitoring plan. The objectives of the monitoring program are to (1) verify that TCE concentrations in indoor air do not increase to concentrations above the RG and (2) evaluate how subslab soil gas concentrations of TCE and degradation products change over time. If TCE is observed above the RG, contingency measures (such as a subslab depressurization system) may be implemented. The details of the monitoring program, such as the precise number of subslab soil gas and indoor air samples to be collected, analytical suite and screening criteria, and contingency measures and triggers, will be provided in the monitoring plan, which is part of the remedial design phase of the CERCLA process.

2.12.3 Remedy Cost Estimate Summary

The estimated capital cost, O&M costs, periodic costs, total cost, and total present value for Alternative 2—Sealing and Monitoring, are presented in Table 2-4.

2.12.4 Expected Outcomes of Selected Remedy

Following implementation of the selected remedy at AOC 18, potential for unacceptable risk from a future commercial/industrial worker exposure to TCE in indoor air within the Fixed Base Operations Building will be mitigated by (1) sealing of vapor entry points to reduce or prevent TCE from being transported through these vapor entry points into the Fixed Base Operations Building and (2) monitoring TCE and degradation products concentrations in subslab soil gas and indoor air through the collection of subslab soil gas and indoor air samples in the Fixed Base Operations Building according to an established monitoring plan.

2.13 Statutory Determinations

The investigation results for AOCs 17, 19, and 103 demonstrated that the No Action remedial action decision is protective of human health and the environment. Therefore, no ARARs were identified, and the statutory determinations for treatment under CERCLA Section 121 are not necessary.

The selected remedy for Fixed Based Operations Building (AOC 18) is protective of human health and the environment and satisfies the statutory requirements of CERCLA §121(b). The selected remedy complies with ARARs (Table 2-2), is cost-effective, and uses permanent solutions. The remedy does not satisfy the statutory preference for treatment as a principal element. The remedy was chosen because it reduces the potential for unacceptable risk from exposure to TCE for future commercial/industrial workers in indoor air within the Fixed Base Operations Building.

Statutory reviews will be conducted for AOC 18 every 5 years after initiating the remedial action to document whether the remedy remains protective of public health, welfare, and the environment. In accordance with Section 121 of CERCLA, as amended in 1986 by SARA, 5-year reviews will be completed as long as hazardous substances, pollutants, or contaminants remain at AOC 18 above levels that allow for unlimited use and unrestricted exposure.

2.14 Documentation of Significant Changes

This Decision Document contains no significant changes from the Proposed Plan.

SECTION 3

Responsiveness Summary

The Proposed Plan was available for a 33-day public comment period (January 20, 2017, through February 22, 2017) in accordance with the NCP, which requires that the public comment period be no less than 30 days. Written comments were received during the public comment period from the CRAA only (Appendix A). No community members attended the public meeting (January 26, 2017), and therefore no comments were received during the public meeting.

3.1 Stakeholder Comments and USACE Responses

Since no comments were received during the public meeting there are no responses from the USACE. A meeting transcript documenting the public meeting is presented in Appendix B.

Written comments from CRAA and USACE responses are provided below.

CRAA Comment 1: The Columbus Regional Airport Authority (CRAA) appreciates the opportunity to provide comments pertaining to the Proposed Plan for AOCs 17/18/19/103 - Former Lockbourne Air Force Base, Ohio (Plan). As you know, the AOCs identified in the proposed plan are located within an area currently used for commercial aeronautical activity. This activity includes aircraft storage and handling, passenger processing, and other customer services available to the aviation community. Contamination from the AOC's is described to be in the soil and groundwater surrounding the passenger terminal, the Fixed Base Operations (FBO) hangar, and west of the air traffic control tower. CRAA does not concur with the proposed plan's alternative, and we have the following comments on the plan and the selected Alternative 2.

USACE Response: *CRAA's statement is acknowledged and responses to CRAA's comments are provided below*.

CRAA Comment 2: Alternative 2 proposes semi-annual indoor air and subslab vapor sampling for TCE in the FBO; with the results being "evaluated with Ohio EPA to reduce future monitoring if/when justified." Is this semiannual sampling intended to continue each year until the first 5-year review described later? Ohio EPA has lent its support for semiannual sampling. If USACE does nothing to clean up the contamination, CRAA believes that a regular and continued program of sampling should be conducted for indoor air and subslab vapor for the life of the building; including slab inspection and maintenance. It is imperative that USACE provides for continued human health protection for the building's occupants, and without regular and continued sampling it is unclear how USACE can score Alternative 2 (see Table 1.) as "satisfying the criterion very well" when describing protectiveness of human health.

USACE Response: *As described in the Final Feasibility Study Report (CH2M 2016), Proposed Plan (CH2M 2017), and this Decision Document, TCE concentrations in subslab soil gas and indoor air would be monitored through the collection of subslab soil gas and indoor air samples in the Fixed Base Operations Building. Long-term monitoring and maintenance of the seals will be required. The specific plan for monitoring, which will include the frequency of inspection of the seals, will be developed in the O&M plan that is part of the remedial design phase of the CERCLA process. The specific plan will be developed by USACE in coordination with Ohio EPA and CRAA.*

CRAA Comment 3a: The proposed plan does not discuss how USACE will continue to monitor the concentrations of contamination in the environment. In Alternative 2 there is a statement that, during the 5-year review, "sampling and analysis can be conducted ...". This leads CRAA to believe that there is not a plan for soil or groundwater sampling. Soil and groundwater monitoring of the complete Site should continue in order to document contaminant concentration, contaminant breakdown, and contaminant movement.

USACE Response: *Soil and groundwater monitoring is not necessary since there is no unacceptable risk. The complete details of the human health risk assessment are provided in the Final Remedial Investigation Report (CH2M 2015) and summarized in the Final Feasibility Study Report (CH2M 2016) and this Decision Document. Further, DERP Manual prevents future expenditures on media that do not have identified risks to human health or the environment.*

CRAA Comment 3b: Alternative 2 centers around TCE, but does not address its byproducts from degradation like Vinyl Chloride; nor does the proposed plan address the movement of contamination from its current location to other CRAA properties and buildings.

USACE Response: *As provided in the Final Remedial Investigation Report (CH2M 2015), contrary to groundwater and vadose zone soil, which typically had higher concentrations of cis-1,2-DCE (a degradation product of TCE) than TCE in samples, soil gas CVOC concentrations were composed primarily of TCE. Groundwater had concentrations of vinyl chloride (a degradation product of TCE). However, neither cis-1,2-DCE nor vinyl chloride were detected in subslab soil gas samples collected beneath the Fixed Base Operations Building. Given that cis-1,2-DCE and VC have higher vapor pressures than TCE, they would be more likely to partition into soil gas from groundwater. The lack of these CVOCs in soil gas suggests that cis-1,2-DCE and VC are degrading. However, the specific plan for sampling (for example how to sample, where to sample, and when to sample) will be developed in the O&M plan that is part of the remedial design phase of the CERCLA process. The specific plan will be developed by USACE in coordination with Ohio EPA and CRAA.*

CRAA Comment 3c: Alternative 2 assumes that “the property deed requires the Site to remain as an airport.” CRAA is able to sell this property and/or seek a release from the FAA for non-aeronautical use. The proposed plan should not assume CRAA will continue to be the land owner or that the property will forever be configured as it is today. This Site, like others on the airport, presents risks to Air Force Base redevelopment. The proposed plan has been written specifically about the FBO building, but does not address the effects of the Site on CRAA property in whole. For example, CRAA is currently in the design phase of a parking lot and detention basin immediately adjacent/downgradient from 2 monitoring wells for AOC 103. The proposed plan must take into account not just indoor air quality for the FBO occupants, but the future state of the Site contaminants and their effect on construction workers, new facilities, and other receptors. The FBO is surrounded with water lines, sanitary sewers, storm sewers, and multiple data and electric lines. The proposed plan describes groundwater movement of 4 feet/year, in a direction toward the air traffic control tower. CRAA remains concerned about the movement of the plume; including its transport into utility backfill/pathways or toward additional buildings.

USACE Response: *Past investigations and the human health risk assessment have taken into consideration media and receptors in addition to indoor air for the Fixed Base Operations Building. As presented in the Final Remedial Investigation Report (CH2M 2015)***,** *a comprehensive human health conceptual site model was used to depict the types of potential exposures to chemicals at or migrating from the site. The most likely future use of the property is for commercial/industrial purposes; removal of FAA restriction would not alter human health risk assumptions.*

Additionally, USACE cannot address VI as an issue for future building construction. In accordance with the DOD DERP Management Manual 4715.20, Enclosure 3, Section 6(c) (DOD 2012), the DOD will not be responsible for investigating or addressing VI concerns in future buildings at the site. The specific plan for sampling (for example how to sample, where to sample, and when to sample) will be developed in the O&M plan that is part of the remedial design phase of the CERCLA process. The specific plan will be developed by USACE in coordination with Ohio EPA and CRAA.

CRAA Comment 3d: The proposed plan states that the groundwater plume at the Site is “stable and possibly shrinking” due to natural processes. Please describe these natural processes and the data or investigations that support the conclusion. It has been our observation that reliance on monitored natural attenuation of TCE contamination at Rickenbacker sites has not been reliable or effective. The Air Force has had to change its remedial approach many times; looking for a means to reduce TCE concentrations at sites under pavement. Finally, with respect to monitored natural attenuation, Ohio EPA guidance on the practice (January 2001) establishes minimum standards for implementation including:

- Clearly demonstrated to be occurring
- Can be reliably monitored in the future
- Rate of attenuation sufficiently remediates in a reasonable time frame
- Levels will not spread to currently uncontaminated areas
- Addresses breakdown products which may be more toxic than the parent compounds
- A monitoring program in place to establish permanent remediation
- Triggers and contingencies if attenuation is not successful

If USACE is relying on monitored natural attenuation as a remedy, please describe your approach to meeting the standards established by Ohio EPA; and the contingency plans that will be established to actively protect human health and the environment from contaminants at the Site.

USACE Response: *The remedy does not include monitored natural attenuation. The remedy is sealing of vapor entry points, if any, and routine collection of subslab soil gas and indoor air samples to evaluate how indoor air and subslab soil gas TCE concentrations change over time within the Fixed Base Operations Building as a result of:*

- *Changes in subslab concentrations of TCE (TCE may serve as a source for indoor air VI)*
- *Aging of the building (additional cracks in the building slab may increase subslab gas migration into the building)*
- *Changes in use or operation (other uses may alter subslab-to-indoor-air migration)*
- *Heating, ventilation, and air conditioning systems (systems may affect airflow in the building)*
- *Seasonal variation (changes in outdoor temperature and pressure may alter subslab-to-indoor-air migration)*

Written comments from Ohio EPA and USACE responses are provided below.

Ohio EPA Comment 1: **Section 2.8, Remedial Action Objectives.** The stated remedial action objective (RAO) is “to prevent future unacceptable risk from exposure to TCE, for future commercial/industrial workers at concentrations above 8.8 µg/m^3 in indoor air within the Fixed Base Operations Building.” Trichloroethene (TCE) is the only identified contaminant of concern (COC); however, RAOs may need to be established for degradation products of TCE. Include a statement that RAOs for degradation products of TCE will be developed if concentrations of these constituents exceed subslab screening levels. Indoor air residential preliminary remediation goals for 1, 1-dichloroethene and vinyl chloride are listed in Section 3.3 of the feasibility study report and may be used as RAOs for indoor air.

USACE Response: The preliminary remediation goals presented in Section 3.3 are for the residential receptors, not commercial/industrial, which is the current and reasonably foreseeable future land use. Remediation goals are developed in the Decision Document for COCs, which is limited to TCE.

Attenuation of aerobically degraded chlorinated volatile organic compounds is likely occurring in the soil gas in the vadose zone. Although cis-1,2-dichloroethene and vinyl chloride were detected in soil and groundwater adjacent to the Aircraft Maintenance Building (aka Fixed Base Operations Building), these chemicals were not detected in subslab soil gas samples. Based on the age of the release and that the groundwater plume is stable and possibly shrinking, likely we would have seen degradation products in the subslab soil gas samples. We don't anticipate a sudden or rapid increase in the TCE degradation process in the future. However, monitoring of TCE degradation products (1,1-dichloroethene and vinyl chloride) will be included in the monitoring program, which will be developed in the remedial design phase. As part of the 5-year review of the remedy, commercial/industrial worker remediation goals can be developed, if needed. Sections 1.3, 2.9.2.2, 2.12.2, and 2.12.4 of the Decision Document were revised to include degradation products in the monitoring program and a statement that screening criteria will be developed to evaluate concentrations of TCE degradation products. The screening criteria will be based on the latest USEPA RSL for industrial air.

Ohio EPA Response: Response is acceptable.

Ohio EPA Comment 2: **Sections 1.3 and 2.12.2, Description of Selected Remedy.** Under "Monitoring," the description states, "The objectives of the monitoring program are to (1) verify that TCE concentrations in indoor air do not increase to concentrations above the remediation goal (RG) and (2) evaluate how subslab soil gas concentrations of TCE change over time." Ohio EPA concurred with the remedial investigation report contingent on the agreement with the U.S. Army Corps of Engineers that the remedial action monitoring will be sufficient to adequately characterize the potential risk to current receptors at the Fixed Base Operations Building. Revise the objectives to state that the information will also be used to characterize the potential risk to current receptors.

USACE Response: Monitoring is sufficient to evaluate the risk conclusions in regards to impact to the commercial/industrial worker. The site was characterized as part of the remedial investigation. However, if the VI criteria are exceeded during the remedial action-operation, then USACE, in consultation with Ohio EPA, will take action per additions described in Comment 3.

Ohio EPA Response: Ohio EPA maintains that the risk assessment conclusions that USACE made in the remedial investigation report are based on insufficient data. Ohio EPA will assume that the vapor intrusion exposure pathway is potentially complete until the risk assessment issue is resolved.

USACE Response: Indoor air data collected as part of the RI was completed based on recommendations by Ohio EPA prior to and during preparation of the approved RI work plans. USACE has worked with Ohio EPA throughout the CERCLA process. Following the fieldwork and as part of the RI report approval, Ohio EPA asked for additional sampling above what was included in the approved work plans. To address Ohio EPA's concerns provided during the RI report phase, USACE agreed to conduct additional sampling as part of the remedy to ensure protectiveness. The USACE technical team has worked diligently to continue sampling and inspections at the Site in the absence of current risk and the FUDS policies regarding vapor intrusion. However, if the VI criteria are exceeded during the remedial action-operation, then USACE, in consultation with Ohio EPA and CRAA, will take action as read in Sections 1.3, 2.9.2.2 and 2.12.2. If TCE is observed above the remediation goal, contingency measures (such as a subslab depressurization system) may be implemented. The details of the monitoring program, such as the precise number of subslab soil gas and indoor air samples to be collected, analytical suite and screening criteria, and contingency measures and triggers, will be provided in the monitoring plan, which is part of the remedial design phase of the CERCLA process.

Ohio EPA Comment 3: **Section 1.3 and 2.12.2, Description of Selected Remedy.** Include a statement that contingency measures will be evaluated and implemented if triggered. Section 3.6.2.2 of the feasibility study report contains a general contingent remedy process that can be referenced or described. The details of the trigger mechanisms and potential mitigation measures can be described in the remedial design/remedial action documents.

USACE Response: Contingency measures were added to Sections 1.3, 2.9.2.2, and 2.12.2.

Ohio EPA Response: Response is acceptable.

Ohio EPA Comment 4: **Section 2.7, Current and Potential Future Site and Resource Uses.** This section states, "The property deed specifies that the property occupied by AOCs 17, 18, 19, and 103 is to be used as an airport (Recorder's Office, Franklin County, Ohio; http://recorderweb.co.franklin.oh.us/pax/). Therefore, the current and most likely future use of the property will be for commercial/industrial purposes." The decision document should include a verification that USACE inspected the property deed and confirmed the restrictions are currently in place for the specific parcel(s) where the AOCs are located. Ohio EPA has the following comments and recommendations.

- Correct the web address for the Franklin County Recorder's Office to http://recorder.franklincountyohio.gov/
- Include the instrument number of the deed restriction referenced in the statement.
- Include a figure or survey plat of the specific parcel(s) in which AOCs are located with parcel numbers.

USACE Response: The web address was corrected and the instrument number was added in Section 2.7. AOC 18 is the Fixed Base Operations Building on the active taxiway of the airport. The property deed, containing the Fixed Base Operations Building, is for the airport property. Figure 2-2 of the Decision Document shows the Fixed Base Operations Building. As part of the statutory reviews, the site will be inspected and building use verified in coordination with Ohio EPA.

Ohio EPA Response: Figure 2-2 does not depict the parcel in which the areas of concern (AOCs) are located (Parcel Number 430-295887). Because the AOCs are located in a parcel within the airport, it should be depicted in a figure for accuracy. The parcel map can be accessed at http://property.franklincountyauditor.com.

USACE Response: Concur. The parcel boundaries and numbers were added to Figure 2-2 (attached).

Ohio EPA Comment 5: **Section 2.9.2.2, Monitoring.** This section states, "Periodic monitoring through the life span of the building is not warranted if subslab soil gas concentrations were to attenuate over time, and sampling and evaluation demonstrates the remedy has met the RAO." The description of the selected remedy contradicts this statement. The selected remedy assumes subslab soil gas concentrations of TCE will not be reduced overtime through attenuation, and RAO achievement is dependent on the continued existence and maintenance of the concrete floor. Elimination or reduction in monitoring is a risk-management decision based on multiple lines of evidence, not only on subslab monitoring data. Revise this section so it is consistent with the selected remedy.

USACE Response: Section 2.9.2.2 states, "Alternative 2 consists of sealing of vapor entry points, if any, and routine collection of subslab soil gas and indoor air samples to evaluate how indoor air and subslab soil gas TCE concentrations change over time within the Fixed Base Operations Building." Also, Section 2.6.4 states, "Section Monitored natural attenuation indicator data provide evidence of reductive dechlorination in groundwater. The mildly oxidizing conditions of the water-bearing zone may facilitate aerobic biodegradation processes, such as oxidation and cometabolism." The Alternative 2 description in the feasibility study stated, "Sealing and monitoring only would not address residual subslab vapor sources. However, subslab concentrations would likely naturally attenuate over time due to natural attenuation of the groundwater plume, and subslab soil gas monitoring would be used to track these changes in concentrations." The selected remedy assumes that sealing and monitoring are needed because the attenuation process can be lengthy (years). Regardless, elimination or reduction in monitoring decisions will be made in coordination with Ohio EPA.

Ohio EPA Response: Ohio EPA maintains that the statement "*Periodic monitoring through the life span of the building is not warranted if subslab soil gas concentrations were to attenuate over time, and sampling and evaluation demonstrates the remedy has met the RAO.*" should be revised to clarify that any reduction in monitoring will be based on multiple lines of evidence; that is, a combination of ground water, soil, and soil-gas data and other information, as required.

USACE Response: Concur. Multiple lines of evidence will be used. The following sentence was added to Section 2.9.2.2, “Reduction or elimination of the monitoring will be based on multiple lines of evidence, which may include subslab soil gas and indoor and outdoor air sampling data and building characteristics.”

Ohio EPA Comment 6: **Section 2.9.2.2, Monitoring.** The land use restrictions should also be monitored. Revise this section to state that land ownership and the property deed will be verified during the CERCLA five-year review process and potential impacts on remedial alternatives will be evaluated. This language is in the feasibility study report and should also be included in the decision document.

USACE Response: Section 2.13 states that statutory reviews will be conducted for AOC 18 every 5 years after initiating the remedial action to document whether the remedy remains protective of public health, welfare, and the environment. The protectiveness evaluation will include site inspections and deed verifications in coordination with Ohio EPA.

Ohio EPA Response: Response is acceptable.

3.2 Technical and Legal Issues

No technical or legal issues exist regarding the Sealing and Monitoring decision at AOC 18 and No Action at AOCs 17, 19, and 103.

SECTION 4

References

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Tables

Table 2-1. Estimated Total ELCRs and HIs from Potential Exposures

Decision Document for AOCs 17/18/19/103, Former Lockbourne Air Force Base, Ohio

Potential Exposures to Chemicals of Potential Concern	Estimated Total Excess Lifetime Cancer Risk (ELCR)	Maximum Target Organ-Specific Hazard Index (HI)
Current Commercial/Industrial Workers (Surface Soil)	9×10^{-5} (cumulative)[b]	0.05
Future Commercial/Industrial Workers (Aircraft Maintenance Building; Total Soil[c] and Indoor Air [Modeled Vapor Intrusion Based on Average Empirical Attenuation Factors])	1×10^{-4} (cumulative)[b] Total soil[c]: 1×10^{-4} Soil Gas-to-Indoor Air: 5×10^{-5}	11 (cumulative)[b] Total soil[c]: 0.2 Soil Gas-to-Indoor Air: 11[a]
Future Construction Workers (Total Soil[c] and Groundwater)	1×10^{-6} (cumulative)[b]	0.3

Notes:

[a] Immune system and heart HIs = 11 associated with trichloroethane.

[b] Cumulative refers to the sum of the ELCRs or HIs from all applicable exposure pathways for the receptor.

[c] Total soil refers to soil from 0 to 10 feet below ground surface.

Table 2-2. ARARs

Decision Document for AOCs 17/18/19/103, Former Lockbourne Air Force Base, Ohio

	ARARs	Description of Regulation	Comments
Chemical-specific			
State			
1	OAC 3745-300-08(D)(2) Voluntary Action Program—Generic Numerical Standards	Generic standards for commercial/industrial indoor air due to vapor intrusion from environmental media. Standards apply to indoor air only for chemicals that have volatilized from environmental media to indoor air.	**Relevant and appropriate.**
Action-specific			
State			
1	OAC 3745-9-07 and 3723-9-10 Water well standards	Requirements for well grouting for closure, and for well sealing during the remedial action. Wells closed after the response is complete are not subject to these requirements.	**Applicable.**

Table 2-3. Comparative Analysis of Remedial Alternatives for AOC 18

Decision Document for AOCs 17/18/19/103, Former Lockbourne Air Force Base, Ohio

Evaluation Criteria	**Alternative 1 No Action**	**Alternative 2 Sealing and Monitoring**	**Alternative 3 Active Subslab Depressurization**	**Alternative 4 Enhanced Biodegradation and Soil Vapor Extraction**
Overall Protection to Human Health and the Environment				
Protection of human health and the environment	Does not provide future protection of human health and the environment.	Will meet the RAO by verifying that future TCE concentrations do not exceed target levels. Alternative is consistent with the likely future industrial/commercial use of property, based on the property deed.	Will meet the RAO by disconnecting the VI pathway and potentially reducing future subslab TCE concentrations. Alternative is consistent with the likely future commercial/industrial use of property, based on the property deed.	Will meet the RAO by removing COCs in soil and degrading COCs in groundwater, thereby reducing future soil gas concentrations. Controls, which are within the limits of the USACE, should be maintained to prevent residential use until remedial goals are met.
Compliance with ARARs				
Chemical-specific and action-specific ARARs	Not in compliance.	Compliant.	Compliant.	Compliant.
Long-term Effectiveness and Permanence				
Magnitude of residual risk	Does not address future risk from soil gas to indoor air if the Fixed Base Operations Building conditions change.	Addresses future risk from soil gas to indoor air by verifying that TCE concentrations in indoor air do not exceed target level. Risks may also gradually reduce through natural attenuation of COCs in soil gas; however, source mass remains.	Addresses future risk from soil gas to indoor air by creating a negative pressure barrier between the subslab and indoor air and verifying that TCE concentrations in indoor air do not exceed target levels. May also reduce TCE concentrations in subslab soil gas by extraction and natural attenuation processes; however, source mass remains.	Addresses future risk from soil gas to indoor air by irreversible removal or degradation of COCs in soil and groundwater that may be a source to soil gas and by verifying that TCE concentrations in indoor air do not exceed target levels. Risks may also gradually reduce through natural attenuation of COCs in subsurface.

Table 2-3. Comparative Analysis of Remedial Alternatives for AOC 18

Decision Document for AOCs 17/18/19/103, Former Lockbourne Air Force Base, Ohio

Evaluation Criteria	**Alternative 1 No Action**	**Alternative 2 Sealing and Monitoring**	**Alternative 3 Active Subslab Depressurization**	**Alternative 4 Enhanced Biodegradation and Soil Vapor Extraction**
Adequacy and reliability of controls	None.	Monitoring and sealing technology is reliable; potential for short-term risks to workers implementing the remedial action	Reliable technology; monitoring will verify TCE concentrations in indoor air remain below target levels	Reliable technology; monitoring will verify COC concentrations in indoor air remain below target levels. Monitoring and inspections needed until levels do not pose potential risk to human health and the environment.
Potential environmental impacts of remedial action	None.	None.	Small amount of concrete debris and/or soil cuttings generated during drilling will be managed in accordance with state and federal requirements. Offsite disposal would result in a loss of landfill space.	None.
Reduction of Toxicity, Mobility, or Volume through Treatment				
Treatment processes used and materials treated	No active treatment	No active treatment. A reduction in the volume of COCs may occur by passive natural attenuation processes.	Volume of COCs in subslab soil gas reduced by extraction and venting to the atmosphere.	Volume, extent, and concentration of COCs in soil and groundwater that may be a source to soil gas will be reduced by enhanced biodegradation and SVE. As a result, migration (or mobility) of COCs into soil gas will decrease. The volume and concentration (and therefore, toxicity) of COCs in soil gas will also reduce. Bioaugmentation will help complete dechlorination.

Table 2-3. Comparative Analysis of Remedial Alternatives for AOC 18
Decision Document for AOCs 17/18/19/103, Former Lockbourne Air Force Base, Ohio

Evaluation Criteria	**Alternative 1 No Action**	**Alternative 2 Sealing and Monitoring**	**Alternative 3 Active Subslab Depressurization**	**Alternative 4 Enhanced Biodegradation and Soil Vapor Extraction**
Amount of hazardous material destroyed or treated	Not applicable since there is no active treatment.	Not applicable since there is no active treatment.	Some mass removal is expected. However, the rate of removal is expected to be slow because the zone of influence does not extend deep into the vadose zone. Treatment area would include the Fixed Base Operations Building footprint.	Soil treatment area would include zone with TCE soil gas concentrations above 10,000 $\mu g/m^3$. Groundwater treatment area would include dissolved contamination within footprint of TCE plume at concentrations above the MCL.
Expected reduction in toxicity, mobility, or volume of the waste	Not applicable since there is no active treatment.	Not applicable since there is no active treatment.	Reduction of TCE concentration in indoor air and subslab soil gas expected due to extraction of vapors beneath the hangar. Does not address potential residual vadose zone impacts.	Reduction of COC concentrations in soil gas expected due to removal from vapor extraction and enhanced biodegradation of groundwater plume.
Irreversibility of treatment	Not applicable since there is no active treatment	Not applicable since there is no active treatment.	Permanent extraction of some mass; however, considered to be minor since the bulk of vadose zone impacts will remain in place.	SVE would permanently remove COCs in soil and soil gas. Enhanced biodegradation would permanently degrade COCs in groundwater that may be a source to soil gas.
Type and quantity of residuals that will remain following treatment	TCE in subslab soil gas and potential residual vadose zone impacts will not be addressed.	TCE in subslab soil gas and potential residual vadose zone impacts will not be addressed.	TCE in subslab soil gas is expected to be reduced; however, potential residual vadose zone impacts will not be addressed.	COCs will be degraded via enhanced bioremediation. Therefore, residuals remaining after treatment would be considered minimal. However, concentrations of reductive degradation products may temporarily increase during treatment. SVE would help to remove COCs and degradation products from subsurface.
Statutory preference for treatment	No.	No.	Yes.	Yes.

Table 2-3. Comparative Analysis of Remedial Alternatives for AOC 18

Decision Document for AOCs 17/18/19/103, Former Lockbourne Air Force Base, Ohio

Evaluation Criteria	**Alternative 1 No Action**	**Alternative 2 Sealing and Monitoring**	**Alternative 3 Active Subslab Depressurization**	**Alternative 4 Enhanced Biodegradation and Soil Vapor Extraction**
Short-term Effectiveness				
Protection of workers during remedial action	Protective. There would be no actions that would impact the workers.	Potential COC exposure to field staff addressed through air monitoring and PPE.	Potential COC exposure, exposure to soils/dust during drilling addressed through air monitoring and PPE. Physical hazards addressed through engineering controls and PPE.	Potential COC exposure during well drilling, SVE construction, and sampling. Potential exposure to enhanced biodegradation substrate during injections; risks addressed through air monitoring and PPE. Relatively high risks of lost time and accidents to workers from handling and transporting bioremediation substrates, from drilling, and from SVE construction.
Protection of the community during remedial action	Protective. There would be no actions that would impact the community.	Protective. There would be minimal to no impacts to the community.	Protective. Construction equipment and travel would create moderate nuisances (such as traffic, noise, and dust).	Protective. Construction equipment and travel would create moderate nuisances (such as, traffic, noise, and dust) during each of the multiple injections.
Potential environmental impacts of remedial action	None.	Relatively low potential impacts. Long-term monitoring requires years of trips to the site. Low GHG and total energy footprint from transportation to and from the site. No loss of beneficial reuse of land.	Relatively high potential impacts. Long-term monitoring and system maintenance require years of trips to the site, and operation of active depressurization system requires significant energy, resulting in high GHG, total energy, and air emissions. However, if active depressurization is determined to not be necessary, then environmental impacts may be significantly lower. No loss of beneficial reuse of land.	Moderate potential impacts. Moderate GHG, total energy, air emissions, and water consumption primarily from direct-push technology injections. Some impacts also attributed to monitoring over time. Reducing concentrations to residential levels will result in a potential gain in the beneficial reuse of land.

Table 2-3. Comparative Analysis of Remedial Alternatives for AOC 18

Decision Document for AOCs 17/18/19/103, Former Lockbourne Air Force Base, Ohio

Evaluation Criteria	**Alternative 1 No Action**	**Alternative 2 Sealing and Monitoring**	**Alternative 3 Active Subslab Depressurization**	**Alternative 4 Enhanced Biodegradation and Soil Vapor Extraction**
Time until protection is achieved	No response action would be conducted, and protection of the site is not expected.	No unacceptable risks to current receptors from indoor air. Monitoring would be conducted to ensure protection.	System construction anticipated to be completed within approximately four weeks. Monitoring would be conducted to ensure protection. Estimated duration for operation and maintenance is 30 years.	Since there are no unacceptable risks to current receptors from indoor air, protection would be achieved as long as residential use is restricted and monitoring is conducted. Estimated remediation timeframe to meet residential goals is 10 years.
Implementability				
Technical feasibility	Feasible.	Feasible. The alternative (sealing of vapor points and sampling subslab soil gas and indoor air) is easily implementable and maintainable. If needed, indoor air mitigation (Alternative 3) is also implementable and maintainable.	Feasible. The alternative (sealing of vapor points, installing an active subslab depressurization system, and sampling subslab soil gas and indoor air) is implementable and maintainable.	Feasible. The alternative (injecting substrates and microbial cultures, installing a vapor extraction system and sampling groundwater, subslab soil gas, and indoor air) are implementable. However, conducting injections and installing an effective vapor extraction system in tight formations can be difficult.
Reliability of technology	Requires no implementation. No potential for schedule delays.	Reliable. Includes only monitoring and sealing of vapor entry points and therefore, would be less subject to schedule delays.	Reliable. Construction of piping and blowers for subslab depressurization system may be subject to schedule delays.	Reliable technologies; however, they have a high degree of uncertainty for this site. The quantity of injection points and difficulty of injecting into silt and clay geology will increase the potential for schedule delays. Because of the water table is shallow, there is the risk that it may rise during precipitation events or during SVE blower operation, and intercept the SVE wells, causing them to be ineffective.

Table 2-3. Comparative Analysis of Remedial Alternatives for AOC 18

Decision Document for AOCs 17/18/19/103, Former Lockbourne Air Force Base, Ohio

Evaluation Criteria	**Alternative 1 No Action**	**Alternative 2 Sealing and Monitoring**	**Alternative 3 Active Subslab Depressurization**	**Alternative 4 Enhanced Biodegradation and Soil Vapor Extraction**
Administrative feasibility	Unlikely to get approval from necessary agencies.	Feasible.	Feasible. Construction activities would need to be coordinated with the CRAA.	Feasible. Activities would need to be coordinated with the CRAA. Injections and construction activities within the Fixed Base Operations Building may be subject to airport operations.
Availability of services, equipment, and materials	N/A	Services and materials are available and are easily implementable.	Services and materials are available and are easily implementable.	Services and materials are available from multiple venders. Water availability is a potential issue.
Cost				
Capital cost	$0	$200,000	$831,000	$1,815,000
Present worth	$0	$385,000	$1,915,000	$3,598,000
Period of analysis (years)	30[a]	30	30	10
Capital and present worth	$0	$585,000	$2,746,000	$5,413,000
Modifying Criteria				
State acceptance	No.	Yes.	Yes.	Yes.
Community acceptance	No.	During the public comment period, the community provided no comments that changed the alternatives.	During the public comment period, the community provided no comments that changed the alternatives.	During the public comment period, the community provided no comments that changed the alternatives.

CRAA, Columbus Regional Airport Authority; GHG, greenhouse gas; PPE, personal protective equipment.

[a] Based on USEPA, 2000, *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study* (EPA 540-R-00-002).

[b] Cost estimate is provided in Appendix C.

Table 2-4. Cost Estimate for Alternative 2—Sealing and Monitoring for AOC 18

Decision Document for AOCs 17/18/19/103, Former Lockbourne Air Force Base, Ohio

Item/Activity	Qty	Unit	Unit Cost	Cost	Notes & Comments
IMPLEMENTATION COST					
Work Plan for Indoor Air Monitoring					
Work Plan for semi-annual sampling for Year 1 and 2 and 5-Year Review Sampling	1	each	$25,000	$25,000	Pre-Draft, Draft, Draft Final, & Final. Includes Scoping sessions. Historical cost from recent similar project. 2015 Labor Rate.
HAPSITE Investigation					
Labor, ODCs, travel	1	each	$32,500	$32,500	Historical cost from recent similar project. 2015 Labor Rate, per diem for Columbus, Ohio 43137, Enterprise standard car rental.
Report	1	each	$15,000	$15,000	Report to include Sealing work. Historical labor effort for similar projects. 2015 Labor Rate.
Entry Point Sealing					
Equipment and Subcontractor					
Mobilization and Site Setup	1	LS	$5,000	$5,000	Historical labor effort for similar projects. 2015 Labor Rate.
Labor - 3-man Crew	50	Hours	$200	$10,000	Historical labor effort for similar projects. Average 2015 Labor Rate for 3 person crew -$200/hr; 5 days, 10-hr days.
Elastomeric Polymer	100	Tube	$8	$800	Vendor quote (2015; Home Depot).
Misc Materials	1	LS	$2,000	$2,000	Historical material costs for similar projects.
Travel and Per Diem	15	day	$162	$2,430	Per diem for Columbus, Ohio 43137, Enterprise standard car rental.
Vehicles for crew (2)	5	day	$250	$1,250	Enterprise standard car rental (2 each @ $125/day with fuel).
Subtotal				***$93,980***	
Contingency	*25%*			*$23,495*	*USEPA 2000, pp. 5-10 & 5-11 (10% Scope + 15% Bid).*
Subtotal				***$117,475***	
Project Management	*10%*			*$11,748*	*USEPA 2000, Exhibit 5-8 on p.5-13, <$100k.*
Remedial Design	*20%*			*$23,495*	*USEPA 2000, Exhibit 5-8 on p.5-13, <$100k.*
Construction Management	*15%*			*$17,621*	*USEPA 2000, Exhibit 5-8 on p.5-13, <$100k.*
Overhead	*15%*			*$17,621*	*USEPA 2000, Exhibit 5-3 on p.5-8.*
Profit	*10%*			*$11,748*	*USEPA 2000, Exhibit 5-3 on p.5-8.*
Total Implementation Cost				**$199,708**	
FUTURE COSTS (30 years)					
5-Year Reviews (Years 5, 10, 15, 20, 25, and 30)					
5-Year Review - Includes LUC Inspections	6	each	$14,000	$84,000	5-year review conducted once every 5 years. Includes pre-draft, draft, draft final, final, fact sheet, and public notices. Historical costs from similar projects. 2015 Labor Rates.
Subtotal				***$84,000***	
Contingency	*25%*			*$21,000*	*USEPA 2000, pp. 5-10 & 5-11 (10% Scope + 15% Bid).*
Subtotal				***$105,000***	
Project Management	*8%*			*$8,400*	*USEPA 2000, Exhibit 5-8 on p.5-13, $100k-$500k.*
Technical Support	*15%*			*$15,750*	*USEPA 2000, p.5-14.*
Overhead	*15%*			*$15,750*	*USEPA 2000, Exhibit 5-3 on p.5-8.*
Profit	*10%*			*$10,500*	*USEPA 2000, Exhibit 5-3 on p.5-8.*
Subtotal				***$155,400***	
Subtotal Annual Cost (at Years 5, 10… and 30)			**$25,900**		Calculated from future costs/6 total years.
Subtotal Future Cost				**$155,400**	
Present Value $_{(1.4\%)}$ of Future Cost of 5-Year Reviews	*30*	*year*	*1.4%*	***$122,699***	
Air Monitoring					
Months 6, 12, 18, and 24					Semi-Annual Sampling for first 2 years.
Labor, ODCs, Travel	4	event	$8,000	$32,000	6 Indoor air samples, 6 subslab samples, 1 outdoor air samples. 2015 Labor Rate, per diem for Columbus, Ohio 43137, Enterprise standard car rental.
Lab & Data Validation	4	each	$5,039	$20,155	Data validation based on historical costs from similar projects. Analytical cost based on Applied Sciences Laboratory (2015).
Equipment	4	event	$3,600	$14,400	Historical cost from recent similar project.
Report	4	each	$8,000	$32,000	Historical labor effort for similar projects. 2015 Labor Rate.
Subtotal				***$98,555***	
Contingency	*25%*			*$24,639*	*USEPA 2000, pp. 5-10 & 5-11 (10% Scope + 15% Bid).*
Subtotal				***$123,193***	
Project Management	*8%*			*$9,855*	*USEPA 2000, Exhibit 5-8 on p.5-13, $100k-$500k.*
Technical Support	*15%*			*$18,479*	*USEPA 2000, p.5-14.*
Overhead	*15%*			*$18,479*	*USEPA 2000, Exhibit 5-3 on p.5-8.*
Profit	*10%*			*$12,319*	*USEPA 2000, Exhibit 5-3 on p.5-8.*
Subtotal Annual Cost			***$91,163.04***		Calculated from future costs/2 total years.
Subtotal Future Cost				***$182,326***	
Present Value $_{(1.4\%)}$ of Future Cost of Air Sampling Years 1-2			*1.4%*	***$178,567***	

Table 2-4. Cost Estimate for Alternative 2—Sealing and Monitoring for AOC 18

Decision Document for AOCs 17/18/19/103, Former Lockbourne Air Force Base, Ohio

Item/Activity	Qty	Unit	Unit Cost	Cost	Notes & Comments
Air Monitoring					
Years 5 and 10					1 Sample Event every 5 years.
Labor, ODCs, Travel	2	event	$8,000	$16,000	6 Indoor air samples, 6 subslab samples, 1 outdoor air samples. 2015 Labor Rate, per diem for Columbus, Ohio 43137, Enterprise standard car rental.
Lab & Data Validation (DV)	2	each	$5,039	$10,077	Data validation based on historical costs from similar projects. Analytical cost based on Applied Sciences Laboratory (2015).
Equipment	2	event	$3,600	$7,200	Historical cost from recent similar project.
Report	2	each	$8,000	$16,000	Historical labor effort for similar projects. 2015 Labor Rate.
Subtotal				***$49,277***	
Contingency	*25%*			*$12,319*	*USEPA 2000, pp. 5-10 & 5-11 (10% Scope + 15% Bid).*
Subtotal				***$61,597***	
Project Management	*10%*			*$6,160*	*USEPA 2000, Exhibit 5-8 on p.5-13, <$100k.*
Technical Support	*15%*			*$9,239*	*USEPA 2000, p.5-14.*
Overhead	*15%*			*$9,239*	*USEPA 2000, Exhibit 5-3 on p.5-8.*
Profit	*10%*			*$6,160*	*USEPA 2000, Exhibit 5-3 on p.5-8.*
Subtotal Annual Cost (at Years 5 and 10)			***$46,197.49***	***$92,395***	Calculated from future costs/2 total years.
Subtotal Future Cost				***$92,395***	
Present Value *(1.4%)* ***of Future Cost of Air Sampling Years 5-10***			*1.4%*	***$83,296***	
Total Present Value of Future Costs			**1.4%**	**$384,563**	Year 2015 present value calculated for 30-yrs-future-cost using 1.4% Real Discount Rate per Office of Management and Budget (2014).

Other Notes and References:

- The "Real" Discount Rate used to calculate the Present Value cost is 1.4% for a timeframe of 30 years per the Office of Management and Budget (OMB), Circular A-94, Appendix C, Revised December 2014, "Discount Rates for Cost Effectiveness, Lease Purchase, and Related Analysis" for Calendar Year 2015.
- USEPA. 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* . OSWER Directive 9355.3-01. EPA/540/G-89/004. October.
- USEPA. 2000. *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study* . With the U.S. Army Corps of Engineers. OSWER 9355.0-75. EPA 540-R-00-002. July.
- The information in this cost estimate is based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during Baseline Sampling and the Remedial Design phase. This is an order-of-magnitude engineering cost estimate that is expected to be within –30 to +50 percent of the actual project cost (per USEPA 1988 and 2000).

Figures

LEGEND

□ FORMER LOCKBOURNE AIR FORCE BASE (AFB)

N

0 20 40 Miles

NOTE:

AOC = AREA OF CONCERN.

FIGURE 1-1
FORMER LOCKBOURNE AFB LOCATION MAP

DECISION DOCUMENT
AOCS 17/18/19/103
FORMER LOCKBOURNE AFB, COLUMBUS, OHIO

RDD BALDUR V:\LOCKBOURNE_AFB_434043\MAPFILES\DECISIONDOC\FIG1-1_LAFB.MXD FELHADID 2/16/2017

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community. 25 August 2013.

LEGEND

⬚ COLUMBUS REGIONAL AIRPORT AUTHORITY BOUNDARY

▭ LOCATION OF AOCS 17/18/19/103

NOTE:

AOC = AREA OF CONCERN.

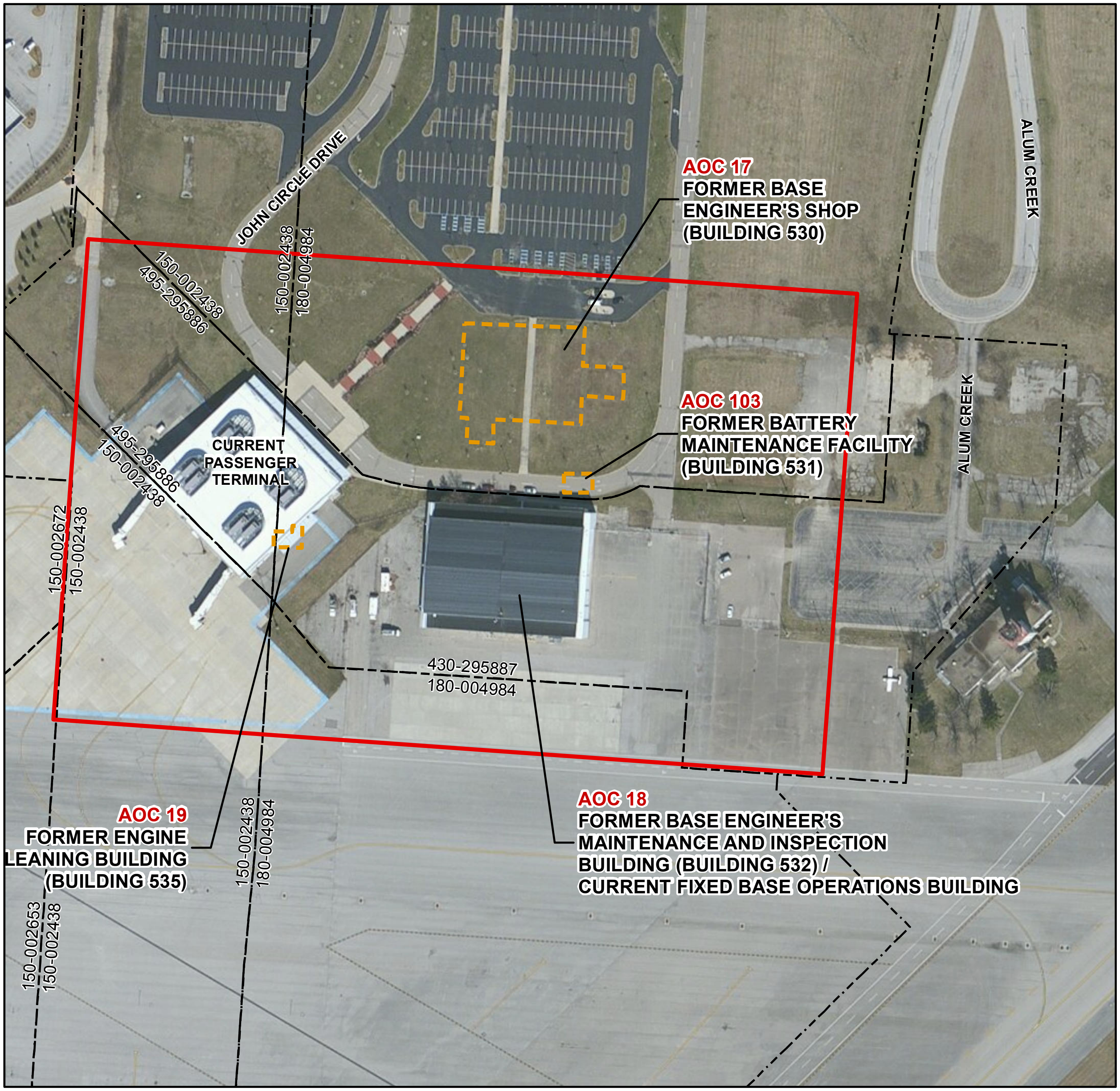
N

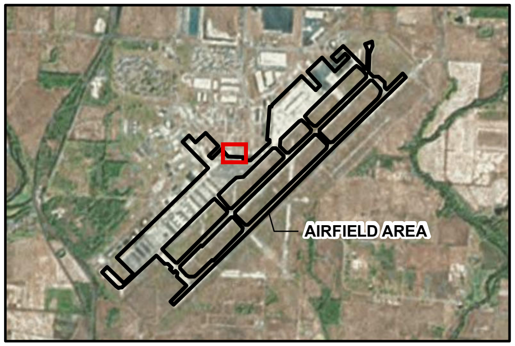
0 3,000 6,000 Feet

FIGURE 2-1
AOC LOCATION MAP

DECISION DOCUMENT
AOCS 17/18/19/103
FORMER LOCKBOURNE AFB, COLUMBUS, OHIO

RDD BALDUR V:\LOCKBOURNE_AFB_434043\MAPFILES\DECISIONDOC\FIG2-1_AOC_LOCATION_FS15.MXD FELHADID 2/16/2017





LEGEND

🟥 LOCATION OF AOCS 17/18/19/103

🟧 FORMER BUILDING

⬚ PARCEL BOUNDARY

NOTES:

AOC = AREA OF CONCERN.

THE SELECTED REMEDY ADDRESSES THE POTENTIAL FOR UNACCEPTABLE RISK FROM A FUTURE COMMERCIAL/INDUSTRIAL WORKER EXPOSURE TO TRICHLOROETHENE IN INDOOR AIR WITHIN THE FIXED BASE OPERATIONS BUILDING (FORMER BASE ENGINEER'S MAINTENANCE AND INSPECTION BUILDING [BUILDING 532]) AT AOC 18.

SERVICE LAYER CREDITS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY, 25 AUGUST 2013.

FRANKLIN COUNTY, OHIO PARCEL BOUNDARIES. AVAILABLE AT FTP://APPS.FRANKLINCOUNTYAUDITOR.COM /GIS_SHAPEFILES/2017/01/. ACCESSED JULY 20, 2017.

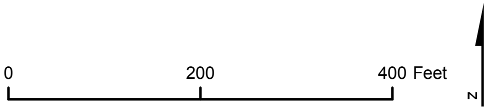
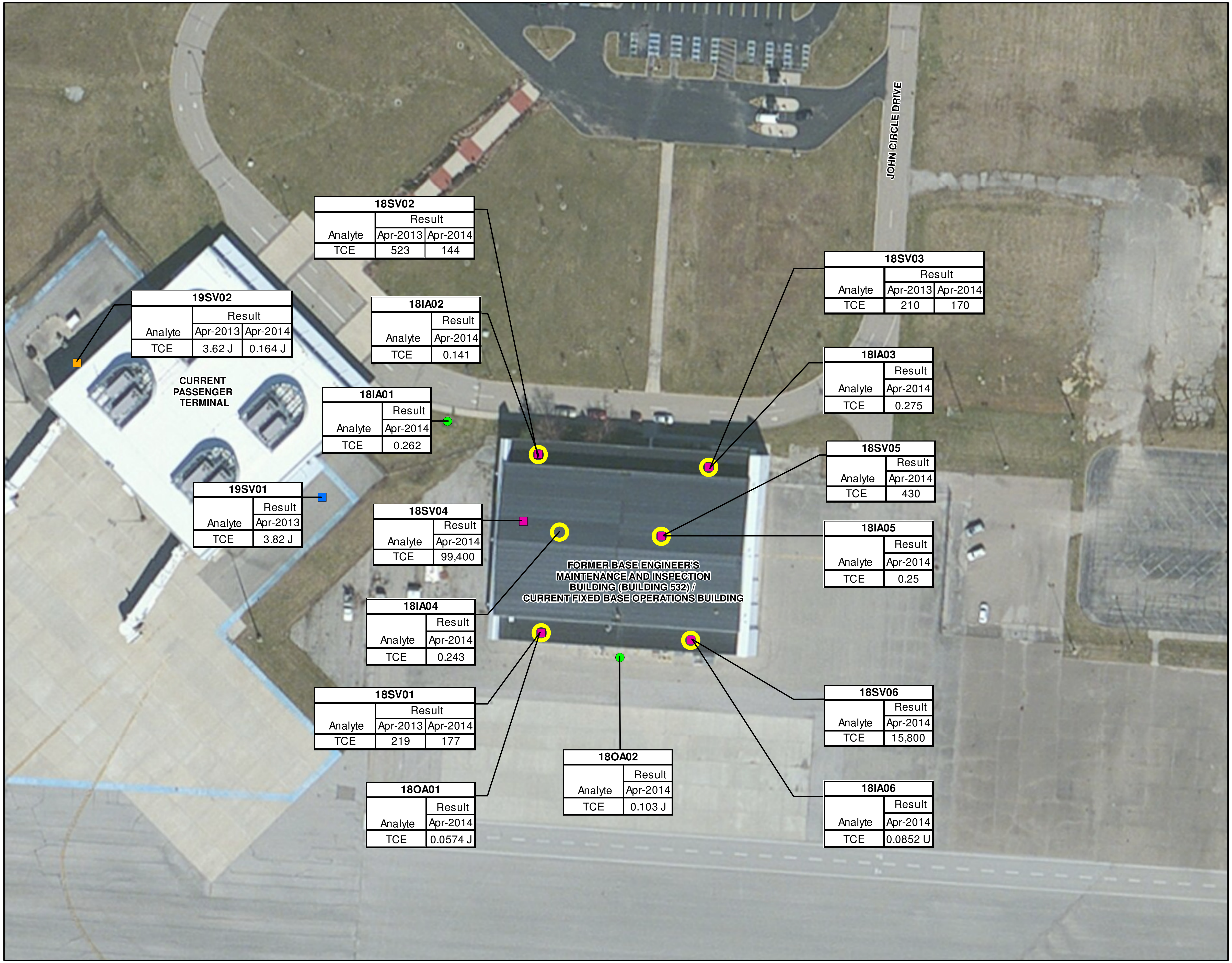


FIGURE 2-2
AOCS 17/18/19/103 LAYOUT

DECISION DOCUMENT
AOCS 17/18/19/103
FORMER LOCKBOURNE AFB, COLUMBUS, OHIO

R:\ENBG\00_PROJ\A\AIRFORCE\LOCKBOURNE_AFB_434043\MAPFILES\DECISIONDOC\FIG2-2_LAYOUT_FS15.MXD FELHADID 7/20/2017



18SV02

Analyte	Result	
	Apr-2013	Apr-2014
TCE	523	144

19SV02

Analyte	Result	
	Apr-2013	Apr-2014
TCE	3.62 J	0.164 J

18IA02

Analyte	Result
	Apr-2014
TCE	0.141

18IA01

Analyte	Result
	Apr-2014
TCE	0.262

19SV01

Analyte	Result
	Apr-2013
TCE	3.82 J

18SV04

Analyte	Result
	Apr-2014
TCE	99,400

18IA04

Analyte	Result
	Apr-2014
TCE	0.243

18SV01

Analyte	Result	
	Apr-2013	Apr-2014
TCE	219	177

18OA01

Analyte	Result
	Apr-2014
TCE	0.0574 J

18OA02

Analyte	Result
	Apr-2014
TCE	0.103 J

18SV03

Analyte	Result	
	Apr-2013	Apr-2014
TCE	210	170

18IA03

Analyte	Result
	Apr-2014
TCE	0.275

18SV05

Analyte	Result
	Apr-2014
TCE	430

18IA05

Analyte	Result
	Apr-2014
TCE	0.25

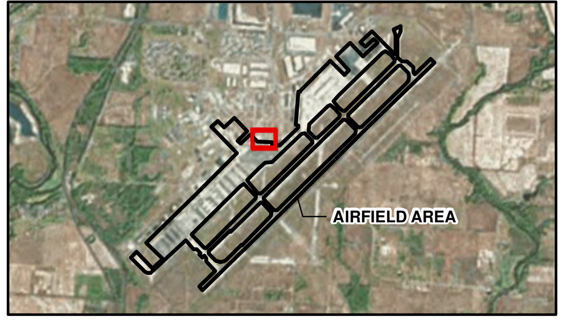
18SV06

Analyte	Result
	Apr-2014
TCE	15,800

18IA06

Analyte	Result
	Apr-2014
TCE	0.0852 U

VICINITY MAP



LEGEND

🟧	RI EXHAUST STACK GAS SAMPLING LOCATION
🟪	RI SUBSLAB SOIL GAS SAMPLING LOCATION
🟦	RI EXTERIOR SOIL GAS SAMPLING LOCATION
●	RI OUTDOOR AIR SAMPLING LOCATION
○	RI INDOOR AIR SAMPLING LOCATION

NOTES:

ALL RESULTS ARE IN UNITS OF MICROGRAMS PER CUBIC METER (µg/m^3).

J = THE ANALYTE WAS POSITIVELY IDENTIFIED AT AN APPROXIMATE CONCENTRATION.

RI = REMEDIAL INVESTIGATION.

SOIL GAS SAMPLES AND THE EXHAUST STACK GAS SAMPLE HAVE THE "SV" DESIGNATION IN THEIR SAMPLE IDENTIFICATIONS. INDOOR AIR SAMPLES HAVE THE "IA" DESIGNATION.

SERVICE LAYER CREDITS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY 25 AUGUST 2013.

TCE = TRICHLOROETHENE.

U = THE ANALYTE WAS NOT DETECTED ABOVE THE LIMIT OF DETECTION.

0 80 160 Feet

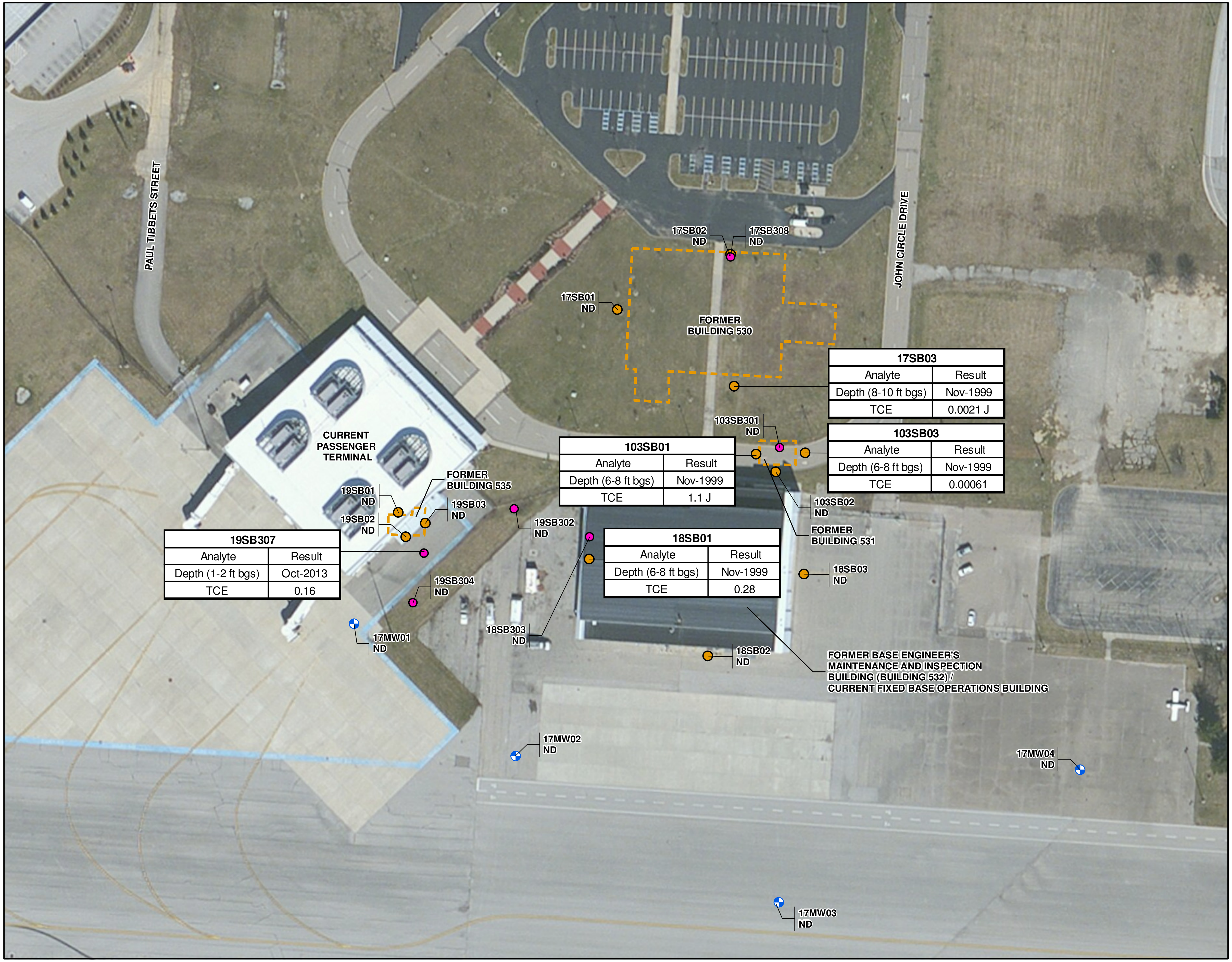
N

FIGURE 2-3

EXCEEDANCES IN SOIL VAPOR AND AIR SAMPLES

DECISION DOCUMENT
AOCS 17/18/19/103
FORMER LOCKBOURNE AFB, COLUMBUS, OHIO

RDD BALDUR V:\LOCKBOURNE_AFB_434043\MAPFILES\DECISIONDOC\FIG2-3_SV_AIR_EXCEED.MXD FELHADID 2/22/2017 6:40:28 PM



17SB03

Analyte	Result
Depth (8-10 ft bgs)	Nov-1999
TCE	0.0021 J

103SB03

Analyte	Result
Depth (6-8 ft bgs)	Nov-1999
TCE	0.00061

103SB01

Analyte	Result
Depth (6-8 ft bgs)	Nov-1999
TCE	1.1 J

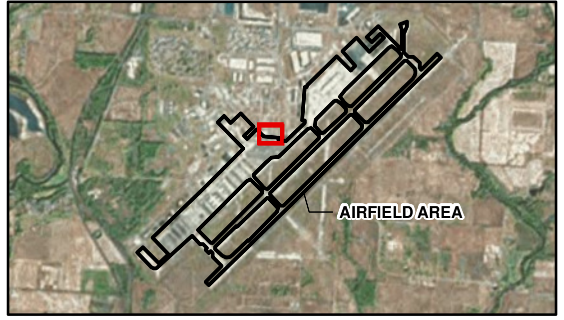
18SB01

Analyte	Result
Depth (6-8 ft bgs)	Nov-1999
TCE	0.28

19SB307

Analyte	Result
Depth (1-2 ft bgs)	Oct-2013
TCE	0.16

VICINITY MAP



LEGEND

- ● RI SOIL SAMPLING LOCATION
- ● PHASE I SI SOIL BORING LOCATION
- ● PHASE II SI MONITORING WELL LOCATION
- ▭ FORMER BUILDING

NOTES:

CHLOROFORM WAS NOT DETECTED IN SOIL.

FT BGS = FEET BELOW GROUND SURFACE.

J = THE ANALYTE WAS POSITIVELY IDENTIFIED AT AN APPROXIMATE CONCENTRATION.

ND =NOT DETECTED.

RI = REMEDIAL INVESTIGATION.

SERVICE LAYER CREDITS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY, 25 AUGUST 2013.

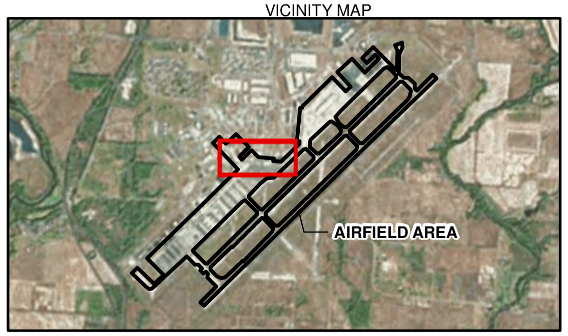
SI = SITE INVESTIGATION.

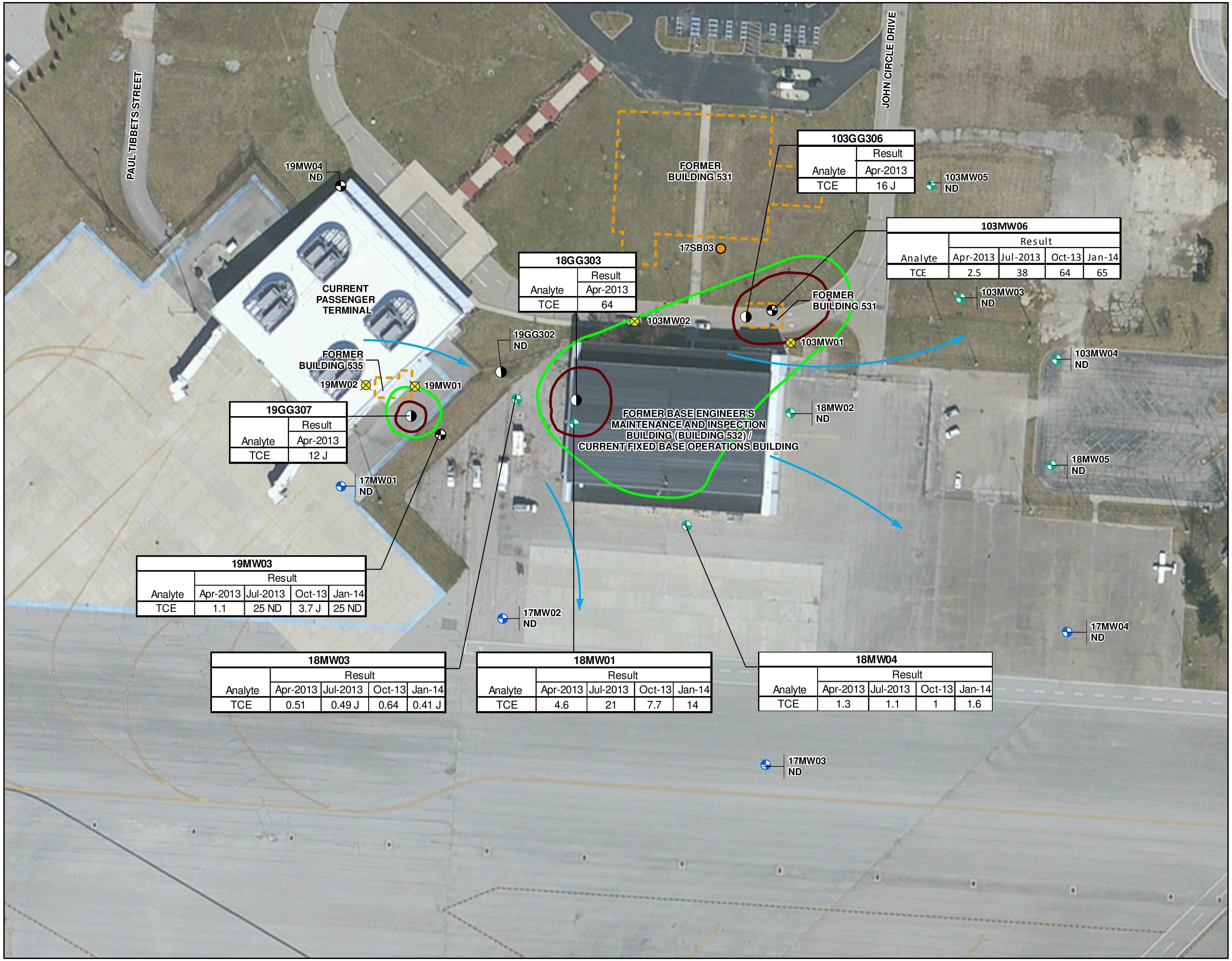
TCE = TRICHLOROETHENE.

TCE CONCENTRATIONS ARE IN UNITS OF MILLIGRAMS PER KILOGRAM (mg/kg).

FIGURE 2-4
TCE IN VADOSE ZONE SOIL

DECISION DOCUMENT
AOCS 17/18/19/103
FORMER LOCKBOURNE AFB, COLUMBUS, OHIO





103GG306

Analyte	Result
	Apr-2013
TCE	16 J

103MW06

Analyte	Result			
	Apr-2013	Jul-2013	Oct-13	Jan-14
TCE	2.5	38	64	65

18GG303

Analyte	Result
	Apr-2013
TCE	64

19GG307

Analyte	Result
	Apr-2013
TCE	12 J

19MW03

Analyte	Result			
	Apr-2013	Jul-2013	Oct-13	Jan-14
TCE	1.1	25 ND	3.7 J	25 ND

18MW03

Analyte	Result			
	Apr-2013	Jul-2013	Oct-13	Jan-14
TCE	0.51	0.49 J	0.64	0.41 J

18MW01

Analyte	Result			
	Apr-2013	Jul-2013	Oct-13	Jan-14
TCE	4.6	21	7.7	14

18MW04

Analyte	Result			
	Apr-2013	Jul-2013	Oct-13	Jan-14
TCE	1.3	1.1	1	1.6

LEGEND

◑	RI GROUNDWATER SAMPLING LOCATION
⊕	RI MONITORING WELL LOCATION
⊕	PHASE I SI MONITORING WELL LOCATION
⊕	PHASE II SI MONITORING WELL LOCATION
⊗	ABANDONED MONITORING WELL LOCATION
●	PHASE I SI SOIL BORING LOCATION
→	GROUNDWATER FLOW DIRECTION
—	TCE ISOCONCENTRATION CONTOUR (5 µg/L)
—	TCE ISOCONCENTRATION CONTOUR (10 µg/L)
⌐¬	FORMER BUILDING

NOTES:

ABANDONED MONITORING WELLS AND PHASE I SOIL BORING LOCATION 17SB03 ARE SHOWN BECAUSE THEY WERE USED TO HELP DEFINE THE EXTENT OF TCE.

ALL RESULTS ARE IN UNITS OF MICROGRAMS PER LITER (µg/L).

J = THE ANALYTE WAS POSITIVELY IDENTIFIED AT AN APPROXIMATE CONCENTRATION.

ND = NOT DETECTED.

SERVICE LAYER CREDITS: SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY, 20 AUGUST 2013.

SI = SITE INVESTIGATION.

TCE = TRICHLOROETHENE.

0 100 200 Feet
N

FIGURE 2-5
TCE IN GROUNDWATER APRIL 2013 – JANUARY 2014

DECISION DOCUMENT
AOCS 17/18/19/103
FORMER LOCKBOURNE AFB, COLUMBUS, OHIO

RDD \\BALDUR\PROJ\LOCKBOURNE_AFB_434043\MAPFILES\RI_2014\FIG4-3_17_18_19_103_GW_EXCEED_RI14.MXD FELHADID 2/22/2017 6:46:34 PM

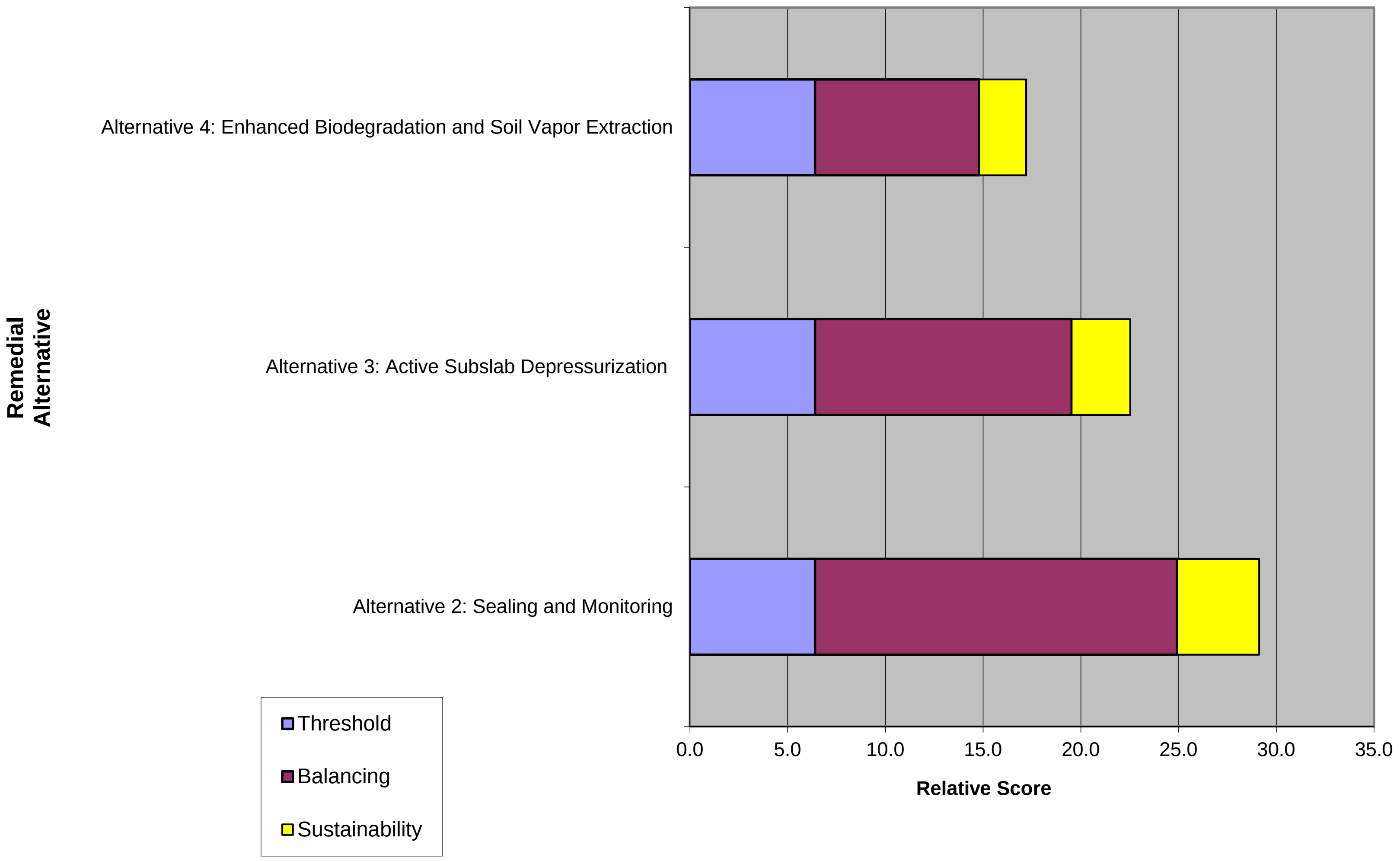


Figure 2-6
Overall Comparative Analysis Ranking
Decision Document
AOCs 17/18/19/103
Former Lockbourne AFB, Columbus, Ohio

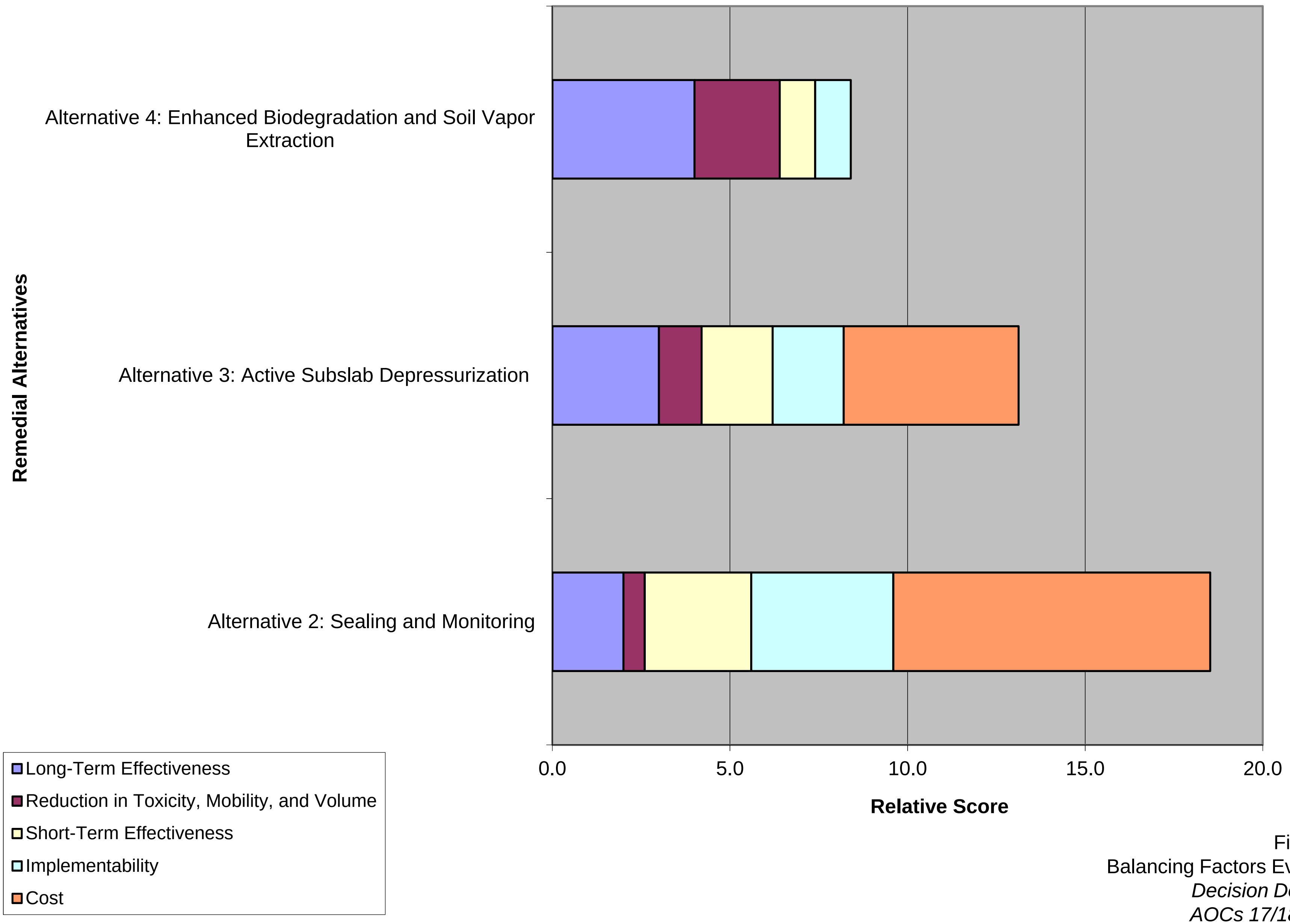


Figure 2-7
Balancing Factors Evaluation
Decision Document
AOCs 17/18/19/103
Former Lockbourne AFB, Columbus, Ohio

Appendix A
Written Comments from Columbus Regional Airport Authority

COLUMBUS
REGIONAL AIRPORT AUTHORITY

February 22, 2017

U.S. Army Corps of Engineers–Louisville District
Environmental Branch
Attn: Dr. David J. Brancato
Room 351 Romano Mazzoli Building
600 Dr. Martin Luther King Jr. Place
Louisville, KY 40202-2232

VIA EMAIL: David.J.Brancato@usace.army.mil

Dear Dr. Brancato:

The Columbus Regional Airport Authority (CRAA) appreciates the opportunity to provide comments pertaining to the *Proposed Plan for AOCs 17/18/19/103 – Former Lockbourne Air Force Base, Ohio* (Plan). As you know, the AOCs identified in the proposed plan are located within an area currently used for commercial aeronautical activity. This activity includes aircraft storage and handling, passenger processing, and other customer services available to the aviation community. Contamination from the AOC's is described to be in the soil and groundwater surrounding the passenger terminal, the Fixed Base Operations (FBO) hangar, and west of the air traffic control tower. CRAA does not concur with the proposed plan's alternative, and we have the following comments on the plan and the selected Alternative 2.

Indoor Air Quality

Alternative 2 proposes semi-annual indoor air and subslab vapor sampling for TCE in the FBO; with the results being "evaluated with Ohio EPA to reduce future monitoring if/when justified." Is this semiannual sampling intended to continue each year until the first 5-year review described later? Ohio EPA has lent its support for semiannual sampling. If USACE does nothing to clean up the contamination, CRAA believes that a regular and continued program of sampling should be conducted for indoor air and subslab vapor for the life of the building; including slab inspection and maintenance. It is imperative that USACE provides for continued human health protection for the building's occupants, and without regular and continued sampling it is unclear how USACE can score Alternative 2 (see Table 1.) as "satisfying the criterion very well" when describing protectiveness of human health.

Site Contamination in the Environment

The proposed plan does not discuss how USACE will continue to monitor the concentrations of contamination in the environment. In Alternative 2 there is a statement that, during the 5-year review, "sampling and analysis can be conducted . . .". This leads CRAA to believe that there is not a plan for soil or groundwater sampling. Soil and groundwater monitoring of the complete Site should continue in order to document contaminant concentration, contaminant breakdown, and contaminant movement. Alternative 2 centers around TCE, but does not address its byproducts from degradation like Vinyl Chloride; nor does the proposed plan address the movement of contamination from its current location to other CRAA properties and buildings.

Alternative 2 assumes that "the property deed requires the Site to remain as an airport." CRAA is able to sell this property and/or seek a release from the FAA for non-aeronautical use. The proposed plan should not assume CRAA will continue to be the land owner or that the property will forever be configured as it is today. This Site, like others on the airport, presents risks to Air Force Base redevelopment. The proposed plan has been written specifically about the FBO building, but does not address the effects of the Site on CRAA property in whole. For example, CRAA is currently in the design phase of a parking lot and detention basin immediately adjacent/downgradient from 2 monitoring wells for AOC 103. The proposed plan must take into account not just indoor air quality for the FBO occupants, but the future state of the Site contaminants and their effect on construction workers, new facilities, and other receptors. The FBO is surrounded with water lines, sanitary sewers, storm sewers, and multiple data and electric lines. The proposed plan describes groundwater movement of 4 feet/year, in a direction toward the air traffic control tower. CRAA remains concerned about the movement of the plume; including its transport into utility backfill/pathways or toward additional buildings.

The proposed plan states that the groundwater plume at the Site is "stable and possibly shrinking" due to natural processes. Please describe these natural processes and the data or investigations that support the conclusion. It has been our observation that reliance on monitored natural attenuation of TCE contamination at Rickenbacker sites has not been reliable or effective. The Air Force has had to change its remedial approach many times; looking for a means to reduce TCE concentrations at sites under pavement. Finally, with respect to monitored natural attenuation, Ohio EPA guidance on the practice (January 2001) establishes minimum standards for implementation including:

- Clearly demonstrated to be occurring
- Can be reliably monitored in the future
- Rate of attenuation sufficiently remediates in a reasonable time frame
- Levels will not spread to currently uncontaminated areas
- Addresses breakdown products which may be more toxic than the parent compounds
- A monitoring program in place to establish permanent remediation
- Triggers and contingencies if attenuation is not successful

If USACE is relying on monitored natural attenuation as a remedy, please describe your approach to meeting the standards established by Ohio EPA; and the contingency plans that will be established to actively protect human health and the environment from contaminants at the Site.

Thank you for the opportunity to review the proposed plan and provide these comments. I can be reached at (614) 239-3347 or pkennedy@columbusairports.com. We look forward to the next steps in the process.

Sincerely,

COLUMBUS REGIONAL AIRPORT AUTHORITY
by

Paul D Kennedy

Paul D. Kennedy, AAE
Manager, Energy & Environment

cc: Fred Myers, Ohio EPA
Charlie Goodwin AAE, CRAA

Appendix B
Public Meeting Transcript

MEETING FOR PROPOSED PLAN PRESENTATION FOR FORMER LOCKBOURNE AIR FORCE BASE

January 26, 2017

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Hamilton Township Community Center
6100 Lockbourne Road
Lockbourne, OH 43137

ATTENDEES

Bob Goodson, PG from CH2M Hill
Amy Brand from CH2M Hill
Katie Newton from US Army Corps of Engineers
Valerie Doss from US Army Corps of Engineers

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P R O C E E D I N G S

\- - - - -

MR. GOODSON: We're here to discuss the proposed plan for former Lockbourne Air Force Base areas of concerns 17, 18, 19 and 103. There were no attendees from the public. It is January 26th, 2017, at 7:45 p.m.

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Thereupon, the foregoing proceedings concluded at 7:44 p.m.

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Appendix C
Green Sustainable Remediation Memorandum

APPENDIX C

Green and Sustainable Remediation, Former Lockbourne Air Force Base, Areas of Concern 17/18/19/103, Columbus, Ohio

This memorandum identifies and evaluates progress in incorporating green and sustainable remediation (GSR) practices into Delivery Order Number CY01 for Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) activities at areas of concern (AOCs) 17, 18, 19, and 103 at the Former Lockbourne Air Force Base (AFB) in Columbus, Ohio. AOCs 17, 18, 19, and 103 are near one another and thus are being evaluated together for the purpose of this memorandum. The former AFB is part of the Formerly Used Defense Site (FUDS) program. The delivery order was awarded under Contract Number W912PP-09-D-0016 and includes the remedial investigation (RI), feasibility study (FS), proposed plan, decision document (DD), and public involvement activities. The USACE, as the lead agency, selected the remedial action decisions, which are sealing and monitoring at the Fixed Base Operations Building for AOC 18 and no action for AOCs 17, 19, and 103. GSR practices continue to be evaluated in future United States Army Corps of Engineers (USACE) contracts for remedial design and remedial action of the sealing and monitoring remedy for AOC 18.

The site description and history are provided in the RI report, and a summary is provided in the DD.

The project stakeholders are provided in Table C-1.

Table C-1. Project Stakeholders

Responsible Affiliation	Name	Phone Number	Procedure
USACE project manager	Valerie Doss	502-315-6108	Primary point of contact (POC) for USACE with Ohio EPA, CRAA, stakeholders, and the community.
USACE contracting officer's representative and technical project manager	Dick Kennard	502-315-6323	Primary POC for USACE contractor (CH2M HILL) regarding contractual and technical issues.
CRAA manager, energy and environment	Paul Kennedy	614-239-3347	Primary POC for CRAA; can delegate communication to other internal or external POCs.
Ohio EPA remediation project manager	Fred Myers	614-728-3830	Primary POC for Ohio EPA; can delegate communication to other internal or external POCs.
Community	Not applicable	Not applicable	Provide input to USACE.

C.1 Purpose

Pursuant to the Department of Defense (DoD) *Defense Environmental Restoration Program Management* manual (DoD, 2012), GSR employs the following strategies throughout the remedial process:

- Uses natural resources and energy efficiently
- Reduces negative impacts on the environment
- Minimizes or eliminates pollution at its source
- Reduces waste to the greatest extent possible

The manual instructs DoD to consider and implement GSR opportunities in all phases of remediation when feasible, and to ensure the use of GSR remediation practices where practicable based on economic and social benefits and costs. In the DD phase, a legal document presents the selected remedies, if applicable, that were previously evaluated in the FS to ensure they are efficient; are environmentally, economically, and fiscally sound; consider sustainable practices; and reduce the footprint of remediation systems in the environment.

This memorandum identifies GSR practices and documentation thereof for this delivery order for the DD phase. There are three overall types of project tasks to consider GSR implementation: reporting, fieldwork, and remedial alternative selection. For this DD phase, the focus includes reporting and remedial alternative selection. Since the remedial action decision for AOCs 17, 19, and 103 is no action, remedial alternative selection is focused only on sealing and monitoring at the Fixed Base Operations Building for AOC 18. There is no fieldwork during the DD phase of this project. To better integrate GSR considerations, this memorandum will be updated as GSR practices are implemented.

C.2 Green and Sustainable Remediation Strategy

The GSR strategy for the project includes implementing sustainability considerations through best management practices (BMPs) and footprint evaluations. The BMPs that are planned, and progress made toward implementing those BMPs, are provided below. The environmental footprint of proposed remedial alternatives has been evaluated as part of the FS. Figure 1 depicts the GSR decision logic for CERCLA activities.

C.2.1 Best Management Practices

BMPs are actions or considerations that are expected to improve the environmental, social, or economic aspects of the remedial process. As with other industries or activities, BMPs for GSR have been developed that apply to soil, sediment, and groundwater remediation activities. Improvements for GSR can be achieved by considering BMPs and implementing those that apply to the project-specific remedial process or potentially implementing alternate GSR practices identified while considering BMPs (USACE 2011).

Consideration of BMPs requires knowledge of the remedial activities and site conditions to determine which are applicable and appropriate. BMPs are divided into the following categories:

A. Planning
B. Characterization or Remedy Approach
C. Energy/Emissions: Transportation
D. Energy/Emissions: Equipment Use
E. Materials and Offsite Services
F. Water Resource Use
G. Waste Generation, Disposal, and Recycling
H. Land Use, Ecosystems, and Cultural Resources
I. Safety and Community
J. Other Site-specific BMPs

Table C-2 (at the end of this appendix) lists the BMPs planned for components of the project and the progress made toward implementing them. Components of the project include reporting, field work, and remedial alternative selection. Since the remedial action decision for AOCs 17, 19, and 103 is no action, Table C-2 addresses remedial alternative selection only for AOC 18. The categories presented in Table C-2 are consistent with those presented in the BMP checklists in USACE's (2012) *Evaluation of Consideration and Incorporation of Green and Sustainable Remediation Practices in Army Environmental Remediation* and consist of BMP description, evaluation status, implementations status, and value evaluation. See the notes to Table C-2 for BMPs deemed applicable but not evaluated.

Table C-2 lists BMPs deemed applicable to the project. The following BMPs (not included in Table C-2) are not currently applicable but would apply to subsequent remedial design and remedial action activities:

- BMP B-7: Consider use of existing site structures/infrastructure or mobilization of temporary structures versus new construction.
- BMP D-5: Use variable frequency drives on motors (e.g., pumps, blowers), or replace oversized motors with properly sized motors.
- BMP D-6: Identify options for generating renewable energy for direct use in the remedial alternatives and/or for alternate use at or near the project site.
- BMP D-7: Consider purchase of renewable energy certificates (RECs) to offset emissions from the remedial activities. The memorandum "Department of the Army Policy for Renewable Energy Credits" (May 24, 2012) states "the Army shall not purchase RECs solely to meet Federal renewable energy goals." It is possible, however, that project teams might in some cases consider the purchase of RECs to address concerns of one or more stakeholders at a specific site.
- BMP D-8: Design/modify housing required for aboveground treatment components for energy efficiency.
- BMP D-9: For remedies that involve groundwater or air extraction, optimize extraction to reduce flow rates (potentially beneficial with respect to energy use, materials usage, water resources, waste disposal, etc.).
- BMP D-10: Consider pulsing for extraction or injection (or both) of water or air to maximize mass removal per unit of time or energy, by extracting higher concentrations.
- BMP D-11: Run electrical equipment during times of lower electric demand if possible (this does not reduce energy use but could lower cost and also can lower stress on the energy grid during periods of peak demand).
- BMP E-4: Identify opportunities for using by-products or "waste" materials from local sources in place of refined chemicals or materials.
- BMP E-5: Reduce demand on publicly owned treatment works.
- BMP F-2: Preferentially use less refined water resources when feasible.
- BMP G-2: Segregate excavated soil in planned staging areas so that "clean" material can be deposited onsite or reused rather than transported for offsite disposal.
- BMP H-1: Minimize erosion and soil transport to surface water bodies.
- BMP H-4: Minimize drawdown of the water table in sensitive areas such as wetlands or areas subject to subsidence.

Table C-3 summarizes BMP applicability and implementation as the project currently stands.

C.2.2 Environmental Footprint

The term "environmental footprint" refers to the quantification of GSR parameters such as amount of energy used, amount of greenhouse gases emitted, and amount of potable water consumed. The environmental footprint was evaluated as part of the FS (CH2M 2016) and will be revised as needed in future USACE contracts for remedial design and remedial action. The environmental footprint for the remedial alternatives evaluated in the FS was calculated using SiteWise version 3.0 (NAVFAC 2013). U.S. Environmental Protection Agency (USEPA) has not provided official guidance on the role of GSR footprint analyses in CERCLA FSs. However, USEPA does support the new ASTM Greener Cleanup

Standard (ASTM E-2893), which includes an option of performing "quantitation." USEPA was involved in the development of the standard and is currently training its staff in the standard's application. The standard provides a section on how footprint analysis results can be used in evaluating alternatives.

The environmental footprints calculated by SiteWise were used to quantitatively compare the alternatives, and a relative impact of high, medium, or low was assigned to each alternative based on its performance against the other alternatives. The tool assigns a ranking of "high" to the highest footprint in each category and assigns the rankings of other alternatives based on the difference in the data between alternatives. Alternative 2 had low environmental footprints and accident risks. Alternative 3 had comparatively high environmental footprints but low accident risks. Operating the depressurization system contributed to almost all of the environmental and water-use footprints for this alternative. Alternative 4 had medium environmental footprints and high accident risks, which were primarily associated with the equipment-use component during soil vapor extraction operations and enhanced biodegradation injections (CH2M 2016). The USACE, as the lead agency, selected the remedial action decisions, which are sealing and monitoring at the Fixed Base Operations Building (Alternative 2) for AOC 18 and no action for AOCs 17, 19, and 103.

C.3 References

CH2M. 2016. *Feasibility Study for AOCs 17/18/19/103, Former Lockbourne Air Force Base, Ohio.* July.

DoD (Department of Defense). 2012. *Defense Environmental Restoration Program (DERP) Management.* Manual Number 4715.20. March.

NAVFAC (Naval Facilities Engineering Command). 2013. *SiteWise Version 3 User's Guide*. July.

USACE. 2011. *Process for Consideration and Incorporation of Process of Green and Sustainable Remediation (GSR) Practices in Army Environmental Remediation*. Prepared by Tetra Tech EC, Inc. May.

USACE. 2012. *Evaluation of Consideration and Incorporation of Green and Sustainable Remediation Practices in Army Environmental Remediation.* August. http://www.fedcenter.gov/Documents/index.cfm?id=22322&pge_prg_id=27392.

Table C-2. Summary of Best Management Practices

Phase	BMP Number	Project Task	BMP Description	Evaluation Status (A, P, E, Null)	Implementation Status (FI, PI, NY, Null)	Value Evaluation	Notes	Completion/ Revision Date
Planning	BMP A-1	Reports/ Documents	Develop a culture of green and sustainable remediation (GSR) within the project team and encourage GSR ideas from project staff, and review similar projects from other sites for possible transfer/adoption of GSR ideas	E	FI	Cost Increase	Chartered project team on GSR as part of fieldwork planning during field charter teleconferences held on March 27 and April 1. Assigned GSR subject matter expert (Paul Favara/CH2M HILL) to support the project and project team. Leveraged GSR ideas and implementation from similar projects as discussed on field charters.	April 2012
Planning	BMP A-1	Fieldwork	Develop a culture of GSR within the project team and encourage GSR ideas from project staff, and review similar projects from other sites for possible transfer/adoption of GSR ideas	E	FI	Cost Increase	Chartered project team on GSR during field charters held on March 27 and April 1. GSR activities were documented in a GSR table following the field event.	January 2014
Planning	BMP A-1	Alternatives	Develop a culture of GSR within the project team and encourage GSR ideas from project staff, and review similar projects from other sites for possible transfer/adoption of GSR ideas	E	FI	Cost Savings	Chartered project team on GSR; GSR subject matter expert supporting the project and project team; Leverage GSR ideas and implementation from similar projects.	February 2017
Planning	BMP A-2	Reports/ Documents	Incorporate a section on GSR in project meetings, work plans, and reports	E	FI	Cost Savings	Remedial investigation/feasibility study work plan, remedial investigation report, feasibility study report, and decision document included a section on GSR. Agenda for project meetings, as appropriate, included GSR as topic. Used paper containing at least 30 percent postconsumer fiber for work plans and reports. Used double sided printing for work plan and reports. Printers and copiers used for producing work plan and reports was Energy Star compliant or better.	February 2017
Planning	BMP A-2	Fieldwork	Incorporate a section on GSR in project meetings, work plans, and reports	null	null	null	Not considered applicable to field activities. BMP is addressed in reports/documents.	null
Planning	BMP A-2	Alternatives	Incorporate a section on GSR in project meetings, work plans, and reports	E	FI	Cost Savings	Reports associated with planning and implementation of the remedial alternatives included GSR considerations.	February 2017
Planning	BMP A-3	Reports/ Documents	Identify and periodically update a list of key stakeholders and their concerns with respect to GSR considerations	E	FI	Cost Increase	Identified list of key stakeholders as part of work planning activities. Identify list of key stakeholders during public involvement activities.	April 2013
Planning	BMP A-3	Fieldwork	Identify and periodically update a list of key stakeholders and their concerns with respect to GSR considerations	E	FI	Cost Increase	Identified list of key stakeholders (USACE and CH2M HILL) and discussed in field charters held March 27 and April 1.	April 2014
Planning	BMP A-3	Alternatives	Identify and periodically update a list of key stakeholders and their concerns with respect to GSR considerations	E	FI	Cost Neutral	Identified list of key stakeholders.	December 2015
Planning	BMP A-4	Reports/ Documents	Schedule activities for appropriate seasons and/or time of day to reduce delays caused by weather conditions and fuel needed for heating or cooling	null	null	null	Not considered applicable to reporting. BMP addressed under fieldwork.	null
Planning	BMP A-4	Fieldwork	Schedule activities for appropriate seasons and/or time of day to reduce delays caused by weather conditions and fuel needed for heating or cooling	E	null	null	Considered seasons when scheduling field activities, but not practical due to overall project schedule and associated funding.	null
Planning	BMP A-4	Alternatives	Schedule activities for appropriate seasons and/or time of day to reduce delays caused by weather conditions and fuel needed for heating or cooling	E	FI	Cost Savings[a]	Remedial action activities associated with selected Alternative 2 will be scheduled for appropriate seasons and/or time of day to reduce delays caused by weather conditions. Reduced delays caused by weather conditions will reduce costs.	February 2017
Planning	BMP A-5	Reports/ Documents	Prepare, store, and distribute documents electronically	E	FI	Cost Savings	Distribute additional reports/documents electronically. Specifically, CH2M HILL files of final reports are limited to the project manager's office. The remaining CH2M HILL team accesses project documents (e.g., Background Memorandum, Work Plans) as electronic files. Also, USACE requested some versions of documents electronically only.	February 2017
Planning	BMP A-5	Fieldwork	Prepare, store, and distribute documents electronically	E	FI	Cost Savings	Field work photographs and field notes were distributed to the project team for review rather than shipping or photocopying files for review. Digital photographs were used rather than film and film development. Field files and equipment were stored at the closest CH2M HILL office (Dayton, OH) rather than sending back to the project manager for storage. Field documents including soil boring logs, monitoring well construction diagrams, and groundwater sampling forms were scanned and shared among offices digitally. No hard copies of the field book were generated.	April 2014
Planning	BMP A-5	Alternatives	Prepare, store, and distribute documents electronically	E	FI	Cost Savings	Distributed reports/documents electronically.	February 2017
Planning	BMP A-6	Reports/ Documents	Utilize teleconferences rather than meetings when feasible	E	FI	Cost Savings	Used teleconference for internal project meetings and project meetings with stakeholders to discuss documents. Field charters were held by teleconference since the project team is located in various offices. Used teleconference for internal project meetings and project meetings with stakeholders to discuss investigation findings and resolve comments on reports/documents. Teleconferences were held with USACE monthly.	February 2017
Planning	BMP A-6	Fieldwork	Use teleconferences rather than meetings when feasible	E	FI	Cost Savings	Used teleconference for internal project meetings and project meetings with stakeholders to discuss investigation findings. Meetings to discuss vapor intrusion sample locations were held with USACE. Further coordination with CRAA was completed by e-mail. Coordination activities include sample locations and field schedule.	February 2017
Planning	BMP A-6	Alternatives	Use teleconferences rather than meetings when feasible	E	FI	Cost Savings[a]	For selected Alternative 2, teleconferences rather than in-person meetings were used when feasible to reduce travel costs.	February 2017
Planning	BMP A-7	Reports/ Documents	Incorporate GSR specifications into solicitations and contracts	null	null	null	Not considered applicable for report and document preparation activities, since subcontractor scope is limited to third-party data validation and graphics. BMP is addressed under fieldwork.	null

Table C-2. Summary of Best Management Practices

Phase	BMP Number	Project Task	BMP Description	Evaluation Status (A, P, E, Null)	Implementation Status (FI, PI, NY, Null)	Value Evaluation	Notes	Completion/ Revision Date
Planning	BMP A-7	Fieldwork	Incorporate GSR specifications into solicitations and contracts	E	FI	Cost Neutral	Included language into subcontracts (investigation-derived waste (IDW) waste) solicitation for subcontractor to consider incorporate sustainable practices into their services.	April 2014
Planning	BMP A-7	Alternatives	Incorporate GSR specifications into solicitations and contracts	E	FI	Cost Savings[a]	For selected Alternative 2, GSR specification will be incorporated into contractor/subcontractor solicitations and contracts. Examples of GSR specifications include no idling of equipment, utilizing local staff and subcontractors, use vehicles that use alternative fuel options, and use alternative power sources (e.g., solar).	February 2017
Planning	BMP A-8	Reports/ Documents	Integrate schedules to allow resource sharing and fewer days of field mobilization	null	null	null	Not considered applicable to reporting. BMP addressed under fieldwork.	null
Planning	BMP A-8	Fieldwork	Integrate schedules to allow resource sharing and fewer days of field mobilization	E	FI	Cost Savings	Reviewed scope of field investigation and field resources to maximize field efficiencies. Scope of investigation was presented in the project work plan. Specifically, an iterative approach to vapor intrusion evaluations was implemented. Additional sampling was justified only after initial sampling results indicated that vapor intrusion needed to be evaluated further. Soil sampling, groundwater sampling, and/or vapor intrusion sampling were scheduled during the same event to minimize trips and staff hours. Field staff from the Midwest region were used.	April 2014
Planning	BMP A-8	Alternatives	Integrate schedules to allow resource sharing and fewer days of field mobilization	E	FI	Cost Savings[a]	For selected Alternative 2, implementation of selected remedy will be sequenced to allow resource sharing and fewer days of field mobilization which will reduce costs.	February 2017
Planning	BMP A-9	Reports/ Documents	Tailor the remedy cleanup goals such that they are appropriate for anticipated end-use of the property, rather than assuming a more conservative exposure scenario with more stringent cleanup goals	E	FI	Cost Neutral	Identified realistic end-use of the site during preparation of work plan. The risk assessment exposure pathways are based on current and foreseeable future uses. The most conservative exposure pathways were not selected, which could cause unnecessary efforts and an increased carbon footprint to address risks that aren't applicable. The feasibility study report presented the preliminary remediation goals based on current and foreseeable future uses.	May 2015
Planning	BMP A-9	Fieldwork	Tailor the remedy cleanup goals such that they are appropriate for anticipated end-use of the property, rather than assuming a more conservative exposure scenario with more stringent cleanup goals	null	null	null	Not considered applicable for fieldwork activities. BMP is addressed under reports/documents and development of alternatives.	null
Planning	BMP A-9	Alternatives	Tailor the remedy cleanup goals such that they are appropriate for anticipated end-use of the property, rather than assuming a more conservative exposure scenario with more stringent cleanup goals	E	FI	Cost Savings	Reevaluated realistic end-use of the site was proposed in the feasibility study report and decision document.	February 2017
Planning	BMP A-10	Reports/ Documents	Conduct thorough review of project documents and historical records to minimize required scope of investigation.	null	null	null	Not considered applicable for report and document preparation activities. BMP is addressed under fieldwork.	null
Planning	BMP A-10	Fieldwork	Conduct thorough review of project documents and historical records to minimize required scope of investigation.	E	FI	Cost Savings	Reviewed existing project documents and historical records to minimize required scope of investigation. Scope of investigation was presented in the project work plan. Additional sampling was only conducted based on results of smaller, initial investigation.	April 2014
Planning	BMP A-10	Alternatives	Conduct thorough review of project documents and historical records to minimize required scope of investigation.	E	FI	Cost Savings	Reviewed existing project documents and historical records to minimize required scope of sampling as part of the remedy. Scope of sampling will be presented in a remedial design.	February 2017
Planning	BMP A-11	Reports/ Documents	Use language in work plans, proposed plans, and decision documents that maximizes flexibility to allow GSR recommendations to be implemented	E	FI	Cost Savings	A habitat assessment was conducted at AOC 94 during the upland sandpiper breeding season to evaluate the presence or absence of habitat and the presence or absence of breeding individuals. If the results of the habitat assessment determined that additional work is warranted, a screening-level ERA would be conducted at AOC 94 to conservatively evaluate the potential for adverse ecological effects from site contamination in surface soil. However, based on results, the potential for risk to ecological receptors were eliminated from further evaluation.	December 2013
Planning	BMP A-11	Fieldwork	Use language in work plans, proposed plans, and decision documents that maximizes flexibility to allow GSR recommendations to be implemented	null	null	null	Not considered applicable since this project task is not a work plan, proposed plan, or decision document. BMP is addressed under reports/documents and development of alternatives.	null
Planning	BMP A-11	Alternatives	Use language in work plans, proposed plans, and decision documents that maximizes flexibility to allow GSR recommendations to be implemented	E	FI	Cost Savings[a]	Incorporate flexibility in feasibility study and decision document to allow GSR recommendations to be implemented. For selected Alternative 2, flexibility to allow GSR recommendations to be implemented will be maximized.	February 2017
Characterization or Remedy Approach	BMP B-1	Reports/ Documents	Develop and routinely update a conceptual site model (CSM) to use as a basis for making remedial process decisions	E	FI	Cost Savings	Developed preliminary CSM for work plan. Updated CSM following evaluation of data collected during from the remedial investigation.	July 2014
Characterization or Remedy Approach	BMP B-1	Fieldwork	Develop and routinely update a CSM to use as a basis for making remedial process decisions	E	FI	Cost Savings	Updated CSM, as applicable, during fieldwork based on visual observations and real-time qualitative data (e.g., vapor intrusion sampling). The initial vapor intrusion investigation was limited to 2 to 3 samples per building. Based on the initial results, only one building needed additional sampling. Also, selected soil sample locations based on the CSM updated following the Triad investigation using membrane interface probe technologies.	April 2014

Table C-2. Summary of Best Management Practices

Phase	BMP Number	Project Task	BMP Description	Evaluation Status (A, P, E, Null)	Implementation Status (FI, PI, NY, Null)	Value Evaluation	Notes	Completion/ Revision Date
Characterization or Remedy Approach	BMP B-1	Alternatives	Develop and routinely update a CSM to use as a basis for making remedial process decisions	E	FI	Cost Savings	Updated CSM, as applicable, during Feasibility Study.	December 2015
Characterization or Remedy Approach	BMP B-2	Reports/ Documents	Perform regular optimization evaluations to improve efficiency of current or planned actions and/or develop alternative remedial approaches that might shorten remedy duration or otherwise improve the net environmental benefit of the remedy, including use of any methodologies, such as TRIAD (www.triadcentral.org), systematic planning (technical project planning), value engineering studies, and remedial system evaluations, expected to optimize the planning and/or execution of the project	null	null	null	Not considered applicable for reports/documents. BMP addressed under fieldwork.	null
Characterization or Remedy Approach	BMP B-2	Fieldwork	Perform regular optimization evaluations to improve efficiency of current or planned actions and/or develop alternative remedial approaches that might shorten remedy duration or otherwise improve the net environmental benefit of the remedy, including use of any methodologies, such as TRIAD (www.triadcentral.org), systematic planning (technical project planning), value engineering studies, and remedial system evaluations, expected to optimize the planning and/or execution of the project	E	FI	Cost Savings	MIP technology was used to collect real-time qualitative data to refine the understanding of the horizontal and vertical distribution of the highest chlorinated volatile organic compound (CVOC)-concentration areas. The use of the MIP optimized the locations of permanent monitoring wells and supports the tenets of Triad investigations. The use of MIP avoided the need to install as many monitoring wells, which resulted in a reduction of roughly 50% fuel usage (avoids emissions of greenhouse gas [GHG], nitrogen oxides [NOx], sulfur oxides [SOx], particulate matter [PM]), IDW of soil cuttings from an 8-inch bore hole, and labor reduction, which helped to avoid potential accidents, as there is a correlation between hours worked and injury potential. Groundwater sampling used past sampling events to evaluate monitoring wells that can be purged dry according to the groundwater sampling SOP due to low recharge rates. By using past groundwater sampling records, the monitoring wells that were immediately purged dry reduced labor hours in comparison to low flow sampling.	April 2014
Characterization or Remedy Approach	BMP B-2	Alternatives	Perform regular optimization evaluations to improve efficiency of current or planned actions and/or develop alternative remedial approaches that might shorten remedy duration or otherwise improve the net environmental benefit of the remedy, including use of any methodologies, such as TRIAD (www.triadcentral.org), systematic planning (technical project planning), value engineering studies, and remedial system evaluations, expected to optimize the planning and/or execution of the project	E	FI	Cost Savings[a]	For selected Alternative 2, monitoring will be conducted to evaluate how subslab soil gas concentrations of TCE change over time. A decrease in concentrations will be used to justify termination of indoor air monitoring if subslab soil gas concentrations were to attenuate over time. Termination of monitoring will reduce costs.	February 2017
Characterization or Remedy Approach	BMP B-3	Reports/ Documents	Use appropriate characterization or remedy approach based on site conditions	null	null	null	Not considered applicable to reporting and document production activities as this is a non-field task. BMP addressed under fieldwork.	null
Characterization or Remedy Approach	BMP B-3	Fieldwork	Use appropriate characterization or remedy approach based on site conditions	E	FI	Cost Savings	Developed preliminary CSM during work planning. Updated CSM following evaluation of data collected during from the remedial investigation fieldwork.	April 2014
Characterization or Remedy Approach	BMP B-3	Alternatives	Use appropriate characterization or remedy approach based on site conditions	E	FI	Cost Savings	Used appropriate remedy approach based on site conditions, as applicable, during Feasibility Study and Decision Document.	February 2017
Characterization or Remedy Approach	BMP B-4	Reports/ Documents	Establish decision points to trigger a change from one technology to another or from one remedy alternative to another	null	null	null	Not considered applicable to reporting activities. BMP addressed under fieldwork.	null
Characterization or Remedy Approach	BMP B-4	Fieldwork	Establish decision points to trigger a change from one technology to another or from one remedy alternative to another	E	FI	Cost Savings	Evaluated real-time qualitative data in the field to confirm that field technology is meeting project objectives. Used hollow-stem auger, which generates less IDW and has cost savings compared to other drilling technologies. Further, a Triad approach was used before drilling.	April 2013
Characterization or Remedy Approach	BMP B-4	Alternatives	Establish decision points to trigger a change from one technology to another or from one remedy alternative to another	E	FI	Cost Savings[a]	For selected Alternative 2, if indoor air concentrations during initial monitoring events were observed to increase above the RGs, a contingency remedy (such as the depressurization system described in Alternative 3) may be triggered.	February 2017
Characterization or Remedy Approach	BMP B-5	Reports/ Documents	Focus sampling efforts to meet objectives of the specific remedial phase (e.g., sampling during O&M should be focused on evaluating remedy performance and not on thorough plume characterization)	null	null	null	Not considered applicable to reporting activities. BMP addressed under fieldwork.	null
Characterization or Remedy Approach	BMP B-5	Fieldwork	Focus sampling efforts to meet objectives of the specific remedial phase (e.g., sampling during O&M should be focused on evaluating remedy performance and not on thorough plume characterization)	E	FI	Cost Savings	Sampling efforts were developed and focused to meet objectives of the site characterization and remedy evaluations during the work planning activities.	April 2014

Table C-2. Summary of Best Management Practices

Phase	BMP Number	Project Task	BMP Description	Evaluation Status (A, P, E, Null)	Implementation Status (FI, PI, NY, Null)	Value Evaluation	Notes	Completion/ Revision Date
Characterization or Remedy Approach	BMP B-5	Alternatives	Focus sampling efforts to meet objectives of the specific remedial phase (e.g., sampling during O&M should be focused on evaluating remedy performance and not on thorough plume characterization)	E	FI	Cost Savings[a]	For selected Alternative 2, monitoring will be conducted to evaluate how subslab soil gas concentrations of TCE change over time. A decrease in concentrations will be used to justify termination of indoor air monitoring if subslab soil gas concentrations were to attenuate over time. Termination of monitoring will reduce costs.	February 2017
Characterization or Remedy Approach	BMP B-6	Reports/ Documents	Consider real-time measurements and dynamic work plans to reduce mobilizations and improve effectiveness of investigation efforts	null	null	null	Not considered applicable to reporting activities as this is a non-field task. BMP addressed under fieldwork.	null
Characterization or Remedy Approach	BMP B-6	Fieldwork	Consider real-time measurements and dynamic work plans to reduce mobilizations and improve effectiveness of investigation efforts	E	FI	Cost Savings	MIP technology was used to collect real-time qualitative data to refine the understanding of the horizontal and vertical distribution of the highest CVOC-concentration areas; MIP borings were based on the preliminary CSM and the Triad approach (systematic planning,	April 2013
Characterization or Remedy Approach	BMP B-6	Alternatives	Consider real-time measurements and dynamic work plans to reduce mobilizations and improve effectiveness of investigation efforts	E	NY	Cost Savings	Consider applicable technologies to during implementation of the remedy. For example, no purge groundwater sampling.	February 2017
Characterization or Remedy Approach	BMP B-8	Reports/ Documents	Establish project-specific decision points to limit extent of remediation	null	null	null	Not considered applicable to reporting activities. BMP addressed under fieldwork.	null
Characterization or Remedy Approach	BMP B-8	Fieldwork	Establish project-specific decision points to limit extent of remediation	E	FI	Cost Savings	Evaluated vapor intrusion data collected in 2013 to develop data quality objectives and scope for additional vapor intrusion sampling to identify limits of contamination and potential human health risks.	April 2014
Characterization or Remedy Approach	BMP B-8	Alternatives	Establish project-specific decision points to limit extent of remediation	E	FI	Cost Savings[a]	For selected Alternative 2, potential vapor entry points will be identified for sealing to reduce or prevent TCE from being transported through these vapor entry points. This would address the most obvious and potentially largest points of vapor entry and thereby result in a reduction of indoor air concentrations, minimizing the frequency of monitoring which will reduce costs.	February 2017
Characterization or Remedy Approach	BMP B-9	Reports/ Documents	Consider leaving in place structures whose removal is not necessary (i.e., foundations, underground pillars, etc.)	null	null	null	Not considered applicable to reporting activities. BMP addressed under fieldwork.	null
Characterization or Remedy Approach	BMP B-9	Fieldwork	Consider leaving in place structures whose removal is not necessary (i.e., foundations, underground pillars, etc.)	E	FI	Cost Neutral	Relocated a subset of soil boring locations due to a subsurface anomaly detected with GPR during the utility locate. Subsurface anomaly potentially represented buried concrete.	April 2013
Characterization or Remedy Approach	BMP B-9	Alternatives	Consider leaving in place structures whose removal is not necessary (i.e., foundations, underground pillars, etc.)	E	FI	Cost Savings	Alternative 2 was selected as the remedy. The remedy will include leaving in place structures.	February 2017
Energy /Emissions: Transportation	BMP C-1	Reports/ Documents	Reduce the number of trips for personnel	null	null	null	Not considered applicable to reporting activities. BMP addressed under fieldwork.	null
Energy /Emissions: Transportation	BMP C-1	Fieldwork	Reduce the number of trips for personnel	E	FI	Cost Savings	Local (Dayton, OH) staff were used for the field events based on early planning. In addition, the field escort has remained consistent to avoid multiple trips to the site for background checks and screening and escort training.	April 2014
Energy /Emissions: Transportation	BMP C-1	Alternatives	Reduce the number of trips for personnel	E	FI	Cost Savings[a]	For selected Alternative 2, monitoring will be conducted to evaluate how subslab soil gas concentrations of TCE change over time. A decrease in concentrations will be used to justify termination of indoor air monitoring if subslab soil gas concentrations were to attenuate over time. Termination of monitoring will reduce the number of trips for personnel to the site and reduce costs.	February 2017
Energy /Emissions: Transportation	BMP C-2	Reports/ Documents	Reduce the number of trips and/or volume for transported materials, equipment, or waste	null	null	null	Not considered applicable to reporting activities. BMP addressed under fieldwork.	null
Energy /Emissions: Transportation	BMP C-2	Fieldwork	Reduce the number of trips and/or volume for transported materials, equipment, or waste	E	FI	Cost Savings	Used previously installed vapor sampling ports for additional event, rather than abandoning as part of initial sampling event. The use of a low flow sampling approach avoids higher volumes of purge water management associated with traditional well purging approaches. Used shared groundwater sampling equipment rather than equipment dedicated to the Lockbourne project resulting in reduced shipping costs. Drums used for IDW containment were transported with the drilling equipment or purchased locally to minimize distance to be transported	April 2014
Energy /Emissions: Transportation	BMP C-2	Alternatives	Reduce the number of trips and/or volume for transported materials, equipment, or waste	E	FI	Cost Savings[a]	For selected Alternative 2, monitoring will be conducted to evaluate how subslab soil gas concentrations of TCE change over time. A decrease in concentrations will be used to justify termination of indoor air monitoring if subslab soil gas concentrations were to attenuate over time. Termination of monitoring will reduce the number of trips transporting materials and equipment to and from the site and will reduce costs.	February 2017
Energy /Emissions: Transportation	BMP C-3	Reports/ Documents	Reduce trip lengths	null	null	null	Not considered applicable to reporting activities. BMP addressed under fieldwork.	null
Energy /Emissions: Transportation	BMP C-3	Fieldwork	Reduce trip lengths	E	FI	Cost Savings	Use locally produced supplies during remedial investigation. For example, field supplies such as trash bags, water, paper towels, etc. were purchased locally rather than transported to the site.	April 2014

Table C-2. Summary of Best Management Practices

Phase	BMP Number	Project Task	BMP Description	Evaluation Status (A, P, E, Null)	Implementation Status (FI, PI, NY, Null)	Value Evaluation	Notes	Completion/ Revision Date
Energy /Emissions: Transportation	BMP C-3	Alternatives	Reduce trip lengths	E	FI	Cost Savings[a]	For selected Alternative 2, trade and construction services will be utilized from the local community minimizing mobilization and demobilization distances which will reduce costs.	February 2017
Energy /Emissions: Transportation	BMP C-4	Reports/ Documents	Use alternate fuels or other options for transportation when possible	null	null	null	Not considered applicable to reporting activities. BMP addressed under fieldwork.	null
Energy /Emissions: Transportation	BMP C-4	Fieldwork	Use alternate fuels or other options for transportation when possible	E	null	null	Vehicles and subcontractor equipment was gasoline or diesel powered. Alternative modes of transportation were not available.	April 2014
Energy /Emissions: Transportation	BMP C-4	Alternatives	Use alternate fuels or other options for transportation when possible	E	FI	Cost Savings[a]	For selected Alternative 2, alternative fuel options for truck and equipment will be evaluated to reduce fuel costs.	February 2017
Energy /Emissions: Equipment Use	BMP D-1	Reports/ Documents	Consider and implement approaches to minimize engine idle times	null	null	null	Not considered applicable to reporting and document production activities as this is a non-field task. BMP addressed under fieldwork.	null
Energy /Emissions: Equipment Use	BMP D-1	Fieldwork	Consider and implement approaches to minimize engine idle times	E	FI	Cost Savings	Engines were shut off during non-use. This included drill rigs and support vehicles. Alternative fuel vehicles were not available for use by the subcontractors.	April 2014
Energy /Emissions: Equipment Use	BMP D-1	Alternatives	Consider and implement approaches to minimize engine idle times	E	FI	Cost Savings[a]	For selected Alternative 2, engine idling will not be allowed during remedial action activities. This requirements will be written into solicitations and contracts with contractor/subcontractors. Eliminating engine idling will reduce fuel consumption and reduce costs.	February 2017
Energy /Emissions: Equipment Use	BMP D-2	Reports/ Documents	Ensure peak operating efficiency of equipment to reduce energy use and emissions	E	FI	Cost Neutral	Printers and copiers used for producing documents were Energy Star compliant or better. Documents produced include the remedial investigation/feasibility study work plan, background memorandum, vapor intrusion work plan, habitat assessment memorandum, remedial investigation report, feasibility study report, and decision document.	February 2017
Energy /Emissions: Equipment Use	BMP D-2	Fieldwork	Ensure peak operating efficiency of equipment to reduce energy use and emissions	E	FI	Cost Savings	Field team shut off engines when not in use. Groundwater sampling and air monitoring equipment consisted of battery operated instruments and pumps rather than electrical equipment that required the use of a generator. Battery powered equipment was charged during night time/off peak hours.	April 2014
Energy /Emissions: Equipment Use	BMP D-2	Alternatives	Ensure peak operating efficiency of equipment to reduce energy use and emissions	E	FI	Cost Savings[a]	For selected Alternative 2, equipment used during the remedial action will be calibrated and/or maintained regularly to ensure peak operating efficiencies to reduce energy use and costs.	February 2017
Energy /Emissions: Equipment Use	BMP D-3	Reports/ Documents	Use alternate fuel options for equipment when possible	null	null	null	Not considered applicable to reporting and document production activities as this is a non-field task. BMP addressed under fieldwork.	null
Energy /Emissions: Equipment Use	BMP D-3	Fieldwork	Use alternate fuel options for equipment when possible	E	FI	Cost Savings	Utilized battery operated pumps for groundwater sampling rather than electrical pumps that required the use of generators.	April 2014
Energy /Emissions: Equipment Use	BMP D-3	Alternatives	Use alternate fuel options for equipment when possible	E	FI	Cost Savings[a]	For selected Alternative 2, contractor/subcontractor will use alternative fuel options for equipment where possible.	February 2017
Energy /Emissions: Equipment Use	BMP D-4	Reports/ Documents	Select appropriate equipment and/or power source for the job	null	null	null	Not considered applicable to preparation of reports and documents since equipment, other than printers, is not used.	null
Energy /Emissions: Equipment Use	BMP D-4	Fieldwork	Select appropriate equipment and/or power source for the job	E	FI	Cost Neutral	Appropriate tools and equipment for fieldwork were evaluated during work planning phase and implemented. The equipment and tools were discussed and re-evaluated as part of the two field work charters. Battery operated tools were available and used for tasks that required mobile equipment, such as groundwater sampling. Electrical equipment, including air pumps were used during the vapor intrusion sampling where access to site electricity was readily available.	April 2014
Energy /Emissions: Equipment Use	BMP D-4	Alternatives	Select appropriate equipment and/or power source for the job	E	FI	Cost Savings[a]	For selected Alternative 2, job-specific equipment and power sources will be used rather than an overly-conservative specified equipment and power requirements that are more costly.	February 2017
Materials and Offsite Services	BMP E-1	Reports/ Documents	Use materials that are made from recycled materials	E	FI	Cost Neutral	Used paper containing at least 30 percent postconsumer fiber for reports.	Throughout delivery order
Materials and Offsite Services	BMP E-1	Fieldwork	Use materials that are made from recycled materials	E	null	null	Use of recycled materials during the field investigation was not identified as being practical based on the limited amount of materials planned for use. In addition, specifications for materials limit use of recycled materials.	null
Materials and Offsite Services	BMP E-1	Alternatives	Use materials that are made from recycled materials	E	FI	Cost Savings[a]	For selected Alternative 2, recycled materials will be used when feasible.	February 2017
Materials and Offsite Services	BMP E-2	Reports/ Documents	Optimize the amount of materials used	E	FI	Cost Savings	Used double-sided printing for reports.	February 2017

Table C-2. Summary of Best Management Practices

Phase	BMP Number	Project Task	BMP Description	Evaluation Status (A, P, E, Null)	Implementation Status (FI, PI, NY, Null)	Value Evaluation	Notes	Completion/ Revision Date
Materials and Offsite Services	BMP E-2	Fieldwork	Optimize the amount of materials used	E	FI	Cost Savings	Optimized number of groundwater samples to be collected using data from previous sampling events under this investigation. Groundwater sampling tubing was dedicated to each monitoring well during each groundwater sampling event, allowing its reuse throughout the duration of the event. Disposable tubing prevented water use for decontamination, which also resulted in less waste to characterize, transport, and dispose of offsite as special waste. Tubing is disposed of at a nearby facility with other CRAA waste. Down-well tooling and equipment was decontaminated using spray bottles and paper towels rather than 5-gallon buckets of decontamination solutions, reducing IDW volumes. Optimized number of vapor and indoor/outdoor air samples to be collected using data from previous sampling events under this investigation. The initial investigation only included 2 to 3 samples per building. As a result, only one building required additional sampling based on review of the initial data.	April 2014
Materials and Offsite Services	BMP E-2	Alternatives	Optimize the amount of materials used	E	FI	Cost Savings[a]	For selected Alternative 2, monitoring will be conducted to evaluate how subslab soil gas concentrations of TCE change over time. A decrease in concentrations will be used to justify termination of indoor air monitoring if subslab soil gas concentrations were to attenuate over time. Termination of monitoring will reduce the amount of equipment and materials used and will reduce costs.	February 2017
Materials and Offsite Services	BMP E-3	Reports/ Documents	Use less refined materials when feasible	E	FI	Cost Neutral	Used paper containing at least 30 percent postconsumer fiber for reports.	Throughout delivery order
Materials and Offsite Services	BMP E-3	Fieldwork	Use less refined materials when feasible	E	null	null	Less refined materials were not needed during field work.	null
Materials and Offsite Services	BMP E-3	Alternatives	Use less refined materials when feasible	E	FI	Cost Savings[a]	For selected Alternative 2, less refined materials will be used when feasible.	February 2017
Water Resource use	BMP F-1	Reports/ Documents	Minimize water consumption	null	null	null	Not considered applicable to reporting activities. BMP addressed under fieldwork.	null
Water Resource use	BMP F-1	Fieldwork	Minimize water consumption	E	FI	Cost Savings	Optimized number of groundwater samples to be collected using data from previous sampling events under this investigation.	April 2014
Water Resource use	BMP F-1	Alternatives	Minimize water consumption	E	FI	Cost Savings[a]	For selected Alternative 2, water consumption will be minimized through implementation of best management practices during decontamination of equipment used in monitoring activities.	February 2017
Water Resource use	BMP F-3	Reports/ Documents	Use extracted and treated water for beneficial purposes	null	null	null	Not considered applicable to reporting activities. BMP addressed under fieldwork.	null
Water Resource use	BMP F-3	Fieldwork	Use extracted and treated water for beneficial purposes	null	null	null	Not considered applicable due to the low volume of purge water that will be generated during the fieldwork.	null
Water Resource use	BMP F-3	Alternatives	Use extracted and treated water for beneficial purposes	E	null	null	Groundwater extraction is not applicable to the remedies developed or selected remedy.	February 2017
Water Resource use	BMP F-4	Reports/ Documents	Promote groundwater recharge	null	null	null	Not considered applicable to reporting activities. BMP addressed under fieldwork.	null
Water Resource use	BMP F-4	Fieldwork	Promote groundwater recharge	null	null	null	Not considered applicable due to the low volume of groundwater purged during the fieldwork.	null
Water Resource use	BMP F-4	Alternatives	Promote groundwater recharge	E	null	null	Groundwater extraction/recharge is not applicable to the remedies developed or the selected remedy.	null
Water Resource use	BMP F-5	Reports/ Documents	Maintain water quality by preventing nutrient loading to surface water or groundwater	null	null	null	Not considered applicable to reporting activities. BMP addressed under fieldwork.	null
Water Resource use	BMP F-5	Fieldwork	Maintain water quality by preventing nutrient loading to surface water or groundwater	E	FI	Cost Neutral	Minimized discharge of detergent wash solutions on ground. For the vapor intrusion investigation, mostly disposable equipment is used due to concerns with cross contamination since the tubing diameter is small. Therefore, decontamination water was not disposed of on the ground.	April 2014
Water Resource use	BMP F-5	Alternatives	Maintain water quality by preventing nutrient loading to surface water or groundwater	E	FI	Cost Savings[a]	For selected Alternative 2, nutrient loading to surface waters or groundwater will not occur.	February 2017
Waste Generation, Disposal, and Recycling	BMP G-1	Reports/ Documents	Minimize drill cuttings and IDW (including personal protection equipment)	null	null	null	Not considered applicable to reporting activities. BMP addressed under fieldwork.	null

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Waste Generation, Disposal, and Recycling	BMP G-1	Fieldwork	Minimize drill cuttings and all other investigation derived waste (including personal protection equipment)	E	FI	Cost Savings	Optimized number of samples to be collected using data from this investigation. See notes above regarding the iterative approach to the sampling. Regarding waste, due to the small diameter tubing, new tubing was used at each location to prevent cross contamination. The waste was disposed of onsite with other waste generated at the facility. Down-well tooling and equipment was decontaminated using spray bottles and paper towels rather than 5-gallon buckets of decontamination solutions, reducing IDW volumes. Direct push sampling methods were used for the background study, installation of temporary monitoring wells, and soil borings for collection of soil samples rather than auger/split-spoon sampling. Direct push sampling reduced soil IDW generation and the amount of bentonite hole plug needed for borehole abandonment.	April 2014
Waste Generation, Disposal, and Recycling	BMP G-1	Alternatives	Minimize drill cuttings and other investigation derived waste (including personal protection equipment)	E	FI	Cost Savings	Will optimize number of samples to be collected using data from previous investigation. Regarding waste, due to the small diameter tubing, new tubing will be used at each location to prevent cross contamination.	February 2017
Waste Generation, Disposal, and Recycling	BMP G-3	Reports/ Documents	Consider onsite treatment and reuse of soil instead of offsite disposal	null	null	null	Not considered applicable to reporting activities. BMP addressed under fieldwork.	null
Waste Generation, Disposal, and Recycling	BMP G-3	Fieldwork	Consider onsite treatment and reuse of soil instead of offsite disposal	E	null	null	Reuse of soil was evaluated and not deemed practical based on the limited amount of soil IDW that would be generated during the field investigation.	null
Waste Generation, Disposal, and Recycling	BMP G-3	Alternatives	Consider onsite treatment and reuse of soil instead of offsite disposal	E	FI	Cost Savings[a]	For selected Alternative 2, soil excavation and offsite disposal is not applicable to the selected remedy.	February 2017
Waste Generation, Disposal, and Recycling	BMP G-4	Reports/ Documents	Minimize need to transport and dispose hazardous waste	null	null	null	Not considered applicable to reporting activities. BMP addressed under fieldwork.	null
Waste Generation, Disposal, and Recycling	BMP G-4	Fieldwork	Minimize need to transport and dispose hazardous waste	null	null	null	Soil and groundwater IDW is classified as nonhazardous.	null
Waste Generation, Disposal, and Recycling	BMP G-4	Alternatives	Minimize need to transport and dispose hazardous waste	E	FI	Cost Savings	Hazardous waste is not present. Also, the implementation of alternatives will minimize the need for materials that require special handling and disposal. As evaluated, the quantities of such materials will be very small, if used at all.	February 2017
Waste Generation, Disposal, and Recycling	BMP G-5	Reports/ Documents	When possible avoid/minimize use of hazardous/toxic materials that may require special handling or disposal	null	null	null	Not considered applicable to reporting activities. BMP addressed under fieldwork.	null
Waste Generation, Disposal, and Recycling	BMP G-5	Fieldwork	When possible avoid/minimize use of hazardous/toxic materials that may require special handling or disposal	E	FI	Cost Savings	Photoionization detectors (PID) were used for soil screening and air monitoring rather than flame-ionization detectors. This resulted in not needing to use or ship hydrogen.	April 2014
Waste Generation, Disposal, and Recycling	BMP G-5	Alternatives	When possible avoid/minimize use of hazardous/toxic materials that may require special handling or disposal	E	FI	Cost Savings[a]	For selected Alternative 2, the implementation of the alternative will minimize the need for materials that require special handling and disposal. As evaluated, the quantities of such materials will be very small, if used at all.	February 2017
Waste Generation, Disposal, and Recycling	BMP G-6	Reports/ Documents	Recycle or reuse materials rather than disposing of them	E	FI	Cost Savings	Recycled paper materials were used when practical during reporting tasks.	February 2017
Waste Generation, Disposal, and Recycling	BMP G-6	Fieldwork	Recycle or reuse materials rather than disposing of them	E	FI	Cost Savings	When applicable, recycled materials were used rather than disposable. Tubing was dedicated to monitoring wells and reused through the duration of individual sampling events. Disposable tubing prevented water use for decontamination, which also resulted in less waste to characterize, transport, and dispose of offsite as special waste. Tubing is disposed of at a nearby facility with other CRAA waste. Equipment such as water level gauges, air monitoring equipment, and vapor sampling equipment were ordered as used equipment from a CH2M HILL warehouse rather than purchasing new equipment. Cardboard boxes and shipping containers were reused rather than disposing of these items.	April 2014
Waste Generation, Disposal, and Recycling	BMP G-6	Alternatives	Recycle or reuse materials rather than disposing of them	E	FI	Cost Savings[a]	For selected Alternative 2, materials that are used during the remedial action will be recycled or reused when applicable.	February 2017
Land Use, Ecosystems, and Cultural Resources	BMP H-2	Reports/ Documents	Minimize disturbances to land	null	null	null	Not considered applicable to reporting activities. BMP addressed under fieldwork.	null

Table C-2. Summary of Best Management Practices

Phase	BMP Number	Project Task	BMP Description	Evaluation Status (A, P, E, Null)	Implementation Status (FI, PI, NY, Null)	Value Evaluation	Notes	Completion/ Revision Date
Land Use, Ecosystems, and Cultural Resources	BMP H-2	Fieldwork	Minimize disturbances to land	E	FI	Cost Neutral	Many of the sampling locations are located in paved areas. Other locations sampled during the background study were either in maintained grassy areas or cleared farm fields. Work occurred before crop planting, which avoided damage to crops.	April 2014
Land Use, Ecosystems, and Cultural Resources	BMP H-2	Alternatives	Minimize disturbances to land	E	FI	Cost Savings	Impacts of land disturbances during remedial alternative development were considered when developing the remedies. Soil/groundwater excavation was not selected as an appropriate remedy to evaluate further.	December 2015
Land Use, Ecosystems, and Cultural Resources	BMP H-3	Reports/ Documents	Preserve/restore ecosystems to the extent possible	null	null	null	Not considered applicable to reporting activities. BMP addressed under fieldwork.	null
Land Use, Ecosystems, and Cultural Resources	BMP H-3	Fieldwork	Preserve/restore ecosystems to the extent possible	E	FI	Cost Increase	No disturbance to ecosystems based on field activities occurring in paved areas or inside buildings and due to the limited duration of field event. An evaluation of the habitat suitable for the upland sandpiper of AOC 94 indicated that the upland sandpiper is not present in this area.	April 2014
Land Use, Ecosystems, and Cultural Resources	BMP H-3	Alternatives	Preserve/restore ecosystems to the extent possible	E	FI	Cost Savings	Ecosystems will not be encountered during the remedial action based on the selected remedy.	February 2017
Land Use, Ecosystems, and Cultural Resources	BMP H-5	Reports/ Documents	Construct wells and other remedial process infrastructure (piping, buildings, etc.) to minimize restrictions to anticipated future use of the site	null	null	null	Not considered applicable to reporting activities. BMP addressed under fieldwork.	null
Land Use, Ecosystems, and Cultural Resources	BMP H-5	Fieldwork	Construct wells and other remedial process infrastructure (piping, buildings, etc.) to minimize restrictions to anticipated future use of the site	E	FI	Cost Neutral	Monitoring wells were constructed of flush-mount construction and soil vapor probes were constructed flush with the flooring to allow reuse of the area.	April 2014
Land Use, Ecosystems, and Cultural Resources	BMP H-5	Alternatives	Construct wells and other remedial process infrastructure (piping, buildings, etc.) to minimize restrictions to anticipated future use of the site	E	FI	Cost Savings[a]	Alternative 2 was selected as the remedy, which is consistent with the current and likely future commercial/industrial use of AOC 18, based on the property deed. However, the remedy could also be used in the unlikely event AOC 18 is redeveloped in the future for residential.	February 2017
Land Use, Ecosystems, and Cultural Resources	BMP H-6	Reports/ Documents	Preserve/restore cultural resources to the extent possible	null	null	null	Not considered applicable to reporting activities. BMP addressed under fieldwork.	null
Land Use, Ecosystems, and Cultural Resources	BMP H-6	Fieldwork	Preserve/restore cultural resources to the extent possible	E	FI	Cost Neutral	Prepared field instructions for field staff that include instructions if cultural resources are encountered onsite. However, the sampling for this investigation occurred within the shallow subsurface beneath existing pavement or flooring.	April 2014
Land Use, Ecosystems, and Cultural Resources	BMP H-6	Alternatives	Preserve/restore cultural resources to the extent possible	E	FI	Cost Savings	Cultural resources will not be encountered during the remedial action based on the remedy selected.	February 2017
Land Use, Ecosystems, and Cultural Resources	BMP H-7	Reports/ Documents	Document sensitive ecological and cultural resources prior to initiating actions that might diminish or destroy those resources	null	null	null	Not considered applicable to reporting activities. BMP addressed under fieldwork.	null
Land Use, Ecosystems, and Cultural Resources	BMP H-7	Fieldwork	Document sensitive ecological and cultural resources prior to initiating actions that might diminish or destroy those resources	E	FI	Cost Increase	Conducted habitat assessment for AOC 94 to assess the presence or absence of habitat and the presences or absence of the upland sandpiper.	April 2013
Land Use, Ecosystems, and Cultural Resources	BMP H-7	Alternatives	Document sensitive ecological and cultural resources prior to initiating actions that might diminish or destroy those resources	E	FI	Cost Savings	Sensitive ecological and cultural resources is not applicable to the remedies developed and remedy selected.	February 2017
Safety and Community	BMP I-1	Reports/ Documents	Minimize and mitigate noise, light and odor disturbance during all phases of the remedial process, to the extent practicable	null	null	null	Not considered applicable to reporting activities. BMP addressed under fieldwork.	null

Table C-2. Summary of Best Management Practices

Phase	BMP Number	Project Task	BMP Description	Evaluation Status (A, P, E, Null)	Implementation Status (FI, PI, NY, Null)	Value Evaluation	Notes	Completion/ Revision Date
Safety and Community	BMP I-1	Fieldwork	Minimize and mitigate noise, light and odor disturbance during all phases of the remedial process, to the extent practicable	E	FI	Cost Neutral	Fieldwork was conducted during daylight hours so light disturbance is not applicable. No odor disturbance was encountered. Vapor sampling purging was contained in Tedlar bags and vented to the outside air.	April 2014
Safety and Community	BMP I-1	Alternatives	Minimize and mitigate noise, light and odor disturbance during all phases of the remedial process, to the extent practicable	E	FI	Cost Savings[a]	For selected Alternative 2, the activities can be completed during standard working hours and would eliminate the need for lighting. Noise and odor disturbance for the remedy are minimal. The limited intrusive site work will occur on airport property. Noise and odor, if any, due to the remedy will be less than standard airport noise and odor disturbances. Limited resources would be needed to monitor and manage noise and odor, thus presenting a cost savings.	February 2017
Safety and Community	BMP I-2	Reports/ Documents	Minimize dust during construction activities by spraying water or techniques such as laying biodegradable mats, tarps, or materials (already in EM385-1-1)	null	null	null	Not considered applicable to reporting activities. BMP addressed under fieldwork.	null
Safety and Community	BMP I-2	Fieldwork	Minimize dust during construction activities by spraying water or techniques such as laying biodegradable mats, tarps, or materials (already in EM385-1-1)	E	FI	Cost Neutral	Dust was not generated during soil or groundwater sampling. Dust generated during the installation of the vapor intrusion ports was collected using a vacuum.	April 2014
Safety and Community	BMP I-2	Alternatives	Minimize dust during construction activities by spraying water or techniques such as laying biodegradable mats, tarps, or materials (already in EM385-1-1)	E	FI	Cost Savings[a]	Evaluated alternatives do not involve earth moving processes and machinery, thus the dust generated with implementing any of the alternatives would not be noticeable above background levels. Limited resources would be needed to address dust mitigation, thus presenting a cost savings.	February 2017
Safety and Community	BMP I-3	Reports/ Documents	Select transportation routes for trucks and heavy equipment that minimize impacts to residential areas to maximize safety and minimize noise and other aesthetic impacts	null	null	null	Not considered applicable to reporting activities. BMP addressed under fieldwork.	null
Safety and Community	BMP I-3	Fieldwork	Select transportation routes for trucks and heavy equipment that minimize impacts to residential areas to maximize safety and minimize noise and other aesthetic impacts	E	FI	Cost Neutral	Transportation routes are dictated by the airport. IDW transportation offsite was reviewed to verify that local staff were used.	April 2014
Safety and Community	BMP I-3	Alternatives	Select transportation routes for trucks and heavy equipment that minimize impacts to residential areas to maximize safety and minimize noise and other aesthetic impacts	E	FI	Cost Savings[a]	For selected Alternative 2, estimates of transportation hazards are low since limited equipment is needed to implement the remedy. For the minimal trucks needed, the airport selects the routes while onsite. For offsite portions of the routes, noise and other aesthetic impacts are minimal resulting in preparation of a streamlined transportation plan resulting in a cost savings.	February 2017
Safety and Community	BMP I-4	Reports/ Documents	Minimize drawdown of the water table in areas that could impact production rates at supply wells and/or irrigation wells	null	null	null	Not considered applicable to reporting activities. BMP addressed under fieldwork.	null
Safety and Community	BMP I-4	Fieldwork	Minimize drawdown of the water table in areas that could impact production rates at supply wells and/or irrigation wells	null	null	null	Not considered applicable due to the low volume of purging during the fieldwork.	null
Safety and Community	BMP I-4	Alternatives	Minimize drawdown of the water table in areas that could impact production rates at supply wells and/or irrigation wells	E	FI	Cost Savings	The proposed remedial alternatives and selected remedy do not include groundwater extraction or implementation of activates where drawdown of the water table could impact production rates at supply wells and/or irrigation wells.	February 2017
Safety and Community	BMP I-5	Reports/ Documents	Minimize amount of time that heavy machinery is needed to enhance safety	null	null	null	Not considered applicable to reporting activities. BMP addressed under fieldwork.	null
Safety and Community	BMP I-5	Fieldwork	Minimize amount of time that heavy machinery is needed to enhance safety	E	FI	Cost Savings	DPT equipment was used for soil borings instead of standard drilling equipment, resulting in less fuel consumption and less IDW generation.	April 2013
Safety and Community	BMP I-5	Alternatives	Minimize amount of time that heavy machinery is needed to enhance safety	E	FI	Cost Savings[a]	For selected Alternative 2, the use of heavy machinery will be minimized resulting in a less conservative level of protectiveness and fewer resources.	February 2017
Safety and Community	BMP I-6	Reports/ Documents	Minimize handling of dangerous chemicals by selecting alternate chemicals and/or engineering to minimize contact with chemicals	null	null	null	Not considered applicable to reporting activities. BMP addressed under fieldwork.	null
Safety and Community	BMP I-6	Fieldwork	Minimize handling of dangerous chemicals by selecting alternate chemicals and/or engineering to minimize contact with chemicals	E	FI	Cost Neutral	Used pre-preserved laboratory sample jars for fieldwork.	April 2014
Safety and Community	BMP I-6	Alternatives	Minimize handling of dangerous chemicals by selecting alternate chemicals and/or engineering to minimize contact with chemicals	E	FI	Cost Savings[a]	For selected Alternative 2, the use of dangerous chemicals (sealants) will be minimal. For selected Alternative 2, the development and implementation of a health and safety plan will limit the potential for negative impacts associated with chemical use. Due to the minimal risks, a less robust health and safety plan will be prepared which will result in a cost savings.	February 2017
Safety and Community	BMP I-7	Reports/ Documents	Contribute to local economy when possible	E	FI	Cost Neutral	Use local newspapers for public notification of proposed plan. Reserve space at local community center for public meetings.	January 2016
Safety and Community	BMP I-7	Fieldwork	Contribute to local economy when possible	E	FI	Cost Savings	Field team stayed at local hotels and utilized local restaurants, rather than commuting to the site. Consumable equipment (paper towels, water, etc..) was purchased locally. Drums for groundwater sampling were obtained locally.	April 2014

Table C-2. Summary of Best Management Practices

Phase	BMP Number	Project Task	BMP Description	Evaluation Status (A, P, E, Null)	Implementation Status (FI, PI, NY, Null)	Value Evaluation	Notes	Completion/ Revision Date
Safety and Community	BMP I-7	Alternatives	Contribute to local economy when possible	E	FI	Cost Savings[a]	For selected Alternative 2, trade and construction services will be utilized from the local community which will contribute to the local economy. Using local trade and construction services will present a cost savings due to reduced mobilization and demobilization fees.	February 2017
Safety and Community	BMP I-8	Reports/ Documents	Use onsite construction practices and personal protective equipment (PPE) requirements for anticipated exposure scenarios rather than an overly conservative level of protectiveness that is more resource intensive	null	null	null	Not considered applicable to reporting activities. BMP addressed under fieldwork.	null
Safety and Community	BMP I-8	Fieldwork	Use onsite construction practices and PPE requirements for anticipated exposure scenarios rather than an overly conservative level of protectiveness that is more resource intensive	E	FI	Cost Savings	Identified Health & Safety subject matter expert to appropriately determine field practices and PPE requirements for remedial investigation field work. PPE requirements were communicated to field team in field project instructions.	April 2014
Safety and Community	BMP I-8	Alternatives	Use onsite construction practices and PPE requirements for anticipated exposure scenarios rather than an overly conservative level of protectiveness that is more resource intensive	E	FI	Cost Savings[a]	For selected Alternative 2, USACE will use onsite construction practices and PPE requirements for anticipated exposure scenarios based on site-specific data rather than an overly conservative level of protectiveness that is more resource intensive.	February 2017

Notes:

1. Evaluation Status through the Feasibility Study Report:
    - A = BMPs that were identified as potentially applying to the project.
    - E = BMPs that were identified as applicable, practical, and then reviewed for implementation.
    - P = BMPs that were identified as applicable and practical for the project to implement.
    - null = not applicable
2. Implementation status through the Feasibility Study Report:
    - FI = Fully implemented.
    - PI = Partially implemented.
    - NY = Not Yet, but expected to be implemented.
    - null = Not applicable
3. Value Evaluation consists of qualitative net cost impact over five (5) years with no discounting. Categories include:
    - Cost Increase
    - Cost Neutral
    - Cost Savings
    - TBD = To be determined.
    - null = Not applicable
4. Subcontract procurement is included under the Fieldwork project task.
5. Includes BMPs deemed applicable to the project. BMPs not included in this table (presented in the memorandum) are not applicable to the current project but may apply to remedial design and remedial action activities.
6. Alternative 1, No Action, was not included in the evaluation.
7. Since the remedial action decision for AOCs 17, 19, and 103 is no action, Project Task "Alternatives" is focused only on sealing and monitoring for AOC 18.

[a] The United States Army Corps of Engineers (USACE) and its contractors will optimize the selected alternative to meet green and sustainable remediation objectives during the remedial design phase of work and implement the optimized design during the remedial construction and long-term O&M phase of work. Subsequent USACE task orders for the remedial design will include an updated SiteWise assessment of the selected alternative to identify potential additional GSR optimization opportunities that may be identified during the design process as well as completion of a best management practices evaluation that can identify BMPs that will be implemented during the construction and long-term O&M phases of work. USACE prefers to realize the anticipated cost savings designation now, but will be re-evaluated after the remedy is selected and during implementation.

Table C-3. Summary of Best Management Practices Applicability and Implementation

	BMP Category								
	A. Planning	**B. Characterization or Remedy Approach**	**C. Energy/ Emissions Transportation**	**D. Energy/ Emissions Equipment Use**	**E. Materials & Offsite Services**	**F. Water Resource Use**	**G. Waste Generation, Disposal, and Recycling**	**H. Land Use, Ecosystems, and Cultural Resources**	**I. Safety and Community**
Total number of BMPs[a]	11	8	4	4	3	4	5	5	8
Applicable BMPs[a]	11	8	4	4	3	4	5	5	8
Practical BMPs[a]	11	8	4	4	3	4	5	5	8
Evaluated BMPs[a]	11	8	4	4	3	4	5	5	8
Null[a]	0	0	0	0	0	0	0	0	0
BMPs Implemented through the Decision Document Report Phase (Includes the Most Mature Implementation Status of Reports/Documents, Fieldwork, and Alternatives)[b]									
Fully[b]	11	8	4	4	3	2	5	5	8
Partially[b]	0	0	0	0	0	0	0	0	0
Not yet[b]	0	0	0	0	0	0	0	0	0
Null[b]	0	0	0	0	0	2	0	0	0
Practical BMPs likely to result in cost savings[c]	10	8	4	4	3	2	5	5	8

[a] Total Number of BMPs = Total Number of BMPs listed in Table C-2 under each BMP Category that are carried forward.

Applicable = BMPs listed in Table C-2 that were identified as potentially applying to the project.

Practical = BMPs listed in Table C-2 that were identified as applicable and practical for the project to implement.

Evaluated = BMPs listed in Table C-2 that were identified as applicable, practical, and them reviewed for implementation.

[b] Number of BMPs listed in Table C-2.

[c] Number of BMPs listed in Table C-2 that will result in cost savings.

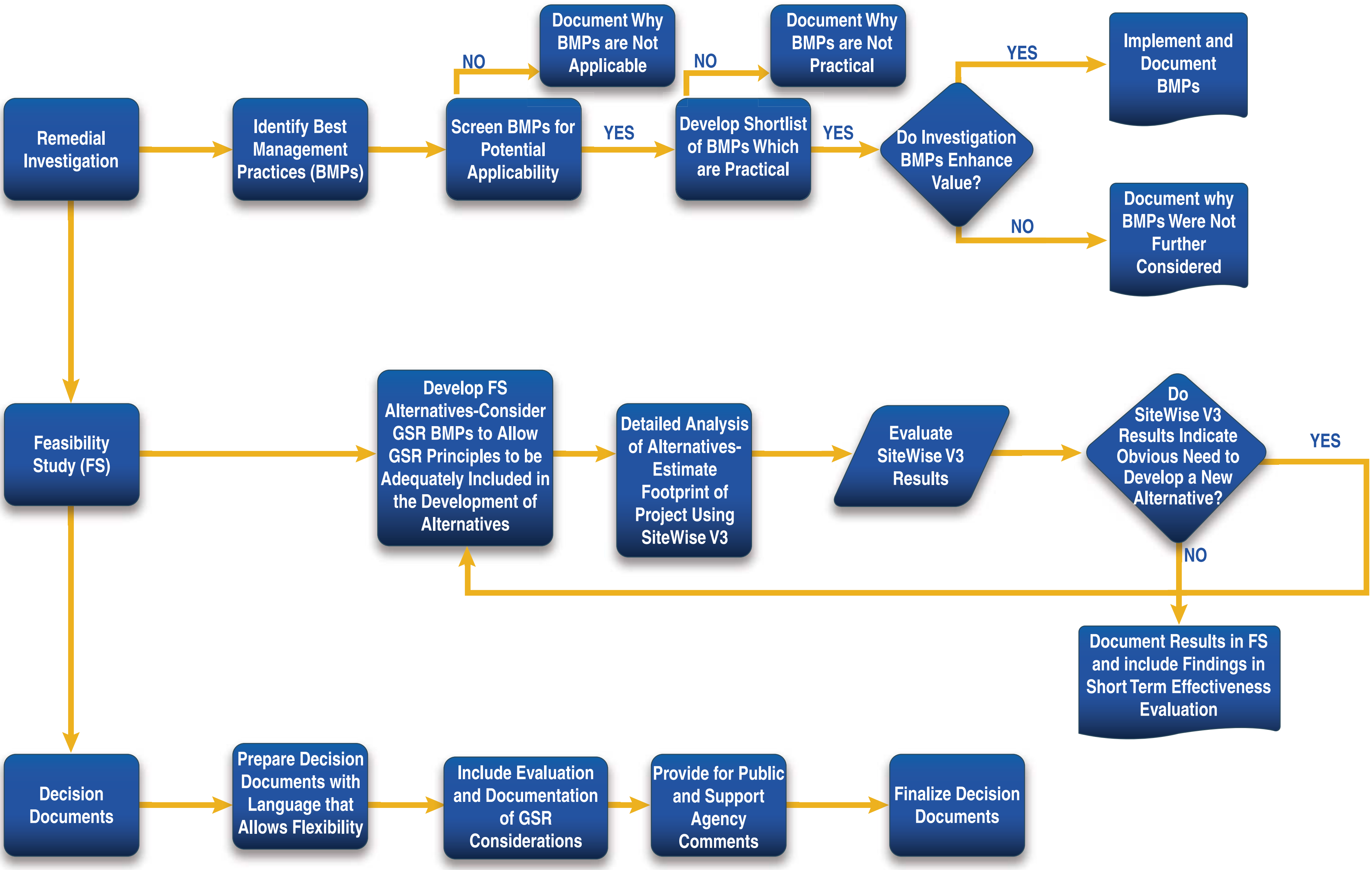
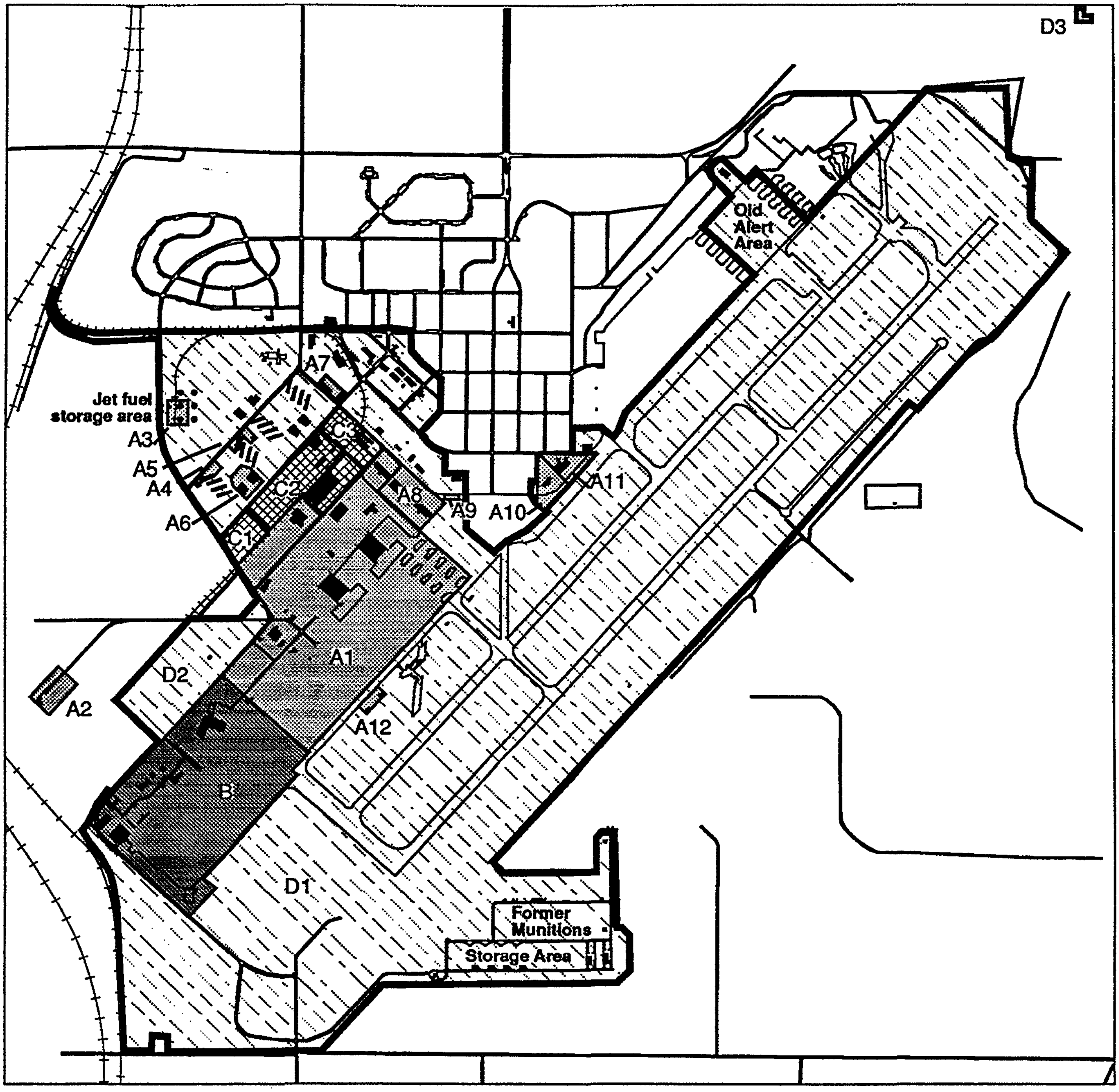


FIGURE 1
GSR Decision Logic
Green and Sustainable Remediation Technical Memorandum
Former Lockbourne, AFB, Columbus, Ohio



EXPLANATIONS

- A ▨ Retained by Air Force, to be used by Air National Guard
- B ▨ Transferred to U.S. Army, to be used by Army National Guard
- C ▨ Transferred to U.S. Army to be used by the Army Reserve
- D ▨ Public Benefit Conveyance to the Rickenbacker Port Authority

Rickenbacker ANGB Parcelization

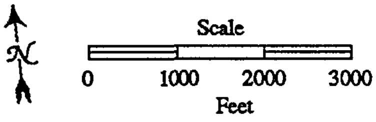


Exhibit 4

Rickenbacker

AECOM

Rickenbacker

Kirkpatrick, Victoria

From: Tait, Kathryn S NFG NG OHARNG (US) <kathryn.s.tait.nfg@mail.mil>
Sent: Wednesday, September 12, 2018 9:16 AM
To: Kirkpatrick, Victoria
Cc: Stenberg, Laurie; Daugherty, Thomas D NFG NG OHARNG (US); Adkins, Kenneth J NFG NG OHARNG (US)
Subject: RE: [Non-DoD Source] ARNG PFAS - Ohio Follow-Up
Attachments: 16 Dec 87 Federal-State Agreement (NGB 33-88-H-0003).pdf; License DACA27-3-98-022.pdf; Fire Station License DACA27-3-07-259.PDF; Fire Station Permit DACA27-3-07-258.PDF

This is what I have found for leases or licenses for Rickenbacker and Mansfield.

As far as I know, Hangar 883 is Air National Guard property and responsibility. Tom or Ken, can you confirm this? Thanks.

Let me know if you need anything else. Thanks.

Katie Tait
Environmental Specialist 2
Ohio Army National Guard
1438 State Route 534 SW
Newton Falls, OH 44444
(614)336-6136
kathryn.s.tait.nfg@mail.mil

-----Original Message-----
From: Kirkpatrick, Victoria [mailto:Victoria.Kirkpatrick@aecom.com]
Sent: Friday, September 7, 2018 1:51 PM
To: Tait, Kathryn S NFG NG OHARNG (US) <kathryn.s.tait.nfg@mail.mil>
Cc: Stenberg, Laurie <laurie.stenberg@aecom.com>
Subject: [Non-DoD Source] ARNG PFAS - Ohio Follow-Up

All active links contained in this email were disabled. Please verify the identity of the sender, and confirm the authenticity of all links contained within the message prior to copying and pasting the address to a Web browser.

Good afternoon Katie,

I just left you a voicemail as I'm not sure you're currently in the office. We met back at the end of July for the PFAS/AFFF related site visits at Green Armory, Mansfield, and Rickenbacker, and I just wanted to do a quick follow-up as we wrap up these PA reports. I received your previous email regarding the follow-up with personnel from the FMS in Mansfield, which confirmed no knowledge of use or storage of AFFF at the facility, so thank you for providing that information.

Would you happen to have copies of lease agreements stating ownership and property rights for Mansfield and Rickenbacker? I believe we only received a copy of the lease agreement for Green Armory.

Additionally, I was hoping you could help to clarify one particular item: in my notes, I have recorded that there were previous AFFF releases at Hangar 883 at the Rickenbacker facility; however, I believe this building is owned by the Air National Guard. The hangar is not labeled on any of our aerial maps and is denoted as "Air Guard" in our notes, which leads me to believe it is outside of Army National Guard property, but I would like to confirm. We do not have access to building numbers which are owned/operated by the Air National Guard, only building numbers for the Army, so I am unsure where this hangar is located in relation to the Army National Guard-owned enclave. Would you be able to confirm that Hangar 883 is indeed owned by the Air National Guard, and not the Army? This is something that can probably be answered in the copies of the lease agreements. If possible, the exact location of Hangar 883 on a map/figure would be extremely helpful.

I believe that is it for now. I will be traveling all next week for additional site visits in Oregon, but will be readily available via email and cell phone. If you have any questions or need additional clarification, please don't hesitate to reach out.

I hope you have a great weekend!

Best,

Victoria Kirkpatrick
Environmental Chemist, Geoenvironmental and Remediation Group D +1-301-820-3624 M +1-301-659-4752
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Kirkpatrick, Victoria

From:	Tait, Kathryn S NFG NG OHARNG (US) <kathryn.s.tait.nfg@mail.mil>
Sent:	Tuesday, October 02, 2018 8:38 AM
To:	Kirkpatrick, Victoria
Subject:	RE: [Non-DoD Source] ARNG PFAS - Ohio Follow-Up
Attachments:	883_location.docx

Victoria:
I asked around and found the location of 883. It is a newer building so not on all of the maps. I have marked the location with an arrow on the attached aerial. It is the hexagonal building next to the rectangular hangers.

Katie

-----Original Message-----
From: Kirkpatrick, Victoria [mailto:Victoria.Kirkpatrick@aecom.com]
Sent: Tuesday, September 25, 2018 12:05 PM
To: Daugherty, Thomas D NFG NG OHARNG (US) <thomas.d.daugherty.nfg@mail.mil>; Adkins, Kenneth J NFG NG OHARNG (US) <kenneth.j.adkins.nfg@mail.mil>
Cc: Tait, Kathryn S NFG NG OHARNG (US) <kathryn.s.tait.nfg@mail.mil>
Subject: RE: [Non-DoD Source] ARNG PFAS - Ohio Follow-Up

Good morning Tom and Ken,

As a follow-up from the previous email below, would either of you have knowledge on the location of Hangar 883, believed to be owned by the Ohio Air National Guard? It is to my and Katie Tait's knowledge that Hangar 883 is owned and operated by the Ohio Air National Guard; however, we cannot seem to locate this hangar on any of our associated maps. Knowing the exact location of Hangar 883, which is believed to have had a large release around 1999, would be extremely helpful when identifying potential off-facility release areas and for creating our conceptual site model.

Additionally, I received the pictures of AFFF foam that was observed during the 2017 EPAS evaluation at AASF #2 (Rickenbacker) from Katie. Would you be able to confirm the exact location (or building number) of the previous storage of this AFFF product?

Any insight you could provide regarding the two data gaps mentioned above would be greatly appreciated.

Thank you again for your time.

Best,

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To: Kirkpatrick, Victoria
Cc: Stenberg, Laurie; Daugherty, Thomas D NFG NG OHARNG (US); Adkins, Kenneth J NFG NG OHARNG (US)
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Let me know if you need anything else. Thanks.

Katie Tait
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Cc: Stenberg, Laurie <laurie.stenberg@aecom.com>
Subject: [Non-DoD Source] ARNG PFAS - Ohio Follow-Up

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Would you happen to have copies of lease agreements stating ownership and property rights for Mansfield and Rickenbacker? I believe we only received a copy of the lease agreement for Green Armory.

Additionally, I was hoping you could help to clarify one particular item: in my notes, I have recorded that there were previous AFFF releases at Hangar 883 at the Rickenbacker facility; however, I believe this building is owned by the Air National Guard. The hangar is not labeled on any of our aerial maps and is denoted as "Air Guard" in our notes, which leads me to believe it is outside of Army National Guard property, but I would like to confirm. We do not have access to building numbers which are owned/operated by the Air National Guard, only building numbers for the Army, so I am unsure where this hangar is located in relation to the Army National Guard-owned enclave. Would you be able to confirm that Hangar 883 is indeed owned by the Air National Guard, and not the Army? This is something that can probably be answered in the copies of the lease agreements. If possible, the exact location of Hangar 883 on a map/figure would be extremely helpful.

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I hope you have a great weekend!

Best,

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Fax To: AECOM	**Fax From: Sean McLaughlin**
Contact: Brittany Kirchmann	**EDR**
Fax : 000-000-0000	**Phone: 1-800-352-0050**
Date: 10/18/2018	

EDR PUR-IQ® Report

"the intelligent way to conduct historical research"

for
Rickenbacker AASF
8227 South Access Road
Groveport, OH 43125
Lat./Long. 39.805672 / 82.928495
EDR Inquiry # 5457852.2s

The EDR PUR-IQ report facilitates historical research planning required to complete the Phase I ESA process. The report identifies the *likelihood* of prior use coverage by searching proprietary EDR-Prior Use Reports® comprising nationwide information on: city directories, fire insurance maps, aerial photographs, historical topographic maps, flood maps and National Wetland Inventory maps.

Potential for EDR Historical (Prior Use) Coverage - Coverage in the following historical information sources may be used as a guide to develop your historical research strategy:

1. City Directory:	Coverage may exist for portions of Franklin County, OH.
2. Fire Insurance Map:	When you order online any EDR Package or the EDR Radius Map with EDR Sanborn Map Search/Print, you receive site specific Sanborn Map coverage information at no charge.
3. Aerial Photograph:	Coverage exists for portions of Franklin County for 1940, 1956, 1980, 1994, 1964, 1988, 1972 Shipping time 3-5 business days.
4. Topographic Map:	The USGS 7.5 min. quad topo sheet(s) associated with this site:

Historical: Coverage exists for FRANKLIN County

Current: Target Property: TP | 2013 | 5964669 Lockbourne, OH

EDR’s network of professional researchers, located throughout the United States, accesses the most extensive national collections of city directory, fire insurance maps, aerial photographs and historical topographic map resources available for Groveport, OH. These collections may be located in multiple libraries throughout the country. To ensure maximum coverage, EDR will often assign researchers at these multiple locations on your behalf. Please call or fax your EDR representative to authorize a search.

EDR™ Environmental
Data Resources Inc

EDR - HISTORICAL SOURCE(S) ORDER FORM

AECOM
Brittany Kirchmann
Account # 1861179

Rickenbacker AASF
8227 South Access Road
Groveport, OH 43125
FRANKLIN County
Lat./Long. 39.805672 / 82.928495
EDR Inquiry # 5457852.2s

Should you wish to change or add to your order, fax this form to your EDR account executive:

Sean McLaughlin
Ph: 1-800-352-0050 Fax: 1-800-231-6802

Reports

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___ EDR Fire Insurance Map Abstract

___ EDR Multi-Tenant Retail Facility® Report

___ EDR City Directory Abstract

___ EDR Aerial Photo Decade Package

___ USGS Aerial 5 Package

___ USGS Aerial 3 Package

___ EDR Historical Topographic Maps

___ Paper Current USGS Topo (7.5 min.)

___ Environmental Lien Search

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Thank you

Rickenbacker AASF
8227 South Access Road
Groveport, OH 43125

Inquiry Number: 5457852.3
October 18, 2018

Certified Sanborn® Map Report

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

Certified Sanborn® Map Report

10/18/18

Site Name:

Rickenbacker AASF
8227 South Access Road
Groveport, OH 43125
EDR Inquiry # 5457852.3

Client Name:

AECOM
12120 Shamrock Plaza
Omaha, NE 68154
Contact: Brittany Kirchmann

The Sanborn Library has been searched by EDR and maps covering the target property location as provided by AECOM were identified for the years listed below. The Sanborn Library is the largest, most complete collection of fire insurance maps. The collection includes maps from Sanborn, Bromley, Perris & Browne, Hopkins, Barlow, and others. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of maps by the Sanborn Library LLC, the copyright holder for the collection. Results can be authenticated by visiting www.edrnet.com/sanborn.

The Sanborn Library is continually enhanced with newly identified map archives. This report accesses all maps in the collection as of the day this report was generated.

Certified Sanborn Results:

Certification # 4229-475B-8A5E

PO # NA

Project Rickenbacker

UNMAPPED PROPERTY

This report certifies that the complete holdings of the Sanborn Library, LLC collection have been searched based on client supplied target property information, and fire insurance maps covering the target property were not found.

Sanborn® Library search results

Certification #: 4229-475B-8A5E

The Sanborn Library includes more than 1.2 million fire insurance maps from Sanborn, Bromley, Perris & Browne, Hopkins, Barlow and others which track historical property usage in approximately 12,000 American cities and towns. Collections searched:

- ☑ Library of Congress
- ☑ University Publications of America
- ☑ EDR Private Collection

The Sanborn Library LLC Since 1866™

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Rickenbacker AASF

8227 South Access Road

Groveport, OH 43125

Inquiry Number: 5457852.5

October 19, 2018

The EDR Aerial Photo Decade Package

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

EDR Aerial Photo Decade Package

10/19/18

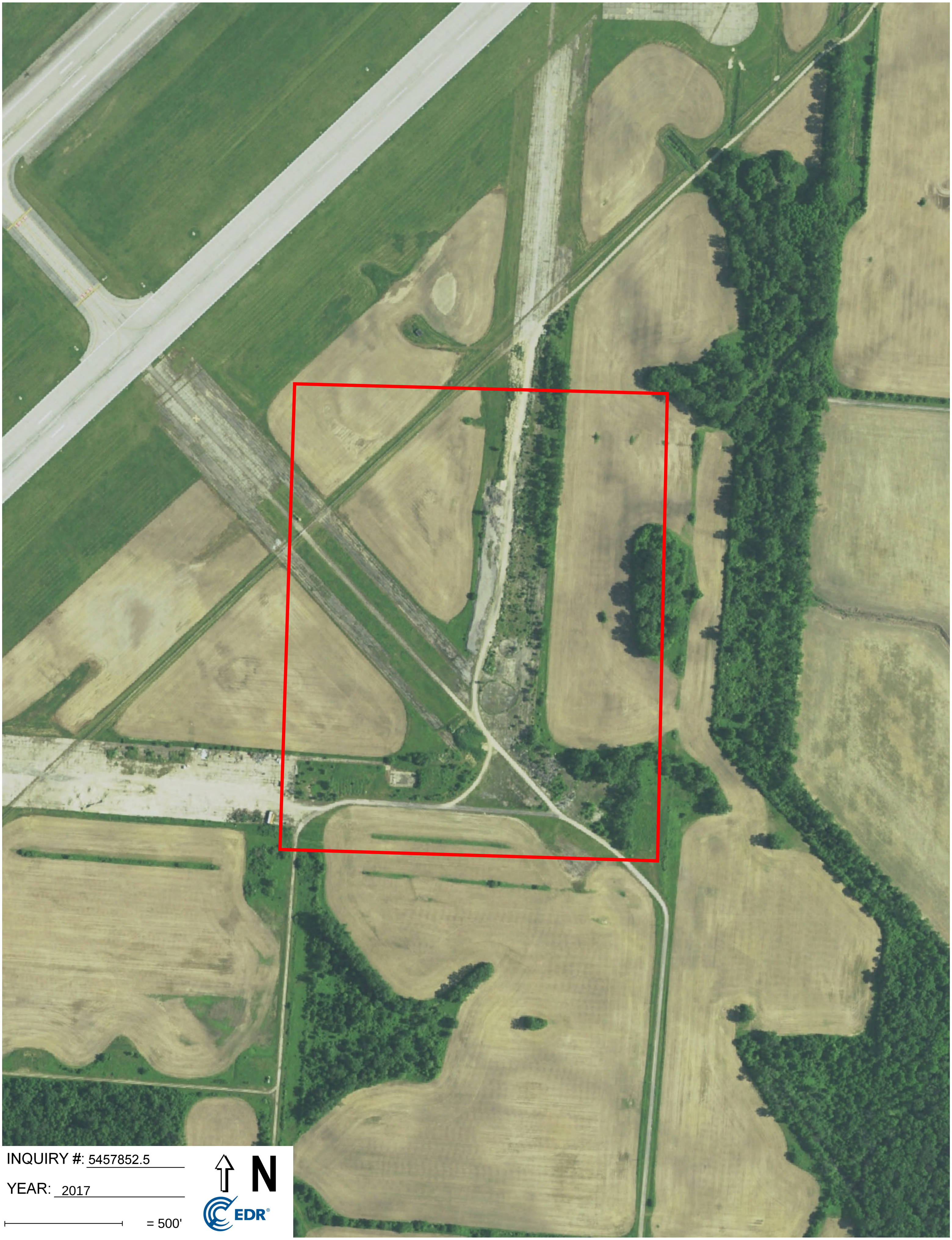
Site Name:	**Client Name:**
Rickenbacker AASF	AECOM
8227 South Access Road	12120 Shamrock Plaza
Groveport, OH 43125	Omaha, NE 68154
EDR Inquiry # 5457852.5	Contact: Brittany Kirchmann

Environmental Data Resources, Inc. (EDR) Aerial Photo Decade Package is a screening tool designed to assist environmental professionals in evaluating potential liability on a target property resulting from past activities. EDR's professional researchers provide digitally reproduced historical aerial photographs, and when available, provide one photo per decade.

Search Results:

Year	Scale	Details	Source
2017	1"=500'	Flight Year: 2017	USDA/NAIP
2013	1"=500'	Flight Year: 2013	USDA/NAIP
2010	1"=500'	Flight Year: 2010	USDA/NAIP
2006	1"=500'	Flight Year: 2006	USDA/NAIP
2000	1"=500'	Flight Date: October 11, 2000	NAPP
1994	1"=500'	Acquisition Date: March 23, 1994	USGS/DOQQ
1988	1"=500'	Flight Date: April 08, 1988	NAPP
1983	1"=500'	Flight Date: April 26, 1983	NHAP
1974	1"=500'	Flight Date: May 01, 1974	USGS
1972	1"=500'	Flight Date: April 18, 1972	USDA
1963	1"=500'	Flight Date: May 06, 1963	USGS
1960	1"=500'	Flight Date: June 04, 1960	USGS
1953	1"=500'	Flight Date: March 01, 1953	USGS
1950	1"=500'	Flight Date: August 14, 1950	USDA
1938	1"=500'	Flight Date: June 14, 1938	USDA

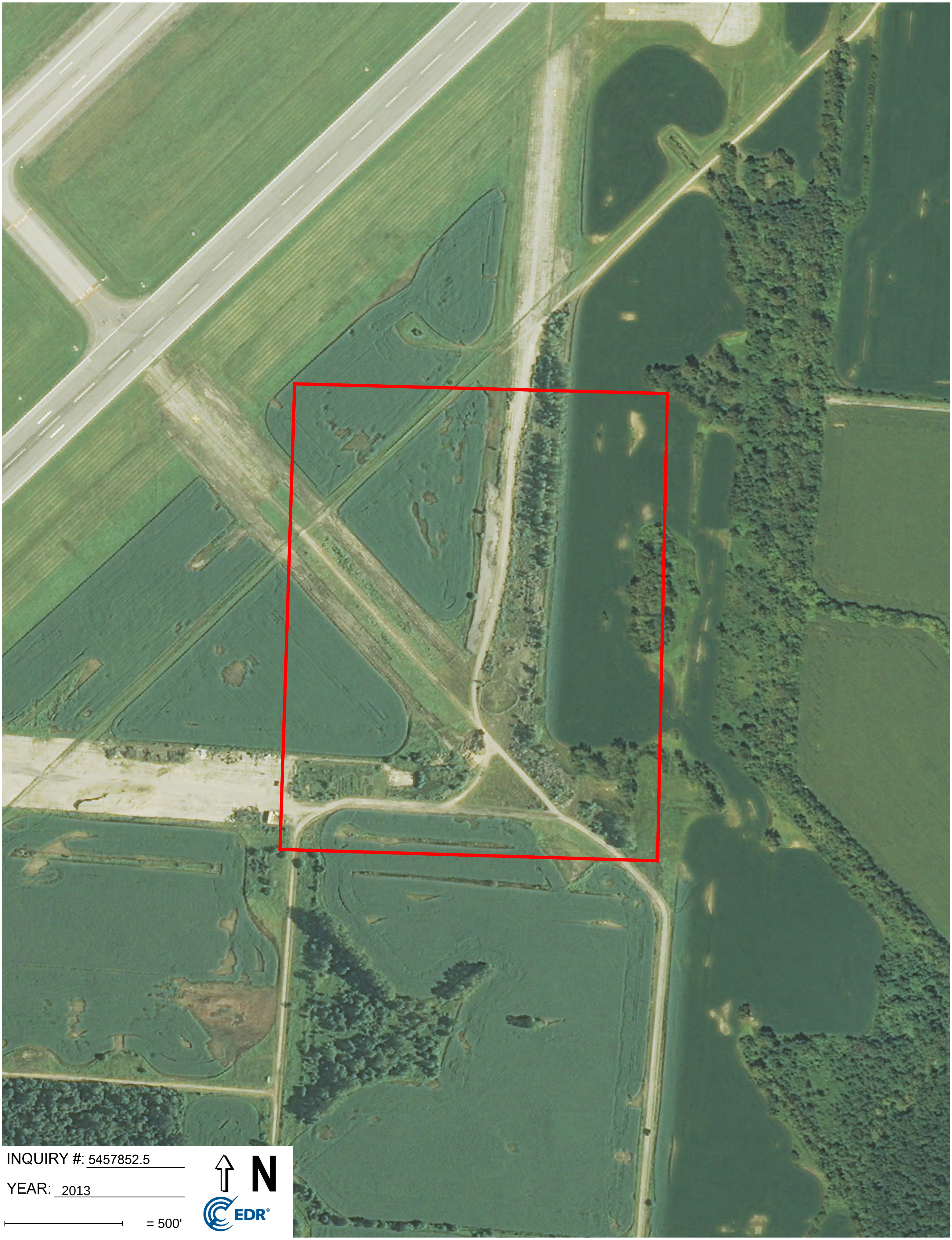
When delivered electronically by EDR, the aerial photo images included with this report are for ONE TIME USE ONLY. Further reproduction of these aerial photo images is prohibited without permission from EDR. For more information contact your EDR Account Executive.



INQUIRY #: 5457852.5

YEAR: 2017

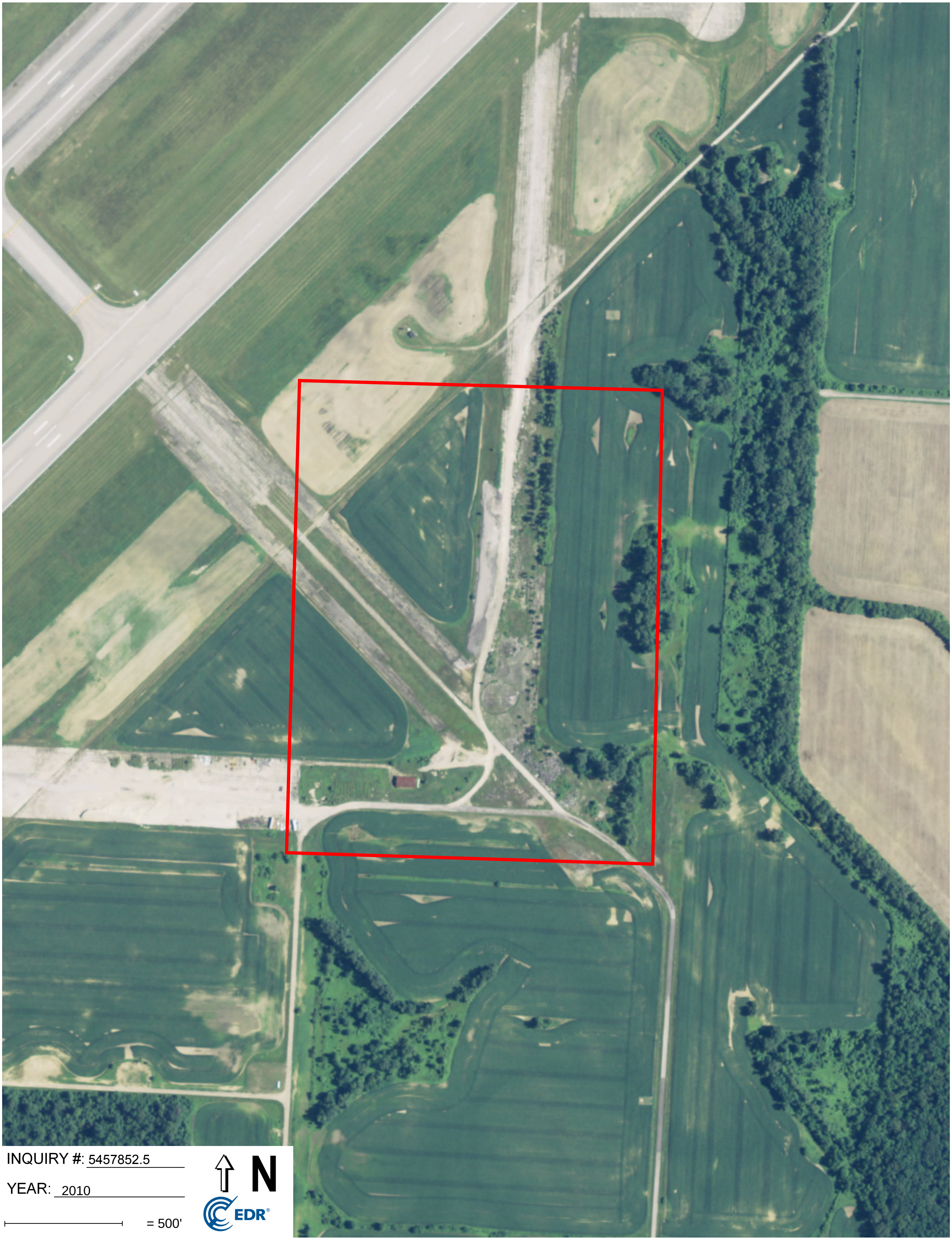
= 500'



INQUIRY #: 5457852.5

YEAR: 2013

= 500'



INQUIRY #: 5457852.5

YEAR: 2010

= 500'

N

EDR®

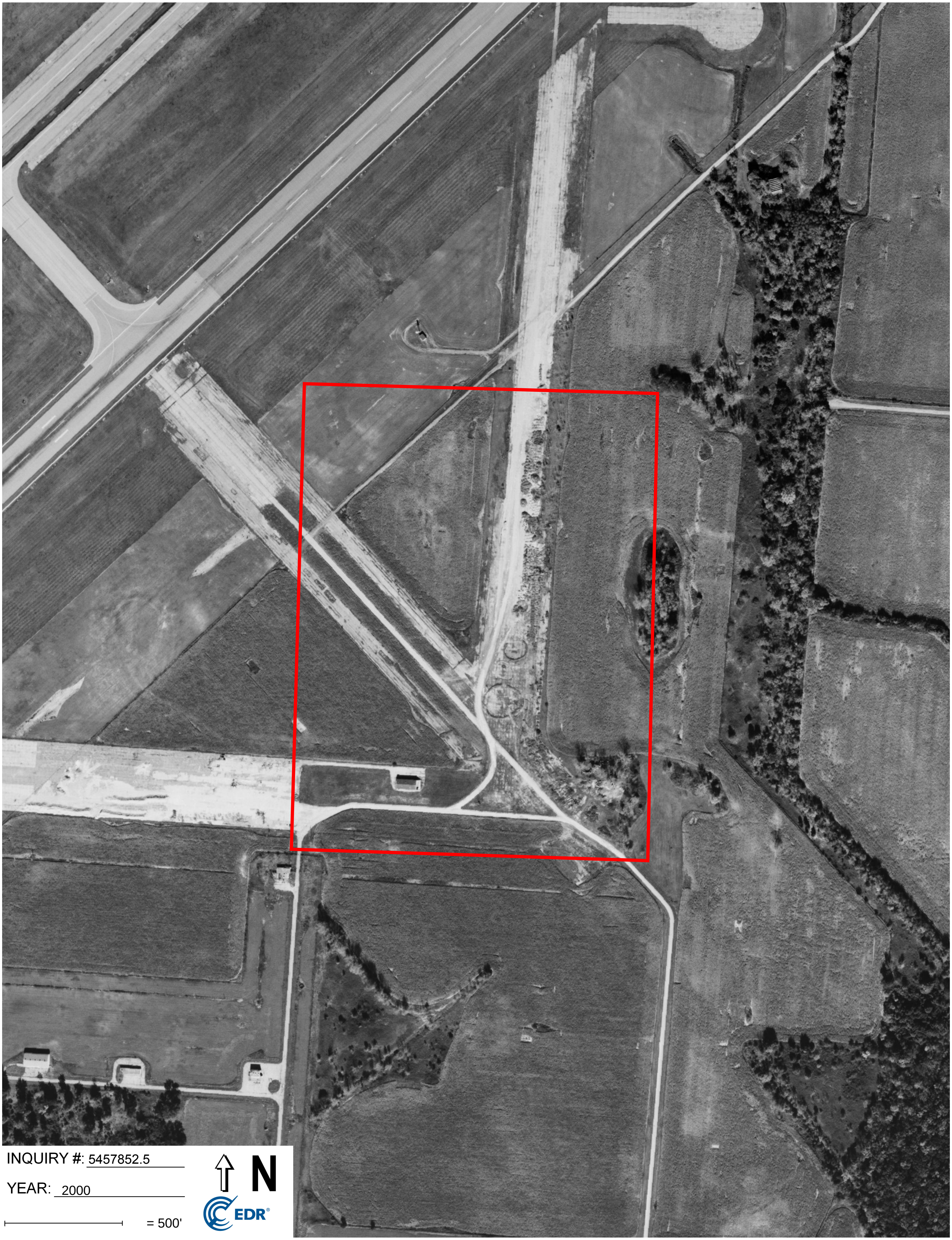
INQUIRY #: 5457852.5

YEAR: 2006

= 500'

N

EDR



INQUIRY #: 5457852.5

YEAR: 2000

= 500'

INQUIRY #: 5457852.5

YEAR: 1994

= 500'

Subject boundary not shown because it exceeds image extent or image is not georeferenced.

INQUIRY #: 5457852.5

YEAR: 1988

= 500'

N

INQUIRY #: 5457852.5

YEAR: 1983

= 500'

INQUIRY #: 5457852.5

YEAR: 1974

= 500'

N

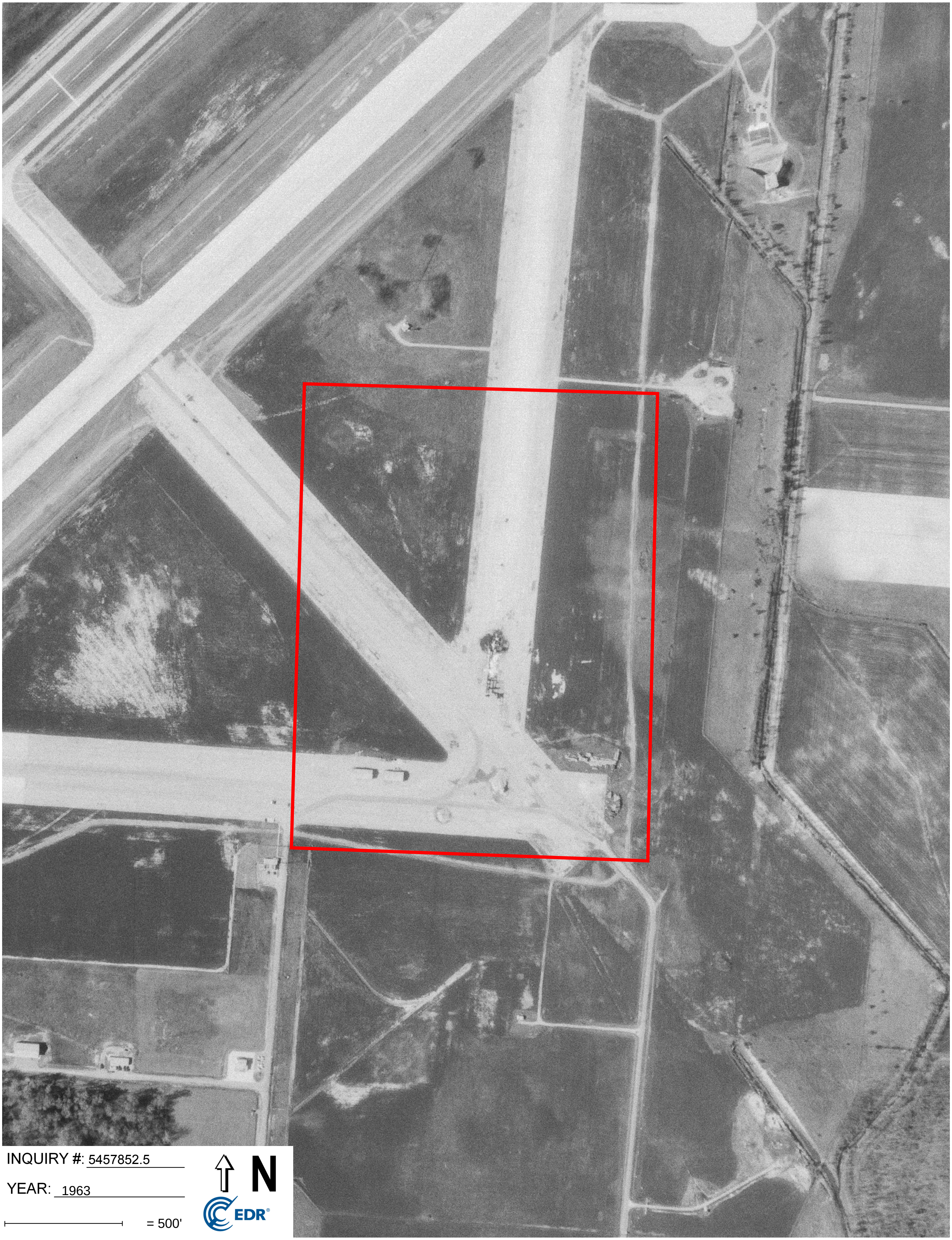
EDR

INQUIRY #: 5457852.5

YEAR: 1972

= 500'

N



INQUIRY #: 5457852.5

YEAR: 1963

= 500'

INQUIRY #: 5457852.5

YEAR: 1960

= 500'

N

INQUIRY #: 5457852.5

YEAR: 1953

= 500'

N

INQUIRY #: 5457852.5

YEAR: 1950

= 500'

N

INQUIRY #: 5457852.5

YEAR: 1938

= 500'

N

EDR

Rickenbacker AASF
8227 South Access Road
Groveport, OH 43125

Inquiry Number: 5457852.2s
October 18, 2018

The EDR Radius Map™ Report with GeoCheck®

EDR®

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
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TABLE OF CONTENTS

SECTION **PAGE**

GEOCHECK ADDENDUM

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc (EDR). The report was designed to assist parties seeking to meet the search requirements of EPA's Standards and Practices for All Appropriate Inquiries (40 CFR Part 312), the ASTM Standard Practice for Environmental Site Assessments (E 1527-13), the ASTM Standard Practice for Environmental Site Assessments for Forestland or Rural Property (E 2247-16), the ASTM Standard Practice for Limited Environmental Due Diligence: Transaction Screen Process (E 1528-14) or custom requirements developed for the evaluation of environmental risk associated with a parcel of real estate.

TARGET PROPERTY INFORMATION

ADDRESS

8227 SOUTH ACCESS ROAD
GROVEPORT, OH 43125

COORDINATES

Latitude (North):	39.8056720 - 39˚ 48' 20.41''
Longitude (West):	82.9284950 - 82˚ 55' 42.58''
Universal Tranverse Mercator:	Zone 17
UTM X (Meters):	334908.6
UTM Y (Meters):	4407758.5
Elevation:	729 ft. above sea level

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property Map:	5964669 LOCKBOURNE, OH
Version Date:	2013

AERIAL PHOTOGRAPHY IN THIS REPORT

Portions of Photo from:	20150716
Source:	USDA

MAPPED SITES SUMMARY

Target Property Address:
8227 SOUTH ACCESS ROAD
GROVEPORT, OH 43125

Click on Map ID to see full detail.

MAP ID	SITE NAME	ADDRESS	DATABASE ACRONYMS	RELATIVE ELEVATION	DIST (ft. & mi.) DIRECTION
1	SOUTH SKEET RANGE		UXO	Lower	1 ft.
A2	LOCKBOURNE AIR FORCE		FUDS	Higher	2201, 0.417, North
A3	FIRING-IN-BUTT/EOD A		UXO	Higher	2201, 0.417, North
A4	NORTH SKEET RANGE		UXO	Higher	2201, 0.417, North
A5	200 YD RIFLE/GRENADE		UXO	Higher	2201, 0.417, North
A6	WEST SKEET RANGE AND		UXO	Higher	2201, 0.417, North
A7	AIR SHOW DROP ZONE		UXO	Higher	2201, 0.417, North
A8	POSSIBLE CWM		UXO	Higher	2201, 0.417, North
B9	RICKENBACKER ANGB BU	7161 2ND ST	SEMS, RCRA-TSDF, US INST CONTROL, RCRA NonGen /...	Higher	4491, 0.851, NW
B10	RICKENBACKER ANGB BU	7161 2ND ST	CORRACTS, PADS, NY MANIFEST	Higher	4574, 0.866, NW
B11	RICKENBACKER ANGB 12	7370 MINUTEMAN WAY	OH DERR, OH SPILLS, OH NPDES, OH VAPOR, OH UIC	Higher	4574, 0.866, NW
12	RICKENBACKER ANG	7556 S PERIMETER RD	OH DERR, OH INST CONTROL, OH SPILLS, OH VAPOR	Higher	4628, 0.877, WNW

EXECUTIVE SUMMARY

TARGET PROPERTY SEARCH RESULTS

The target property was not listed in any of the databases searched by EDR.

DATABASES WITH NO MAPPED SITES

No mapped sites were found in EDR's search of available ("reasonably ascertainable ") government records either on the target property or within the search radius around the target property for the following databases:

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL	National Priority List
Proposed NPL	Proposed National Priority List Sites
NPL LIENS	Federal Superfund Liens

Federal Delisted NPL site list

Delisted NPL	National Priority List Deletions

Federal CERCLIS list

FEDERAL FACILITY	Federal Facility Site Information listing

Federal CERCLIS NFRAP site list

SEMS-ARCHIVE	Superfund Enterprise Management System Archive

Federal RCRA generators list

RCRA-LQG	RCRA - Large Quantity Generators
RCRA-SQG	RCRA - Small Quantity Generators
RCRA-CESQG	RCRA - Conditionally Exempt Small Quantity Generator

Federal institutional controls / engineering controls registries

LUCIS	Land Use Control Information System
US ENG CONTROLS	Engineering Controls Sites List

Federal ERNS list

ERNS	Emergency Response Notification System

State- and tribal - equivalent CERCLIS

OH SHWS	This state does not maintain a SHWS list. See the Federal CERCLIS list and Federal NPL list.

State and tribal landfill and/or solid waste disposal site lists

OH SWF/LF	Licensed Solid Waste Facilities

State and tribal leaking storage tank lists

OH LUST	Leaking Underground Storage Tank File
INDIAN LUST	Leaking Underground Storage Tanks on Indian Land
OH UNREG LTANKS	Ohio Leaking UST File

State and tribal registered storage tank lists

FEMA UST	Underground Storage Tank Listing
OH UST	Underground Storage Tank File
OH AST	Above Ground Storage Tanks
INDIAN UST	Underground Storage Tanks on Indian Land

State and tribal institutional control / engineering control registries

OH HIST INST CONTROLS	Institutional Controls Database
OH HIST ENG CONTROLS	Operation & Maintenance Agreements Database
OH ENG CONTROLS	Sites with Engineering Controls

State and tribal voluntary cleanup sites

OH VCP	Voluntary Action Program Sites
INDIAN VCP	Voluntary Cleanup Priority Listing

State and tribal Brownfields sites

OH BROWNFIELDS	Ohio Brownfield Inventory

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS	A Listing of Brownfields Sites

Local Lists of Landfill / Solid Waste Disposal Sites

OH HIST LF	Old Solid Waste Landfill
OH SWRCY	Recycling Facility Listing
INDIAN ODI	Report on the Status of Open Dumps on Indian Lands
ODI	Open Dump Inventory
DEBRIS REGION 9	Torres Martinez Reservation Illegal Dump Site Locations
IHS OPEN DUMPS	Open Dumps on Indian Land

Local Lists of Hazardous waste / Contaminated Sites

US HIST CDL	Delisted National Clandestine Laboratory Register
OH CDL	Clandestine Drug Lab Locations
US CDL	National Clandestine Laboratory Register

Local Lists of Registered Storage Tanks

OH ARCHIVE UST	Archived Underground Storage Tank Sites

EXECUTIVE SUMMARY

Local Land Records

LIENS 2	CERCLA Lien Information

Records of Emergency Release Reports

HMIRS	Hazardous Materials Information Reporting System
OH SPILLS 90	SPILLS 90 data from FirstSearch
OH SPILLS 80	SPILLS 80 data from FirstSearch

Other Ascertainable Records

DOD	Department of Defense Sites
SCRD DRYCLEANERS	State Coalition for Remediation of Drycleaners Listing
US FIN ASSUR	Financial Assurance Information
EPA WATCH LIST	EPA WATCH LIST
2020 COR ACTION	2020 Corrective Action Program List
TSCA	Toxic Substances Control Act
TRIS	Toxic Chemical Release Inventory System
SSTS	Section 7 Tracking Systems
RMP	Risk Management Plans
RAATS	RCRA Administrative Action Tracking System
PRP	Potentially Responsible Parties
ICIS	Integrated Compliance Information System
FTTS	FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
MLTS	Material Licensing Tracking System
COAL ASH DOE	Steam-Electric Plant Operation Data
COAL ASH EPA	Coal Combustion Residues Surface Impoundments List
PCB TRANSFORMER	PCB Transformer Registration Database
RADINFO	Radiation Information Database
HIST FTTS	FIFRA/TSCA Tracking System Administrative Case Listing
DOT OPS	Incident and Accident Data
CONSENT	Superfund (CERCLA) Consent Decrees
INDIAN RESERV	Indian Reservations
FUSRAP	Formerly Utilized Sites Remedial Action Program
UMTRA	Uranium Mill Tailings Sites
LEAD SMELTERS	Lead Smelter Sites
US AIRS	Aerometric Information Retrieval System Facility Subsystem
US MINES	Mines Master Index File
ABANDONED MINES	Abandoned Mines
FINDS	Facility Index System/Facility Registry System
DOCKET HWC	Hazardous Waste Compliance Docket Listing
ECHO	Enforcement & Compliance History Information
FUELS PROGRAM	EPA Fuels Program Registered Listing
OH AIRS	Title V Permits Listing
OH COAL ASH	Coal Ash Disposal Site Listing
OH CRO	Cessation of Regulated Operations Facility Listing
OH DRYCLEANERS	Drycleaner Facility Listing
OH Financial Assurance	Financial Assurance Information Listing
OH HIST USD	Urban Setting Designations Database
OH LEAD	Lead Inspections Listing
OH TOWNGAS	DERR Towngas Database
OH USD	Urban Setting Designation Sites

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR MGP	EDR Proprietary Manufactured Gas Plants
EDR Hist Auto	EDR Exclusive Historical Auto Stations
EDR Hist Cleaner	EDR Exclusive Historical Cleaners

EDR RECOVERED GOVERNMENT ARCHIVES

Exclusive Recovered Govt. Archives

OH RGA LF	Recovered Government Archive Solid Waste Facilities List
OH RGA LUST	Recovered Government Archive Leaking Underground Storage Tank

SURROUNDING SITES: SEARCH RESULTS

Surrounding sites were identified in the following databases.

Elevations have been determined from the USGS Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified. Sites with an elevation equal to or higher than the target property have been differentiated below from sites with an elevation lower than the target property.
Page numbers and map identification numbers refer to the EDR Radius Map report where detailed data on individual sites can be reviewed.

Sites listed in ***bold italics*** are in multiple databases.

Unmappable (orphan) sites are not considered in the foregoing analysis.

STANDARD ENVIRONMENTAL RECORDS

Federal RCRA CORRACTS facilities list

CORRACTS: CORRACTS is a list of handlers with RCRA Corrective Action Activity. This report shows which nationally-defined corrective action core events have occurred for every handler that has had corrective action activity.

A review of the CORRACTS list, as provided by EDR, and dated 03/01/2018 has revealed that there is 1 CORRACTS site within approximately 1 mile of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
RICKENBACKER ANGB BU EPA ID:: OH3571924544	***7161 2ND ST***	***NW 1/2 - 1 (0.866 mi.)***	***B10***	***46***

EXECUTIVE SUMMARY

State- and tribal - equivalent CERCLIS

OH DERR: The DERR database is an index of sites for which Ohio EPA maintains files. It includes sites with known or suspected contamination, but a site's inclusion in the database does not mean that it is now or has ever been contaminated.

A review of the OH DERR list, as provided by EDR, and dated 12/22/2017 has revealed that there are 2 OH DERR sites within approximately 1 mile of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
RICKENBACKER ANGB 12 DERR Id: 125002029 Activity: ER, SA, RR	***7370 MINUTEMAN WAY***	***NW 1/2 - 1 (0.866 mi.)***	***B11***	***51***
RICKENBACKER ANG DERR Id: 125000685 DERR Id: 125001255 DERR Id: 125001513 Activity: SA, RR	***7556 S PERIMETER RD***	***WNW 1/2 - 1 (0.877 mi.)***	***12***	***56***

ADDITIONAL ENVIRONMENTAL RECORDS

Other Ascertainable Records

FUDS: The Listing includes locations of Formerly Used Defense Sites Properties where the US Army Corps Of Engineers is actively working or will take necessary cleanup actions.

A review of the FUDS list, as provided by EDR, and dated 01/31/2015 has revealed that there is 1 FUDS site within approximately 1 mile of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
LOCKBOURNE AIR FORCE Federal Facility ID:: OH9799F3637 INST ID:: 55586		N 1/4 - 1/2 (0.417 mi.)	A2	8

ROD: Record of Decision. ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid the cleanup.

A review of the ROD list, as provided by EDR, and dated 07/17/2018 has revealed that there is 1 ROD site within approximately 1 mile of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
RICKENBACKER ANGB BU EPA ID:: OH3571924544	***7161 2ND ST***	***NW 1/2 - 1 (0.851 mi.)***	***B9***	***12***

EXECUTIVE SUMMARY

UXO: A listing of unexploded ordnance site locations

A review of the UXO list, as provided by EDR, and dated 09/30/2017 has revealed that there are 7 UXO sites within approximately 1 mile of the target property.

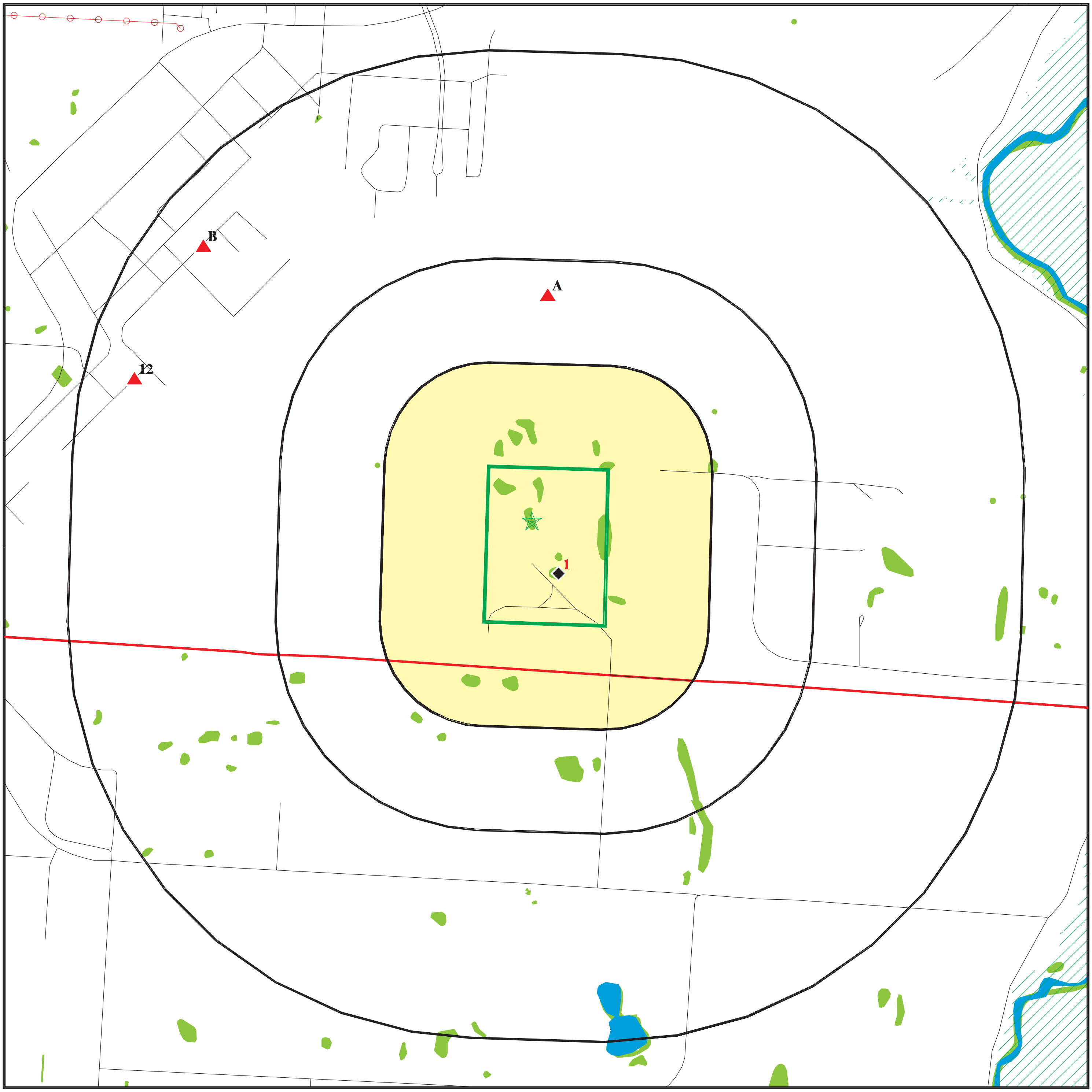
Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
FIRING-IN-BUTT/EOD A		N 1/4 - 1/2 (0.417 mi.)	A3	11
NORTH SKEET RANGE		N 1/4 - 1/2 (0.417 mi.)	A4	11
200 YD RIFLE/GRENADE		N 1/4 - 1/2 (0.417 mi.)	A5	11
WEST SKEET RANGE AND		N 1/4 - 1/2 (0.417 mi.)	A6	12
AIR SHOW DROP ZONE		N 1/4 - 1/2 (0.417 mi.)	A7	12
POSSIBLE CWM		N 1/4 - 1/2 (0.417 mi.)	A8	12

Lower Elevation	Address	Direction / Distance	Map ID	Page
SOUTH SKEET RANGE		0 - 1/8 (0.000 mi.)	1	8

EXECUTIVE SUMMARY

There were no unmapped sites in this report.

OVERVIEW MAP - 5457852.2S



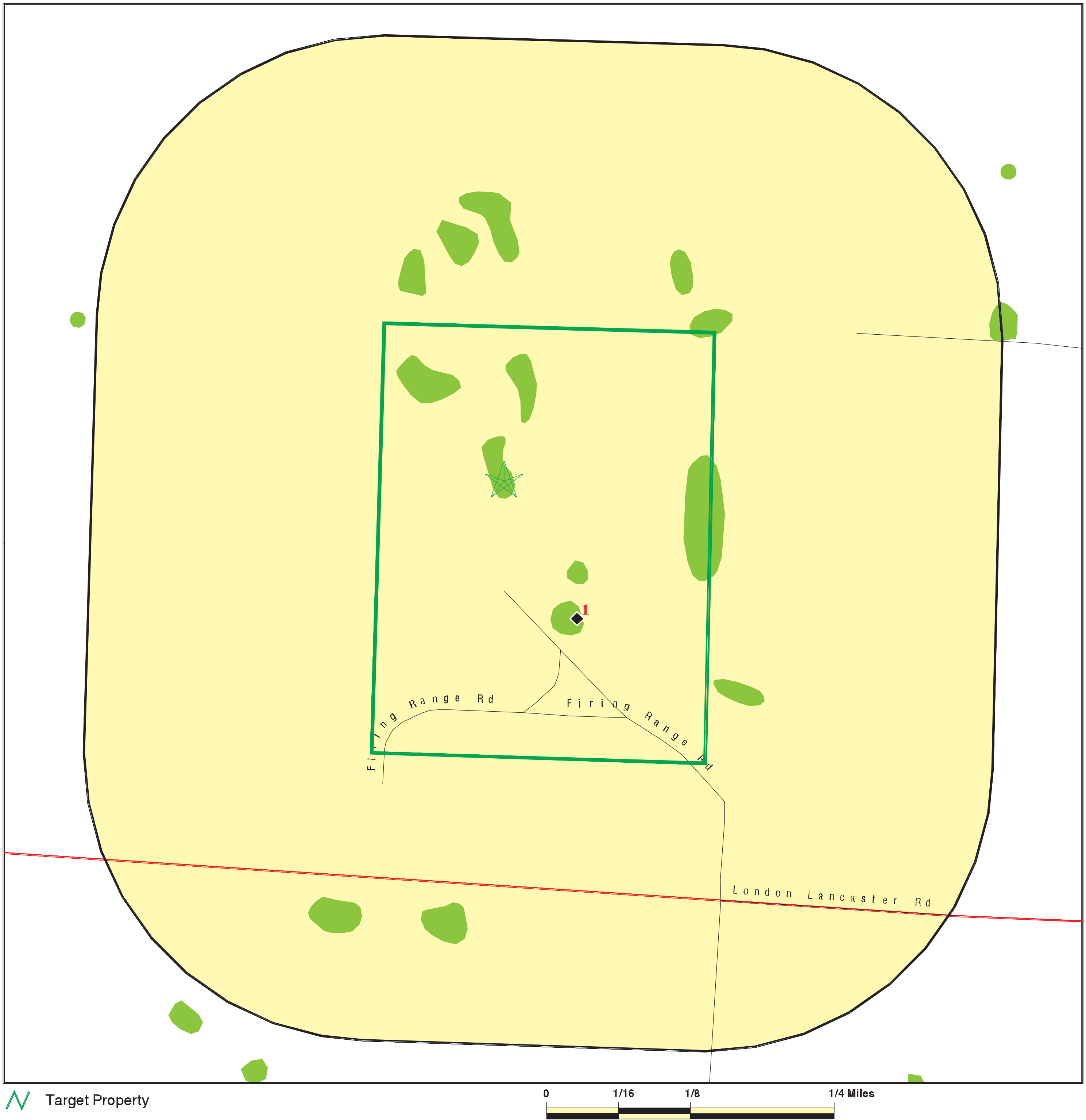
0 1/4 1/2 1 Miles

- ⋀ Target Property
- ▲ Sites at elevations higher than or equal to the target property
- ◆ Sites at elevations lower than the target property
- ♟ Manufactured Gas Plants
- ▨ National Priority List Sites
- ▨ Dept. Defense Sites
- ▨ Indian Reservations BIA
- ⋀ County Boundary
- ⋀ Power transmission lines
- ▨ 100-year flood zone
- ▨ 500-year flood zone
- 🟩 National Wetland Inventory

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME:	Rickenbacker AASF	CLIENT:	AECOM
ADDRESS:	8227 South Access Road Groveport OH 43125	CONTACT:	Brittany Kirchmann
		INQUIRY #:	5457852.2s
LAT/LONG:	39.805672 / 82.928495	DATE:	October 18, 2018 1:36 pm

DETAIL MAP - 5457852.2S



- Target Property
- ▲ Sites at elevations higher than or equal to the target property
- ◆ Sites at elevations lower than the target property
- Manufactured Gas Plants
- Sensitive Receptors
- 🟥 National Priority List Sites
- ▨ Dept. Defense Sites
- ▨ Indian Reservations BIA
- County Boundary
- ▨ 100-year flood zone
- ▨ 500-year flood zone
- 🟩 National Wetland Inventory

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME:	Rickenbacker AASF	CLIENT:	AECOM
ADDRESS:	8227 South Access Road Groveport OH 43125	CONTACT:	Brittany Kirchmann
		INQUIRY #:	5457852.2s
LAT/LONG:	39.805672 / 82.928495	DATE:	October 18, 2018 1:38 pm

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
STANDARD ENVIRONMENTAL RECORDS								
Federal NPL site list								
NPL	1.000		0	0	0	0	NR	0
Proposed NPL	1.000		0	0	0	0	NR	0
NPL LIENS	TP		NR	NR	NR	NR	NR	0
Federal Delisted NPL site list								
Delisted NPL	1.000		0	0	0	0	NR	0
Federal CERCLIS list								
FEDERAL FACILITY	0.500		0	0	0	NR	NR	0
SEMS	0.500		0	0	0	NR	NR	0
Federal CERCLIS NFRAP site list								
SEMS-ARCHIVE	0.500		0	0	0	NR	NR	0
Federal RCRA CORRACTS facilities list								
CORRACTS	1.000		0	0	0	1	NR	1
Federal RCRA non-CORRACTS TSD facilities list								
RCRA-TSDF	0.500		0	0	0	NR	NR	0
Federal RCRA generators list								
RCRA-LQG	0.250		0	0	NR	NR	NR	0
RCRA-SQG	0.250		0	0	NR	NR	NR	0
RCRA-CESQG	0.250		0	0	NR	NR	NR	0
Federal institutional controls / engineering controls registries								
LUCIS	0.500		0	0	0	NR	NR	0
US ENG CONTROLS	0.500		0	0	0	NR	NR	0
US INST CONTROL	0.500		0	0	0	NR	NR	0
Federal ERNS list								
ERNS	TP		NR	NR	NR	NR	NR	0
State- and tribal - equivalent CERCLIS								
OH SHWS	N/A		N/A	N/A	N/A	N/A	N/A	N/A
OH DERR	1.000		0	0	0	2	NR	2
State and tribal landfill and/or solid waste disposal site lists								
OH SWF/LF	0.500		0	0	0	NR	NR	0
State and tribal leaking storage tank lists								
OH LUST	0.500		0	0	0	NR	NR	0
INDIAN LUST	0.500		0	0	0	NR	NR	0
OH UNREG LTANKS	0.500		0	0	0	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
State and tribal registered storage tank lists								
FEMA UST	0.250		0	0	NR	NR	NR	0
OH UST	0.250		0	0	NR	NR	NR	0
OH AST	0.250		0	0	NR	NR	NR	0
INDIAN UST	0.250		0	0	NR	NR	NR	0
State and tribal institutional control / engineering control registries								
OH HIST INST CONTROLS	0.500		0	0	0	NR	NR	0
OH HIST ENG CONTROLS	0.500		0	0	0	NR	NR	0
OH ENG CONTROLS	0.500		0	0	0	NR	NR	0
OH INST CONTROL	0.500		0	0	0	NR	NR	0
State and tribal voluntary cleanup sites								
OH VCP	0.500		0	0	0	NR	NR	0
INDIAN VCP	0.500		0	0	0	NR	NR	0
State and tribal Brownfields sites								
OH BROWNFIELDS	0.500		0	0	0	NR	NR	0
ADDITIONAL ENVIRONMENTAL RECORDS								
Local Brownfield lists								
US BROWNFIELDS	0.500		0	0	0	NR	NR	0
Local Lists of Landfill / Solid Waste Disposal Sites								
OH HIST LF	0.500		0	0	0	NR	NR	0
OH SWRCY	0.500		0	0	0	NR	NR	0
INDIAN ODI	0.500		0	0	0	NR	NR	0
ODI	0.500		0	0	0	NR	NR	0
DEBRIS REGION 9	0.500		0	0	0	NR	NR	0
IHS OPEN DUMPS	0.500		0	0	0	NR	NR	0
Local Lists of Hazardous waste / Contaminated Sites								
US HIST CDL	TP		NR	NR	NR	NR	NR	0
OH CDL	TP		NR	NR	NR	NR	NR	0
US CDL	TP		NR	NR	NR	NR	NR	0
Local Lists of Registered Storage Tanks								
OH ARCHIVE UST	0.250		0	0	NR	NR	NR	0
Local Land Records								
LIENS 2	TP		NR	NR	NR	NR	NR	0
Records of Emergency Release Reports								
HMIRS	TP		NR	NR	NR	NR	NR	0
OH SPILLS	TP		NR	NR	NR	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
OH SPILLS 90	TP		NR	NR	NR	NR	NR	0
OH SPILLS 80	TP		NR	NR	NR	NR	NR	0
Other Ascertainable Records								
RCRA NonGen / NLR	0.250		0	0	NR	NR	NR	0
FUDS	1.000		0	0	1	0	NR	1
DOD	1.000		0	0	0	0	NR	0
SCRD DRYCLEANERS	0.500		0	0	0	NR	NR	0
US FIN ASSUR	TP		NR	NR	NR	NR	NR	0
EPA WATCH LIST	TP		NR	NR	NR	NR	NR	0
2020 COR ACTION	0.250		0	0	NR	NR	NR	0
TSCA	TP		NR	NR	NR	NR	NR	0
TRIS	TP		NR	NR	NR	NR	NR	0
SSTS	TP		NR	NR	NR	NR	NR	0
ROD	1.000		0	0	0	1	NR	1
RMP	TP		NR	NR	NR	NR	NR	0
RAATS	TP		NR	NR	NR	NR	NR	0
PRP	TP		NR	NR	NR	NR	NR	0
PADS	TP		NR	NR	NR	NR	NR	0
ICIS	TP		NR	NR	NR	NR	NR	0
FTTS	TP		NR	NR	NR	NR	NR	0
MLTS	TP		NR	NR	NR	NR	NR	0
COAL ASH DOE	TP		NR	NR	NR	NR	NR	0
COAL ASH EPA	0.500		0	0	0	NR	NR	0
PCB TRANSFORMER	TP		NR	NR	NR	NR	NR	0
RADINFO	TP		NR	NR	NR	NR	NR	0
HIST FTTS	TP		NR	NR	NR	NR	NR	0
DOT OPS	TP		NR	NR	NR	NR	NR	0
CONSENT	1.000		0	0	0	0	NR	0
INDIAN RESERV	1.000		0	0	0	0	NR	0
FUSRAP	1.000		0	0	0	0	NR	0
UMTRA	0.500		0	0	0	NR	NR	0
LEAD SMELTERS	TP		NR	NR	NR	NR	NR	0
US AIRS	TP		NR	NR	NR	NR	NR	0
US MINES	0.250		0	0	NR	NR	NR	0
ABANDONED MINES	0.250		0	0	NR	NR	NR	0
FINDS	TP		NR	NR	NR	NR	NR	0
UXO	1.000		1	0	6	0	NR	7
DOCKET HWC	TP		NR	NR	NR	NR	NR	0
ECHO	TP		NR	NR	NR	NR	NR	0
FUELS PROGRAM	0.250		0	0	NR	NR	NR	0
OH AIRS	TP		NR	NR	NR	NR	NR	0
OH COAL ASH	0.500		0	0	0	NR	NR	0
OH CRO	TP		NR	NR	NR	NR	NR	0
OH DRYCLEANERS	0.250		0	0	NR	NR	NR	0
OH Financial Assurance	TP		NR	NR	NR	NR	NR	0
OH HIST USD	0.500		0	0	0	NR	NR	0
OH LEAD	TP		NR	NR	NR	NR	NR	0
NY MANIFEST	0.250		0	0	NR	NR	NR	0
OH NPDES	TP		NR	NR	NR	NR	NR	0
OH VAPOR	0.500		0	0	0	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
OH TOWNGAS	1.000		0	0	0	0	NR	0
OH UIC	TP		NR	NR	NR	NR	NR	0
OH USD	0.500		0	0	0	NR	NR	0
EDR HIGH RISK HISTORICAL RECORDS								
EDR Exclusive Records								
EDR MGP	1.000		0	0	0	0	NR	0
EDR Hist Auto	0.125		0	NR	NR	NR	NR	0
EDR Hist Cleaner	0.125		0	NR	NR	NR	NR	0
EDR RECOVERED GOVERNMENT ARCHIVES								
Exclusive Recovered Govt. Archives								
OH RGA LF	TP		NR	NR	NR	NR	NR	0
OH RGA LUST	TP		NR	NR	NR	NR	NR	0
- Totals --		0	1	0	7	4	0	12

NOTES:

TP = Target Property

NR = Not Requested at this Search Distance

Sites may be listed in more than one database

N/A = This State does not maintain a SHWS list. See the Federal CERCLIS list.

1 **SOUTH SKEET RANGE** **UXO** **1023964250**
N/A

< 1/8 **COLUMBUS, OH**
1 ft.

Relative:
Lower

Actual:
726 ft.

UXO:
DoD Component: FUDS
Installation Name: LOCKBOURNE AIR FORCE BASE
Facility Address 2: Not reported
Site ID: 27OEW
Site Type: Trap and Skeet Range
Latitude: 39.803902
Longitude: -82.927299

A2 **LOCKBOURNE AIR FORCE BASE** **FUDS** **1007211689**
N/A
North
1/4-1/2 **COLUMBUS, OH**
0.417 mi.
2201 ft. **Site 1 of 7 in cluster A**

Relative:
Higher

Actual:
733 ft.

FUDS:
EPA Region: 05
Congressional District: 15
FUDS Number: G05OH0007
State: OH
Facility Name: LOCKBOURNE AIR FORCE BASE
Fiscal Year: 2013
City: COLUMBUS
Federal Facility ID: OH9799F3637
Telephone: 502-315-6768
INST ID: 55586
County: FRANKLIN
RAB: Not reported
CORPS_DIST: Louisville District (LRL)
NPL Status: Not Listed
CTC: 60451.099999999999
Current Owner: Public Sector; Local Government; State Government; Private Sector
Future Prog: Not reported
Description: The Lockbourne Air Force Base project is located 9 miles south of Columbus, Ohio, and 0.5 mile northeast of the village of Lockbourne. The site consisted of 4,371.07 acres; 2,114 acres have been sold or transferred, which includes 1,642 acres that were excessed by the General Services Administration in July 1981 and obtained by the Rickenbacker Port Authority in March 1984. The property is now owned and managed by the Columbus Regional Airport Authority.
Current Program: Not reported
History: The Lockbourne Air Force Base was used by the Air Force as a military airfield. This property is known or suspected to contain military munitions and explosives of concern (e.g., unexploded ordnance) and therefore may present an explosive hazard. About 24 acres were transferred to the Navy. The site is currently operated as a public airport by the Rickenbacker Port Authority; it is also occupied by the Air National Guard. The active 2,015-acre Rickenbacker Air National Guard Base provides airfield support for the Ohio Air National Guard and the Air Force Reserve. The Air Force is going through base closure at this time.The property is now owned and managed by the Columbus Regional Airport Authority.
Latitude Degree: 39
Latitude Minute: 48
Latitude Second: 14

LOCKBOURNE AIR FORCE BASE (Continued) **1007211689**

Latitude Direction:	N
Longitude Degree:	-82
Longitude Minute:	56
Longitude Second:	38
Longitude Direction:	E

FUDS:

Inst ID:	55586
FUDS Number:	G05OH0007
Facility Name:	LOCKBOURNE AIR FORCE BASE
PHASE:	4
ARC:	Y
DIST:	LRL
MMRP:	Y
MRA ID:	G05OH000704R03
Inst ID:	55586
FUDS Number:	G05OH0007
Facility Name:	LOCKBOURNE AIR FORCE BASE
PHASE:	4
ARC:	Y
DIST:	LRL
MMRP:	Y
MRA ID:	G05OH000704N01
Inst ID:	55586
FUDS Number:	G05OH0007
Facility Name:	LOCKBOURNE AIR FORCE BASE
PHASE:	4
ARC:	Y
DIST:	LRL
MMRP:	Y
MRA ID:	G05OH000704R02
Inst ID:	55586
FUDS Number:	G05OH0007
Facility Name:	LOCKBOURNE AIR FORCE BASE
PHASE:	4
ARC:	Y
DIST:	LRL
MMRP:	Y
MRA ID:	G05OH000704R01
Inst ID:	55586
FUDS Number:	G05OH0007
Facility Name:	LOCKBOURNE AIR FORCE BASE
PHASE:	4
ARC:	Y
DIST:	LRL
MMRP:	Y
MRA ID:	G05OH000704R04
Inst ID:	55586
FUDS Number:	G05OH0007
Facility Name:	LOCKBOURNE AIR FORCE BASE
PHASE:	4
ARC:	Y
DIST:	LRL

LOCKBOURNE AIR FORCE BASE (Continued) **1007211689**

MMRP: Y
MRA ID: G05OH000704R05

FUDS:

Inst ID: 55586
FUDS Number: G05OH0007
Facility Name: LOCKBOURNE AIR FORCE BASE
PHASE: 4
Site ID: 04
DIST: LRL
MMRP: Y
MRA ID: G05OH000704R03
PROJ NO: G05OH000704

Inst ID: 55586
FUDS Number: G05OH0007
Facility Name: LOCKBOURNE AIR FORCE BASE
PHASE: 4
Site ID: 26
DIST: LRL
MMRP: Y
MRA ID: G05OH000704N01
PROJ NO: G05OH000726

Inst ID: 55586
FUDS Number: G05OH0007
Facility Name: LOCKBOURNE AIR FORCE BASE
PHASE: 4
Site ID: 27
DIST: LRL
MMRP: Y
MRA ID: G05OH000704R02
PROJ NO: G05OH000727

Inst ID: 55586
FUDS Number: G05OH0007
Facility Name: LOCKBOURNE AIR FORCE BASE
PHASE: 4
Site ID: 28
DIST: LRL
MMRP: Y
MRA ID: G05OH000704R01
PROJ NO: G05OH000728

Inst ID: 55586
FUDS Number: G05OH0007
Facility Name: LOCKBOURNE AIR FORCE BASE
PHASE: 4
Site ID: 29
DIST: LRL
MMRP: Y
MRA ID: G05OH000704R04
PROJ NO: G05OH000729

Inst ID: 55586
FUDS Number: G05OH0007
Facility Name: LOCKBOURNE AIR FORCE BASE

LOCKBOURNE AIR FORCE BASE (Continued) **1007211689**

PHASE: 4
Site ID: 30
DIST: LRL
MMRP: Y
MRA ID: G05OH000704R05
PROJ NO: G05OH000730

A3
North
1/4-1/2
0.417 mi.
2201 ft.

FIRING-IN-BUTT/EOD AREA **UXO** **1018151584**
N/A

COLUMBUS, OH

Site 2 of 7 in cluster A

Relative:
Higher

Actual:
733 ft.

UXO:
DoD Component: FUDS
Installation Name: LOCKBOURNE AIR FORCE BASE
Facility Address 2: Not reported
Site ID: 28OEW
Site Type: Multi Use Range
Latitude: 39.803902
Longitude: -82.927299

A4
North
1/4-1/2
0.417 mi.
2201 ft.

NORTH SKEET RANGE **UXO** **1018151586**
N/A

COLUMBUS, OH

Site 3 of 7 in cluster A

Relative:
Higher

Actual:
733 ft.

UXO:
DoD Component: FUDS
Installation Name: LOCKBOURNE AIR FORCE BASE
Facility Address 2: Not reported
Site ID: 29OEW
Site Type: Trap and Skeet Range
Latitude: 39.803902
Longitude: -82.927299

A5
North
1/4-1/2
0.417 mi.
2201 ft.

200 YD RIFLE/GRENADE/PRIME BEEF **UXO** **1018151587**
N/A

COLUMBUS, OH

Site 4 of 7 in cluster A

Relative:
Higher

Actual:
733 ft.

UXO:
DoD Component: FUDS
Installation Name: LOCKBOURNE AIR FORCE BASE
Facility Address 2: Not reported
Site ID: 30OEW
Site Type: Multi Use Range
Latitude: 39.803902
Longitude: -82.927299

A6 **WEST SKEET RANGE AND 20MM DISCOVERY AREA** **UXO** **1018151227**
North **N/A**
1/4-1/2 **COLUMBUS, OH**
0.417 mi.
2201 ft. **Site 5 of 7 in cluster A**

Relative:
Higher

Actual:
733 ft.

UXO:

DoD Component:	FUDS
Installation Name:	LOCKBOURNE AIR FORCE BASE
Facility Address 2:	Not reported
Site ID:	04OEW
Site Type:	Trap and Skeet Range
Latitude:	39.803902
Longitude:	-82.927299

A7 **AIR SHOW DROP ZONE** **UXO** **1018151583**
North **N/A**
1/4-1/2 **COLUMBUS, OH**
0.417 mi.
2201 ft. **Site 6 of 7 in cluster A**

Relative:
Higher

Actual:
733 ft.

UXO:

DoD Component:	FUDS
Installation Name:	LOCKBOURNE AIR FORCE BASE
Facility Address 2:	Not reported
Site ID:	26OEW
Site Type:	Training and Maneuver Area
Latitude:	39.803902
Longitude:	-82.927299

A8 **POSSIBLE CWM** **UXO** **1018151581**
North **N/A**
1/4-1/2 **COLUMBUS, OH**
0.417 mi.
2201 ft. **Site 7 of 7 in cluster A**

Relative:
Higher

Actual:
733 ft.

UXO:

DoD Component:	FUDS
Installation Name:	LOCKBOURNE AIR FORCE BASE
Facility Address 2:	Not reported
Site ID:	25OEW/CWM
Site Type:	Training and Maneuver Area
Latitude:	39.803902
Longitude:	-82.927299

B9 **RICKENBACKER ANGB BUILDING 560** **SEMS** **1009968774**
NW **7161 2ND ST** **RCRA-TSDF** **OH3571924544**
1/2-1 **COLUMBUS, OH 43217** **US INST CONTROL**
0.851 mi. **RCRA NonGen / NLR**
4491 ft. **Site 1 of 3 in cluster B** **ROD**

Relative:
Higher

Actual:
740 ft.

SEMS:

Site ID:	506870
EPA ID:	OH3571924544
Cong District:	7
FIPS Code:	39049
Latitude:	Not reported

RICKENBACKER ANGB BUILDING 560 (Continued) **1009968774**

Longitude: Not reported
FF: Y
NPL: Removed from Proposed NPL
Non NPL Status: Not reported

SEMS Detail:

Region: 5
Site ID: 506870
EPA ID: OH3571924544
Site Name: RICKENBACKER AIR NATIONAL GUARD (USAF)
NPL: R
FF: Y
OU: 0
Action Code: NR
Action Name: REM PROP
SEQ: 1
Start Date: 2016-04-07 00:00:00
Finish Date: Not reported
Qual: Not reported
Current Action Lead: EPA Perf

Region: 5
Site ID: 506870
EPA ID: OH3571924544
Site Name: RICKENBACKER AIR NATIONAL GUARD (USAF)
NPL: R
FF: Y
OU: 1
Action Code: LW
Action Name: FF RI/FS
SEQ: 1
Start Date: 1993-09-15 00:00:00
Finish Date: Not reported
Qual: Not reported
Current Action Lead: Fed Fac

Region: 5
Site ID: 506870
EPA ID: OH3571924544
Site Name: RICKENBACKER AIR NATIONAL GUARD (USAF)
NPL: R
FF: Y
OU: 0
Action Code: LV
Action Name: FF RV
SEQ: 1
Start Date: 1995-05-08 00:00:00
Finish Date: Not reported
Qual: Not reported
Current Action Lead: Fed Fac

Region: 5
Site ID: 506870
EPA ID: OH3571924544
Site Name: RICKENBACKER AIR NATIONAL GUARD (USAF)
NPL: R
FF: Y
OU: 0

RICKENBACKER ANGB BUILDING 560 (Continued) **1009968774**

Action Code: HR
Action Name: HAZRANK
SEQ: 1
Start Date: 1994-01-18 00:00:00
Finish Date: Not reported
Qual: Not reported
Current Action Lead: Fed Fac

Region: 5
Site ID: 506870
EPA ID: OH3571924544
Site Name: RICKENBACKER AIR NATIONAL GUARD (USAF)
NPL: R
FF: Y
OU: 0
Action Code: DS
Action Name: DISCVRY
SEQ: 1
Start Date: 1981-10-01 00:00:00
Finish Date: Not reported
Qual: Not reported
Current Action Lead: Fed Fac

Region: 5
Site ID: 506870
EPA ID: OH3571924544
Site Name: RICKENBACKER AIR NATIONAL GUARD (USAF)
NPL: R
FF: Y
OU: 1
Action Code: LX
Action Name: FF RD
SEQ: 1
Start Date: 1999-05-07 00:00:00
Finish Date: Not reported
Qual: Not reported
Current Action Lead: Fed Fac

Region: 5
Site ID: 506870
EPA ID: OH3571924544
Site Name: RICKENBACKER AIR NATIONAL GUARD (USAF)
NPL: R
FF: Y
OU: 1
Action Code: RO
Action Name: ROD
SEQ: 1
Start Date: 1999-10-14 00:00:00
Finish Date: Not reported
Qual: R
Current Action Lead: Fed Fac

Region: 5
Site ID: 506870
EPA ID: OH3571924544
Site Name: RICKENBACKER AIR NATIONAL GUARD (USAF)

RICKENBACKER ANGB BUILDING 560 (Continued) **1009968774**

NPL:	R
FF:	Y
OU:	1
Action Code:	LY
Action Name:	FF RA
SEQ:	1
Start Date:	2000-05-17 00:00:00
Finish Date:	Not reported
Qual:	Not reported
Current Action Lead:	Fed Fac
Region:	5
Site ID:	506870
EPA ID:	OH3571924544
Site Name:	RICKENBACKER AIR NATIONAL GUARD (USAF)
NPL:	R
FF:	Y
OU:	0
Action Code:	SI
Action Name:	SI
SEQ:	2
Start Date:	1991-01-28 00:00:00
Finish Date:	Not reported
Qual:	H
Current Action Lead:	Fed Fac
Region:	5
Site ID:	506870
EPA ID:	OH3571924544
Site Name:	RICKENBACKER AIR NATIONAL GUARD (USAF)
NPL:	R
FF:	Y
OU:	0
Action Code:	SI
Action Name:	SI
SEQ:	1
Start Date:	1987-01-07 00:00:00
Finish Date:	Not reported
Qual:	H
Current Action Lead:	Fed Fac
Region:	5
Site ID:	506870
EPA ID:	OH3571924544
Site Name:	RICKENBACKER AIR NATIONAL GUARD (USAF)
NPL:	R
FF:	Y
OU:	0
Action Code:	PA
Action Name:	PA
SEQ:	2
Start Date:	1992-06-12 00:00:00
Finish Date:	Not reported
Qual:	D
Current Action Lead:	Fed Fac
Region:	5

RICKENBACKER ANGB BUILDING 560 (Continued) **1009968774**

Site ID: 506870
EPA ID: OH3571924544
Site Name: RICKENBACKER AIR NATIONAL GUARD (USAF)
NPL: R
FF: Y
OU: 0
Action Code: PA
Action Name: PA
SEQ: 1
Start Date: 1987-06-01 00:00:00
Finish Date: Not reported
Qual: L
Current Action Lead: Fed Fac

Region: 5
Site ID: 506870
EPA ID: OH3571924544
Site Name: RICKENBACKER AIR NATIONAL GUARD (USAF)
NPL: R
FF: Y
OU: 0
Action Code: NP
Action Name: PROPOSED
SEQ: 1
Start Date: 1994-01-18 00:00:00
Finish Date: Not reported
Qual: Not reported
Current Action Lead: Fed Fac

Region: 5
Site ID: 506870
EPA ID: OH3571924544
Site Name: RICKENBACKER AIR NATIONAL GUARD (USAF)
NPL: R
FF: Y
OU: 1
Action Code: LW
Action Name: FF RI/FS
SEQ: 2
Start Date: 1996-04-15 00:00:00
Finish Date: Not reported
Qual: Not reported
Current Action Lead: Fed Fac

RCRA-TSDF:
Date form received by agency: 07/25/2014
Facility name: RICKENBACKER ANGB BUILDING 560
Facility address: 7161 2ND ST
COLUMBUS, OH 43217-1161
EPA ID: OH3571924544
Mailing address: 154 DEVELOPMENT DR STE G
LIMESTONE, ME 04750
Contact: PETER W FORBES
Contact address: 154 DEVELOPMENT DR STE G
LIMESTONE, ME 04750
Contact country: US

RICKENBACKER ANGB BUILDING 560 (Continued) **1009968774**

Contact telephone:	207-328-7109
Telephone ext.:	7
Contact email:	PETER.FORBES@US.AF.MIL
EPA Region:	05
Land type:	Other land type
Classification:	TSDF
Description:	Handler is engaged in the treatment, storage or disposal of hazardous waste
Classification:	Non-Generator
Description:	Handler: Non-Generators do not presently generate hazardous waste

Owner/Operator Summary:

Owner/operator name:	COLUMBUS REGIONAL
Owner/operator address:	4600 INTERNATIONAL GATEWAY COLUMBUS, OH 43219
Owner/operator country:	US
Owner/operator telephone:	999-999-9999
Owner/operator email:	Not reported
Owner/operator fax:	Not reported
Owner/operator extension:	Not reported
Legal status:	Municipal
Owner/Operator Type:	Owner
Owner/Op start date:	06/26/2007
Owner/Op end date:	Not reported

Owner/operator name:	AIR FORCE CIVIL ENGINEER CENTER
Owner/operator address:	154 DEVELOPMENT DR STE G LIMESTONE, ME 04750
Owner/operator country:	US
Owner/operator telephone:	207-328-7109
Owner/operator email:	Not reported
Owner/operator fax:	Not reported
Owner/operator extension:	Not reported
Legal status:	Federal
Owner/Operator Type:	Operator
Owner/Op start date:	01/01/1900
Owner/Op end date:	Not reported

Handler Activities Summary:

U.S. importer of hazardous waste:	No
Mixed waste (haz. and radioactive):	No
Recycler of hazardous waste:	No
Transporter of hazardous waste:	No
Treater, storer or disposer of HW:	No
Underground injection activity:	No
On-site burner exemption:	No
Furnace exemption:	No
Used oil fuel burner:	No
Used oil processor:	No
User oil refiner:	No
Used oil fuel marketer to burner:	No
Used oil Specification marketer:	No
Used oil transfer facility:	No
Used oil transporter:	No

. Waste code: D040

RICKENBACKER ANGB BUILDING 560 (Continued) **1009968774**

. Waste name: TRICHLOROETHYLENE

Historical Generators:

Date form received by agency: 04/21/2009
Site name: RICKENBACKER ANGB , IRP SITE 1
Classification: Not a generator, verified

Date form received by agency: 01/31/2007
Site name: RICKENBACKER ANGB BLDG 560
Classification: Large Quantity Generator

. Waste code: D001
. Waste name: IGNITABLE HAZARDOUS WASTES ARE THOSE WASTES WHICH HAVE A FLASHPOINT OF LESS THAN 140 DEGREES FAHRENHEIT AS DETERMINED BY A PENSKY-MARTENS CLOSED CUP FLASH POINT TESTER. ANOTHER METHOD OF DETERMINING THE FLASH POINT OF A WASTE IS TO REVIEW THE MATERIAL SAFETY DATA SHEET, WHICH CAN BE OBTAINED FROM THE MANUFACTURER OR DISTRIBUTOR OF THE MATERIAL. LACQUER THINNER IS AN EXAMPLE OF A COMMONLY USED SOLVENT WHICH WOULD BE CONSIDERED AS IGNITABLE HAZARDOUS WASTE.

. Waste code: D002
. Waste name: A WASTE WHICH HAS A PH OF LESS THAN 2 OR GREATER THAN 12.5 IS CONSIDERED TO BE A CORROSIVE HAZARDOUS WASTE. SODIUM HYDROXIDE, A CAUSTIC SOLUTION WITH A HIGH PH, IS OFTEN USED BY INDUSTRIES TO CLEAN OR DEGREASE PARTS. HYDROCHLORIC ACID, A SOLUTION WITH A LOW PH, IS USED BY MANY INDUSTRIES TO CLEAN METAL PARTS PRIOR TO PAINTING. WHEN THESE CAUSTIC OR ACID SOLUTIONS BECOME CONTAMINATED AND MUST BE DISPOSED, THE WASTE WOULD BE A CORROSIVE HAZARDOUS WASTE.

. Waste code: D018
. Waste name: BENZENE

. Waste code: D039
. Waste name: TETRACHLOROETHYLENE

. Waste code: D040
. Waste name: TRICHLOROETHYLENE

. Waste code: D043
. Waste name: VINYL CHLORIDE

. Waste code: F003
. Waste name: THE FOLLOWING SPENT NON-HALOGENATED SOLVENTS: XYLENE, ACETONE, ETHYL ACETATE, ETHYL BENZENE, ETHYL ETHER, METHYL ISOBUTYL KETONE, N-BUTYL ALCOHOL, CYCLOHEXANONE, AND METHANOL; ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, ONLY THE ABOVE SPENT NON-HALOGENATED SOLVENTS; AND ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, ONE OR MORE OF THE ABOVE NON-HALOGENATED SOLVENTS, AND, A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THOSE SOLVENTS LISTED IN F001, F002, F004, AND F005, AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.

Date form received by agency: 02/22/2006
Site name: RICKENBACKER ANGB BLDG 560
Classification: Large Quantity Generator

RICKENBACKER ANGB BUILDING 560 (Continued) **1009968774**

. Waste code: D001
. Waste name: IGNITABLE HAZARDOUS WASTES ARE THOSE WASTES WHICH HAVE A FLASHPOINT OF LESS THAN 140 DEGREES FAHRENHEIT AS DETERMINED BY A PENSKY-MARTENS CLOSED CUP FLASH POINT TESTER. ANOTHER METHOD OF DETERMINING THE FLASH POINT OF A WASTE IS TO REVIEW THE MATERIAL SAFETY DATA SHEET, WHICH CAN BE OBTAINED FROM THE MANUFACTURER OR DISTRIBUTOR OF THE MATERIAL. LACQUER THINNER IS AN EXAMPLE OF A COMMONLY USED SOLVENT WHICH WOULD BE CONSIDERED AS IGNITABLE HAZARDOUS WASTE.

. Waste code: D002
. Waste name: A WASTE WHICH HAS A PH OF LESS THAN 2 OR GREATER THAN 12.5 IS CONSIDERED TO BE A CORROSIVE HAZARDOUS WASTE. SODIUM HYDROXIDE, A CAUSTIC SOLUTION WITH A HIGH PH, IS OFTEN USED BY INDUSTRIES TO CLEAN OR DEGREASE PARTS. HYDROCHLORIC ACID, A SOLUTION WITH A LOW PH, IS USED BY MANY INDUSTRIES TO CLEAN METAL PARTS PRIOR TO PAINTING. WHEN THESE CAUSTIC OR ACID SOLUTIONS BECOME CONTAMINATED AND MUST BE DISPOSED, THE WASTE WOULD BE A CORROSIVE HAZARDOUS WASTE.

. Waste code: D018
. Waste name: BENZENE

. Waste code: D039
. Waste name: TETRACHLOROETHYLENE

. Waste code: D040
. Waste name: TRICHLOROETHYLENE

. Waste code: D043
. Waste name: VINYL CHLORIDE

. Waste code: F003
. Waste name: THE FOLLOWING SPENT NON-HALOGENATED SOLVENTS: XYLENE, ACETONE, ETHYL ACETATE, ETHYL BENZENE, ETHYL ETHER, METHYL ISOBUTYL KETONE, N-BUTYL ALCOHOL, CYCLOHEXANONE, AND METHANOL; ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, ONLY THE ABOVE SPENT NON-HALOGENATED SOLVENTS; AND ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, ONE OR MORE OF THE ABOVE NON-HALOGENATED SOLVENTS, AND, A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THOSE SOLVENTS LISTED IN F001, F002, F004, AND F005, AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.

Date form received by agency: 08/16/2005
Site name: RICKENBACKER ANGB BLDG 560
Classification: Large Quantity Generator

. Waste code: D039
. Waste name: TETRACHLOROETHYLENE

Date form received by agency: 08/03/2005
Site name: RICKENBACKER ANGB BUILDING 560
Classification: Large Quantity Generator

Date form received by agency: 05/11/2005
Site name: RICKENBACKER ANGB BLDG 560
Classification: Large Quantity Generator

RICKENBACKER ANGB BUILDING 560 (Continued) **1009968774**

. Waste code: D039
. Waste name: TETRACHLOROETHYLENE

Date form received by agency: 02/24/2004
Site name: RICKENBACKER ANGB BLDG 560
Classification: Large Quantity Generator

Date form received by agency: 02/20/2003
Site name: RICKENBACKER ANGB B 560
Classification: Large Quantity Generator

Date form received by agency: 06/27/2002
Site name: RICKENBACKER ANGB BUILDING 560
Classification: Small Quantity Generator

Date form received by agency: 04/23/2001
Site name: AFBCA RICKENBACKER
Classification: Small Quantity Generator

. Waste code: D001
. Waste name: IGNITABLE HAZARDOUS WASTES ARE THOSE WASTES WHICH HAVE A FLASHPOINT OF LESS THAN 140 DEGREES FAHRENHEIT AS DETERMINED BY A PENSKY-MARTENS CLOSED CUP FLASH POINT TESTER. ANOTHER METHOD OF DETERMINING THE FLASH POINT OF A WASTE IS TO REVIEW THE MATERIAL SAFETY DATA SHEET, WHICH CAN BE OBTAINED FROM THE MANUFACTURER OR DISTRIBUTOR OF THE MATERIAL. LACQUER THINNER IS AN EXAMPLE OF A COMMONLY USED SOLVENT WHICH WOULD BE CONSIDERED AS IGNITABLE HAZARDOUS WASTE.

. Waste code: D007
. Waste name: CHROMIUM

. Waste code: D008
. Waste name: LEAD

. Waste code: F001
. Waste name: THE FOLLOWING SPENT HALOGENATED SOLVENTS USED IN DEGREASING: TETRACHLOROETHYLENE, TRICHLOROETHYLENE, METHYLENE CHLORIDE, 1,1,1-TRICHLOROETHANE, CARBON TETRACHLORIDE, AND CHLORINATED FLUOROCARBONS; ALL SPENT SOLVENT MIXTURES/BLENDS USED IN DEGREASING CONTAINING, BEFORE USE, A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THE ABOVE HALOGENATED SOLVENTS OR THOSE SOLVENTS LISTED IN F002, F004, AND F005, AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.

. Waste code: F004
. Waste name: THE FOLLOWING SPENT NON-HALOGENATED SOLVENTS: CRESOLS AND CRESYLIC ACID, AND NITROBENZENE; ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THE ABOVE NON-HALOGENATED SOLVENTS OR THOSE SOLVENTS LISTED IN F001, F002, AND F005; AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.

. Waste code: F005
. Waste name: THE FOLLOWING SPENT NON-HALOGENATED SOLVENTS: TOLUENE, METHYL ETHYL KETONE, CARBON DISULFIDE, ISOBUTANOL, PYRIDINE, BENZENE, 2-ETHOXYETHANOL, AND 2-NITROPROPANE; ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF

RICKENBACKER ANGB BUILDING 560 (Continued) **1009968774**

ONE OR MORE OF THE ABOVE NON-HALOGENATED SOLVENTS OR THOSE SOLVENTS LISTED IN F001, F002, OR F004; AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.

Date form received by agency: 01/11/2000
Site name: RICKENBACKER ANGB BUILDING 560
Classification: Small Quantity Generator

Date form received by agency: 02/23/1998
Site name: RICKENBACKER ANGB BUILDING 560
Classification: Large Quantity Generator

Date form received by agency: 07/08/1997
Site name: AFBCA RICKENBACKER
Classification: Small Quantity Generator

Date form received by agency: 02/22/1996
Site name: 121ST AIR REFUELING WING
Classification: Large Quantity Generator

Date form received by agency: 02/23/1994
Site name: RICKENBACKER AIR NATIONAL GUARD BASE
Classification: Large Quantity Generator

Date form received by agency: 04/01/1992
Site name: RICKENBACKER AIR NATIONAL GUARD BASE
Classification: Large Quantity Generator

Date form received by agency: 03/22/1983
Site name: AFBCA RICKENBACKER
Classification: Not a generator, verified

. Waste code: D001
. Waste name: IGNITABLE HAZARDOUS WASTES ARE THOSE WASTES WHICH HAVE A FLASHPOINT OF LESS THAN 140 DEGREES FAHRENHEIT AS DETERMINED BY A PENSKY-MARTENS CLOSED CUP FLASH POINT TESTER. ANOTHER METHOD OF DETERMINING THE FLASH POINT OF A WASTE IS TO REVIEW THE MATERIAL SAFETY DATA SHEET, WHICH CAN BE OBTAINED FROM THE MANUFACTURER OR DISTRIBUTOR OF THE MATERIAL. LACQUER THINNER IS AN EXAMPLE OF A COMMONLY USED SOLVENT WHICH WOULD BE CONSIDERED AS IGNITABLE HAZARDOUS WASTE.

. Waste code: D002
. Waste name: A WASTE WHICH HAS A PH OF LESS THAN 2 OR GREATER THAN 12.5 IS CONSIDERED TO BE A CORROSIVE HAZARDOUS WASTE. SODIUM HYDROXIDE, A CAUSTIC SOLUTION WITH A HIGH PH, IS OFTEN USED BY INDUSTRIES TO CLEAN OR DEGREASE PARTS. HYDROCHLORIC ACID, A SOLUTION WITH A LOW PH, IS USED BY MANY INDUSTRIES TO CLEAN METAL PARTS PRIOR TO PAINTING. WHEN THESE CAUSTIC OR ACID SOLUTIONS BECOME CONTAMINATED AND MUST BE DISPOSED, THE WASTE WOULD BE A CORROSIVE HAZARDOUS WASTE.

. Waste code: D004
. Waste name: ARSENIC

. Waste code: D005
. Waste name: BARIUM

. Waste code: D006

RICKENBACKER ANGB BUILDING 560 (Continued) **1009968774**

. Waste name: CADMIUM

. Waste code: D007
. Waste name: CHROMIUM

. Waste code: D008
. Waste name: LEAD

. Waste code: D009
. Waste name: MERCURY

. Waste code: D010
. Waste name: SELENIUM

. Waste code: D011
. Waste name: SILVER

. Waste code: D012
. Waste name: ENDRIN

. Waste code: D013
. Waste name: LINDANE

. Waste code: D014
. Waste name: METHOXYCHLOR

. Waste code: D015
. Waste name: TOXAPHENE

. Waste code: D016
. Waste name: 2,4-D

. Waste code: D017
. Waste name: 2,4,5-TP (SILVEX)

. Waste code: F001
. Waste name: THE FOLLOWING SPENT HALOGENATED SOLVENTS USED IN DEGREASING: TETRACHLOROETHYLENE, TRICHLOROETHYLENE, METHYLENE CHLORIDE, 1,1,1-TRICHLOROETHANE, CARBON TETRACHLORIDE, AND CHLORINATED FLUOROCARBONS; ALL SPENT SOLVENT MIXTURES/BLENDS USED IN DEGREASING CONTAINING, BEFORE USE, A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THE ABOVE HALOGENATED SOLVENTS OR THOSE SOLVENTS LISTED IN F002, F004, AND F005, AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.

. Waste code: F002
. Waste name: THE FOLLOWING SPENT HALOGENATED SOLVENTS: TETRACHLOROETHYLENE, METHYLENE CHLORIDE, TRICHLOROETHYLENE, 1,1,1-TRICHLOROETHANE, CHLOROBENZENE, 1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE, ORTHO-DICHLOROBENZENE, TRICHLOROFLUOROMETHANE, AND 1,1,2-TRICHLOROETHANE; ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THE ABOVE HALOGENATED SOLVENTS OR THOSE LISTED IN F001, F004, OR F005, AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.

. Waste code: F003

RICKENBACKER ANGB BUILDING 560 (Continued) **1009968774**

. Waste name: THE FOLLOWING SPENT NON-HALOGENATED SOLVENTS: XYLENE, ACETONE, ETHYL ACETATE, ETHYL BENZENE, ETHYL ETHER, METHYL ISOBUTYL KETONE, N-BUTYL ALCOHOL, CYCLOHEXANONE, AND METHANOL; ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, ONLY THE ABOVE SPENT NON-HALOGENATED SOLVENTS; AND ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, ONE OR MORE OF THE ABOVE NON-HALOGENATED SOLVENTS, AND, A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THOSE SOLVENTS LISTED IN F001, F002, F004, AND F005, AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.

. Waste code: F005
. Waste name: THE FOLLOWING SPENT NON-HALOGENATED SOLVENTS: TOLUENE, METHYL ETHYL KETONE, CARBON DISULFIDE, ISOBUTANOL, PYRIDINE, BENZENE, 2-ETHOXYETHANOL, AND 2-NITROPROPANE; ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THE ABOVE NON-HALOGENATED SOLVENTS OR THOSE SOLVENTS LISTED IN F001, F002, OR F004; AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.

. Waste code: U002
. Waste name: ACETONE (I)

. Waste code: U051
. Waste name: CREOSOTE

. Waste code: U075
. Waste name: DICHLORODIFLUOROMETHANE

. Waste code: U154
. Waste name: METHANOL (I)

. Waste code: U159
. Waste name: 2-BUTANONE (I,T)

. Waste code: U160
. Waste name: 2-BUTANONE, PEROXIDE (R,T)

. Waste code: U161
. Waste name: METHYL ISOBUTYL KETONE (I)

. Waste code: U210
. Waste name: ETHENE, TETRACHLORO-

. Waste code: U220
. Waste name: BENZENE, METHYL-

. Waste code: U226
. Waste name: ETHANE, 1,1,1-TRICHLORO-

. Waste code: U228
. Waste name: ETHENE, TRICHLORO-

. Waste code: U239
. Waste name: BENZENE, DIMETHYL- (I,T)

Date form received by agency: 01/01/1979

RICKENBACKER ANGB BUILDING 560 (Continued) **1009968774**

Site name:	AFBCA RICKENBACKER
Classification:	Large Quantity Generator

Corrective Action Summary:

Event date:	09/27/1991
Event:	CA PRIORITIZATION-HIGH CA PRIORITY
Event date:	02/28/1992
Event:	STABILIZATION MEASURES EVALUATION-FACILITY NOT AMENABLE TO STABILIZATION
Event date:	04/01/1992
Event:	DETERMINATION OF NEED FOR AN INVESTIGATION-INVESTIGATION IS NECESSARY
Event date:	04/01/1992
Event:	RFA COMPLETED
Event date:	08/16/1995
Event:	REFERRED TO A NON-RCRA AUTHORITY-REFERRED TO CERCLA
Event date:	04/11/1997
Event:	REFERRED TO A NON-RCRA AUTHORITY-REFERRED TO CERCLA

Facility Has Received Notices of Violations:

Regulation violated:	Not reported
Area of violation:	TSD - Releases from SWMUs
Date violation determined:	05/10/2011
Date achieved compliance:	01/04/2012
Violation lead agency:	State
Enforcement action:	WRITTEN INFORMAL
Enforcement action date:	05/17/2011
Enf. disposition status:	Not reported
Enf. disp. status date:	Not reported
Enforcement lead agency:	State
Proposed penalty amount:	Not reported
Final penalty amount:	Not reported
Paid penalty amount:	Not reported
Regulation violated:	Not reported
Area of violation:	TSD - Releases from SWMUs
Date violation determined:	06/11/2010
Date achieved compliance:	01/04/2012
Violation lead agency:	State
Enforcement action:	WRITTEN INFORMAL
Enforcement action date:	09/28/2010
Enf. disposition status:	Not reported
Enf. disp. status date:	Not reported
Enforcement lead agency:	State
Proposed penalty amount:	Not reported
Final penalty amount:	Not reported
Paid penalty amount:	Not reported
Regulation violated:	Not reported
Area of violation:	TSD - Releases from SWMUs
Date violation determined:	06/11/2010
Date achieved compliance:	01/04/2012

RICKENBACKER ANGB BUILDING 560 (Continued) **1009968774**

Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 06/22/2010
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: TSD - Releases from SWMUs
Date violation determined: 06/11/2010
Date achieved compliance: 01/04/2012
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 05/17/2011
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: TSD IS-Closure/Post-Closure
Date violation determined: 04/21/2009
Date achieved compliance: 06/03/2009
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 05/04/2009
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-54-100(G)
Area of violation: TSD IS-Ground-Water Monitoring
Date violation determined: 05/11/2005
Date achieved compliance: 10/11/2005
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 06/27/2005
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-52-41
Area of violation: Generators - General
Date violation determined: 05/11/2005
Date achieved compliance: 08/05/2005
Violation lead agency: State

RICKENBACKER ANGB BUILDING 560 (Continued) **1009968774**

Enforcement action: WRITTEN INFORMAL
Enforcement action date: 06/27/2005
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-270-07 & 270-09
Area of violation: LDR - General
Date violation determined: 05/11/2005
Date achieved compliance: 07/24/2006
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 06/27/2005
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-52-20
Area of violation: Generators - Manifest
Date violation determined: 05/11/2005
Date achieved compliance: 07/24/2006
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 10/13/2005
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-66-17(D)
Area of violation: TSD - Closure/Post-Closure
Date violation determined: 05/11/2005
Date achieved compliance: 10/11/2005
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 06/27/2005
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-270-07 & 270-09
Area of violation: LDR - General
Date violation determined: 05/11/2005
Date achieved compliance: 07/24/2006
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL

RICKENBACKER ANGB BUILDING 560 (Continued) **1009968774**

Enforcement action date: 10/13/2005
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-52-20
Area of violation: Generators - Manifest
Date violation determined: 05/11/2005
Date achieved compliance: 07/24/2006
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 06/27/2005
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-52-11
Area of violation: Generators - General
Date violation determined: 04/13/2005
Date achieved compliance: 10/11/2005
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 05/02/2005
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3734.02(F)
Area of violation: TSD - General
Date violation determined: 03/18/2005
Date achieved compliance: 07/24/2006
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 10/13/2005
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3734.02(F)
Area of violation: TSD - General
Date violation determined: 03/18/2005
Date achieved compliance: 07/24/2006
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 03/18/2005

RICKENBACKER ANGB BUILDING 560 (Continued) **1009968774**

Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-55-17(D)
Area of violation: TSD - Closure/Post-Closure
Date violation determined: 03/18/2005
Date achieved compliance: 03/18/2005
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 03/18/2005
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-66-13
Area of violation: TSD - Closure/Post-Closure
Date violation determined: 05/01/2002
Date achieved compliance: 05/07/2002
Violation lead agency: State
Enforcement action: FINAL 3008(A) COMPLIANCE ORDER
Enforcement action date: 03/26/2003
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: 32682
Paid penalty amount: Not reported

Regulation violated: SR - 3745-66-74
Area of violation: Generators - Pre-transport
Date violation determined: 05/01/2002
Date achieved compliance: 07/22/2002
Violation lead agency: State
Enforcement action: FINAL 3008(A) COMPLIANCE ORDER
Enforcement action date: 03/26/2003
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: 32682
Paid penalty amount: Not reported

Regulation violated: SR - 3745-66-74
Area of violation: Generators - Pre-transport
Date violation determined: 05/01/2002
Date achieved compliance: 07/22/2002
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 05/30/2002
Enf. disposition status: Not reported

RICKENBACKER ANGB BUILDING 560 (Continued) **1009968774**

Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SS - 3734.02(F)
Area of violation: Generators - General
Date violation determined: 05/01/2002
Date achieved compliance: 07/22/2002
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 05/30/2002
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SS - 3734.02(F)
Area of violation: Generators - General
Date violation determined: 05/01/2002
Date achieved compliance: 07/22/2002
Violation lead agency: State
Enforcement action: FINAL 3008(A) COMPLIANCE ORDER
Enforcement action date: 03/26/2003
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: 32682
Paid penalty amount: Not reported

Regulation violated: SR - 3745-52-11
Area of violation: Generators - General
Date violation determined: 05/01/2002
Date achieved compliance: 07/22/2002
Violation lead agency: State
Enforcement action: FINAL 3008(A) COMPLIANCE ORDER
Enforcement action date: 03/26/2003
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: 32682
Paid penalty amount: Not reported

Regulation violated: SR - 3745-52-11
Area of violation: Generators - General
Date violation determined: 05/01/2002
Date achieved compliance: 07/22/2002
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 05/30/2002
Enf. disposition status: Not reported
Enf. disp. status date: Not reported

RICKENBACKER ANGB BUILDING 560 (Continued) **1009968774**

Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-66-13
Area of violation: TSD - Closure/Post-Closure
Date violation determined: 05/01/2002
Date achieved compliance: 05/07/2002
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 05/30/2002
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-66-74
Area of violation: Generators - Pre-transport
Date violation determined: 05/02/2001
Date achieved compliance: 06/18/2001
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 05/24/2001
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-65-33
Area of violation: TSD - Preparedness and Prevention
Date violation determined: 05/02/2001
Date achieved compliance: 06/18/2001
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 05/24/2001
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-66-74
Area of violation: Generators - Pre-transport
Date violation determined: 06/28/1999
Date achieved compliance: 08/09/1999
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 07/06/1999
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State

RICKENBACKER ANGB BUILDING 560 (Continued) **1009968774**

Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-65-33
Area of violation: Generators - Pre-transport
Date violation determined: 06/28/1999
Date achieved compliance: 08/09/1999
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 07/06/1999
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-52-34(D)(5)(b)
Area of violation: Generators - Pre-transport
Date violation determined: 06/28/1999
Date achieved compliance: 08/09/1999
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 07/06/1999
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-65-91(C)
Area of violation: TSD IS-Ground-Water Monitoring
Date violation determined: 06/01/1995
Date achieved compliance: 04/10/1996
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 12/15/1995
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-65-91(C)
Area of violation: TSD IS-Ground-Water Monitoring
Date violation determined: 06/01/1995
Date achieved compliance: 04/10/1996
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 08/04/1995
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported

RICKENBACKER ANGB BUILDING 560 (Continued) **1009968774**

Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: FR - 40 CFR 264.54(d)
Area of violation: TSD - Preparedness and Prevention
Date violation determined: 09/10/1994
Date achieved compliance: 08/16/1995
Violation lead agency: EPA
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 05/22/1995
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: EPA
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: FR - 40 CFR 262.34(A)(2)(3)
Area of violation: TSD - Container Use and Management
Date violation determined: 09/01/1994
Date achieved compliance: 08/16/1995
Violation lead agency: EPA
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 05/22/1995
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: EPA
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: FR - 40 CFR 262.11
Area of violation: LDR - General
Date violation determined: 09/01/1994
Date achieved compliance: 08/16/1995
Violation lead agency: EPA
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 05/22/1995
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: EPA
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-59-07(A)(1)(b)
Area of violation: LDR - General
Date violation determined: 06/13/1994
Date achieved compliance: 07/26/1994
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 06/24/1994
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported

RICKENBACKER ANGB BUILDING 560 (Continued) **1009968774**

Paid penalty amount:	Not reported
Regulation violated:	SR - 3745-52-42
Area of violation:	Generators - Records/Reporting
Date violation determined:	05/26/1993
Date achieved compliance:	08/10/1993
Violation lead agency:	State
Enforcement action:	WRITTEN INFORMAL
Enforcement action date:	06/29/1993
Enf. disposition status:	Not reported
Enf. disp. status date:	Not reported
Enforcement lead agency:	State
Proposed penalty amount:	Not reported
Final penalty amount:	Not reported
Paid penalty amount:	Not reported
Regulation violated:	SR - 3745-52-34
Area of violation:	Generators - Pre-transport
Date violation determined:	05/26/1993
Date achieved compliance:	08/11/1993
Violation lead agency:	State
Enforcement action:	WRITTEN INFORMAL
Enforcement action date:	06/29/1993
Enf. disposition status:	Not reported
Enf. disp. status date:	Not reported
Enforcement lead agency:	State
Proposed penalty amount:	Not reported
Final penalty amount:	Not reported
Paid penalty amount:	Not reported
Regulation violated:	SS - 3734.15(C)
Area of violation:	Transporters - Manifest and Recordkeeping
Date violation determined:	05/26/1993
Date achieved compliance:	08/11/1993
Violation lead agency:	State
Enforcement action:	WRITTEN INFORMAL
Enforcement action date:	06/29/1993
Enf. disposition status:	Not reported
Enf. disp. status date:	Not reported
Enforcement lead agency:	State
Proposed penalty amount:	Not reported
Final penalty amount:	Not reported
Paid penalty amount:	Not reported
Regulation violated:	SR - 3745-53-11(D)
Area of violation:	Transporters - General
Date violation determined:	05/26/1993
Date achieved compliance:	08/11/1993
Violation lead agency:	State
Enforcement action:	WRITTEN INFORMAL
Enforcement action date:	06/29/1993
Enf. disposition status:	Not reported
Enf. disp. status date:	Not reported
Enforcement lead agency:	State
Proposed penalty amount:	Not reported
Final penalty amount:	Not reported
Paid penalty amount:	Not reported

RICKENBACKER ANGB BUILDING 560 (Continued) **1009968774**

Regulation violated: SR - 3745-53-11(A)
Area of violation: Transporters - General
Date violation determined: 05/26/1993
Date achieved compliance: 08/11/1993
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 06/29/1993
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-59-07(A)(1)(b)
Area of violation: LDR - General
Date violation determined: 08/03/1992
Date achieved compliance: 10/07/1992
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 08/24/1992
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-59-07(A)(1)(b)
Area of violation: LDR - General
Date violation determined: 08/03/1992
Date achieved compliance: 10/07/1992
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 10/07/1992
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-52-34(A)(1)
Area of violation: Generators - Pre-transport
Date violation determined: 08/03/1992
Date achieved compliance: 06/16/1993
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 08/24/1992
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 3745-52-34(A)(1)

RICKENBACKER ANGB BUILDING 560 (Continued) **1009968774**

Area of violation: Generators - Pre-transport
Date violation determined: 08/03/1992
Date achieved compliance: 06/16/1993
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 10/07/1992
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: TSD - General
Date violation determined: 05/30/1991
Date achieved compliance: 10/21/1991
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 06/27/1991
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: - 40 CFR 268
Area of violation: LDR - General
Date violation determined: 05/30/1991
Date achieved compliance: 10/21/1991
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 06/27/1991
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: TSD - General
Date violation determined: 06/28/1990
Date achieved compliance: 12/07/1990
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 10/26/1990
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: LDR - General

RICKENBACKER ANGB BUILDING 560 (Continued) **1009968774**

Date violation determined: 06/28/1990
Date achieved compliance: 06/16/1993
Violation lead agency: EPA
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 03/08/1991
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: EPA
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: FR - 40 CFR 268
Area of violation: LDR - General
Date violation determined: 06/28/1990
Date achieved compliance: 05/30/1991
Violation lead agency: State
Enforcement action: Not reported
Enforcement action date: Not reported
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: Not reported
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: LDR - General
Date violation determined: 06/28/1990
Date achieved compliance: 08/29/1991
Violation lead agency: EPA
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 03/08/1991
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: EPA
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: TSD - General
Date violation determined: 06/28/1990
Date achieved compliance: 12/07/1990
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 08/01/1990
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: TSD - General
Date violation determined: 11/01/1988

RICKENBACKER ANGB BUILDING 560 (Continued) **1009968774**

Date achieved compliance: 08/01/1990
Violation lead agency: EPA
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 06/06/1990
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: EPA
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: TSD - General
Date violation determined: 09/28/1988
Date achieved compliance: 11/18/1988
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 10/03/1988
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: TSD - General
Date violation determined: 04/14/1988
Date achieved compliance: 12/13/1988
Violation lead agency: EPA
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 08/08/1988
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: EPA
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: TSD - General
Date violation determined: 04/08/1988
Date achieved compliance: 10/03/1988
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 07/29/1988
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: FR - 40 CFR 268
Area of violation: LDR - General
Date violation determined: 04/08/1988
Date achieved compliance: 06/28/1990

RICKENBACKER ANGB BUILDING 560 (Continued) **1009968774**

Violation lead agency: State
Enforcement action: Not reported
Enforcement action date: Not reported
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: Not reported
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Evaluation Action Summary:
Evaluation date: 11/08/2017
Evaluation: FOCUSED COMPLIANCE INSPECTION
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 04/25/2017
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 04/04/2016
Evaluation: OPERATION AND MAINTENANCE INSPECTION
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 04/04/2016
Evaluation: FOCUSED COMPLIANCE INSPECTION
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 04/04/2013
Evaluation: FOCUSED COMPLIANCE INSPECTION
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 05/10/2011
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: TSD - Releases from SWMUs
Date achieved compliance: 01/04/2012
Evaluation lead agency: State

Evaluation date: 04/12/2011
Evaluation: FOCUSED COMPLIANCE INSPECTION
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 01/05/2011
Evaluation: FOCUSED COMPLIANCE INSPECTION
Area of violation: Not reported
Date achieved compliance: Not reported

RICKENBACKER ANGB BUILDING 560 (Continued) **1009968774**

Evaluation lead agency: State

Evaluation date: 09/08/2010
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: TSD - Releases from SWMUs
Date achieved compliance: 01/04/2012
Evaluation lead agency: State

Evaluation date: 06/11/2010
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: TSD - Releases from SWMUs
Date achieved compliance: 01/04/2012
Evaluation lead agency: State

Evaluation date: 06/03/2009
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 04/21/2009
Evaluation: FOCUSED COMPLIANCE INSPECTION
Area of violation: TSD IS-Closure/Post-Closure
Date achieved compliance: 06/03/2009
Evaluation lead agency: State

Evaluation date: 10/11/2005
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: Generators - Manifest
Date achieved compliance: 07/24/2006
Evaluation lead agency: State

Evaluation date: 10/11/2005
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: TSD - General
Date achieved compliance: 07/24/2006
Evaluation lead agency: State

Evaluation date: 10/11/2005
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: LDR - General
Date achieved compliance: 07/24/2006
Evaluation lead agency: State

Evaluation date: 05/11/2005
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: TSD - Closure/Post-Closure
Date achieved compliance: 10/11/2005
Evaluation lead agency: State

Evaluation date: 05/11/2005
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: LDR - General
Date achieved compliance: 07/24/2006
Evaluation lead agency: State

Evaluation date: 05/11/2005

RICKENBACKER ANGB BUILDING 560 (Continued) **1009968774**

Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Generators - Manifest
Date achieved compliance: 07/24/2006
Evaluation lead agency: State

Evaluation date: 05/11/2005
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Generators - General
Date achieved compliance: 08/05/2005
Evaluation lead agency: State

Evaluation date: 05/11/2005
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: TSD IS-Ground-Water Monitoring
Date achieved compliance: 10/11/2005
Evaluation lead agency: State

Evaluation date: 04/13/2005
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: Generators - General
Date achieved compliance: 10/11/2005
Evaluation lead agency: State

Evaluation date: 03/18/2005
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: TSD - Closure/Post-Closure
Date achieved compliance: 03/18/2005
Evaluation lead agency: State

Evaluation date: 03/18/2005
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: TSD - General
Date achieved compliance: 07/24/2006
Evaluation lead agency: State

Evaluation date: 05/11/2004
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 10/03/2003
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 05/13/2003
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 03/26/2003
Evaluation: NOT A SIGNIFICANT NON-COMPLIER
Area of violation: Not reported
Date achieved compliance: Not reported

RICKENBACKER ANGB BUILDING 560 (Continued) **1009968774**

Evaluation lead agency: State

Evaluation date: 07/19/2002
Evaluation: SIGNIFICANT NON-COMPLIER
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 05/01/2002
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Generators - General
Date achieved compliance: 07/22/2002
Evaluation lead agency: State

Evaluation date: 05/01/2002
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Generators - Pre-transport
Date achieved compliance: 07/22/2002
Evaluation lead agency: State

Evaluation date: 05/01/2002
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: EPA

Evaluation date: 05/01/2002
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: TSD - Closure/Post-Closure
Date achieved compliance: 05/07/2002
Evaluation lead agency: State

Evaluation date: 05/02/2001
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: EPA

Evaluation date: 05/02/2001
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: TSD - Preparedness and Prevention
Date achieved compliance: 06/18/2001
Evaluation lead agency: State

Evaluation date: 05/02/2001
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Generators - Pre-transport
Date achieved compliance: 06/18/2001
Evaluation lead agency: State

Evaluation date: 09/07/2000
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: EPA

Evaluation date: 05/25/2000

RICKENBACKER ANGB BUILDING 560 (Continued) **1009968774**

Evaluation:	COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation:	Not reported
Date achieved compliance:	Not reported
Evaluation lead agency:	State
Evaluation date:	06/28/1999
Evaluation:	COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation:	Generators - Pre-transport
Date achieved compliance:	08/09/1999
Evaluation lead agency:	State
Evaluation date:	10/01/1998
Evaluation:	NOT A SIGNIFICANT NON-COMPLIER
Area of violation:	Not reported
Date achieved compliance:	Not reported
Evaluation lead agency:	EPA
Evaluation date:	09/28/1998
Evaluation:	COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation:	Not reported
Date achieved compliance:	Not reported
Evaluation lead agency:	EPA
Evaluation date:	06/15/1998
Evaluation:	GROUNDWATER MONITORING EVALUATION
Area of violation:	Not reported
Date achieved compliance:	Not reported
Evaluation lead agency:	State
Evaluation date:	09/30/1997
Evaluation:	SIGNIFICANT NON-COMPLIER
Area of violation:	Not reported
Date achieved compliance:	Not reported
Evaluation lead agency:	EPA
Evaluation date:	09/24/1997
Evaluation:	COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation:	Not reported
Date achieved compliance:	Not reported
Evaluation lead agency:	EPA
Evaluation date:	03/19/1996
Evaluation:	FOLLOW-UP INSPECTION
Area of violation:	Not reported
Date achieved compliance:	Not reported
Evaluation lead agency:	State
Evaluation date:	09/13/1995
Evaluation:	COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation:	Not reported
Date achieved compliance:	Not reported
Evaluation lead agency:	EPA
Evaluation date:	06/01/1995
Evaluation:	GROUNDWATER MONITORING EVALUATION
Area of violation:	TSD IS-Ground-Water Monitoring
Date achieved compliance:	04/10/1996

RICKENBACKER ANGB BUILDING 560 (Continued) **1009968774**

Evaluation lead agency: State

Evaluation date: 02/02/1995
Evaluation: FOCUSED COMPLIANCE INSPECTION
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 09/01/1994
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: LDR - General
Date achieved compliance: 08/16/1995
Evaluation lead agency: EPA

Evaluation date: 09/01/1994
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: TSD - Preparedness and Prevention
Date achieved compliance: 08/16/1995
Evaluation lead agency: EPA

Evaluation date: 09/01/1994
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: TSD - Container Use and Management
Date achieved compliance: 08/16/1995
Evaluation lead agency: EPA

Evaluation date: 06/13/1994
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: LDR - General
Date achieved compliance: 07/26/1994
Evaluation lead agency: State

Evaluation date: 05/26/1993
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Transporters - General
Date achieved compliance: 08/11/1993
Evaluation lead agency: State

Evaluation date: 05/26/1993
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Transporters - Manifest and Recordkeeping
Date achieved compliance: 08/11/1993
Evaluation lead agency: State

Evaluation date: 05/26/1993
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Generators - Records/Reporting
Date achieved compliance: 08/10/1993
Evaluation lead agency: State

Evaluation date: 05/26/1993
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Generators - Pre-transport
Date achieved compliance: 08/11/1993
Evaluation lead agency: State

Evaluation date: 08/03/1992

RICKENBACKER ANGB BUILDING 560 (Continued) **1009968774**

Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: LDR - General
Date achieved compliance: 10/07/1992
Evaluation lead agency: State

Evaluation date: 08/03/1992
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Generators - Pre-transport
Date achieved compliance: 06/16/1993
Evaluation lead agency: State

Evaluation date: 05/30/1991
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: TSD - General
Date achieved compliance: 10/21/1991
Evaluation lead agency: State

Evaluation date: 05/30/1991
Evaluation: FOCUSED COMPLIANCE INSPECTION
Area of violation: LDR - General
Date achieved compliance: 10/21/1991
Evaluation lead agency: State

Evaluation date: 06/28/1990
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: LDR - General
Date achieved compliance: 08/29/1991
Evaluation lead agency: EPA

Evaluation date: 06/28/1990
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: TSD - General
Date achieved compliance: 12/07/1990
Evaluation lead agency: State

Evaluation date: 06/28/1990
Evaluation: FOCUSED COMPLIANCE INSPECTION
Area of violation: LDR - General
Date achieved compliance: 05/30/1991
Evaluation lead agency: State

Evaluation date: 06/28/1990
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: LDR - General
Date achieved compliance: 06/16/1993
Evaluation lead agency: EPA

Evaluation date: 11/01/1988
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: TSD - General
Date achieved compliance: 08/01/1990
Evaluation lead agency: EPA

Evaluation date: 09/30/1988
Evaluation: COMPLIANCE SCHEDULE EVALUATION
Area of violation: Not reported
Date achieved compliance: Not reported

RICKENBACKER ANGB BUILDING 560 (Continued) **1009968774**

Evaluation lead agency: State

Evaluation date: 09/28/1988
Evaluation: FOCUSED COMPLIANCE INSPECTION
Area of violation: TSD - General
Date achieved compliance: 11/18/1988
Evaluation lead agency: State

Evaluation date: 07/29/1988
Evaluation: COMPLIANCE SCHEDULE EVALUATION
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 04/14/1988
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: TSD - General
Date achieved compliance: 12/13/1988
Evaluation lead agency: EPA

Evaluation date: 04/08/1988
Evaluation: FOCUSED COMPLIANCE INSPECTION
Area of violation: LDR - General
Date achieved compliance: 06/28/1990
Evaluation lead agency: State

Evaluation date: 04/08/1988
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: TSD - General
Date achieved compliance: 10/03/1988
Evaluation lead agency: State

US INST CONTROL:
EPA ID: OH3571924544
Site ID: 0506870
Name: RICKENBACKER AIR NATIONAL GUARD (USAF)
Action Name: RECORD OF DECISION
Address: 1/2 MILE E OF LOCKBOURNE
LOCKBOURNE, OH 43217
EPA Region: 05
County: FRANKLIN
Event Code: Not reported
Inst. Control: Access Restriction
Actual Date: Not reported
Complet. Date: 10/14/1999
Operable Unit: 01
Contaminated Media : Groundwater
Contact Name : Not reported
Contact Phone and Ext : Not reported
Event Code Description: Not reported

EPA ID: OH3571924544
Site ID: 0506870
Name: RICKENBACKER AIR NATIONAL GUARD (USAF)
Action Name: RECORD OF DECISION
Address: 1/2 MILE E OF LOCKBOURNE
LOCKBOURNE, OH 43217
EPA Region: 05

RICKENBACKER ANGB BUILDING 560 (Continued) **1009968774**

County: FRANKLIN
Event Code: Not reported
Inst. Control: Deed Restriction
Actual Date: Not reported
Complet. Date: 10/14/1999
Operable Unit: 01
Contaminated Media : Groundwater
Contact Name : Not reported
Contact Phone and Ext : Not reported
Event Code Description: Not reported

EPA ID: OH3571924544
Site ID: 0506870
Name: RICKENBACKER AIR NATIONAL GUARD (USAF)
Action Name: RECORD OF DECISION
Address: 1/2 MILE E OF LOCKBOURNE
LOCKBOURNE, OH 43217
EPA Region: 05
County: FRANKLIN
Event Code: Not reported
Inst. Control: Drilling Restriction
Actual Date: Not reported
Complet. Date: 10/14/1999
Operable Unit: 01
Contaminated Media : Groundwater
Contact Name : Not reported
Contact Phone and Ext : Not reported
Event Code Description: Not reported

ROD:
Full-text of USEPA Record of Decision(s) is available from EDR.

B10 **RICKENBACKER ANGB BUILDING 560** **CORRACTS** **1015757932**
NW **7161 2ND ST** **PADS** **OH3571924544**
1/2-1 **COLUMBUS, OH 43217** **NY MANIFEST**
0.866 mi.
4574 ft. **Site 2 of 3 in cluster B**

Relative:
Higher

Actual:
740 ft.

CORRACTS:
EPA ID: OH3571924544
EPA Region: 5
Area Name: ENTIRE FACILITY
Actual Date: 19970411
Action: CA210SF - CA Responsibility Referred To A Non-RCRA Federal Authority, Corrective Action at the facility or area referred to CERCLA
NAICS Code(s): 48811
Airport Operations
Original schedule date: Not reported
Schedule end date: Not reported

EPA ID: OH3571924544
EPA Region: 5
Area Name: ENTIRE FACILITY
Actual Date: 19950816
Action: CA210SF - CA Responsibility Referred To A Non-RCRA Federal Authority, Corrective Action at the facility or area referred to CERCLA
NAICS Code(s): 48811

RICKENBACKER ANGB BUILDING 560 (Continued) **1015757932**

	Airport Operations
Original schedule date:	Not reported
Schedule end date:	Not reported
EPA ID:	OH3571924544
EPA Region:	5
Area Name:	ENTIRE FACILITY
Actual Date:	19920401
Action:	CA050 - RFA Completed
NAICS Code(s):	48811 Airport Operations
Original schedule date:	Not reported
Schedule end date:	Not reported
EPA ID:	OH3571924544
EPA Region:	5
Area Name:	ENTIRE FACILITY
Actual Date:	19920401
Action:	CA070YE - RFA Determination Of Need For An RFI, RFI is Necessary
NAICS Code(s):	48811 Airport Operations
Original schedule date:	Not reported
Schedule end date:	Not reported
EPA ID:	OH3571924544
EPA Region:	5
Area Name:	ENTIRE FACILITY
Actual Date:	19920228
Action:	CA225NR - Stabilization Measures Evaluation, This facility is, not amenable to stabilization activity at the, present time for reasons other than (1) it appears to be technically, infeasible or inappropriate (NF) or (2) there is a lack of technical, information (IN). Reasons for this conclusion may be the status of, closure at the facility, the degree of risk, timing considerations, the status of corrective action work at the facility, or other, administrative considerations
NAICS Code(s):	48811 Airport Operations
Original schedule date:	Not reported
Schedule end date:	Not reported
EPA ID:	OH3571924544
EPA Region:	5
Area Name:	ENTIRE FACILITY
Actual Date:	19910927
Action:	CA075HI - CA Prioritization, Facility or area was assigned a high corrective action priority
NAICS Code(s):	48811 Airport Operations
Original schedule date:	Not reported
Schedule end date:	Not reported

PADS:

EPAID:	OH3571924544
Facility name:	RICKENBACKER ANGB
Facility Address:	7556 S PERIMETER ROAD, BLDG 905 COLUMBUS, OH 43217-5910

RICKENBACKER ANGB BUILDING 560 (Continued) **1015757932**

Facility country: US
Generator: Yes
Storer: No
Transporter: No
Disposer: No
Research facility: No
Smelter: No
Facility owner name: RICKENBACKER ANGB
Contact title: Not reported
Contact name: ST. ALVAREZ, SAUL
Contact tel: (614)492-3132
Contact extension: Not reported
Mailing address: 7556 S. PERIMETER ROAD, 121 SG/EM
COLUMBUS, OH 43217-5910
Mailing country: US
Cert. title: Not reported
Cert. name: Not reported
Cert. date: 02/07/1994
Date received: 03/02/1994

NY MANIFEST:
Country: USA
EPA ID: OH0000553826
Facility Status: Not reported
Location Address 1: 7556 SOUTH PERIMETER RD
Code: BP
Location Address 2: Not reported
Total Tanks: Not reported
Location City: COLUMBUS
Location State: OH
Location Zip: 43217
Location Zip 4: Not reported

NY MANIFEST:
EPAID: OH0000553826
Mailing Name: RICKENBACKER ANGB121ST SG
Mailing Contact: LEROY EDWARDS
Mailing Address 1: 7556 SOUTH PERIMETER RD
Mailing Address 2: Not reported
Mailing City: COLUMBUS
Mailing State: OH
Mailing Zip: 43217
Mailing Zip 4: Not reported
Mailing Country: USA
Mailing Phone: 6144923200

NY MANIFEST:
Document ID: NYG1228941
Manifest Status: Not reported
seq: 02
Year: 1998
Trans1 State ID: Not reported
Trans2 State ID: Not reported
Generator Ship Date: 12/18/1998
Trans1 Recv Date: 12/18/1998
Trans2 Recv Date: Not reported
TSD Site Recv Date: 12/28/1998

RICKENBACKER ANGB BUILDING 560 (Continued) **1015757932**

Part A Recv Date: Not reported
Part B Recv Date: Not reported
Generator EPA ID: OH0000553826
Trans1 EPA ID: OHR000028498
Trans2 EPA ID: Not reported
TSDF ID 1: NYD049836679
TSDF ID 2: Not reported
Manifest Tracking Number: Not reported
Import Indicator: Not reported
Export Indicator: Not reported
Discr Quantity Indicator: Not reported
Discr Type Indicator: Not reported
Discr Residue Indicator: Not reported
Discr Partial Reject Indicator: Not reported
Discr Full Reject Indicator: Not reported
Manifest Ref Number: Not reported
Alt Facility RCRA ID: Not reported
Alt Facility Sign Date: Not reported
MGMT Method Type Code: Not reported
Waste Code: D009 - MERCURY 0.2 MG/L TCLP
Waste Code: Not reported
Waste Code: Not reported
Waste Code: Not reported
Waste Code: Not reported
Waste Code: Not reported
Quantity: 00004
Units: P - Pounds
Number of Containers: 001
Container Type: DF - Fiberboard or plastic drums (glass)
Handling Method: T Chemical, physical, or biological treatment.
Specific Gravity: 01.00
Waste Code: D009 - MERCURY 0.2 MG/L TCLP
Waste Code: Not reported
Waste Code: Not reported
Waste Code: Not reported
Waste Code: Not reported
Quantity: 00007
Units: P - Pounds
Number of Containers: 001
Container Type: DF - Fiberboard or plastic drums (glass)
Handling Method: R Material recovery of more than 75 percent of the total material.
Specific Gravity: 01.00
Waste Code: D009 - MERCURY 0.2 MG/L TCLP
Waste Code: Not reported
Waste Code: Not reported
Waste Code: Not reported
Waste Code: Not reported
Quantity: 00004
Units: P - Pounds
Number of Containers: 001
Container Type: DF - Fiberboard or plastic drums (glass)
Handling Method: T Chemical, physical, or biological treatment.
Specific Gravity: 01.00
Waste Code: D009 - MERCURY 0.2 MG/L TCLP
Waste Code: Not reported
Waste Code: Not reported
Waste Code: Not reported

RICKENBACKER ANGB BUILDING 560 (Continued) **1015757932**

Waste Code: Not reported
Quantity: 00007
Units: P - Pounds
Number of Containers: 001
Container Type: DF - Fiberboard or plastic drums (glass)
Handling Method: R Material recovery of more than 75 percent of the total material.
Specific Gravity: 01.00

Country: USA
EPA ID: OH3571924544
Facility Status: Not reported
Location Address 1: DET 1 HQ OANG/DE
Code: BP
Location Address 2: Not reported
Total Tanks: Not reported
Location City: RICKENBACKER AIR FORCE
Location State: OH
Location Zip: 43217
Location Zip 4: Not reported

NY MANIFEST:
EPAID: OH3571924544
Mailing Name: UNITED STATES AIRFORCE BASE-RICKENBACKER
Mailing Contact: JOSEPH J FURLOUGH
Mailing Address 1: DET 1 HQ OANG/DE RICKENBACKER
Mailing Address 2: Not reported
Mailing City: AIR FORCE BASE
Mailing State: OH
Mailing Zip: 43217
Mailing Zip 4: Not reported
Mailing Country: USA
Mailing Phone: 6142383244

NY MANIFEST:
Document ID: NYO4196016
Manifest Status: C
seq: Not reported
Year: 1984
Trans1 State ID: NYJA044
Trans2 State ID: Not reported
Generator Ship Date: 06/07/1984
Trans1 Recv Date: 06/07/1984
Trans2 Recv Date: / /
TSD Site Recv Date: 06/07/1984
Part A Recv Date: 06/13/1984
Part B Recv Date: 06/27/1984
Generator EPA ID: OH3571924544
Trans1 EPA ID: NJD071629976
Trans2 EPA ID: Not reported
TSDF ID 1: NYD049836679
TSDF ID 2: Not reported
Manifest Tracking Number: Not reported
Import Indicator: Not reported
Export Indicator: Not reported
Discr Quantity Indicator: Not reported
Discr Type Indicator: Not reported

RICKENBACKER ANGB BUILDING 560 (Continued) **1015757932**

Discr Residue Indicator: Not reported
Discr Partial Reject Indicator: Not reported
Discr Full Reject Indicator: Not reported
Manifest Ref Number: Not reported
Alt Facility RCRA ID: Not reported
Alt Facility Sign Date: Not reported
MGMT Method Type Code: Not reported
Waste Code: B002 - PETROLEUM OIL WITH 50 BUT < 500 PPM PCB
Waste Code: Not reported
Waste Code: Not reported
Waste Code: Not reported
Waste Code: Not reported
Waste Code: Not reported
Quantity: 01925
Units: P - Pounds
Number of Containers: 008
Container Type: DM - Metal drums, barrels
Handling Method: Not reported
Specific Gravity: 100

Click this hyperlink while viewing on your computer to access
-1 additional NY MANIFEST: record(s) in the EDR Site Report.

B11 **RICKENBACKER ANGB 121ST** **OH DERR** **S105153725**
NW **7370 MINUTEMAN WAY** **OH SPILLS** **N/A**
1/2-1 **COLUMBUS, OH 43217** **OH NPDES**
0.866 mi. **OH VAPOR**
4574 ft. **Site 3 of 3 in cluster B** **OH UIC**

Relative:
Higher

Actual:
740 ft.

DERR:
DERR ID: 125002029
District: CDO
Alias: Not reported
Lat/Long: 39.811859 -82.943438
CERCLIS ID: Not reported
Program: **Emergency Response Site Assessment Remedial Response**
Decode for Activity: Emergency Response, Site Assessment, Remedial Response

SPILLS:
Spill Number: 1012-25-3434
Spill Year: 2010
Date Spill Reported: 12/30/2010
Spill Month: 12
Spill Number: 3434
Rep Name: JANICE CHURCH
Confidential: Not reported
District Code: CD
District Description: Central
EMP Number: 1786
Area Name: Not reported
Affiliation: Not reported
Object ID: Not reported
Spill Size: Not reported
Spill Type: Not reported
Ext Haz: Not reported
OEPA Dist: Not reported

RICKENBACKER ANGB 121ST (Continued) **S105153725**

Incident Type Code:	Not reported
Incident Type Description:	Not reported
Modifying Circumstance Code:	Not reported
Modifying Circumstance Description:	Not reported
Latitude:	3948428
Longitude:	8256362

SPILLS:

Substance:	JP8 FUEL
Media:	Not reported
Reported Amount:	Not reported
Reported UOM:	Not reported
Spill Number:	1012-25-3434

Spill Number:	1410-25-2164
Spill Year:	2014
Date Spill Reported:	10/16/2014
Spill Month:	10
Spill Number:	2164
Rep Name:	BETH MOWERY
Confidential:	Not reported
District Code:	CD
District Description:	Central
EMP Number:	1752
Area Name:	Not reported
Affiliation:	Not reported
Object ID:	Not reported
Spill Size:	Not reported
Spill Type:	Not reported
Ext Haz:	Not reported
OEPA Dist:	Not reported
Incident Type Code:	Not reported
Incident Type Description:	Not reported
Modifying Circumstance Code:	Not reported
Modifying Circumstance Description:	Not reported
Latitude:	3948360
Longitude:	8256347

SPILLS:

Substance:	ASPHALT EMULSION
Media:	Not reported
Reported Amount:	Not reported
Reported UOM:	Not reported
Spill Number:	1410-25-2164

OH NPDES:

Issue Date:	01/23/2012
Township:	Not reported
Facility Npdes Permit:	4GC03745*AG
Applicant Name:	SHERRICK WOOLPERT JV LLC
Applicant Address:	307 EMERY DR NASHVILLETN 37214

Issue Date:	10/23/2015
Township:	Not reported
Facility Npdes Permit:	4GC05123*AG
Applicant Name:	JOHN CECIL CONSTRUCTION LLC

RICKENBACKER ANGB 121ST (Continued) **S105153725**

Applicant Address: 743 N JAMES RD COLUMBUSOH 43219

VAPOR:
Parent ID: 125002029
Project ID: 125002029005
Project Name: Ohang Rickenbacker, Columbus
Program: RR
District: CDO
Site Coordinator: Not reported
Project Type: Remedial Action
Site Screen Completed?: Yes
Follow Up Required?: Yes
Follow Up Completed?: Not reported
Disclaimer: http://epa.ohio.gov/Portals/30/TCE_Disclaimer.pdf

UIC:
Facility Status: Temporarily Abandoned
UIC Number: Not reported
Type Of UIC Well: Ground Water Remediation
Well Status: Not reported
AUT Status: Rule Authorized
Latitude: 39.81633
Longitude: -82.94203
Number Of UIC Wells: Not reported
Well Site: Class V
Type Description: Not reported

Facility Status: Temporarily Abandoned
UIC Number: Not reported
Type Of UIC Well: Ground Water Remediation
Well Status: Not reported
AUT Status: Rule Authorized
Latitude: 39.81633
Longitude: -82.94203
Number Of UIC Wells: Not reported
Well Site: Class V
Type Description: Not reported

Facility Status: Temporarily Abandoned
UIC Number: Not reported
Type Of UIC Well: Ground Water Remediation
Well Status: Not reported
AUT Status: Rule Authorized
Latitude: 39.81633
Longitude: -82.94203
Number Of UIC Wells: Not reported
Well Site: Class V
Type Description: Not reported

Facility Status: Temporarily Abandoned
UIC Number: Not reported
Type Of UIC Well: Ground Water Remediation
Well Status: Not reported
AUT Status: Rule Authorized
Latitude: 39.81633
Longitude: -82.94203

RICKENBACKER ANGB 121ST (Continued) **S105153725**

Number Of UIC Wells:	Not reported
Well Site:	Class V
Type Description:	Not reported

Facility Status:	Temporarily Abandoned
UIC Number:	Not reported
Type Of UIC Well:	Ground Water Remediation
Well Status:	Not reported
AUT Status:	Rule Authorized
Latitude:	39.81633
Longitude:	-82.94203
Number Of UIC Wells:	Not reported
Well Site:	Class V
Type Description:	Not reported

Facility Status:	Temporarily Abandoned
UIC Number:	Not reported
Type Of UIC Well:	Ground Water Remediation
Well Status:	Not reported
AUT Status:	Rule Authorized
Latitude:	39.81633
Longitude:	-82.94203
Number Of UIC Wells:	Not reported
Well Site:	Class V
Type Description:	Not reported

Facility Status:	Permenantly Abandoned
UIC Number:	Not reported
Type Of UIC Well:	Ground Water Remediation
Well Status:	Not reported
AUT Status:	Rule Authorized
Latitude:	39.81633
Longitude:	-82.94203
Number Of UIC Wells:	Not reported
Well Site:	Class V
Type Description:	Not reported

Facility Status:	Permenantly Abandoned
UIC Number:	Not reported
Type Of UIC Well:	Ground Water Remediation
Well Status:	Not reported
AUT Status:	Rule Authorized
Latitude:	39.81633
Longitude:	-82.94203
Number Of UIC Wells:	Not reported
Well Site:	Class V
Type Description:	Not reported

Facility Status:	Permenantly Abandoned
UIC Number:	Not reported
Type Of UIC Well:	Ground Water Remediation
Well Status:	Not reported
AUT Status:	Rule Authorized
Latitude:	39.81633
Longitude:	-82.94203
Number Of UIC Wells:	Not reported
Well Site:	Class V

RICKENBACKER ANGB 121ST (Continued) **S105153725**

Type Description: Not reported

Facility Status: Permenantly Abandoned
UIC Number: Not reported
Type Of UIC Well: Ground Water Remediation
Well Status: Not reported
AUT Status: Rule Authorized
Latitude: 39.81633
Longitude: -82.94203
Number Of UIC Wells: Not reported
Well Site: Class V
Type Description: Not reported

Facility Status: Permenantly Abandoned
UIC Number: Not reported
Type Of UIC Well: Ground Water Remediation
Well Status: Not reported
AUT Status: Rule Authorized
Latitude: 39.81633
Longitude: -82.94203
Number Of UIC Wells: Not reported
Well Site: Class V
Type Description: Not reported

Facility Status: Permenantly Abandoned
UIC Number: Not reported
Type Of UIC Well: Ground Water Remediation
Well Status: Not reported
AUT Status: Rule Authorized
Latitude: 39.81633
Longitude: -82.94203
Number Of UIC Wells: Not reported
Well Site: Class V
Type Description: Not reported

Facility Status: Permenantly Abandoned
UIC Number: Not reported
Type Of UIC Well: Ground Water Remediation
Well Status: Not reported
AUT Status: Rule Authorized
Latitude: 39.81633
Longitude: -82.94203
Number Of UIC Wells: Not reported
Well Site: Class V
Type Description: Not reported

Facility Status: Permenantly Abandoned
UIC Number: Not reported
Type Of UIC Well: Ground Water Remediation
Well Status: Not reported
AUT Status: Rule Authorized
Latitude: 39.81633
Longitude: -82.94203
Number Of UIC Wells: Not reported
Well Site: Class V
Type Description: Not reported

RICKENBACKER ANGB 121ST (Continued) **S105153725**

Facility Status: Permenantly Abandoned
UIC Number: Not reported
Type Of UIC Well: Ground Water Remediation
Well Status: Not reported
AUT Status: Rule Authorized
Latitude: 39.81633
Longitude: -82.94203
Number Of UIC Wells: Not reported
Well Site: Class V
Type Description: Not reported

Facility Status: Permenantly Abandoned
UIC Number: Not reported
Type Of UIC Well: Ground Water Remediation
Well Status: Not reported
AUT Status: Rule Authorized
Latitude: 39.81633
Longitude: -82.94203
Number Of UIC Wells: Not reported
Well Site: Class V
Type Description: Not reported

Facility Status: Permenantly Abandoned
UIC Number: Not reported
Type Of UIC Well: Ground Water Remediation
Well Status: Not reported
AUT Status: Rule Authorized
Latitude: 39.81633
Longitude: -82.94203
Number Of UIC Wells: Not reported
Well Site: Class V
Type Description: Not reported

Facility Status: Permenantly Abandoned
UIC Number: Not reported
Type Of UIC Well: Ground Water Remediation
Well Status: Not reported
AUT Status: Rule Authorized
Latitude: 39.81633
Longitude: -82.94203
Number Of UIC Wells: Not reported
Well Site: Class V
Type Description: Not reported

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12 **WNW** **1/2-1** **0.877 mi.** **4628 ft.**	**RICKENBACKER ANG** **7556 S PERIMETER RD** **COLUMBUS, OH 43217**	**OH DERR** **OH INST CONTROL** **OH SPILLS** **OH VAPOR**	**S100752865** **N/A**

Relative:
Higher

Actual:
734 ft.

DERR:
DERR ID: 125000685
District: CDO
Alias: Not reported
Lat/Long: 39.820469 -82.950967
CERCLIS ID: OH3571924544
Program: **Site Assessment Remedial Response**
Decode for Activity: Site Assessment, Remedial Response

RICKENBACKER ANG (Continued) **S100752865**

DERR ID: 125001255
District: CDO
Alias: Not reported
Lat/Long: 39.807738 -82.958122
CERCLIS ID: Not reported
Program: **Site Assessment Remedial Response**
Decode for Activity: Site Assessment, Remedial Response

DERR ID: 125001513
District: CDO
Alias: Not reported
Lat/Long: 39.80239 -82.930414
CERCLIS ID: Not reported
Program: **Site Assessment Remedial Response**
Decode for Activity: Site Assessment, Remedial Response

INST CONTROL:

NFA Number: Not reported
Land Use: Not reported
Site Id: 125000685
Project Id: 125000685003
District: CDO
Lat/Long: Not reported
Program Area: RR
Project Type: EBS/FOST/FOSL
IC Type: Commercial Use Restriction
IC Mechanism: Declaration of Use Restriction
Prog Area Decode: Remedial Response

NFA Number: Not reported
Land Use: Not reported
Site Id: 125000685
Project Id: 125000685003
District: CDO
Lat/Long: Not reported
Program Area: RR
Project Type: EBS/FOST/FOSL
IC Type: Industrial Use Restriction
IC Mechanism: Declaration of Use Restriction
Prog Area Decode: Remedial Response

NFA Number: Not reported
Land Use: Not reported
Site Id: 125000685
Project Id: 125000685003
District: CDO
Lat/Long: Not reported
Program Area: RR
Project Type: EBS/FOST/FOSL
IC Type: Potable & Non-potable GW Extraction/Use Restriction
IC Mechanism: Declaration of Use Restriction
Prog Area Decode: Remedial Response

NFA Number: Not reported
Land Use: Not reported
Site Id: 125000685
Project Id: 125000685003

RICKENBACKER ANG (Continued) **S100752865**

District:	CDO
Lat/Long:	Not reported
Program Area:	RR
Project Type:	EBS/FOST/FOSL
IC Type:	Transportation Use Restriction
IC Mechanism:	Declaration of Use Restriction
Prog Area Decode:	Remedial Response

NFA Number:	Not reported
Land Use:	Not reported
Site Id:	125000685
Project Id:	125000685008
District:	CDO
Lat/Long:	Not reported
Program Area:	RR
Project Type:	EBS/FOST/FOSL
IC Type:	Commercial Use Restriction
IC Mechanism:	Declaration of Use Restriction
Prog Area Decode:	Remedial Response

NFA Number:	Not reported
Land Use:	Not reported
Site Id:	125000685
Project Id:	125000685008
District:	CDO
Lat/Long:	Not reported
Program Area:	RR
Project Type:	EBS/FOST/FOSL
IC Type:	Industrial Use Restriction
IC Mechanism:	Declaration of Use Restriction
Prog Area Decode:	Remedial Response

NFA Number:	Not reported
Land Use:	Not reported
Site Id:	125000685
Project Id:	125000685008
District:	CDO
Lat/Long:	Not reported
Program Area:	RR
Project Type:	EBS/FOST/FOSL
IC Type:	Transportation Use Restriction
IC Mechanism:	Declaration of Use Restriction
Prog Area Decode:	Remedial Response

NFA Number:	Not reported
Land Use:	Not reported
Site Id:	125000685
Project Id:	125000685010
District:	CDO
Lat/Long:	Not reported
Program Area:	RR
Project Type:	EBS/FOST/FOSL
IC Type:	Commercial Use Restriction
IC Mechanism:	Declaration of Use Restriction
Prog Area Decode:	Remedial Response

NFA Number:	Not reported

RICKENBACKER ANG (Continued) **S100752865**

Land Use: Not reported
Site Id: 125000685
Project Id: 125000685010
District: CDO
Lat/Long: Not reported
Program Area: RR
Project Type: EBS/FOST/FOSL
IC Type: Industrial Use Restriction
IC Mechanism: Declaration of Use Restriction
Prog Area Decode: Remedial Response

NFA Number: Not reported
Land Use: Not reported
Site Id: 125000685
Project Id: 125000685010
District: CDO
Lat/Long: Not reported
Program Area: RR
Project Type: EBS/FOST/FOSL
IC Type: Transportation Use Restriction
IC Mechanism: Declaration of Use Restriction
Prog Area Decode: Remedial Response

NFA Number: Not reported
Land Use: Not reported
Site Id: 125000685
Project Id: 125000685013
District: CDO
Lat/Long: Not reported
Program Area: RR
Project Type: EBS/FOST/FOSL
IC Type: Commercial Use Restriction
IC Mechanism: Declaration of Use Restriction
Prog Area Decode: Remedial Response

NFA Number: Not reported
Land Use: Not reported
Site Id: 125000685
Project Id: 125000685013
District: CDO
Lat/Long: Not reported
Program Area: RR
Project Type: EBS/FOST/FOSL
IC Type: Industrial Use Restriction
IC Mechanism: Declaration of Use Restriction
Prog Area Decode: Remedial Response

NFA Number: Not reported
Land Use: Not reported
Site Id: 125000685
Project Id: 125000685013
District: CDO
Lat/Long: Not reported
Program Area: RR
Project Type: EBS/FOST/FOSL
IC Type: Potable & Non-potable GW Extraction/Use Restriction
IC Mechanism: Declaration of Use Restriction

RICKENBACKER ANG (Continued) **S100752865**

Prog Area Decode: Remedial Response

NFA Number: Not reported
Land Use: Not reported
Site Id: 125000685
Project Id: 125000685013
District: CDO
Lat/Long: Not reported
Program Area: RR
Project Type: EBS/FOST/FOSL
IC Type: Transportation Use Restriction
IC Mechanism: Declaration of Use Restriction
Prog Area Decode: Remedial Response

NFA Number: Not reported
Land Use: Not reported
Site Id: 125000685
Project Id: 125000685058
District: CDO
Lat/Long: Not reported
Program Area: RR
Project Type: EBS/FOST/FOSL
IC Type: Commercial Use Restriction
IC Mechanism: Declaration of Use Restriction
Prog Area Decode: Remedial Response

NFA Number: Not reported
Land Use: Not reported
Site Id: 125000685
Project Id: 125000685058
District: CDO
Lat/Long: Not reported
Program Area: RR
Project Type: EBS/FOST/FOSL
IC Type: Industrial Use Restriction
IC Mechanism: Declaration of Use Restriction
Prog Area Decode: Remedial Response

NFA Number: Not reported
Land Use: Not reported
Site Id: 125000685
Project Id: 125000685058
District: CDO
Lat/Long: Not reported
Program Area: RR
Project Type: EBS/FOST/FOSL
IC Type: Potable & Non-potable GW Extraction/Use Restriction
IC Mechanism: Declaration of Use Restriction
Prog Area Decode: Remedial Response

NFA Number: Not reported
Land Use: Not reported
Site Id: 125000685
Project Id: 125000685058
District: CDO
Lat/Long: Not reported
Program Area: RR

RICKENBACKER ANG (Continued) **S100752865**

Project Type: EBS/FOST/FOSL
IC Type: Transportation Use Restriction
IC Mechanism: Declaration of Use Restriction
Prog Area Decode: Remedial Response

NFA Number: Not reported
Land Use: Not reported
Site Id: 125000685
Project Id: 125000685089
District: CDO
Lat/Long: Not reported
Program Area: RR
Project Type: EBS/FOST/FOSL
IC Type: Transportation Use Restriction
IC Mechanism: Declaration of Use Restriction
Prog Area Decode: Remedial Response

NFA Number: Not reported
Land Use: Not reported
Site Id: 125000685
Project Id: 125000685091
District: CDO
Lat/Long: Not reported
Program Area: RR
Project Type: EBS/FOST/FOSL
IC Type: Commercial Use Restriction
IC Mechanism: Declaration of Use Restriction
Prog Area Decode: Remedial Response

NFA Number: Not reported
Land Use: Not reported
Site Id: 125000685
Project Id: 125000685091
District: CDO
Lat/Long: Not reported
Program Area: RR
Project Type: EBS/FOST/FOSL
IC Type: Industrial Use Restriction
IC Mechanism: Declaration of Use Restriction
Prog Area Decode: Remedial Response

NFA Number: Not reported
Land Use: Not reported
Site Id: 125000685
Project Id: 125000685091
District: CDO
Lat/Long: Not reported
Program Area: RR
Project Type: EBS/FOST/FOSL
IC Type: Transportation Use Restriction
IC Mechanism: Declaration of Use Restriction
Prog Area Decode: Remedial Response

NFA Number: Not reported
Land Use: Not reported
Site Id: 125000685
Project Id: 125000685093

RICKENBACKER ANG (Continued) **S100752865**

District: CDO
Lat/Long: Not reported
Program Area: RR
Project Type: EBS/FOST/FOSL
IC Type: Potable & Non-potable GW Extraction/Use Restriction
IC Mechanism: Declaration of Use Restriction
Prog Area Decode: Remedial Response

NFA Number: Not reported
Land Use: Not reported
Site Id: 125000685
Project Id: 125000685093
District: CDO
Lat/Long: Not reported
Program Area: RR
Project Type: EBS/FOST/FOSL
IC Type: Transportation Use Restriction
IC Mechanism: Declaration of Use Restriction
Prog Area Decode: Remedial Response

NFA Number: Not reported
Land Use: Not reported
Site Id: 125000685
Project Id: 125000685095
District: CDO
Lat/Long: Not reported
Program Area: RR
Project Type: EBS/FOST/FOSL
IC Type: Transportation Use Restriction
IC Mechanism: Declaration of Use Restriction
Prog Area Decode: Remedial Response

NFA Number: Not reported
Land Use: Not reported
Site Id: 125000685
Project Id: 125000685097
District: CDO
Lat/Long: Not reported
Program Area: RR
Project Type: EBS/FOST/FOSL
IC Type: Transportation Use Restriction
IC Mechanism: Declaration of Use Restriction
Prog Area Decode: Remedial Response

NFA Number: Not reported
Land Use: Not reported
Site Id: 125000685
Project Id: 125000685098
District: CDO
Lat/Long: Not reported
Program Area: RR
Project Type: EBS/FOST/FOSL
IC Type: Commercial Use Restriction
IC Mechanism: Declaration of Use Restriction
Prog Area Decode: Remedial Response

NFA Number: Not reported

RICKENBACKER ANG (Continued) **S100752865**

Land Use: Not reported
Site Id: 125000685
Project Id: 125000685098
District: CDO
Lat/Long: Not reported
Program Area: RR
Project Type: EBS/FOST/FOSL
IC Type: Industrial Use Restriction
IC Mechanism: Declaration of Use Restriction
Prog Area Decode: Remedial Response

NFA Number: Not reported
Land Use: Not reported
Site Id: 125000685
Project Id: 125000685098
District: CDO
Lat/Long: Not reported
Program Area: RR
Project Type: EBS/FOST/FOSL
IC Type: Transportation Use Restriction
IC Mechanism: Declaration of Use Restriction
Prog Area Decode: Remedial Response

NFA Number: Not reported
Land Use: Not reported
Site Id: 125000685
Project Id: 125000685101
District: CDO
Lat/Long: Not reported
Program Area: RR
Project Type: EBS/FOST/FOSL
IC Type: Commercial Use Restriction
IC Mechanism: Declaration of Use Restriction
Prog Area Decode: Remedial Response

NFA Number: Not reported
Land Use: Not reported
Site Id: 125000685
Project Id: 125000685101
District: CDO
Lat/Long: Not reported
Program Area: RR
Project Type: EBS/FOST/FOSL
IC Type: Industrial Use Restriction
IC Mechanism: Declaration of Use Restriction
Prog Area Decode: Remedial Response

NFA Number: Not reported
Land Use: Not reported
Site Id: 125000685
Project Id: 125000685101
District: CDO
Lat/Long: Not reported
Program Area: RR
Project Type: EBS/FOST/FOSL
IC Type: Potable & Non-potable GW Extraction/Use Restriction
IC Mechanism: Declaration of Use Restriction

RICKENBACKER ANG (Continued) **S100752865**

Prog Area Decode: Remedial Response

NFA Number: Not reported
Land Use: Not reported
Site Id: 125000685
Project Id: 125000685101
District: CDO
Lat/Long: Not reported
Program Area: RR
Project Type: EBS/FOST/FOSL
IC Type: Subsurface Structure Construction Restriction
IC Mechanism: Declaration of Use Restriction
Prog Area Decode: Remedial Response

NFA Number: Not reported
Land Use: Not reported
Site Id: 125000685
Project Id: 125000685101
District: CDO
Lat/Long: Not reported
Program Area: RR
Project Type: EBS/FOST/FOSL
IC Type: Transportation Use Restriction
IC Mechanism: Declaration of Use Restriction
Prog Area Decode: Remedial Response

NFA Number: Not reported
Land Use: Not reported
Site Id: 125000685
Project Id: 125000685114
District: CDO
Lat/Long: Not reported
Program Area: RR
Project Type: Remedial Action
IC Type: Potable & Non-potable GW Extraction/Use Restriction
IC Mechanism: Use Restriction Agreement (Equitable Servitude)
Prog Area Decode: Remedial Response

NFA Number: Not reported
Land Use: Not reported
Site Id: 125000685
Project Id: 125000685114
District: CDO
Lat/Long: Not reported
Program Area: RR
Project Type: Remedial Action
IC Type: Transportation Use Restriction
IC Mechanism: Use Restriction Agreement (Equitable Servitude)
Prog Area Decode: Remedial Response

SPILLS:
Spill Number: 9601-25-0028
Spill Year: 1996
Date Spill Reported: 01/03/1996
Spill Month: 1
Spill Number: 0028
Rep Name: ROGER JONES

RICKENBACKER ANG (Continued) **S100752865**

Confidential: N
District Code: CD
District Description: Central
EMP Number: Not reported
Area Name: Not reported
Affiliation: Not reported
Object ID: Not reported
Spill Size: Not reported
Spill Type: Not reported
Ext Haz: Not reported
OEPA Dist: Not reported
Incident Type Code: Not reported
Incident Type Description: Not reported
Modifying Circumstance Code: Not reported
Modifying Circumstance Description: Not reported
Latitude: Not reported
Longitude: Not reported

SPILLS:
Substance: JET A FUEL
Media: Not reported
Reported Amount: Not reported
Reported UOM: Not reported
Spill Number: 9601-25-0028

VAPOR:
Parent ID: 125000685
Project ID: 125000685001
Project Name: Rickenbacker AFB, Columbus
Program: RR
District: CDO
Site Coordinator: Not reported
Project Type: Remedial Action Operation & Maintenance
Site Screen Completed?: Yes
Follow Up Required?: Yes
Follow Up Completed?: Not reported
Disclaimer: http://epa.ohio.gov/Portals/30/TCE_Disclaimer.pdf

Parent ID: 125000685
Project ID: 125000685105 125000685106 125000685107 OH3571924544
Project Name: Rickenbacker AFB, Columbus
Program: RCRA
District: CDO
Site Coordinator: Not reported
Project Type: Closure Oversight & Verification Post Closure Care RCRA Periodic Review
Site Screen Completed?: Yes
Follow Up Required?: Yes
Follow Up Completed?: Not reported
Disclaimer: http://epa.ohio.gov/Portals/30/TCE_Disclaimer.pdf

Parent ID: 125000685
Project ID: 125000685108
Project Name: Rickenbacker AFB, Columbus
Program: SA
District: CDO
Site Coordinator: Not reported

RICKENBACKER ANG (Continued) **S100752865**

Project Type: Site Inspection
Site Screen Completed?: Yes
Follow Up Required?: Yes
Follow Up Completed?: Not reported
Disclaimer: http://epa.ohio.gov/Portals/30/TCE_Disclaimer.pdf

Parent ID: 125000685
Project ID: 125000685110
Project Name: Rickenbacker AFB, Columbus
Program: RR
District: CDO
Site Coordinator: Not reported
Project Type: Remedial Action
Site Screen Completed?: Yes
Follow Up Required?: Yes
Follow Up Completed?: Not reported
Disclaimer: http://epa.ohio.gov/Portals/30/TCE_Disclaimer.pdf

Parent ID: 125001513
Project ID: 125001513002
Project Name: Lockbourne AFB UST Contamination, Columbus
Program: SA
District: CDO
Site Coordinator: Not reported
Project Type: Site Inspection
Site Screen Completed?: Yes
Follow Up Required?: Yes
Follow Up Completed?: Not reported
Disclaimer: http://epa.ohio.gov/Portals/30/TCE_Disclaimer.pdf

Parent ID: 125001513
Project ID: 125001513016
Project Name: Lockbourne AFB UST Contamination, Columbus
Program: RR
District: CDO
Site Coordinator: Not reported
Project Type: Site Inspection
Site Screen Completed?: Yes
Follow Up Required?: Yes
Follow Up Completed?: Not reported
Disclaimer: http://epa.ohio.gov/Portals/30/TCE_Disclaimer.pdf

Parent ID: 125001513
Project ID: 125001513019
Project Name: Lockbourne AFB UST Contamination, Columbus
Program: RR
District: CDO
Site Coordinator: Not reported
Project Type: Remedial Investigation
Site Screen Completed?: Yes
Follow Up Required?: Yes
Follow Up Completed?: Not reported
Disclaimer: http://epa.ohio.gov/Portals/30/TCE_Disclaimer.pdf

Count: 0 records.

ORPHAN SUMMARY

City	EDR ID	Site Name	Site Address	Zip	Database(s)
		NO SITES FOUND			

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

To maintain currency of the following federal and state databases, EDR contacts the appropriate governmental agency on a monthly or quarterly basis, as required.

Number of Days to Update: Provides confirmation that EDR is reporting records that have been updated within 90 days from the date the government agency made the information available to the public.

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL: National Priority List

National Priorities List (Superfund). The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. NPL sites may encompass relatively large areas. As such, EDR provides polygon coverage for over 1,000 NPL site boundaries produced by EPA's Environmental Photographic Interpretation Center (EPIC) and regional EPA offices.

Date of Government Version: 07/17/2018
Date Data Arrived at EDR: 08/09/2018
Date Made Active in Reports: 09/07/2018
Number of Days to Update: 29

Source: EPA
Telephone: N/A
Last EDR Contact: 10/04/2018
Next Scheduled EDR Contact: 01/14/2019
Data Release Frequency: Quarterly

NPL Site Boundaries

Sources:

EPA's Environmental Photographic Interpretation Center (EPIC)
Telephone: 202-564-7333

EPA Region 1
Telephone 617-918-1143

EPA Region 3
Telephone 215-814-5418

EPA Region 4
Telephone 404-562-8033

EPA Region 5
Telephone 312-886-6686

EPA Region 10
Telephone 206-553-8665

EPA Region 6
Telephone: 214-655-6659

EPA Region 7
Telephone: 913-551-7247

EPA Region 8
Telephone: 303-312-6774

EPA Region 9
Telephone: 415-947-4246

Proposed NPL: Proposed National Priority List Sites

A site that has been proposed for listing on the National Priorities List through the issuance of a proposed rule in the Federal Register. EPA then accepts public comments on the site, responds to the comments, and places on the NPL those sites that continue to meet the requirements for listing.

Date of Government Version: 07/17/2018
Date Data Arrived at EDR: 08/09/2018
Date Made Active in Reports: 09/07/2018
Number of Days to Update: 29

Source: EPA
Telephone: N/A
Last EDR Contact: 10/04/2018
Next Scheduled EDR Contact: 01/14/2019
Data Release Frequency: Quarterly

NPL LIENS: Federal Superfund Liens

Federal Superfund Liens. Under the authority granted the USEPA by CERCLA of 1980, the USEPA has the authority to file liens against real property in order to recover remedial action expenditures or when the property owner received notification of potential liability. USEPA compiles a listing of filed notices of Superfund Liens.

Date of Government Version: 10/15/1991	Source: EPA
Date Data Arrived at EDR: 02/02/1994	Telephone: 202-564-4267
Date Made Active in Reports: 03/30/1994	Last EDR Contact: 08/15/2011
Number of Days to Update: 56	Next Scheduled EDR Contact: 11/28/2011
	Data Release Frequency: No Update Planned

Federal Delisted NPL site list

Delisted NPL: National Priority List Deletions

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate.

Date of Government Version: 07/17/2018	Source: EPA
Date Data Arrived at EDR: 08/09/2018	Telephone: N/A
Date Made Active in Reports: 09/07/2018	Last EDR Contact: 10/04/2018
Number of Days to Update: 29	Next Scheduled EDR Contact: 01/14/2019
	Data Release Frequency: Quarterly

Federal CERCLIS list

FEDERAL FACILITY: Federal Facility Site Information listing

A listing of National Priority List (NPL) and Base Realignment and Closure (BRAC) sites found in the Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) Database where EPA Federal Facilities Restoration and Reuse Office is involved in cleanup activities.

Date of Government Version: 11/07/2016	Source: Environmental Protection Agency
Date Data Arrived at EDR: 01/05/2017	Telephone: 703-603-8704
Date Made Active in Reports: 04/07/2017	Last EDR Contact: 07/06/2018
Number of Days to Update: 92	Next Scheduled EDR Contact: 10/15/2018
	Data Release Frequency: Varies

SEMS: Superfund Enterprise Management System

SEMS (Superfund Enterprise Management System) tracks hazardous waste sites, potentially hazardous waste sites, and remedial activities performed in support of EPA's Superfund Program across the United States. The list was formerly know as CERCLIS, renamed to SEMS by the EPA in 2015. The list contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). This dataset also contains sites which are either proposed to or on the National Priorities List (NPL) and the sites which are in the screening and assessment phase for possible inclusion on the NPL.

Date of Government Version: 07/17/2018	Source: EPA
Date Data Arrived at EDR: 08/09/2018	Telephone: 800-424-9346
Date Made Active in Reports: 09/07/2018	Last EDR Contact: 10/04/2018
Number of Days to Update: 29	Next Scheduled EDR Contact: 10/29/2018
	Data Release Frequency: Quarterly

Federal CERCLIS NFRAP site list

SEMS-ARCHIVE: Superfund Enterprise Management System Archive

SEMS-ARCHIVE (Superfund Enterprise Management System Archive) tracks sites that have no further interest under the Federal Superfund Program based on available information. The list was formerly known as the CERCLIS-NFRAP, renamed to SEMS ARCHIVE by the EPA in 2015. EPA may perform a minimal level of assessment work at a site while it is archived if site conditions change and/or new information becomes available. Archived sites have been removed and archived from the inventory of SEMS sites. Archived status indicates that, to the best of EPA's knowledge, assessment at a site has been completed and that EPA has determined no further steps will be taken to list the site on the National Priorities List (NPL), unless information indicates this decision was not appropriate or other considerations require a recommendation for listing at a later time. The decision does not necessarily mean that there is no hazard associated with a given site; it only means that. based upon available information, the location is not judged to be potential NPL site.

Date of Government Version: 07/17/2018
Date Data Arrived at EDR: 08/09/2018
Date Made Active in Reports: 09/07/2018
Number of Days to Update: 29

Source: EPA
Telephone: 800-424-9346
Last EDR Contact: 10/04/2018
Next Scheduled EDR Contact: 01/14/2019
Data Release Frequency: Quarterly

Federal RCRA CORRACTS facilities list

CORRACTS: Corrective Action Report
CORRACTS identifies hazardous waste handlers with RCRA corrective action activity.

Date of Government Version: 03/01/2018
Date Data Arrived at EDR: 03/28/2018
Date Made Active in Reports: 06/22/2018
Number of Days to Update: 86

Source: EPA
Telephone: 800-424-9346
Last EDR Contact: 09/19/2018
Next Scheduled EDR Contact: 01/07/2019
Data Release Frequency: Quarterly

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF: RCRA - Treatment, Storage and Disposal
RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Transporters are individuals or entities that move hazardous waste from the generator offsite to a facility that can recycle, treat, store, or dispose of the waste. TSDFs treat, store, or dispose of the waste.

Date of Government Version: 03/01/2018
Date Data Arrived at EDR: 03/28/2018
Date Made Active in Reports: 06/22/2018
Number of Days to Update: 86

Source: Environmental Protection Agency
Telephone: 312-886-6186
Last EDR Contact: 09/19/2018
Next Scheduled EDR Contact: 01/07/2019
Data Release Frequency: Quarterly

Federal RCRA generators list

RCRA-LQG: RCRA - Large Quantity Generators
RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Large quantity generators (LQGs) generate over 1,000 kilograms (kg) of hazardous waste, or over 1 kg of acutely hazardous waste per month.

Date of Government Version: 03/01/2018
Date Data Arrived at EDR: 03/28/2018
Date Made Active in Reports: 06/22/2018
Number of Days to Update: 86

Source: Environmental Protection Agency
Telephone: 312-886-6186
Last EDR Contact: 09/19/2018
Next Scheduled EDR Contact: 01/07/2019
Data Release Frequency: Quarterly

RCRA-SQG: RCRA - Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Small quantity generators (SQGs) generate between 100 kg and 1,000 kg of hazardous waste per month.

Date of Government Version: 03/01/2018	Source: Environmental Protection Agency
Date Data Arrived at EDR: 03/28/2018	Telephone: 312-886-6186
Date Made Active in Reports: 06/22/2018	Last EDR Contact: 09/19/2018
Number of Days to Update: 86	Next Scheduled EDR Contact: 01/07/2019
	Data Release Frequency: Quarterly

RCRA-CESQG: RCRA - Conditionally Exempt Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Conditionally exempt small quantity generators (CESQGs) generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month.

Date of Government Version: 03/01/2018	Source: Environmental Protection Agency
Date Data Arrived at EDR: 03/28/2018	Telephone: 312-886-6186
Date Made Active in Reports: 06/22/2018	Last EDR Contact: 09/19/2018
Number of Days to Update: 86	Next Scheduled EDR Contact: 01/07/2019
	Data Release Frequency: Quarterly

Federal institutional controls / engineering controls registries

LUCIS: Land Use Control Information System

LUCIS contains records of land use control information pertaining to the former Navy Base Realignment and Closure properties.

Date of Government Version: 05/14/2018	Source: Department of the Navy
Date Data Arrived at EDR: 05/18/2018	Telephone: 843-820-7326
Date Made Active in Reports: 07/20/2018	Last EDR Contact: 07/16/2018
Number of Days to Update: 63	Next Scheduled EDR Contact: 11/26/2018
	Data Release Frequency: Varies

US ENG CONTROLS: Engineering Controls Sites List

A listing of sites with engineering controls in place. Engineering controls include various forms of caps, building foundations, liners, and treatment methods to create pathway elimination for regulated substances to enter environmental media or effect human health.

Date of Government Version: 07/31/2018	Source: Environmental Protection Agency
Date Data Arrived at EDR: 08/28/2018	Telephone: 703-603-0695
Date Made Active in Reports: 09/14/2018	Last EDR Contact: 08/28/2018
Number of Days to Update: 17	Next Scheduled EDR Contact: 12/10/2018
	Data Release Frequency: Varies

US INST CONTROL: Sites with Institutional Controls

A listing of sites with institutional controls in place. Institutional controls include administrative measures, such as groundwater use restrictions, construction restrictions, property use restrictions, and post remediation care requirements intended to prevent exposure to contaminants remaining on site. Deed restrictions are generally required as part of the institutional controls.

Date of Government Version: 07/31/2018	Source: Environmental Protection Agency
Date Data Arrived at EDR: 08/28/2018	Telephone: 703-603-0695
Date Made Active in Reports: 09/14/2018	Last EDR Contact: 08/28/2018
Number of Days to Update: 17	Next Scheduled EDR Contact: 12/10/2018
	Data Release Frequency: Varies

Federal ERNS list

ERNS: Emergency Response Notification System

Emergency Response Notification System. ERNS records and stores information on reported releases of oil and hazardous substances.

Date of Government Version: 06/18/2018
Date Data Arrived at EDR: 06/27/2018
Date Made Active in Reports: 09/14/2018
Number of Days to Update: 79

Source: National Response Center, United States Coast Guard
Telephone: 202-267-2180
Last EDR Contact: 09/25/2018
Next Scheduled EDR Contact: 01/07/2019
Data Release Frequency: Quarterly

State- and tribal - equivalent CERCLIS

SHWS: This state does not maintain a SHWS list. See the Federal CERCLIS list and Federal NPL list.

State Hazardous Waste Sites. State hazardous waste site records are the states' equivalent to CERCLIS. These sites may or may not already be listed on the federal CERCLIS list. Priority sites planned for cleanup using state funds (state equivalent of Superfund) are identified along with sites where cleanup will be paid for by potentially responsible parties. Available information varies by state.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: Ohio EPA
Telephone: 614-644-2924
Last EDR Contact: 09/04/2018
Next Scheduled EDR Contact: 11/19/2018
Data Release Frequency: N/A

DERR: Division of Emergency & Remedial Response's Database

The DERR listings contains sites from all of Ohio that are in the Division of Environmental Response and Revitalization (DERR) database, which is an index of sites for which our district offices maintain files. The database is NOT a record of contaminated sites or sites suspected of contamination. Not all sites in the database are contaminated, and a site's absence from the database does not imply that it is uncontaminated.

Date of Government Version: 12/22/2017
Date Data Arrived at EDR: 02/08/2018
Date Made Active in Reports: 03/02/2018
Number of Days to Update: 22

Source: Ohio EPA
Telephone: 614-644-3538
Last EDR Contact: 08/10/2018
Next Scheduled EDR Contact: 11/19/2018
Data Release Frequency: Semi-Annually

State and tribal landfill and/or solid waste disposal site lists

SWF/LF: Licensed Solid Waste Facilities

Solid Waste Facilities/Landfill Sites. SWF/LF type records typically contain an inventory of solid waste disposal facilities or landfills in a particular state. Depending on the state, these may be active or inactive facilities or open dumps that failed to meet RCRA Subtitle D Section 4004 criteria for solid waste landfills or disposal sites.

Date of Government Version: 07/09/2018
Date Data Arrived at EDR: 07/13/2018
Date Made Active in Reports: 08/15/2018
Number of Days to Update: 33

Source: Ohio Environmental Protection Agency
Telephone: 614-644-2621
Last EDR Contact: 10/09/2018
Next Scheduled EDR Contact: 01/21/2019
Data Release Frequency: Semi-Annually

State and tribal leaking storage tank lists

LUST: Leaking Underground Storage Tank File

Leaking Underground Storage Tank Incident Reports. LUST records contain an inventory of reported leaking underground storage tank incidents. Not all states maintain these records, and the information stored varies by state.

Date of Government Version: 08/08/2018
Date Data Arrived at EDR: 08/10/2018
Date Made Active in Reports: 09/24/2018
Number of Days to Update: 45

Source: Department of Commerce
Telephone: 614-752-8200
Last EDR Contact: 08/10/2018
Next Scheduled EDR Contact: 11/26/2018
Data Release Frequency: Quarterly

INDIAN LUST R10: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Alaska, Idaho, Oregon and Washington.

Date of Government Version: 04/12/2018	Source: EPA Region 10
Date Data Arrived at EDR: 05/18/2018	Telephone: 206-553-2857
Date Made Active in Reports: 07/20/2018	Last EDR Contact: 07/27/2018
Number of Days to Update: 63	Next Scheduled EDR Contact: 11/05/2018
	Data Release Frequency: Varies

INDIAN LUST R9: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Arizona, California, New Mexico and Nevada

Date of Government Version: 04/10/2018	Source: Environmental Protection Agency
Date Data Arrived at EDR: 05/18/2018	Telephone: 415-972-3372
Date Made Active in Reports: 07/20/2018	Last EDR Contact: 07/27/2018
Number of Days to Update: 63	Next Scheduled EDR Contact: 11/05/2018
	Data Release Frequency: Varies

INDIAN LUST R8: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Colorado, Montana, North Dakota, South Dakota, Utah and Wyoming.

Date of Government Version: 04/25/2018	Source: EPA Region 8
Date Data Arrived at EDR: 05/18/2018	Telephone: 303-312-6271
Date Made Active in Reports: 07/20/2018	Last EDR Contact: 07/27/2018
Number of Days to Update: 63	Next Scheduled EDR Contact: 11/05/2018
	Data Release Frequency: Varies

INDIAN LUST R7: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Iowa, Kansas, and Nebraska

Date of Government Version: 04/24/2018	Source: EPA Region 7
Date Data Arrived at EDR: 05/18/2018	Telephone: 913-551-7003
Date Made Active in Reports: 07/20/2018	Last EDR Contact: 07/27/2018
Number of Days to Update: 63	Next Scheduled EDR Contact: 11/05/2018
	Data Release Frequency: Varies

INDIAN LUST R6: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in New Mexico and Oklahoma.

Date of Government Version: 04/01/2018	Source: EPA Region 6
Date Data Arrived at EDR: 05/18/2018	Telephone: 214-665-6597
Date Made Active in Reports: 07/20/2018	Last EDR Contact: 07/27/2018
Number of Days to Update: 63	Next Scheduled EDR Contact: 11/05/2018
	Data Release Frequency: Varies

INDIAN LUST R1: Leaking Underground Storage Tanks on Indian Land
A listing of leaking underground storage tank locations on Indian Land.

Date of Government Version: 04/13/2018	Source: EPA Region 1
Date Data Arrived at EDR: 05/18/2018	Telephone: 617-918-1313
Date Made Active in Reports: 07/20/2018	Last EDR Contact: 07/27/2018
Number of Days to Update: 63	Next Scheduled EDR Contact: 11/05/2018
	Data Release Frequency: Varies

INDIAN LUST R5: Leaking Underground Storage Tanks on Indian Land
Leaking underground storage tanks located on Indian Land in Michigan, Minnesota and Wisconsin.

Date of Government Version: 04/12/2018	Source: EPA, Region 5
Date Data Arrived at EDR: 05/18/2018	Telephone: 312-886-7439
Date Made Active in Reports: 07/20/2018	Last EDR Contact: 07/27/2018
Number of Days to Update: 63	Next Scheduled EDR Contact: 11/05/2018
	Data Release Frequency: Varies

INDIAN LUST R4: Leaking Underground Storage Tanks on Indian Land

LUSTs on Indian land in Florida, Mississippi and North Carolina.

Date of Government Version: 05/08/2018	Source: EPA Region 4
Date Data Arrived at EDR: 05/18/2018	Telephone: 404-562-8677
Date Made Active in Reports: 07/20/2018	Last EDR Contact: 07/27/2018
Number of Days to Update: 63	Next Scheduled EDR Contact: 11/05/2018
	Data Release Frequency: Varies

UNREG LTANKS: Ohio Leaking UST File

A suspected or confirmed release of petroleum from a non-regulated UST.

Date of Government Version: 08/25/1999	Source: Department of Commerce
Date Data Arrived at EDR: 08/19/2003	Telephone: 614-752-7938
Date Made Active in Reports: 08/26/2003	Last EDR Contact: 08/01/2003
Number of Days to Update: 7	Next Scheduled EDR Contact: N/A
	Data Release Frequency: No Update Planned

State and tribal registered storage tank lists

FEMA UST: Underground Storage Tank Listing

A listing of all FEMA owned underground storage tanks.

Date of Government Version: 05/15/2017	Source: FEMA
Date Data Arrived at EDR: 05/30/2017	Telephone: 202-646-5797
Date Made Active in Reports: 10/13/2017	Last EDR Contact: 10/10/2018
Number of Days to Update: 136	Next Scheduled EDR Contact: 01/21/2019
	Data Release Frequency: Varies

UST: Underground Storage Tank Tank File

Registered Underground Storage Tanks. UST’s are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA) and must be registered with the state department responsible for administering the UST program. Available information varies by state program.

Date of Government Version: 08/08/2018	Source: Department of Commerce
Date Data Arrived at EDR: 08/10/2018	Telephone: 614-752-8200
Date Made Active in Reports: 09/19/2018	Last EDR Contact: 08/10/2018
Number of Days to Update: 40	Next Scheduled EDR Contact: 11/26/2018
	Data Release Frequency: Quarterly

AST: Above Ground Storage Tanks

A listing of aboveground storage tank site locations in the state.

Date of Government Version: 08/01/2018	Source: Department of Commerce
Date Data Arrived at EDR: 08/02/2018	Telephone: 614-752-7037
Date Made Active in Reports: 08/15/2018	Last EDR Contact: 08/01/2018
Number of Days to Update: 13	Next Scheduled EDR Contact: 11/19/2018
	Data Release Frequency: Quarterly

INDIAN UST R8: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 8 (Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming and 27 Tribal Nations).

Date of Government Version: 04/25/2018	Source: EPA Region 8
Date Data Arrived at EDR: 05/18/2018	Telephone: 303-312-6137
Date Made Active in Reports: 07/20/2018	Last EDR Contact: 07/27/2018
Number of Days to Update: 63	Next Scheduled EDR Contact: 11/05/2018
	Data Release Frequency: Varies

INDIAN UST R1: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 1 (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont and ten Tribal Nations).

Date of Government Version: 04/13/2018	Source: EPA, Region 1
Date Data Arrived at EDR: 05/18/2018	Telephone: 617-918-1313
Date Made Active in Reports: 07/20/2018	Last EDR Contact: 07/27/2018
Number of Days to Update: 63	Next Scheduled EDR Contact: 11/05/2018
	Data Release Frequency: Varies

INDIAN UST R10: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 10 (Alaska, Idaho, Oregon, Washington, and Tribal Nations).

Date of Government Version: 04/12/2018	Source: EPA Region 10
Date Data Arrived at EDR: 05/18/2018	Telephone: 206-553-2857
Date Made Active in Reports: 07/20/2018	Last EDR Contact: 07/27/2018
Number of Days to Update: 63	Next Scheduled EDR Contact: 11/05/2018
	Data Release Frequency: Varies

INDIAN UST R7: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 7 (Iowa, Kansas, Missouri, Nebraska, and 9 Tribal Nations).

Date of Government Version: 04/24/2018	Source: EPA Region 7
Date Data Arrived at EDR: 05/18/2018	Telephone: 913-551-7003
Date Made Active in Reports: 07/20/2018	Last EDR Contact: 07/27/2018
Number of Days to Update: 63	Next Scheduled EDR Contact: 11/05/2018
	Data Release Frequency: Varies

INDIAN UST R6: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 6 (Louisiana, Arkansas, Oklahoma, New Mexico, Texas and 65 Tribes).

Date of Government Version: 04/01/2018	Source: EPA Region 6
Date Data Arrived at EDR: 05/18/2018	Telephone: 214-665-7591
Date Made Active in Reports: 07/20/2018	Last EDR Contact: 07/27/2018
Number of Days to Update: 63	Next Scheduled EDR Contact: 11/05/2018
	Data Release Frequency: Varies

INDIAN UST R5: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 5 (Michigan, Minnesota and Wisconsin and Tribal Nations).

Date of Government Version: 04/12/2018	Source: EPA Region 5
Date Data Arrived at EDR: 05/18/2018	Telephone: 312-886-6136
Date Made Active in Reports: 07/20/2018	Last EDR Contact: 07/27/2018
Number of Days to Update: 63	Next Scheduled EDR Contact: 11/05/2018
	Data Release Frequency: Varies

INDIAN UST R4: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 4 (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee and Tribal Nations)

Date of Government Version: 05/08/2018	Source: EPA Region 4
Date Data Arrived at EDR: 05/18/2018	Telephone: 404-562-9424
Date Made Active in Reports: 07/20/2018	Last EDR Contact: 07/27/2018
Number of Days to Update: 63	Next Scheduled EDR Contact: 11/05/2018
	Data Release Frequency: Varies

INDIAN UST R9: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 9 (Arizona, California, Hawaii, Nevada, the Pacific Islands, and Tribal Nations).

Date of Government Version: 04/10/2018
Date Data Arrived at EDR: 05/18/2018
Date Made Active in Reports: 07/20/2018
Number of Days to Update: 63

Source: EPA Region 9
Telephone: 415-972-3368
Last EDR Contact: 07/27/2018
Next Scheduled EDR Contact: 11/05/2018
Data Release Frequency: Varies

State and tribal institutional control / engineering control registries

HIST INST CONTROLS: Institutional Controls Database

"Institutional control" is a restriction that is recorded in the same manner as a deed which limits access to or use of the property such that exposure to hazardous substances or petroleum are effectively and reliably eliminated or mitigated. Examples of institutional controls include land and water use restrictions. This database is no longer updated or maintained by the state agency.

Date of Government Version: 05/10/2005
Date Data Arrived at EDR: 04/06/2006
Date Made Active in Reports: 05/04/2006
Number of Days to Update: 28

Source: Ohio EPA
Telephone: 614-644-2306
Last EDR Contact: 06/02/2008
Next Scheduled EDR Contact: 09/01/2008
Data Release Frequency: No Update Planned

HIST ENG CONTROLS: Operation & Maintenance Agreements Database

Volunteers that complete a voluntary action that relies on the ongoing operation and maintenance (O&M) of an engineered control to make the site protective (e.g" cap systems and ground water treatment systems) must enter into a legally binding agreement with the Ohio EPA before the director issues a covenant not to sue. This O&M Agreement must describe how the remedy is constructed and how itwill be monitored, maintained and repaired. It also lays out inspection opportunities for the agency. Companies must document that they have the financial capability to operate any remedy relied on, before the agency will agree to enter into the O&M Agreement. The statute requires that the agency be notified of any change in ownership. This database is no longer updated or maintained by the state agency.

Date of Government Version: 05/10/2005
Date Data Arrived at EDR: 04/04/2006
Date Made Active in Reports: 05/04/2006
Number of Days to Update: 30

Source: Ohio EPA
Telephone: 614-644-2306
Last EDR Contact: 06/02/2008
Next Scheduled EDR Contact: 09/01/2008
Data Release Frequency: No Update Planned

ENG CONTROLS: Sites with Engineering Controls

A database that tracks properties with engineering controls.

Date of Government Version: 12/22/2017
Date Data Arrived at EDR: 02/08/2018
Date Made Active in Reports: 03/02/2018
Number of Days to Update: 22

Source: Ohio EPA
Telephone: 614-644-2306
Last EDR Contact: 08/10/2018
Next Scheduled EDR Contact: 11/19/2018
Data Release Frequency: Semi-Annually

INST CONTROL: Sites with Institutional Engineering Controls

A database that tracks properties with institutional controls.

Date of Government Version: 12/22/2017
Date Data Arrived at EDR: 02/08/2018
Date Made Active in Reports: 03/02/2018
Number of Days to Update: 22

Source: Ohio Environmental Protection Agency
Telephone: 614-644-2306
Last EDR Contact: 08/10/2018
Next Scheduled EDR Contact: 11/19/2018
Data Release Frequency: Semi-Annually

State and tribal voluntary cleanup sites

INDIAN VCP R1: Voluntary Cleanup Priority Listing

A listing of voluntary cleanup priority sites located on Indian Land located in Region 1.

Date of Government Version: 07/27/2015	Source: EPA, Region 1
Date Data Arrived at EDR: 09/29/2015	Telephone: 617-918-1102
Date Made Active in Reports: 02/18/2016	Last EDR Contact: 09/24/2018
Number of Days to Update: 142	Next Scheduled EDR Contact: 01/07/2019
	Data Release Frequency: Varies

INDIAN VCP R7: Voluntary Cleanup Priority Lisitng

A listing of voluntary cleanup priority sites located on Indian Land located in Region 7.

Date of Government Version: 03/20/2008	Source: EPA, Region 7
Date Data Arrived at EDR: 04/22/2008	Telephone: 913-551-7365
Date Made Active in Reports: 05/19/2008	Last EDR Contact: 04/20/2009
Number of Days to Update: 27	Next Scheduled EDR Contact: 07/20/2009
	Data Release Frequency: Varies

VCP: Voluntary Action Program Sites

Site involved in the Voluntary Action Program.

Date of Government Version: 12/22/2017	Source: Ohio EPA, Voluntary Action Program
Date Data Arrived at EDR: 02/08/2018	Telephone: 614-728-1298
Date Made Active in Reports: 03/02/2018	Last EDR Contact: 08/10/2018
Number of Days to Update: 22	Next Scheduled EDR Contact: 11/19/2018
	Data Release Frequency: Semi-Annually

State and tribal Brownfields sites

BROWNFIELDS: Ohio Brownfield Inventory

A statewide brownfields inventory. A brownfield is an abandoned, idled or under-used industrial or commercial property where expansion or redevelopment is complicated by known or potential releases of hazardous substances and/or petroleum.

Date of Government Version: 09/10/2018	Source: Ohio EPA
Date Data Arrived at EDR: 09/13/2018	Telephone: 614-644-3748
Date Made Active in Reports: 10/16/2018	Last EDR Contact: 09/13/2018
Number of Days to Update: 33	Next Scheduled EDR Contact: 12/24/2018
	Data Release Frequency: Quarterly

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS: A Listing of Brownfields Sites

Brownfields are real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. Cleaning up and reinvesting in these properties takes development pressures off of undeveloped, open land, and both improves and protects the environment. Assessment, Cleanup and Redevelopment Exchange System (ACRES) stores information reported by EPA Brownfields grant recipients on brownfields properties assessed or cleaned up with grant funding as well as information on Targeted Brownfields Assessments performed by EPA Regions. A listing of ACRES Brownfield sites is obtained from Cleanups in My Community. Cleanups in My Community provides information on Brownfields properties for which information is reported back to EPA, as well as areas served by Brownfields grant programs.

Date of Government Version: 06/18/2018	Source: Environmental Protection Agency
Date Data Arrived at EDR: 06/20/2018	Telephone: 202-566-2777
Date Made Active in Reports: 09/14/2018	Last EDR Contact: 09/18/2018
Number of Days to Update: 86	Next Scheduled EDR Contact: 12/31/2018
	Data Release Frequency: Semi-Annually

Local Lists of Landfill / Solid Waste Disposal Sites

HIST LF: Old Solid Waste Landfill

A list of about 1200 old abandoned dumps or landfills. This database was developed from Ohio EPA staff notebooks and other information dating from the mid-1970s

Date of Government Version: 09/08/2018
Date Data Arrived at EDR: 09/13/2018
Date Made Active in Reports: 10/16/2018
Number of Days to Update: 33

Source: Ohio EPA
Telephone: 614-644-3749
Last EDR Contact: 09/13/2018
Next Scheduled EDR Contact: 12/24/2018
Data Release Frequency: No Update Planned

SWRCY: Recycling Facility Listing

A listing of recycling facility locations.

Date of Government Version: 07/23/2018
Date Data Arrived at EDR: 07/25/2018
Date Made Active in Reports: 08/15/2018
Number of Days to Update: 21

Source: Ohio EPA
Telephone: 614-728-5357
Last EDR Contact: 10/09/2018
Next Scheduled EDR Contact: 01/21/2019
Data Release Frequency: Quarterly

INDIAN ODI: Report on the Status of Open Dumps on Indian Lands

Location of open dumps on Indian land.

Date of Government Version: 12/31/1998
Date Data Arrived at EDR: 12/03/2007
Date Made Active in Reports: 01/24/2008
Number of Days to Update: 52

Source: Environmental Protection Agency
Telephone: 703-308-8245
Last EDR Contact: 07/30/2018
Next Scheduled EDR Contact: 11/12/2018
Data Release Frequency: Varies

ODI: Open Dump Inventory

An open dump is defined as a disposal facility that does not comply with one or more of the Part 257 or Part 258 Subtitle D Criteria.

Date of Government Version: 06/30/1985
Date Data Arrived at EDR: 08/09/2004
Date Made Active in Reports: 09/17/2004
Number of Days to Update: 39

Source: Environmental Protection Agency
Telephone: 800-424-9346
Last EDR Contact: 06/09/2004
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

DEBRIS REGION 9: Torres Martinez Reservation Illegal Dump Site Locations

A listing of illegal dump sites location on the Torres Martinez Indian Reservation located in eastern Riverside County and northern Imperial County, California.

Date of Government Version: 01/12/2009
Date Data Arrived at EDR: 05/07/2009
Date Made Active in Reports: 09/21/2009
Number of Days to Update: 137

Source: EPA, Region 9
Telephone: 415-947-4219
Last EDR Contact: 07/17/2018
Next Scheduled EDR Contact: 11/05/2018
Data Release Frequency: No Update Planned

IHS OPEN DUMPS: Open Dumps on Indian Land

A listing of all open dumps located on Indian Land in the United States.

Date of Government Version: 04/01/2014
Date Data Arrived at EDR: 08/06/2014
Date Made Active in Reports: 01/29/2015
Number of Days to Update: 176

Source: Department of Health & Human Serivces, Indian Health Service
Telephone: 301-443-1452
Last EDR Contact: 08/03/2018
Next Scheduled EDR Contact: 11/12/2018
Data Release Frequency: Varies

Local Lists of Hazardous waste / Contaminated Sites

US HIST CDL: National Clandestine Laboratory Register

A listing of clandestine drug lab locations that have been removed from the DEAs National Clandestine Laboratory Register.

Date of Government Version: 05/18/2018	Source: Drug Enforcement Administration
Date Data Arrived at EDR: 06/20/2018	Telephone: 202-307-1000
Date Made Active in Reports: 09/14/2018	Last EDR Contact: 08/28/2018
Number of Days to Update: 86	Next Scheduled EDR Contact: 12/10/2018
	Data Release Frequency: No Update Planned

CDL: Clandestine Drug Lab Locations

A list of clandestine drug lab sites with environmental impact. This list is extracted from the SPILLS database based on the "product" type.

Date of Government Version: 08/20/2018	Source: Ohio EPA
Date Data Arrived at EDR: 08/22/2018	Telephone: 614-644-2080
Date Made Active in Reports: 09/27/2018	Last EDR Contact: 08/20/2018
Number of Days to Update: 36	Next Scheduled EDR Contact: 11/19/2018
	Data Release Frequency: Semi-Annually

US CDL: Clandestine Drug Labs

A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 05/18/2018	Source: Drug Enforcement Administration
Date Data Arrived at EDR: 06/20/2018	Telephone: 202-307-1000
Date Made Active in Reports: 09/14/2018	Last EDR Contact: 08/28/2018
Number of Days to Update: 86	Next Scheduled EDR Contact: 12/10/2018
	Data Release Frequency: Quarterly

Local Lists of Registered Storage Tanks

ARCHIVE UST: Archived Underground Storage Tank Sites

Underground storage tank records that have been removed from the Underground Storage Tank database.

Date of Government Version: 08/08/2018	Source: Department of Commerce, Division of State Fire Marshal
Date Data Arrived at EDR: 08/10/2018	Telephone: 614-752-7938
Date Made Active in Reports: 09/19/2018	Last EDR Contact: 08/10/2018
Number of Days to Update: 40	Next Scheduled EDR Contact: 11/26/2018
	Data Release Frequency: Quarterly

Local Land Records

LIENS 2: CERCLA Lien Information

A Federal CERCLA ('Superfund') lien can exist by operation of law at any site or property at which EPA has spent Superfund monies. These monies are spent to investigate and address releases and threatened releases of contamination. CERCLIS provides information as to the identity of these sites and properties.

Date of Government Version: 07/17/2018	Source: Environmental Protection Agency
Date Data Arrived at EDR: 08/09/2018	Telephone: 202-564-6023
Date Made Active in Reports: 10/05/2018	Last EDR Contact: 10/04/2018
Number of Days to Update: 57	Next Scheduled EDR Contact: 01/14/2019
	Data Release Frequency: Semi-Annually

Records of Emergency Release Reports

HMIRS: Hazardous Materials Information Reporting System

Hazardous Materials Incident Report System. HMIRS contains hazardous material spill incidents reported to DOT.

Date of Government Version: 03/26/2018	Source: U.S. Department of Transportation
Date Data Arrived at EDR: 03/27/2018	Telephone: 202-366-4555
Date Made Active in Reports: 06/08/2018	Last EDR Contact: 09/25/2018
Number of Days to Update: 73	Next Scheduled EDR Contact: 01/07/2019
	Data Release Frequency: Quarterly

SPILLS: Emergency Response Database

Incidents reported to the Emergency Response Unit. The focus of the ER program is to minimize the impact on the environment from accidental releases, spills, and unauthorized discharges from any fixed or mobile sources. Incidents involving petroleum products, hazardous materials, hazardous waste, abandoned drums, or other materials which may pose as a pollution threat to the state?s water, land, or air should be reported immediately. Not all incidents included in the database are actual SPILLS, they can simply be reported incidents.

Date of Government Version: 08/20/2018	Source: Ohio EPA
Date Data Arrived at EDR: 08/22/2018	Telephone: 614-644-2084
Date Made Active in Reports: 09/27/2018	Last EDR Contact: 08/20/2018
Number of Days to Update: 36	Next Scheduled EDR Contact: 11/19/2018
	Data Release Frequency: Semi-Annually

SPILLS 90: SPILLS90 data from FirstSearch

Spills 90 includes those spill and release records available exclusively from FirstSearch databases. Typically, they may include chemical, oil and/or hazardous substance spills recorded after 1990. Duplicate records that are already included in EDR incident and release records are not included in Spills 90.

Date of Government Version: 09/13/2012	Source: FirstSearch
Date Data Arrived at EDR: 01/03/2013	Telephone: N/A
Date Made Active in Reports: 02/27/2013	Last EDR Contact: 01/03/2013
Number of Days to Update: 55	Next Scheduled EDR Contact: N/A
	Data Release Frequency: No Update Planned

SPILLS 80: SPILLS80 data from FirstSearch

Spills 80 includes those spill and release records available from FirstSearch databases prior to 1990. Typically, they may include chemical, oil and/or hazardous substance spills recorded before 1990. Duplicate records that are already included in EDR incident and release records are not included in Spills 80.

Date of Government Version: 04/24/2004	Source: FirstSearch
Date Data Arrived at EDR: 01/03/2013	Telephone: N/A
Date Made Active in Reports: 03/01/2013	Last EDR Contact: 01/03/2013
Number of Days to Update: 57	Next Scheduled EDR Contact: N/A
	Data Release Frequency: No Update Planned

Other Ascertainable Records

RCRA NonGen / NLR: RCRA - Non Generators / No Longer Regulated

RCRAInfo is EPA’s comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Non-Generators do not presently generate hazardous waste.

Date of Government Version: 03/01/2018	Source: Environmental Protection Agency
Date Data Arrived at EDR: 03/28/2018	Telephone: 312-886-6186
Date Made Active in Reports: 06/22/2018	Last EDR Contact: 09/19/2018
Number of Days to Update: 86	Next Scheduled EDR Contact: 01/07/2019
	Data Release Frequency: Quarterly

FUDS: Formerly Used Defense Sites

The listing includes locations of Formerly Used Defense Sites properties where the US Army Corps of Engineers is actively working or will take necessary cleanup actions.

Date of Government Version: 01/31/2015
Date Data Arrived at EDR: 07/08/2015
Date Made Active in Reports: 10/13/2015
Number of Days to Update: 97

Source: U.S. Army Corps of Engineers
Telephone: 202-528-4285
Last EDR Contact: 08/24/2018
Next Scheduled EDR Contact: 12/03/2018
Data Release Frequency: Varies

DOD: Department of Defense Sites

This data set consists of federally owned or administered lands, administered by the Department of Defense, that have any area equal to or greater than 640 acres of the United States, Puerto Rico, and the U.S. Virgin Islands.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 11/10/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 62

Source: USGS
Telephone: 888-275-8747
Last EDR Contact: 10/12/2018
Next Scheduled EDR Contact: 01/21/2019
Data Release Frequency: Semi-Annually

FEDLAND: Federal and Indian Lands

Federally and Indian administrated lands of the United States. Lands included are administrated by: Army Corps of Engineers, Bureau of Reclamation, National Wild and Scenic River, National Wildlife Refuge, Public Domain Land, Wilderness, Wilderness Study Area, Wildlife Management Area, Bureau of Indian Affairs, Bureau of Land Management, Department of Justice, Forest Service, Fish and Wildlife Service, National Park Service.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 02/06/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 339

Source: U.S. Geological Survey
Telephone: 888-275-8747
Last EDR Contact: 10/12/2018
Next Scheduled EDR Contact: 01/21/2019
Data Release Frequency: N/A

SCRD DRYCLEANERS: State Coalition for Remediation of Drycleaners Listing

The State Coalition for Remediation of Drycleaners was established in 1998, with support from the U.S. EPA Office of Superfund Remediation and Technology Innovation. It is comprised of representatives of states with established drycleaner remediation programs. Currently the member states are Alabama, Connecticut, Florida, Illinois, Kansas, Minnesota, Missouri, North Carolina, Oregon, South Carolina, Tennessee, Texas, and Wisconsin.

Date of Government Version: 01/01/2017
Date Data Arrived at EDR: 02/03/2017
Date Made Active in Reports: 04/07/2017
Number of Days to Update: 63

Source: Environmental Protection Agency
Telephone: 615-532-8599
Last EDR Contact: 08/17/2018
Next Scheduled EDR Contact: 11/26/2018
Data Release Frequency: Varies

US FIN ASSUR: Financial Assurance Information

All owners and operators of facilities that treat, store, or dispose of hazardous waste are required to provide proof that they will have sufficient funds to pay for the clean up, closure, and post-closure care of their facilities.

Date of Government Version: 05/31/2018
Date Data Arrived at EDR: 06/27/2018
Date Made Active in Reports: 10/05/2018
Number of Days to Update: 100

Source: Environmental Protection Agency
Telephone: 202-566-1917
Last EDR Contact: 09/25/2018
Next Scheduled EDR Contact: 01/07/2019
Data Release Frequency: Quarterly

EPA WATCH LIST: EPA WATCH LIST

EPA maintains a "Watch List" to facilitate dialogue between EPA, state and local environmental agencies on enforcement matters relating to facilities with alleged violations identified as either significant or high priority. Being on the Watch List does not mean that the facility has actually violated the law only that an investigation by EPA or a state or local environmental agency has led those organizations to allege that an unproven violation has in fact occurred. Being on the Watch List does not represent a higher level of concern regarding the alleged violations that were detected, but instead indicates cases requiring additional dialogue between EPA, state and local agencies - primarily because of the length of time the alleged violation has gone unaddressed or unresolved.

Date of Government Version: 08/30/2013	Source: Environmental Protection Agency
Date Data Arrived at EDR: 03/21/2014	Telephone: 617-520-3000
Date Made Active in Reports: 06/17/2014	Last EDR Contact: 08/03/2018
Number of Days to Update: 88	Next Scheduled EDR Contact: 11/19/2018
	Data Release Frequency: Quarterly

2020 COR ACTION: 2020 Corrective Action Program List

The EPA has set ambitious goals for the RCRA Corrective Action program by creating the 2020 Corrective Action Universe. This RCRA cleanup baseline includes facilities expected to need corrective action. The 2020 universe contains a wide variety of sites. Some properties are heavily contaminated while others were contaminated but have since been cleaned up. Still others have not been fully investigated yet, and may require little or no remediation. Inclusion in the 2020 Universe does not necessarily imply failure on the part of a facility to meet its RCRA obligations.

Date of Government Version: 09/30/2017	Source: Environmental Protection Agency
Date Data Arrived at EDR: 05/08/2018	Telephone: 703-308-4044
Date Made Active in Reports: 07/20/2018	Last EDR Contact: 08/10/2018
Number of Days to Update: 73	Next Scheduled EDR Contact: 11/19/2018
	Data Release Frequency: Varies

TSCA: Toxic Substances Control Act

Toxic Substances Control Act. TSCA identifies manufacturers and importers of chemical substances included on the TSCA Chemical Substance Inventory list. It includes data on the production volume of these substances by plant site.

Date of Government Version: 12/31/2016	Source: EPA
Date Data Arrived at EDR: 06/21/2017	Telephone: 202-260-5521
Date Made Active in Reports: 01/05/2018	Last EDR Contact: 09/21/2018
Number of Days to Update: 198	Next Scheduled EDR Contact: 12/31/2018
	Data Release Frequency: Every 4 Years

TRIS: Toxic Chemical Release Inventory System

Toxic Release Inventory System. TRIS identifies facilities which release toxic chemicals to the air, water and land in reportable quantities under SARA Title III Section 313.

Date of Government Version: 12/31/2016	Source: EPA
Date Data Arrived at EDR: 01/10/2018	Telephone: 202-566-0250
Date Made Active in Reports: 01/12/2018	Last EDR Contact: 08/24/2018
Number of Days to Update: 2	Next Scheduled EDR Contact: 12/03/2018
	Data Release Frequency: Annually

SSTS: Section 7 Tracking Systems

Section 7 of the Federal Insecticide, Fungicide and Rodenticide Act, as amended (92 Stat. 829) requires all registered pesticide-producing establishments to submit a report to the Environmental Protection Agency by March 1st each year. Each establishment must report the types and amounts of pesticides, active ingredients and devices being produced, and those having been produced and sold or distributed in the past year.

Date of Government Version: 12/31/2009	Source: EPA
Date Data Arrived at EDR: 12/10/2010	Telephone: 202-564-4203
Date Made Active in Reports: 02/25/2011	Last EDR Contact: 07/27/2018
Number of Days to Update: 77	Next Scheduled EDR Contact: 11/05/2018
	Data Release Frequency: Annually

ROD: Records Of Decision

Record of Decision. ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid in the cleanup.

Date of Government Version: 07/17/2018	Source: EPA
Date Data Arrived at EDR: 08/09/2018	Telephone: 703-416-0223
Date Made Active in Reports: 10/05/2018	Last EDR Contact: 10/04/2018
Number of Days to Update: 57	Next Scheduled EDR Contact: 12/17/2018
	Data Release Frequency: Annually

RMP: Risk Management Plans

When Congress passed the Clean Air Act Amendments of 1990, it required EPA to publish regulations and guidance for chemical accident prevention at facilities using extremely hazardous substances. The Risk Management Program Rule (RMP Rule) was written to implement Section 112(r) of these amendments. The rule, which built upon existing industry codes and standards, requires companies of all sizes that use certain flammable and toxic substances to develop a Risk Management Program, which includes a(n): Hazard assessment that details the potential effects of an accidental release, an accident history of the last five years, and an evaluation of worst-case and alternative accidental releases; Prevention program that includes safety precautions and maintenance, monitoring, and employee training measures; and Emergency response program that spells out emergency health care, employee training measures and procedures for informing the public and response agencies (e.g the fire department) should an accident occur.

Date of Government Version: 08/01/2018	Source: Environmental Protection Agency
Date Data Arrived at EDR: 08/22/2018	Telephone: 202-564-8600
Date Made Active in Reports: 10/05/2018	Last EDR Contact: 07/20/2018
Number of Days to Update: 44	Next Scheduled EDR Contact: 11/05/2018
	Data Release Frequency: Varies

RAATS: RCRA Administrative Action Tracking System

RCRA Administration Action Tracking System. RAATS contains records based on enforcement actions issued under RCRA pertaining to major violators and includes administrative and civil actions brought by the EPA. For administration actions after September 30, 1995, data entry in the RAATS database was discontinued. EPA will retain a copy of the database for historical records. It was necessary to terminate RAATS because a decrease in agency resources made it impossible to continue to update the information contained in the database.

Date of Government Version: 04/17/1995	Source: EPA
Date Data Arrived at EDR: 07/03/1995	Telephone: 202-564-4104
Date Made Active in Reports: 08/07/1995	Last EDR Contact: 06/02/2008
Number of Days to Update: 35	Next Scheduled EDR Contact: 09/01/2008
	Data Release Frequency: No Update Planned

PRP: Potentially Responsible Parties

A listing of verified Potentially Responsible Parties

Date of Government Version: 10/25/2013	Source: EPA
Date Data Arrived at EDR: 10/17/2014	Telephone: 202-564-6023
Date Made Active in Reports: 10/20/2014	Last EDR Contact: 10/04/2018
Number of Days to Update: 3	Next Scheduled EDR Contact: 11/19/2018
	Data Release Frequency: Quarterly

PADS: PCB Activity Database System

PCB Activity Database. PADS Identifies generators, transporters, commercial storers and/or brokers and disposers of PCB’s who are required to notify the EPA of such activities.

Date of Government Version: 06/01/2017	Source: EPA
Date Data Arrived at EDR: 06/09/2017	Telephone: 202-566-0500
Date Made Active in Reports: 10/13/2017	Last EDR Contact: 10/11/2018
Number of Days to Update: 126	Next Scheduled EDR Contact: 01/21/2019
	Data Release Frequency: Annually

ICIS: Integrated Compliance Information System

The Integrated Compliance Information System (ICIS) supports the information needs of the national enforcement and compliance program as well as the unique needs of the National Pollutant Discharge Elimination System (NPDES) program.

Date of Government Version: 11/18/2016	Source: Environmental Protection Agency
Date Data Arrived at EDR: 11/23/2016	Telephone: 202-564-2501
Date Made Active in Reports: 02/10/2017	Last EDR Contact: 10/09/2018
Number of Days to Update: 79	Next Scheduled EDR Contact: 01/21/2019
	Data Release Frequency: Quarterly

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

FTTS: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)

FTTS tracks administrative cases and pesticide enforcement actions and compliance activities related to FIFRA, TSCA and EPCRA (Emergency Planning and Community Right-to-Know Act). To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 04/09/2009	Source: EPA/Office of Prevention, Pesticides and Toxic Substances
Date Data Arrived at EDR: 04/16/2009	Telephone: 202-566-1667
Date Made Active in Reports: 05/11/2009	Last EDR Contact: 08/18/2017
Number of Days to Update: 25	Next Scheduled EDR Contact: 12/04/2017
	Data Release Frequency: Quarterly

FTTS INSP: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)

A listing of FIFRA/TSCA Tracking System (FTTS) inspections and enforcements.

Date of Government Version: 04/09/2009	Source: EPA
Date Data Arrived at EDR: 04/16/2009	Telephone: 202-566-1667
Date Made Active in Reports: 05/11/2009	Last EDR Contact: 08/18/2017
Number of Days to Update: 25	Next Scheduled EDR Contact: 12/04/2017
	Data Release Frequency: Quarterly

MLTS: Material Licensing Tracking System

MLTS is maintained by the Nuclear Regulatory Commission and contains a list of approximately 8,100 sites which possess or use radioactive materials and which are subject to NRC licensing requirements. To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 08/30/2016	Source: Nuclear Regulatory Commission
Date Data Arrived at EDR: 09/08/2016	Telephone: 301-415-7169
Date Made Active in Reports: 10/21/2016	Last EDR Contact: 09/28/2018
Number of Days to Update: 43	Next Scheduled EDR Contact: 11/05/2018
	Data Release Frequency: Quarterly

COAL ASH DOE: Steam-Electric Plant Operation Data

A listing of power plants that store ash in surface ponds.

Date of Government Version: 12/31/2005	Source: Department of Energy
Date Data Arrived at EDR: 08/07/2009	Telephone: 202-586-8719
Date Made Active in Reports: 10/22/2009	Last EDR Contact: 09/07/2018
Number of Days to Update: 76	Next Scheduled EDR Contact: 12/17/2018
	Data Release Frequency: Varies

COAL ASH EPA: Coal Combustion Residues Surface Impoundments List

A listing of coal combustion residues surface impoundments with high hazard potential ratings.

Date of Government Version: 07/01/2014	Source: Environmental Protection Agency
Date Data Arrived at EDR: 09/10/2014	Telephone: N/A
Date Made Active in Reports: 10/20/2014	Last EDR Contact: 09/04/2018
Number of Days to Update: 40	Next Scheduled EDR Contact: 12/17/2018
	Data Release Frequency: Varies

PCB TRANSFORMER: PCB Transformer Registration Database

The database of PCB transformer registrations that includes all PCB registration submittals.

Date of Government Version: 05/24/2017	Source: Environmental Protection Agency
Date Data Arrived at EDR: 11/30/2017	Telephone: 202-566-0517
Date Made Active in Reports: 12/15/2017	Last EDR Contact: 07/27/2018
Number of Days to Update: 15	Next Scheduled EDR Contact: 11/05/2018
	Data Release Frequency: Varies

RADINFO: Radiation Information Database

The Radiation Information Database (RADINFO) contains information about facilities that are regulated by U.S. Environmental Protection Agency (EPA) regulations for radiation and radioactivity.

Date of Government Version: 07/02/2018	Source: Environmental Protection Agency
Date Data Arrived at EDR: 07/05/2018	Telephone: 202-343-9775
Date Made Active in Reports: 10/05/2018	Last EDR Contact: 10/03/2018
Number of Days to Update: 92	Next Scheduled EDR Contact: 01/14/2019
	Data Release Frequency: Quarterly

HIST FTTS: FIFRA/TSCA Tracking System Administrative Case Listing

A complete administrative case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006	Source: Environmental Protection Agency
Date Data Arrived at EDR: 03/01/2007	Telephone: 202-564-2501
Date Made Active in Reports: 04/10/2007	Last EDR Contact: 12/17/2007
Number of Days to Update: 40	Next Scheduled EDR Contact: 03/17/2008
	Data Release Frequency: No Update Planned

HIST FTTS INSP: FIFRA/TSCA Tracking System Inspection & Enforcement Case Listing

A complete inspection and enforcement case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006	Source: Environmental Protection Agency
Date Data Arrived at EDR: 03/01/2007	Telephone: 202-564-2501
Date Made Active in Reports: 04/10/2007	Last EDR Contact: 12/17/2008
Number of Days to Update: 40	Next Scheduled EDR Contact: 03/17/2008
	Data Release Frequency: No Update Planned

DOT OPS: Incident and Accident Data

Department of Transporation, Office of Pipeline Safety Incident and Accident data.

Date of Government Version: 07/31/2012	Source: Department of Transporation, Office of Pipeline Safety
Date Data Arrived at EDR: 08/07/2012	Telephone: 202-366-4595
Date Made Active in Reports: 09/18/2012	Last EDR Contact: 08/09/2018
Number of Days to Update: 42	Next Scheduled EDR Contact: 11/12/2018
	Data Release Frequency: Varies

CONSENT: Superfund (CERCLA) Consent Decrees

Major legal settlements that establish responsibility and standards for cleanup at NPL (Superfund) sites. Released periodically by United States District Courts after settlement by parties to litigation matters.

Date of Government Version: 06/30/2018	Source: Department of Justice, Consent Decree Library
Date Data Arrived at EDR: 07/17/2018	Telephone: Varies
Date Made Active in Reports: 10/05/2018	Last EDR Contact: 10/01/2018
Number of Days to Update: 80	Next Scheduled EDR Contact: 12/31/2018
	Data Release Frequency: Varies

BRS: Biennial Reporting System

The Biennial Reporting System is a national system administered by the EPA that collects data on the generation and management of hazardous waste. BRS captures detailed data from two groups: Large Quantity Generators (LQG) and Treatment, Storage, and Disposal Facilities.

Date of Government Version: 12/31/2015	Source: EPA/NTIS
Date Data Arrived at EDR: 02/22/2017	Telephone: 800-424-9346
Date Made Active in Reports: 09/28/2017	Last EDR Contact: 08/24/2018
Number of Days to Update: 218	Next Scheduled EDR Contact: 12/03/2018
	Data Release Frequency: Biennially

INDIAN RESERV: Indian Reservations

This map layer portrays Indian administered lands of the United States that have any area equal to or greater than 640 acres.

Date of Government Version: 12/31/2014
Date Data Arrived at EDR: 07/14/2015
Date Made Active in Reports: 01/10/2017
Number of Days to Update: 546

Source: USGS
Telephone: 202-208-3710
Last EDR Contact: 10/09/2018
Next Scheduled EDR Contact: 01/21/2019
Data Release Frequency: Semi-Annually

FUSRAP: Formerly Utilized Sites Remedial Action Program

DOE established the Formerly Utilized Sites Remedial Action Program (FUSRAP) in 1974 to remediate sites where radioactive contamination remained from Manhattan Project and early U.S. Atomic Energy Commission (AEC) operations.

Date of Government Version: 08/08/2017
Date Data Arrived at EDR: 09/11/2018
Date Made Active in Reports: 09/14/2018
Number of Days to Update: 3

Source: Department of Energy
Telephone: 202-586-3559
Last EDR Contact: 09/11/2018
Next Scheduled EDR Contact: 11/19/2018
Data Release Frequency: Varies

UMTRA: Uranium Mill Tailings Sites

Uranium ore was mined by private companies for federal government use in national defense programs. When the mills shut down, large piles of the sand-like material (mill tailings) remain after uranium has been extracted from the ore. Levels of human exposure to radioactive materials from the piles are low; however, in some cases tailings were used as construction materials before the potential health hazards of the tailings were recognized.

Date of Government Version: 06/23/2017
Date Data Arrived at EDR: 10/11/2017
Date Made Active in Reports: 11/03/2017
Number of Days to Update: 23

Source: Department of Energy
Telephone: 505-845-0011
Last EDR Contact: 08/20/2018
Next Scheduled EDR Contact: 12/03/2018
Data Release Frequency: Varies

LEAD SMELTER 1: Lead Smelter Sites

A listing of former lead smelter site locations.

Date of Government Version: 07/17/2018
Date Data Arrived at EDR: 08/09/2018
Date Made Active in Reports: 10/05/2018
Number of Days to Update: 57

Source: Environmental Protection Agency
Telephone: 703-603-8787
Last EDR Contact: 10/04/2018
Next Scheduled EDR Contact: 01/14/2019
Data Release Frequency: Varies

LEAD SMELTER 2: Lead Smelter Sites

A list of several hundred sites in the U.S. where secondary lead smelting was done from 1931and 1964. These sites may pose a threat to public health through ingestion or inhalation of contaminated soil or dust

Date of Government Version: 04/05/2001
Date Data Arrived at EDR: 10/27/2010
Date Made Active in Reports: 12/02/2010
Number of Days to Update: 36

Source: American Journal of Public Health
Telephone: 703-305-6451
Last EDR Contact: 12/02/2009
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

US AIRS (AFS): Aerometric Information Retrieval System Facility Subsystem (AFS)

The database is a sub-system of Aerometric Information Retrieval System (AIRS). AFS contains compliance data on air pollution point sources regulated by the U.S. EPA and/or state and local air regulatory agencies. This information comes from source reports by various stationary sources of air pollution, such as electric power plants, steel mills, factories, and universities, and provides information about the air pollutants they produce. Action, air program, air program pollutant, and general level plant data. It is used to track emissions and compliance data from industrial plants.

Date of Government Version: 10/12/2016
Date Data Arrived at EDR: 10/26/2016
Date Made Active in Reports: 02/03/2017
Number of Days to Update: 100

Source: EPA
Telephone: 202-564-2496
Last EDR Contact: 09/26/2017
Next Scheduled EDR Contact: 01/08/2018
Data Release Frequency: Annually

US AIRS MINOR: Air Facility System Data

A listing of minor source facilities.

Date of Government Version: 10/12/2016
Date Data Arrived at EDR: 10/26/2016
Date Made Active in Reports: 02/03/2017
Number of Days to Update: 100

Source: EPA
Telephone: 202-564-2496
Last EDR Contact: 09/26/2017
Next Scheduled EDR Contact: 01/08/2018
Data Release Frequency: Annually

US MINES: Mines Master Index File

Contains all mine identification numbers issued for mines active or opened since 1971. The data also includes violation information.

Date of Government Version: 08/01/2018
Date Data Arrived at EDR: 08/29/2018
Date Made Active in Reports: 10/05/2018
Number of Days to Update: 37

Source: Department of Labor, Mine Safety and Health Administration
Telephone: 303-231-5959
Last EDR Contact: 08/29/2018
Next Scheduled EDR Contact: 12/10/2018
Data Release Frequency: Semi-Annually

US MINES 2: Ferrous and Nonferrous Metal Mines Database Listing

This map layer includes ferrous (ferrous metal mines are facilities that extract ferrous metals, such as iron ore or molybdenum) and nonferrous (Nonferrous metal mines are facilities that extract nonferrous metals, such as gold, silver, copper, zinc, and lead) metal mines in the United States.

Date of Government Version: 12/05/2005
Date Data Arrived at EDR: 02/29/2008
Date Made Active in Reports: 04/18/2008
Number of Days to Update: 49

Source: USGS
Telephone: 703-648-7709
Last EDR Contact: 08/31/2018
Next Scheduled EDR Contact: 12/10/2018
Data Release Frequency: Varies

US MINES 3: Active Mines & Mineral Plants Database Listing

Active Mines and Mineral Processing Plant operations for commodities monitored by the Minerals Information Team of the USGS.

Date of Government Version: 04/14/2011
Date Data Arrived at EDR: 06/08/2011
Date Made Active in Reports: 09/13/2011
Number of Days to Update: 97

Source: USGS
Telephone: 703-648-7709
Last EDR Contact: 08/31/2018
Next Scheduled EDR Contact: 12/10/2018
Data Release Frequency: Varies

ABANDONED MINES: Abandoned Mines

An inventory of land and water impacted by past mining (primarily coal mining) is maintained by OSMRE to provide information needed to implement the Surface Mining Control and Reclamation Act of 1977 (SMCRA). The inventory contains information on the location, type, and extent of AML impacts, as well as, information on the cost associated with the reclamation of those problems. The inventory is based upon field surveys by State, Tribal, and OSMRE program officials. It is dynamic to the extent that it is modified as new problems are identified and existing problems are reclaimed.

Date of Government Version: 09/10/2018
Date Data Arrived at EDR: 09/11/2018
Date Made Active in Reports: 09/14/2018
Number of Days to Update: 3

Source: Department of Interior
Telephone: 202-208-2609
Last EDR Contact: 09/10/2018
Next Scheduled EDR Contact: 12/24/2018
Data Release Frequency: Quarterly

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

FINDS: Facility Index System/Facility Registry System

Facility Index System. FINDS contains both facility information and 'pointers' to other sources that contain more detail. EDR includes the following FINDS databases in this report: PCS (Permit Compliance System), AIRS (Aerometric Information Retrieval System), DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes), FURS (Federal Underground Injection Control), C-DOCKET (Criminal Docket System used to track criminal enforcement actions for all environmental statutes), FFIS (Federal Facilities Information System), STATE (State Environmental Laws and Statutes), and PADS (PCB Activity Data System).

Date of Government Version: 08/07/2018	Source: EPA
Date Data Arrived at EDR: 09/05/2018	Telephone: (312) 353-2000
Date Made Active in Reports: 10/05/2018	Last EDR Contact: 09/18/2018
Number of Days to Update: 30	Next Scheduled EDR Contact: 12/17/2018
	Data Release Frequency: Quarterly

ECHO: Enforcement & Compliance History Information

ECHO provides integrated compliance and enforcement information for about 800,000 regulated facilities nationwide.

Date of Government Version: 09/02/2018	Source: Environmental Protection Agency
Date Data Arrived at EDR: 09/05/2018	Telephone: 202-564-2280
Date Made Active in Reports: 09/14/2018	Last EDR Contact: 09/05/2018
Number of Days to Update: 9	Next Scheduled EDR Contact: 12/17/2018
	Data Release Frequency: Quarterly

UXO: Unexploded Ordnance Sites

A listing of unexploded ordnance site locations

Date of Government Version: 09/30/2017	Source: Department of Defense
Date Data Arrived at EDR: 06/19/2018	Telephone: 703-704-1564
Date Made Active in Reports: 09/14/2018	Last EDR Contact: 10/15/2018
Number of Days to Update: 87	Next Scheduled EDR Contact: 01/28/2019
	Data Release Frequency: Varies

DOCKET HWC: Hazardous Waste Compliance Docket Listing

A complete list of the Federal Agency Hazardous Waste Compliance Docket Facilities.

Date of Government Version: 05/31/2018	Source: Environmental Protection Agency
Date Data Arrived at EDR: 07/26/2018	Telephone: 202-564-0527
Date Made Active in Reports: 10/05/2018	Last EDR Contact: 08/31/2018
Number of Days to Update: 71	Next Scheduled EDR Contact: 12/10/2018
	Data Release Frequency: Varies

FUELS PROGRAM: EPA Fuels Program Registered Listing

This listing includes facilities that are registered under the Part 80 (Code of Federal Regulations) EPA Fuels Programs. All companies now are required to submit new and updated registrations.

Date of Government Version: 08/22/2018	Source: EPA
Date Data Arrived at EDR: 08/22/2018	Telephone: 800-385-6164
Date Made Active in Reports: 10/05/2018	Last EDR Contact: 08/22/2018
Number of Days to Update: 44	Next Scheduled EDR Contact: 12/03/2018
	Data Release Frequency: Quarterly

AIRS: Title V Permits Listing

A listing of Title V Permits issued by the Division of Air Pollution Control. It is a federal operating permit program adopted and implemented by the state. The basic program elements typically specify that major sources will submit an operating application to the specified state environmental regulatory agency according to a schedule.

Date of Government Version: 09/25/2018	Source: Ohio EPA
Date Data Arrived at EDR: 09/27/2018	Telephone: 614-644-2270
Date Made Active in Reports: 10/17/2018	Last EDR Contact: 09/17/2018
Number of Days to Update: 20	Next Scheduled EDR Contact: 12/31/2018
	Data Release Frequency: Quarterly

COAL ASH: Coal Ash Disposal Site Listing

A listing of coal ash disposal site locations.

Date of Government Version: 04/13/2015	Source: Ohio EPA
Date Data Arrived at EDR: 04/16/2015	Telephone: 614-644-2134
Date Made Active in Reports: 05/29/2015	Last EDR Contact: 10/09/2018
Number of Days to Update: 43	Next Scheduled EDR Contact: 01/21/2019
	Data Release Frequency: Varies

CRO: Cessation of Regulated Operations Facility Listing

"Cessation of Regulated Operations" means the discontinuation or termination of regulated operations or the finalizing of any transaction or proceeding through which those operations are discontinued. "Regulated Operations" means the production, use, storage or handling of regulated substances.

Date of Government Version: 09/27/2017	Source: Ohio EPA
Date Data Arrived at EDR: 11/09/2017	Telephone: 614-644-3065
Date Made Active in Reports: 01/08/2018	Last EDR Contact: 08/10/2018
Number of Days to Update: 60	Next Scheduled EDR Contact: 11/19/2018
	Data Release Frequency: Varies

DRYCLEANERS: Drycleaner Facility Listing

A listing of drycleaner facility locations.

Date of Government Version: 09/26/2018	Source: Ohio EPA
Date Data Arrived at EDR: 09/28/2018	Telephone: 614-644-3469
Date Made Active in Reports: 10/16/2018	Last EDR Contact: 09/24/2018
Number of Days to Update: 18	Next Scheduled EDR Contact: 01/07/2019
	Data Release Frequency: Semi-Annually

Financial Assurance: Financial Assurance Information Listing

Financial assurance information.

Date of Government Version: 12/05/2017	Source: Ohio EPA
Date Data Arrived at EDR: 12/08/2017	Telephone: 614-644-2955
Date Made Active in Reports: 01/08/2018	Last EDR Contact: 10/09/2018
Number of Days to Update: 31	Next Scheduled EDR Contact: 01/21/2019
	Data Release Frequency: Semi-Annually

FINANCIAL ASSURANCE 3: Financial Assurance3 Information Listing

Information for solid waste facilities. Financial assurance is intended to ensure that resources are available to pay for the cost of closure, post-closure care, and corrective measures if the owner or operator of a regulated facility is unable or unwilling to pay.

Date of Government Version: 07/27/2018	Source: Ohio EPA
Date Data Arrived at EDR: 07/31/2018	Telephone: 614-644-2621
Date Made Active in Reports: 09/14/2018	Last EDR Contact: 10/09/2018
Number of Days to Update: 45	Next Scheduled EDR Contact: 01/21/2019
	Data Release Frequency: Varies

HIST USD: Urban Setting Designations Database

A USD may be requested for properties participating in the VAP when there is no current or future use of the ground water by local residents for drinking, showering, bathing or cooking. In these areas, an approved USD would lower the cost of cleanup and promote economic redevelopment while still protecting public health and safety. If these USDs were to be approved, the ground water cleanup or response requirements for the areas could be lessened. The Ohio EPA director may approve a USD request based on a demonstration that the USD requirements are met and an evaluation of existing and future uses of ground water in the area. The Ohio EPA director’s decision on approval or denial of the request is needed before cleanup requirements for the site can be determined. This database is no longer updated or maintained by the state agency.

Date of Government Version: 05/10/2005	Source: Ohio EPA
Date Data Arrived at EDR: 04/25/2006	Telephone: 614-644-3749
Date Made Active in Reports: 05/11/2006	Last EDR Contact: 06/02/2008
Number of Days to Update: 16	Next Scheduled EDR Contact: 09/01/2008
	Data Release Frequency: No Update Planned

LEAD: Lead Inspections Listing

Department of Health lead inspections included in the Environmental Licensing System.

Date of Government Version: 09/18/2018	Source: Department of Health
Date Data Arrived at EDR: 09/19/2018	Telephone: 614-466-3543
Date Made Active in Reports: 10/16/2018	Last EDR Contact: 09/19/2018
Number of Days to Update: 27	Next Scheduled EDR Contact: 12/31/2018
	Data Release Frequency: Quarterly

NPDES: NPDES General Permit List

General information regarding NPDES (National Pollutant Discharge Elimination System) permits.

Date of Government Version: 08/06/2018	Source: Ohio EPA
Date Data Arrived at EDR: 08/08/2018	Telephone: 614-644-2031
Date Made Active in Reports: 09/25/2018	Last EDR Contact: 08/08/2018
Number of Days to Update: 48	Next Scheduled EDR Contact: 11/19/2018
	Data Release Frequency: Quarterly

VAPOR: Vapor Intrusion

A listing of vapor intrusion related sites.

Date of Government Version: 09/18/2018	Source: Ohio EPA
Date Data Arrived at EDR: 09/20/2018	Telephone: 614-644-2924
Date Made Active in Reports: 10/16/2018	Last EDR Contact: 09/17/2018
Number of Days to Update: 26	Next Scheduled EDR Contact: 12/31/2018
	Data Release Frequency: Varies

TOWNGAS: DERR Towngas Database

The database includes 82 very old sites (circa 1895) which produced gas from coal for street lighting. Most visual evidence of these sites has disappeared, however the potential for buried coal tar remains. The database is no longer in active use.

Date of Government Version: 07/28/1992	Source: Ohio EPA
Date Data Arrived at EDR: 02/21/2003	Telephone: 614-644-3749
Date Made Active in Reports: 03/05/2003	Last EDR Contact: 02/12/2003
Number of Days to Update: 12	Next Scheduled EDR Contact: N/A
	Data Release Frequency: No Update Planned

UIC: Underground Injection Wells Listing

A listing of underground injection well locations.

Date of Government Version: 07/11/2018	Source: Ohio EPA
Date Data Arrived at EDR: 08/08/2018	Telephone: 614-644-2752
Date Made Active in Reports: 09/24/2018	Last EDR Contact: 08/08/2018
Number of Days to Update: 47	Next Scheduled EDR Contact: 11/19/2018
	Data Release Frequency: Varies

USD: Urban Setting Designation Sites

A USD may be requested for properties participating in the VAP when there is no current or future use of the ground water by local residents for drinking, showering, bathing or cooking. In these areas, an approved USD would lower the cost of cleanup and promote economic redevelopment while still protecting public health and safety. If these USDs were to be approved, the ground water cleanup or response requirements for the areas could be lessened. The Ohio EPA director may approve a USD request based on a demonstration that the USD requirements are met and an evaluation of existing and future uses of ground water in the area. The Ohio EPA director’s decision on approval or denial of the request is needed before cleanup requirements for the site can be determined.

Date of Government Version: 06/21/2018
Date Data Arrived at EDR: 08/08/2018
Date Made Active in Reports: 09/24/2018
Number of Days to Update: 47

Source: Ohio EPA
Telephone: 614-644-3749
Last EDR Contact: 08/08/2018
Next Scheduled EDR Contact: 11/19/2018
Data Release Frequency: Semi-Annually

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR MGP: EDR Proprietary Manufactured Gas Plants

The EDR Proprietary Manufactured Gas Plant Database includes records of coal gas plants (manufactured gas plants) compiled by EDR's researchers. Manufactured gas sites were used in the United States from the 1800's to 1950's to produce a gas that could be distributed and used as fuel. These plants used whale oil, rosin, coal, or a mixture of coal, oil, and water that also produced a significant amount of waste. Many of the byproducts of the gas production, such as coal tar (oily waste containing volatile and non-volatile chemicals), sludges, oils and other compounds are potentially hazardous to human health and the environment. The byproduct from this process was frequently disposed of directly at the plant site and can remain or spread slowly, serving as a continuous source of soil and groundwater contamination.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

EDR Hist Auto: EDR Exclusive Historical Auto Stations

EDR has searched selected national collections of business directories and has collected listings of potential gas station/filling station/service station sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include gas station/filling station/service station establishments. The categories reviewed included, but were not limited to gas, gas station, gasoline station, filling station, auto, automobile repair, auto service station, service station, etc. This database falls within a category of information EDR classifies as "High Risk Historical Records", or HRHR. EDR's HRHR effort presents unique and sometimes proprietary data about past sites and operations that typically create environmental concerns, but may not show up in current government records searches.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

EDR Hist Cleaner: EDR Exclusive Historical Cleaners

EDR has searched selected national collections of business directories and has collected listings of potential dry cleaner sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include dry cleaning establishments. The categories reviewed included, but were not limited to dry cleaners, cleaners, laundry, laundromat, cleaning/laundry, wash & dry etc. This database falls within a category of information EDR classifies as "High Risk Historical Records", or HRHR. EDR's HRHR effort presents unique and sometimes proprietary data about past sites and operations that typically create environmental concerns, but may not show up in current government records searches.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

EDR RECOVERED GOVERNMENT ARCHIVES

Exclusive Recovered Govt. Archives

RGA LF: Recovered Government Archive Solid Waste Facilities List

The EDR Recovered Government Archive Landfill database provides a list of landfills derived from historical databases and includes many records that no longer appear in current government lists. Compiled from Records formerly available from the Ohio Environmental Procetion Agency in Ohio.

Date of Government Version: N/A	Source: Ohio Environmental Protection Agency
Date Data Arrived at EDR: 07/01/2013	Telephone: N/A
Date Made Active in Reports: 01/13/2014	Last EDR Contact: 06/01/2012
Number of Days to Update: 196	Next Scheduled EDR Contact: N/A
	Data Release Frequency: Varies

RGA LUST: Recovered Government Archive Leaking Underground Storage Tank

The EDR Recovered Government Archive Leaking Underground Storage Tank database provides a list of LUST incidents derived from historical databases and includes many records that no longer appear in current government lists. Compiled from Records formerly available from the Department of Commerce in Ohio.

Date of Government Version: N/A	Source: Department of Commerce
Date Data Arrived at EDR: 07/01/2013	Telephone: N/A
Date Made Active in Reports: 12/20/2013	Last EDR Contact: 06/01/2012
Number of Days to Update: 172	Next Scheduled EDR Contact: N/A
	Data Release Frequency: Varies

OTHER DATABASE(S)

Depending on the geographic area covered by this report, the data provided in these specialty databases may or may not be complete. For example, the existence of wetlands information data in a specific report does not mean that all wetlands in the area covered by the report are included. Moreover, the absence of any reported wetlands information does not necessarily mean that wetlands do not exist in the area covered by the report.

CT MANIFEST: Hazardous Waste Manifest Data

Facility and manifest data. Manifest is a document that lists and tracks hazardous waste from the generator through transporters to a tsd facility.

Date of Government Version: 08/10/2018	Source: Department of Energy & Environmental Protection
Date Data Arrived at EDR: 08/10/2018	Telephone: 860-424-3375
Date Made Active in Reports: 09/10/2018	Last EDR Contact: 08/09/2018
Number of Days to Update: 31	Next Scheduled EDR Contact: 11/26/2018
	Data Release Frequency: No Update Planned

NJ MANIFEST: Manifest Information

Hazardous waste manifest information.

Date of Government Version: 12/31/2017	Source: Department of Environmental Protection
Date Data Arrived at EDR: 07/13/2018	Telephone: N/A
Date Made Active in Reports: 08/01/2018	Last EDR Contact: 10/09/2018
Number of Days to Update: 19	Next Scheduled EDR Contact: 01/21/2019
	Data Release Frequency: Annually

NY MANIFEST: Facility and Manifest Data

Manifest is a document that lists and tracks hazardous waste from the generator through transporters to a TSD facility.

Date of Government Version: 07/01/2018	Source: Department of Environmental Conservation
Date Data Arrived at EDR: 08/01/2018	Telephone: 518-402-8651
Date Made Active in Reports: 08/31/2018	Last EDR Contact: 08/01/2018
Number of Days to Update: 30	Next Scheduled EDR Contact: 11/12/2018
	Data Release Frequency: Quarterly

PA MANIFEST: Manifest Information
Hazardous waste manifest information.

Date of Government Version: 12/31/2016	Source: Department of Environmental Protection
Date Data Arrived at EDR: 07/25/2017	Telephone: 717-783-8990
Date Made Active in Reports: 09/25/2017	Last EDR Contact: 10/15/2018
Number of Days to Update: 62	Next Scheduled EDR Contact: 01/28/2019
	Data Release Frequency: Annually

RI MANIFEST: Manifest information
Hazardous waste manifest information

Date of Government Version: 12/31/2017	Source: Department of Environmental Management
Date Data Arrived at EDR: 02/23/2018	Telephone: 401-222-2797
Date Made Active in Reports: 04/09/2018	Last EDR Contact: 08/21/2018
Number of Days to Update: 45	Next Scheduled EDR Contact: 12/03/2018
	Data Release Frequency: Annually

VT MANIFEST: Hazardous Waste Manifest Data
Hazardous waste manifest information.

Date of Government Version: 08/23/2018	Source: Department of Environmental Conservation
Date Data Arrived at EDR: 08/23/2018	Telephone: 802-241-3443
Date Made Active in Reports: 09/18/2018	Last EDR Contact: 10/15/2018
Number of Days to Update: 26	Next Scheduled EDR Contact: 01/28/2019
	Data Release Frequency: Annually

WI MANIFEST: Manifest Information
Hazardous waste manifest information.

Date of Government Version: 12/31/2017	Source: Department of Natural Resources
Date Data Arrived at EDR: 06/15/2018	Telephone: N/A
Date Made Active in Reports: 07/09/2018	Last EDR Contact: 09/06/2018
Number of Days to Update: 24	Next Scheduled EDR Contact: 12/24/2018
	Data Release Frequency: Annually

Oil/Gas Pipelines
Source: PennWell Corporation
Petroleum Bundle (Crude Oil, Refined Products, Petrochemicals, Gas Liquids (LPG/NGL), and Specialty Gases (Miscellaneous)) N = Natural Gas Bundle (Natural Gas, Gas Liquids (LPG/NGL), and Specialty Gases (Miscellaneous)). This map includes information copyrighted by PennWell Corporation. This information is provided on a best effort basis and PennWell Corporation does not guarantee its accuracy nor warrant its fitness for any particular purpose. Such information has been reprinted with the permission of PennWell.

Electric Power Transmission Line Data
Source: PennWell Corporation
This map includes information copyrighted by PennWell Corporation. This information is provided on a best effort basis and PennWell Corporation does not guarantee its accuracy nor warrant its fitness for any particular purpose. Such information has been reprinted with the permission of PennWell.

Sensitive Receptors: There are individuals deemed sensitive receptors due to their fragile immune systems and special sensitivity to environmental discharges. These sensitive receptors typically include the elderly, the sick, and children. While the location of all sensitive receptors cannot be determined, EDR indicates those buildings and facilities - schools, daycares, hospitals, medical centers, and nursing homes - where individuals who are sensitive receptors are likely to be located.

AHA Hospitals:
Source: American Hospital Association, Inc.
Telephone: 312-280-5991
The database includes a listing of hospitals based on the American Hospital Association’s annual survey of hospitals.

Medical Centers: Provider of Services Listing
Source: Centers for Medicare & Medicaid Services
Telephone: 410-786-3000
A listing of hospitals with Medicare provider number, produced by Centers of Medicare & Medicaid Services, a federal agency within the U.S. Department of Health and Human Services.

Nursing Homes
Source: National Institutes of Health
Telephone: 301-594-6248
Information on Medicare and Medicaid certified nursing homes in the United States.

Public Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on elementary and secondary public education in the United States. It is a comprehensive, annual, national statistical database of all public elementary and secondary schools and school districts, which contains data that are comparable across all states.

Private Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on private school locations in the United States.

Daycare Centers: Licensed Child Day Care Facilities
Source: Department of Job & Family Services
Telephone: 614-466-6282

Flood Zone Data: This data was obtained from the Federal Emergency Management Agency (FEMA). It depicts 100-year and 500-year flood zones as defined by FEMA. It includes the National Flood Hazard Layer (NFHL) which incorporates Flood Insurance Rate Map (FIRM) data and Q3 data from FEMA in areas not covered by NFHL.
Source: FEMA
Telephone: 877-336-2627
Date of Government Version: 2003, 2015

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002, 2005 and 2010 from the U.S. Fish and Wildlife Service.

Current USGS 7.5 Minute Topographic Map
Source: U.S. Geological Survey

STREET AND ADDRESS INFORMATION

GEOCHECK ®- PHYSICAL SETTING SOURCE ADDENDUM

TARGET PROPERTY ADDRESS

RICKENBACKER AASF
8227 SOUTH ACCESS ROAD
GROVEPORT, OH 43125

TARGET PROPERTY COORDINATES

Latitude (North):	39.805672 - 39˚ 48’ 20.42’’
Longitude (West):	82.928495 - 82˚ 55’ 42.58’’
Universal Tranverse Mercator:	Zone 17
UTM X (Meters):	334908.6
UTM Y (Meters):	4407758.5
Elevation:	729 ft. above sea level

USGS TOPOGRAPHIC MAP

Target Property Map:	5964669 LOCKBOURNE, OH
Version Date:	2013

EDR’s GeoCheck Physical Setting Source Addendum is provided to assist the environmental professional in forming an opinion about the impact of potential contaminant migration.

Assessment of the impact of contaminant migration generally has two principle investigative components:

1. Groundwater flow direction, and
2. Groundwater flow velocity.

Groundwater flow direction may be impacted by surface topography, hydrology, hydrogeology, characteristics of the soil, and nearby wells. Groundwater flow velocity is generally impacted by the nature of the geologic strata.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW DIRECTION INFORMATION

Groundwater flow direction for a particular site is best determined by a qualified environmental professional using site-specific well data. If such data is not reasonably ascertainable, it may be necessary to rely on other sources of information, such as surface topographic information, hydrologic information, hydrogeologic data collected on nearby properties, and regional groundwater flow information (from deep aquifers).

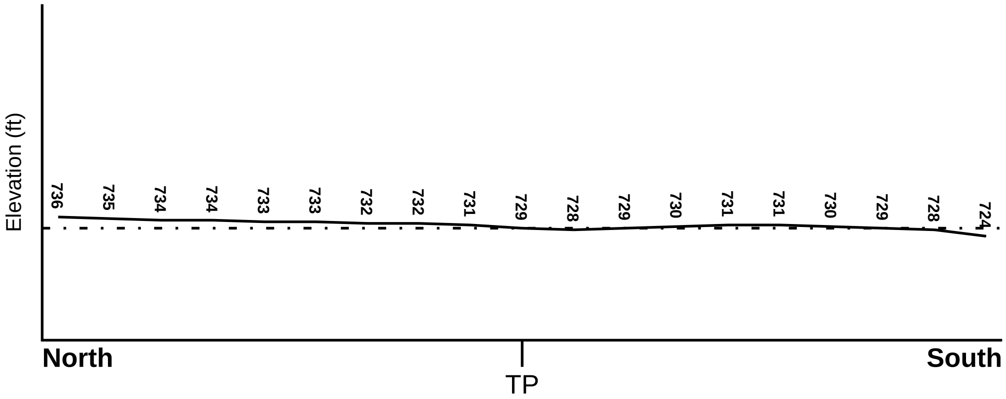
TOPOGRAPHIC INFORMATION

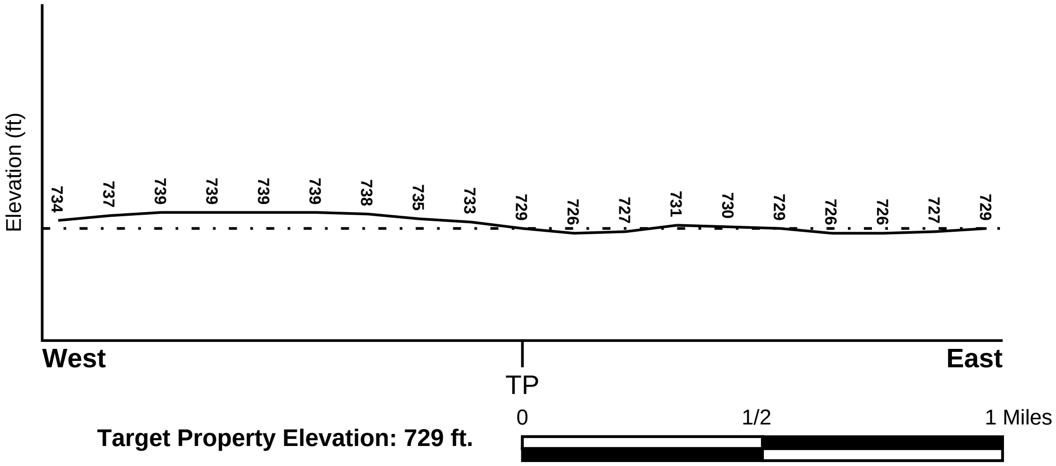
Surface topography may be indicative of the direction of surficial groundwater flow. This information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

TARGET PROPERTY TOPOGRAPHY

General Topographic Gradient: General East

SURROUNDING TOPOGRAPHY: ELEVATION PROFILES





Target Property Elevation: 729 ft.

Source: Topography has been determined from the USGS 7.5' Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

HYDROLOGIC INFORMATION

Surface water can act as a hydrologic barrier to groundwater flow. Such hydrologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

Refer to the Physical Setting Source Map following this summary for hydrologic information (major waterways and bodies of water).

FEMA FLOOD ZONE

Flood Plain Panel at Target Property	FEMA Source Type
39129C0075J	FEMA FIRM Flood data

Additional Panels in search area:	FEMA Source Type
Not Reported	

NATIONAL WETLAND INVENTORY

NWI Quad at Target Property	NWI Electronic Data Coverage
LOCKBOURNE	YES - refer to the Overview Map and Detail Map

HYDROGEOLOGIC INFORMATION

Hydrogeologic information obtained by installation of wells on a specific site can often be an indicator of groundwater flow direction in the immediate area. Such hydrogeologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

AQUIFLOW®

Search Radius: 1.000 Mile.

EDR has developed the AQUIFLOW Information System to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted by environmental professionals to regulatory authorities at select sites and has extracted the date of the report, groundwater flow direction as determined hydrogeologically, and the depth to water table.

MAP ID	LOCATION FROM TP	GENERAL DIRECTION GROUNDWATER FLOW
J51	1/2 - 1 Mile NW	SE
J52	1/2 - 1 Mile NW	SSE
J54	1/2 - 1 Mile NW	E
1G	1/2 - 1 Mile NW	SE
2G	1/2 - 1 Mile NW	SSE
4G	1/2 - 1 Mile NW	E

For additional site information, refer to Physical Setting Source Map Findings.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW VELOCITY INFORMATION

Groundwater flow velocity information for a particular site is best determined by a qualified environmental professional using site specific geologic and soil strata data. If such data are not reasonably ascertainable, it may be necessary to rely on other sources of information, including geologic age identification, rock stratigraphic unit and soil characteristics data collected on nearby properties and regional soil information. In general, contaminant plumes move more quickly through sandy-gravelly types of soils than silty-clayey types of soils.

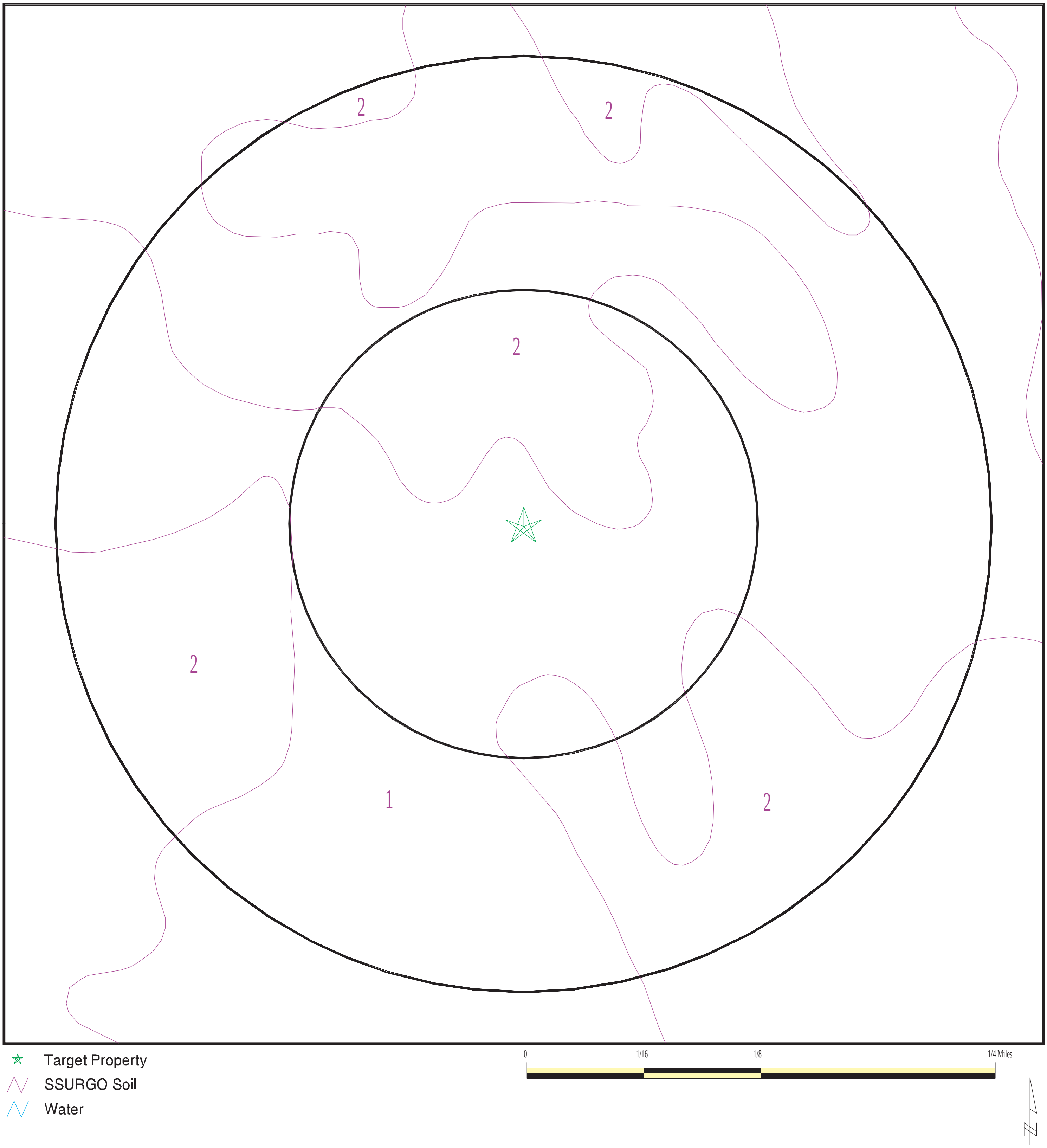
GEOLOGIC INFORMATION IN GENERAL AREA OF TARGET PROPERTY

Geologic information can be used by the environmental professional in forming an opinion about the relative speed at which contaminant migration may be occurring.

ROCK STRATIGRAPHIC UNIT		GEOLOGIC AGE IDENTIFICATION	
Era:	Paleozoic	Category:	Stratified Sequence
System:	Devonian		
Series:	Upper Devonian		
Code:	D3 *(decoded above as Era, System & Series)*		

Geologic Age and Rock Stratigraphic Unit Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - a digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

SSURGO SOIL MAP - 5457852.2s



SITE NAME: Rickenbacker AASF
ADDRESS: 8227 South Access Road
Groveport OH 43125
LAT/LONG: 39.805672 / 82.928495

CLIENT: AECOM
CONTACT: Brittany Kirchmann
INQUIRY #: 5457852.2s
DATE: October 18, 2018 1:38 pm

DOMINANT SOIL COMPOSITION IN GENERAL AREA OF TARGET PROPERTY

The U.S. Department of Agriculture's (USDA) Soil Conservation Service (SCS) leads the National Cooperative Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. The following information is based on Soil Conservation Service SSURGO data.

Soil Map ID: 1

Soil Component Name:	Kokomo
Soil Surface Texture:	silty clay loam
Hydrologic Group:	Class B/D - Drained/undrained hydrology class of soils that can be drained and are classified.
Soil Drainage Class:	Very poorly drained

Hydric Status: Partially hydric

Corrosion Potential - Uncoated Steel:	High
Depth to Bedrock Min:	> 0 inches
Depth to Watertable Min:	> 15 inches

Soil Layer Information

	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	
Layer	**Upper**	**Lower**	**Soil Texture Class**	**AASHTO Group**	**Unified Soil**		**Soil Reaction (pH)**
1	0 inches	9 inches	silty clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 4.23 Min: 1.41	Max: 8.4 Min: 7.4
2	9 inches	42 inches	silty clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 4.23 Min: 1.41	Max: 8.4 Min: 7.4
3	42 inches	70 inches	clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 4.23 Min: 1.41	Max: 8.4 Min: 7.4

Soil Map ID: 2

Soil Component Name: Crosby

Soil Surface Texture: silt loam

Hydrologic Group: Class B/D - Drained/undrained hydrology class of soils that can be drained and are classified.

Soil Drainage Class:
Hydric Status: Partially hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 61 inches

Soil Layer Information

	Boundary			Classification			
Layer	**Upper**	**Lower**	**Soil Texture Class**	**AASHTO Group**	**Unified Soil**	**Saturated hydraulic conductivity micro m/sec**	**Soil Reaction (pH)**
1	0 inches	9 inches	silt loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 4.23 Min: 0.42	Max: 8.4 Min: 7.9
2	9 inches	35 inches	silty clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 4.23 Min: 0.42	Max: 8.4 Min: 7.9
3	35 inches	70 inches	loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 4.23 Min: 0.42	Max: 8.4 Min: 7.9

LOCAL / REGIONAL WATER AGENCY RECORDS

EDR Local/Regional Water Agency records provide water well information to assist the environmental professional in assessing sources that may impact ground water flow direction, and in forming an opinion about the impact of contaminant migration on nearby drinking water wells.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

WELL SEARCH DISTANCE INFORMATION

DATABASE	SEARCH DISTANCE (miles)
Federal USGS	1.000
Federal FRDS PWS	Nearest PWS within 1 mile
State Database	1.000

FEDERAL USGS WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
No Wells Found		

FEDERAL FRDS PUBLIC WATER SUPPLY SYSTEM INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
No PWS System Found		

Note: PWS System location is not always the same as well location.

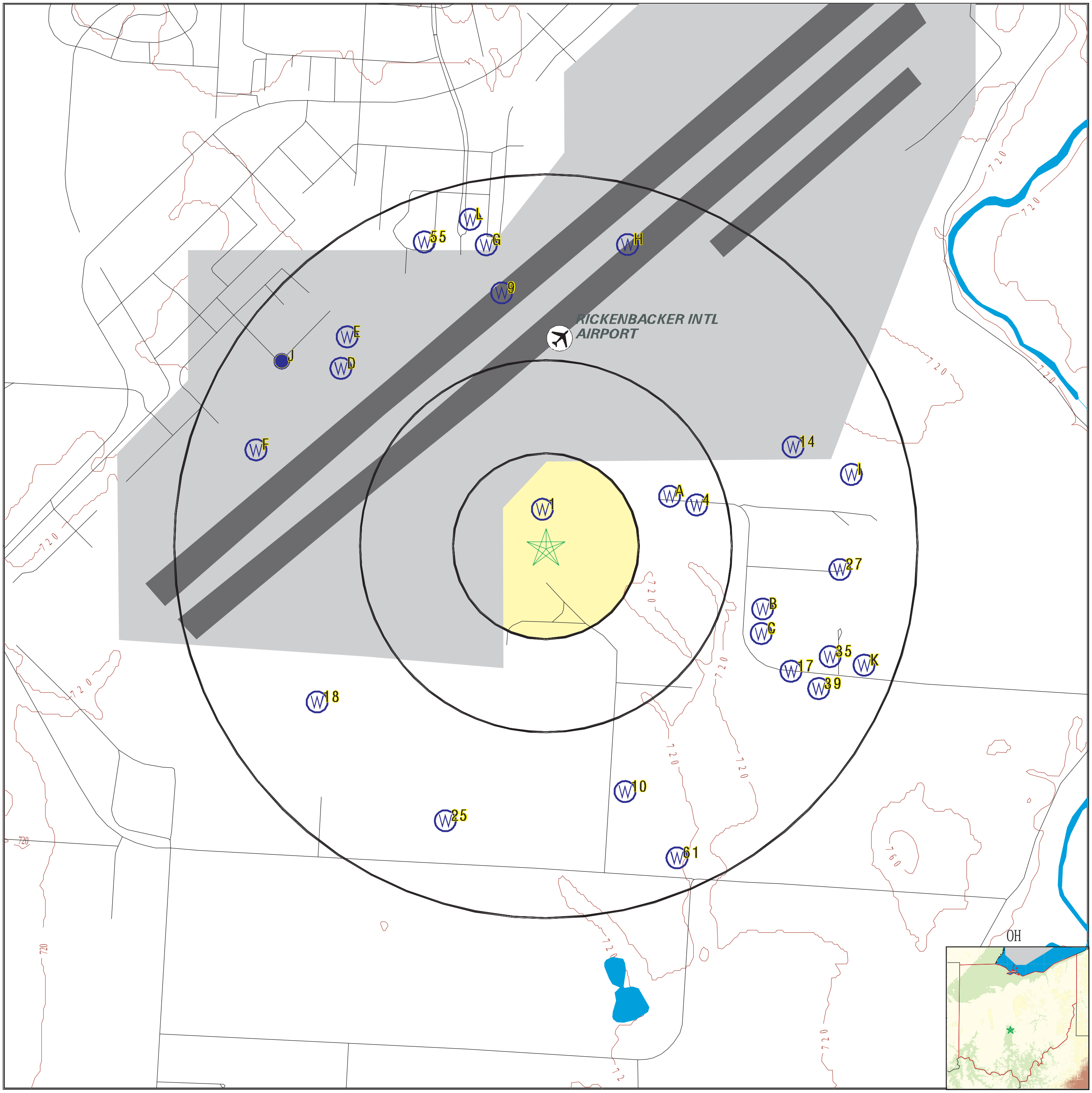
STATE DATABASE WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
1	OHDM20000451086	0 - 1/8 Mile North
A2	OHD800000045833	1/4 - 1/2 Mile ENE
A3	OHD800000235077	1/4 - 1/2 Mile ENE
4	OHD800000413138	1/4 - 1/2 Mile ENE
B5	OHD800000045754	1/2 - 1 Mile ESE
C6	OHD800000342666	1/2 - 1 Mile ESE
B7	OHD800000045755	1/2 - 1 Mile ESE
C8	OHD800000045756	1/2 - 1 Mile ESE
9	OHDM20000256044	1/2 - 1 Mile North
10	OHD800000239202	1/2 - 1 Mile SSE
D11	OHDM20000294258	1/2 - 1 Mile NW
D12	OHDM20000294245	1/2 - 1 Mile NW
D13	OHDM20000294259	1/2 - 1 Mile NW
14	OHDM20000407072	1/2 - 1 Mile ENE
D15	OHDM20000294244	1/2 - 1 Mile NW
D16	OHDM20000294257	1/2 - 1 Mile NW
17	OHD800000378317	1/2 - 1 Mile ESE
18	OHD800000123361	1/2 - 1 Mile SW
D19	OHDM20000294263	1/2 - 1 Mile NW
D20	OHDM20000294260	1/2 - 1 Mile NW
D21	OHDM20000294266	1/2 - 1 Mile NW
E22	OHDM20000294265	1/2 - 1 Mile NW
E23	OHDM20000294264	1/2 - 1 Mile NW
E24	OHDM20000294269	1/2 - 1 Mile NW
25	OHDM20000454305	1/2 - 1 Mile SSW

STATE DATABASE WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
E26	OHDM20000294268	1/2 - 1 Mile NW
27	OHD800000045753	1/2 - 1 Mile East
F28	OHDM20000440784	1/2 - 1 Mile WNW
F29	OHDM20000294267	1/2 - 1 Mile WNW
F30	OHDM20000294271	1/2 - 1 Mile WNW
G31	OHDM20000451462	1/2 - 1 Mile NNW
F32	OHDM20000429535	1/2 - 1 Mile WNW
H33	OHDM20000453778	1/2 - 1 Mile NNE
F34	OHDM20000294270	1/2 - 1 Mile WNW
35	OHD800000045758	1/2 - 1 Mile ESE
G36	OHDM20000449078	1/2 - 1 Mile North
G37	OHDM20000451005	1/2 - 1 Mile North
F38	OHDM20000294275	1/2 - 1 Mile WNW
39	OHD800000045757	1/2 - 1 Mile ESE
F40	OHDM20000294276	1/2 - 1 Mile WNW
F41	OHDM20000435255	1/2 - 1 Mile WNW
F42	OHDM20000294274	1/2 - 1 Mile WNW
G43	OHDM20000451461	1/2 - 1 Mile North
I44	OHDM20000407377	1/2 - 1 Mile ENE
I45	OHDM20000407378	1/2 - 1 Mile ENE
F46	OHDM20000294273	1/2 - 1 Mile WNW
G47	OHDM20000451065	1/2 - 1 Mile NNW
H48	OHDM20000454342	1/2 - 1 Mile NNE
F49	OHDM20000294272	1/2 - 1 Mile WNW
H50	OHDM20000453542	1/2 - 1 Mile NNE
55	OHDM20000453544	1/2 - 1 Mile NNW
K56	OHD800000045759	1/2 - 1 Mile ESE
L57	OHDM20000362945	1/2 - 1 Mile NNW
L58	OHDM20000362944	1/2 - 1 Mile NNW
L59	OHDM20000377060	1/2 - 1 Mile NNW
L60	OHDM20000362946	1/2 - 1 Mile NNW
61	OHD800000267879	1/2 - 1 Mile SSE
K62	OHD800000045760	1/2 - 1 Mile ESE

PHYSICAL SETTING SOURCE MAP - 5457852.2s



- County Boundary
- Major Roads
- Contour Lines
- Airports
- ◎ Earthquake epicenter, Richter 5 or greater
- Ⓦ Water Wells
- Ⓟ Public Water Supply Wells
- ● Cluster of Multiple Icons

- ↑ Groundwater Flow Direction
- (G I) Indeterminate Groundwater Flow at Location
- (G V) Groundwater Flow Varies at Location
- ● Oil, gas or related wells

SITE NAME: Rickenbacker AASF
ADDRESS: 8227 South Access Road
Groveport OH 43125
LAT/LONG: 39.805672 / 82.928495

CLIENT: AECOM
CONTACT: Brittany Kirchmann
INQUIRY #: 5457852.2s
DATE: October 18, 2018 1:38 pm

Map ID Direction Distance Elevation	Database	EDR ID Number
1 **North** **0 - 1/8 Mile** **Higher**	**OH WELLS**	**OHDM20000451086**

Database:	Monitoring Water Wells Listing		
Well Log #:	2062284	Well Type:	Water Well
Drill Type:	AUGER	Test Type:	Not Reported
Well Use:	Monitor	Aquifer Type:	SAND
Permit #:	Not Reported	Test Rate:	0
Draw Down:	0	Test Duration:	0
Surface Water Level:	3.7	Date Measured:	20-FEB-17
Casing Height:	0	Screen Length:	10
Total Depth:	16	Completion Date:	20-FEB-17
Depth to Bedrock:	0	Drill Year:	Not Reported
Well Seal Rpt #:	0	Screen Diameter:	2
Screen Type:	MACHINE SLOTTED	Screen Material:	PVC
Pump Type:	Not Reported	Pump Capacity:	0
Pump Installed By:	Not Reported	Water Level Elevation:	0
Well Drilled By:	Not Reported		

A2 **ENE** **1/4 - 1/2 Mile** **Higher**	**OH WELLS**	**OHD800000045833**

Database:	Water Well Database	Well Log #:	765490
Well Type:	Water Well	Drill Type:	CABLE TOOL
Test Type:	Not Reported	Well Use:	Not Reported
Aquifer Type:	SAND AND GRAVEL	Permit #:	Not Reported
Test Rate:	15	Draw Down:	2
Test Duration:	4	Surface Water Level:	23
Date Measured:	0	Casing Height:	0
Screen Length:	0	Total Depth:	97
Completion Date:	19931028	Depth to Bedrock:	0
Drill Year:	Not Reported	Well Seal Rpt #:	0
Screen Diameter:	0	Screen Type:	Not Reported
Screen Material:	Not Reported	Pump Type:	Not Reported
Pump Capacity:	0	Pump Installed By:	Not Reported
Water Level Elevation:	0	Well Drilled By:	Not Reported

A3 **ENE** **1/4 - 1/2 Mile** **Higher**	**OH WELLS**	**OHD800000235077**

Database:	Water Well Database	Well Log #:	922558
Well Type:	Water Well	Drill Type:	Not Reported
Test Type:	Bailing	Well Use:	DOMESTIC
Aquifer Type:	GRAVEL	Permit #:	01-55
Test Rate:	20	Draw Down:	2
Test Duration:	2	Surface Water Level:	10
Date Measured:	2001 7 5	Casing Height:	2
Screen Length:	3	Total Depth:	34
Completion Date:	2001 7 5	Depth to Bedrock:	0
Drill Year:	Not Reported	Well Seal Rpt #:	0

Screen Diameter:	0	Screen Type:	Not Reported
Screen Material:	Not Reported	Pump Type:	Not Reported
Pump Capacity:	0	Pump Installed By:	Not Reported
Water Level Elevation:	0	Well Drilled By:	Not Reported

4
ENE **OH WELLS** **OHD800000413138**
1/4 - 1/2 Mile
Higher

Database:	Water Well Database	Well Log #:	770543
Well Type:	Water Well	Drill Type:	CABLE TOOL
Test Type:	Not Reported	Well Use:	DOMESTIC
Aquifer Type:	SAND AND GRAVEL	Permit #:	Not Reported
Test Rate:	15	Draw Down:	0
Test Duration:	2	Surface Water Level:	28
Date Measured:	0	Casing Height:	0
Screen Length:	0	Total Depth:	50
Completion Date:	1993 914	Depth to Bedrock:	0
Drill Year:	Not Reported	Well Seal Rpt #:	0
Screen Diameter:	0	Screen Type:	Not Reported
Screen Material:	Not Reported	Pump Type:	Not Reported
Pump Capacity:	0	Pump Installed By:	Not Reported
Water Level Elevation:	0	Well Drilled By:	Not Reported

B5
ESE **OH WELLS** **OHD800000045754**
1/2 - 1 Mile
Lower

Database:	Water Well Database	Well Log #:	593332
Well Type:	Water Well	Drill Type:	Not Reported
Test Type:	Not Reported	Well Use:	Not Reported
Aquifer Type:	SAND AND GRAVEL	Permit #:	Not Reported
Test Rate:	16	Draw Down:	2
Test Duration:	3	Surface Water Level:	18
Date Measured:	0	Casing Height:	0
Screen Length:	0	Total Depth:	71
Completion Date:	1983 920	Depth to Bedrock:	0
Drill Year:	Not Reported	Well Seal Rpt #:	0
Screen Diameter:	0	Screen Type:	Not Reported
Screen Material:	Not Reported	Pump Type:	Not Reported
Pump Capacity:	0	Pump Installed By:	Not Reported
Water Level Elevation:	708	Well Drilled By:	Not Reported

C6
ESE **OH WELLS** **OHD800000342666**
1/2 - 1 Mile
Higher

Database:	Water Well Database	Well Log #:	2011702
Well Type:	Water Well	Drill Type:	ROTARY
Test Type:	Pumping	Well Use:	DOMESTIC
Aquifer Type:	SAND AND GRAVEL	Permit #:	2007-96
Test Rate:	15	Draw Down:	1
Test Duration:	1	Surface Water Level:	15

Date Measured:	2007 7 3	Casing Height:	1.5
Screen Length:	3	Total Depth:	111
Completion Date:	2007 727	Depth to Bedrock:	0
Drill Year:	Not Reported	Well Seal Rpt #:	0
Screen Diameter:	5	Screen Type:	CONTINOUS WIRE WOUND
Screen Material:	STAINLESS STEEL	Pump Type:	SUBMERSIBLE
Pump Capacity:	10	Pump Installed By:	BEINHOWER BROS.
Water Level Elevation:	0	Well Drilled By:	Not Reported

B7
ESE
1/2 - 1 Mile
Higher

OH WELLS OHD800000045755

Database:	Water Well Database	Well Log #:	461572
Well Type:	Water Well	Drill Type:	Not Reported
Test Type:	Not Reported	Well Use:	Not Reported
Aquifer Type:	SAND AND GRAVEL	Permit #:	Not Reported
Test Rate:	20	Draw Down:	0
Test Duration:	1	Surface Water Level:	7
Date Measured:	0	Casing Height:	0
Screen Length:	0	Total Depth:	87
Completion Date:	1974 412	Depth to Bedrock:	0
Drill Year:	Not Reported	Well Seal Rpt #:	0
Screen Diameter:	0	Screen Type:	Not Reported
Screen Material:	Not Reported	Pump Type:	Not Reported
Pump Capacity:	0	Pump Installed By:	Not Reported
Water Level Elevation:	723	Well Drilled By:	Not Reported

C8
ESE
1/2 - 1 Mile
Higher

OH WELLS OHD800000045756

Database:	Water Well Database	Well Log #:	439507
Well Type:	Water Well	Drill Type:	Not Reported
Test Type:	Not Reported	Well Use:	Not Reported
Aquifer Type:	SAND AND GRAVEL	Permit #:	Not Reported
Test Rate:	20	Draw Down:	0
Test Duration:	1	Surface Water Level:	8
Date Measured:	0	Casing Height:	0
Screen Length:	0	Total Depth:	29
Completion Date:	1972 619	Depth to Bedrock:	0
Drill Year:	Not Reported	Well Seal Rpt #:	0
Screen Diameter:	0	Screen Type:	Not Reported
Screen Material:	Not Reported	Pump Type:	Not Reported
Pump Capacity:	0	Pump Installed By:	Not Reported
Water Level Elevation:	722	Well Drilled By:	Not Reported

9
North
1/2 - 1 Mile
Higher

OH WELLS OHDM20000256044

Database:	Monitoring Water Wells Listing		
Well Log #:	947494	Well Type:	Water Well

Drill Type:	AUGER	Test Type:	Not Reported
Well Use:	Monitor	Aquifer Type:	Not Reported
Permit #:	Not Reported	Test Rate:	0
Draw Down:	0	Test Duration:	0
Surface Water Level:	0	Date Measured:	Not Reported
Casing Height:	0	Screen Length:	10
Total Depth:	17	Completion Date:	21-AUG-02
Depth to Bedrock:	0	Drill Year:	Not Reported
Well Seal Rpt #:	0	Screen Diameter:	0
Screen Type:	Not Reported	Screen Material:	Not Reported
Pump Type:	Not Reported	Pump Capacity:	0
Pump Installed By:	Not Reported	Water Level Elevation:	0
Well Drilled By:	Not Reported		

10
SSE
1/2 - 1 Mile
Higher

OH WELLS **OHD800000239202**

Database:	Water Well Database	Well Log #:	871563
Well Type:	Water Well	Drill Type:	ROTARY
Test Type:	Pumping	Well Use:	DOMESTIC
Aquifer Type:	SAND AND GRAVEL	Permit #:	EPA
Test Rate:	20	Draw Down:	1.8
Test Duration:	24	Surface Water Level:	13.5
Date Measured:	1998 323	Casing Height:	2
Screen Length:	0	Total Depth:	111
Completion Date:	1998 320	Depth to Bedrock:	0
Drill Year:	Not Reported	Well Seal Rpt #:	0
Screen Diameter:	0	Screen Type:	Not Reported
Screen Material:	Not Reported	Pump Type:	Not Reported
Pump Capacity:	0	Pump Installed By:	Not Reported
Water Level Elevation:	0	Well Drilled By:	Not Reported

D11
NW
1/2 - 1 Mile
Higher

OH WELLS **OHDM20000294258**

Database:	Monitoring Water Wells Listing		
Well Log #:	986692	Well Type:	Water Well
Drill Type:	AUGER	Test Type:	Not Reported
Well Use:	Monitor	Aquifer Type:	Not Reported
Permit #:	Not Reported	Test Rate:	0
Draw Down:	0	Test Duration:	0
Surface Water Level:	1	Date Measured:	04-JAN-05
Casing Height:	0	Screen Length:	10
Total Depth:	15	Completion Date:	04-JAN-05
Depth to Bedrock:	0	Drill Year:	Not Reported
Well Seal Rpt #:	0	Screen Diameter:	0
Screen Type:	Not Reported	Screen Material:	Not Reported
Pump Type:	Not Reported	Pump Capacity:	0
Pump Installed By:	Not Reported	Water Level Elevation:	0
Well Drilled By:	Not Reported		

Map ID Direction Distance Elevation	Database	EDR ID Number
D12 **NW** **1/2 - 1 Mile** **Higher**	**OH WELLS**	**OHDM20000294245**

Database:	Monitoring Water Wells Listing		
Well Log #:	986690	Well Type:	Water Well
Drill Type:	AUGER	Test Type:	Not Reported
Well Use:	Monitor	Aquifer Type:	Not Reported
Permit #:	Not Reported	Test Rate:	0
Draw Down:	0	Test Duration:	0
Surface Water Level:	2	Date Measured:	04-JAN-05
Casing Height:	0	Screen Length:	10
Total Depth:	15	Completion Date:	04-JAN-05
Depth to Bedrock:	0	Drill Year:	Not Reported
Well Seal Rpt #:	0	Screen Diameter:	0
Screen Type:	Not Reported	Screen Material:	Not Reported
Pump Type:	Not Reported	Pump Capacity:	0
Pump Installed By:	Not Reported	Water Level Elevation:	0
Well Drilled By:	Not Reported		

D13 **NW** **1/2 - 1 Mile** **Higher**	**OH WELLS**	**OHDM20000294259**

Database:	Monitoring Water Wells Listing		
Well Log #:	986693	Well Type:	Water Well
Drill Type:	AUGER	Test Type:	Not Reported
Well Use:	Monitor	Aquifer Type:	Not Reported
Permit #:	Not Reported	Test Rate:	0
Draw Down:	0	Test Duration:	0
Surface Water Level:	0	Date Measured:	04-JAN-05
Casing Height:	0	Screen Length:	10
Total Depth:	15	Completion Date:	04-JAN-05
Depth to Bedrock:	0	Drill Year:	Not Reported
Well Seal Rpt #:	0	Screen Diameter:	0
Screen Type:	Not Reported	Screen Material:	Not Reported
Pump Type:	Not Reported	Pump Capacity:	0
Pump Installed By:	Not Reported	Water Level Elevation:	0
Well Drilled By:	Not Reported		

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14 **ENE** **1/2 - 1 Mile** **Lower**	**OH WELLS**	**OHDM20000407072**

Database:	Monitoring Water Wells Listing		
Well Log #:	2043105	Well Type:	Water Well
Drill Type:	AUGER	Test Type:	O
Well Use:	Monitor	Aquifer Type:	SAND AND CLAY
Permit #:	Not Reported	Test Rate:	0
Draw Down:	0	Test Duration:	0
Surface Water Level:	10.6	Date Measured:	Not Reported
Casing Height:	0	Screen Length:	5
Total Depth:	13	Completion Date:	15-APR-13

Depth to Bedrock:	0	Drill Year:	Not Reported
Well Seal Rpt #:	0	Screen Diameter:	2
Screen Type:	MACHINE SLOTTED	Screen Material:	PVC
Pump Type:	Not Reported	Pump Capacity:	0
Pump Installed By:	Not Reported	Water Level Elevation:	0
Well Drilled By:	Not Reported		

D15
NW
1/2 - 1 Mile
Higher

OH WELLS **OHDM20000294244**

Database:	Monitoring Water Wells Listing		
Well Log #:	986689	Well Type:	Water Well
Drill Type:	AUGER	Test Type:	Not Reported
Well Use:	Monitor	Aquifer Type:	Not Reported
Permit #:	Not Reported	Test Rate:	0
Draw Down:	0	Test Duration:	0
Surface Water Level:	1	Date Measured:	04-JAN-05
Casing Height:	0	Screen Length:	10
Total Depth:	15	Completion Date:	04-JAN-05
Depth to Bedrock:	0	Drill Year:	Not Reported
Well Seal Rpt #:	0	Screen Diameter:	0
Screen Type:	Not Reported	Screen Material:	Not Reported
Pump Type:	Not Reported	Pump Capacity:	0
Pump Installed By:	Not Reported	Water Level Elevation:	0
Well Drilled By:	Not Reported		

D16
NW
1/2 - 1 Mile
Higher

OH WELLS **OHDM20000294257**

Database:	Monitoring Water Wells Listing		
Well Log #:	986691	Well Type:	Water Well
Drill Type:	AUGER	Test Type:	Not Reported
Well Use:	Monitor	Aquifer Type:	Not Reported
Permit #:	Not Reported	Test Rate:	0
Draw Down:	0	Test Duration:	0
Surface Water Level:	1	Date Measured:	04-JAN-05
Casing Height:	0	Screen Length:	10
Total Depth:	14	Completion Date:	04-JAN-05
Depth to Bedrock:	0	Drill Year:	Not Reported
Well Seal Rpt #:	0	Screen Diameter:	0
Screen Type:	Not Reported	Screen Material:	Not Reported
Pump Type:	Not Reported	Pump Capacity:	0
Pump Installed By:	Not Reported	Water Level Elevation:	0
Well Drilled By:	Not Reported		

17
ESE
1/2 - 1 Mile
Higher

OH WELLS **OHD800000378317**

Database:	Water Well Database	Well Log #:	2022589
Well Type:	Water Well	Drill Type:	ROTARY

Test Type:	Air	Well Use:	DOMESTIC
Aquifer Type:	GRAVEL	Permit #:	2009-18
Test Rate:	20	Draw Down:	0
Test Duration:	1	Surface Water Level:	18
Date Measured:	2009 527	Casing Height:	1.5
Screen Length:	5	Total Depth:	74
Completion Date:	2009 527	Depth to Bedrock:	0
Drill Year:	Not Reported	Well Seal Rpt #:	0
Screen Diameter:	5	Screen Type:	MACHINE SLOTTED
Screen Material:	PVC	Pump Type:	SUBMERSIBLE
Pump Capacity:	10	Pump Installed By:	JACKSON & SONS DRILLING & PUMP, INC
Water Level Elevation:	0	Well Drilled By:	Not Reported

18
SW **OH WELLS** **OHD800000123361**
1/2 - 1 Mile
Higher

Database:	Water Well Database	Well Log #:	55001
Well Type:	Water Well	Drill Type:	Not Reported
Test Type:	Not Reported	Well Use:	Not Reported
Aquifer Type:	GRAVEL	Permit #:	Not Reported
Test Rate:	0	Draw Down:	0
Test Duration:	0	Surface Water Level:	30
Date Measured:	0	Casing Height:	0
Screen Length:	0	Total Depth:	85
Completion Date:	1950 8 1	Depth to Bedrock:	0
Drill Year:	Not Reported	Well Seal Rpt #:	0
Screen Diameter:	0	Screen Type:	Not Reported
Screen Material:	Not Reported	Pump Type:	Not Reported
Pump Capacity:	0	Pump Installed By:	Not Reported
Water Level Elevation:	0	Well Drilled By:	Not Reported

D19
NW **OH WELLS** **OHDM20000294263**
1/2 - 1 Mile
Higher

Database:	Monitoring Water Wells Listing		
Well Log #:	986688	Well Type:	Water Well
Drill Type:	AUGER	Test Type:	Not Reported
Well Use:	Monitor	Aquifer Type:	Not Reported
Permit #:	Not Reported	Test Rate:	0
Draw Down:	0	Test Duration:	0
Surface Water Level:	2	Date Measured:	03-JAN-05
Casing Height:	0	Screen Length:	10
Total Depth:	15	Completion Date:	03-JAN-05
Depth to Bedrock:	0	Drill Year:	Not Reported
Well Seal Rpt #:	0	Screen Diameter:	0
Screen Type:	Not Reported	Screen Material:	Not Reported
Pump Type:	Not Reported	Pump Capacity:	0
Pump Installed By:	Not Reported	Water Level Elevation:	0
Well Drilled By:	Not Reported		

Map ID Direction Distance Elevation	Database	EDR ID Number
D20 **NW** **1/2 - 1 Mile** **Higher**	**OH WELLS**	**OHDM20000294260**

Database: Monitoring Water Wells Listing

Well Log #:	986687	Well Type:	Water Well
Drill Type:	AUGER	Test Type:	Not Reported
Well Use:	Monitor	Aquifer Type:	Not Reported
Permit #:	Not Reported	Test Rate:	0
Draw Down:	0	Test Duration:	0
Surface Water Level:	2	Date Measured:	04-JAN-05
Casing Height:	0	Screen Length:	10
Total Depth:	15	Completion Date:	04-JAN-05
Depth to Bedrock:	0	Drill Year:	Not Reported
Well Seal Rpt #:	0	Screen Diameter:	0
Screen Type:	Not Reported	Screen Material:	Not Reported
Pump Type:	Not Reported	Pump Capacity:	0
Pump Installed By:	Not Reported	Water Level Elevation:	0
Well Drilled By:	Not Reported		

D21 **NW** **1/2 - 1 Mile** **Higher**	**OH WELLS**	**OHDM20000294266**

Database: Monitoring Water Wells Listing

Well Log #:	986686	Well Type:	Water Well
Drill Type:	AUGER	Test Type:	Not Reported
Well Use:	Monitor	Aquifer Type:	Not Reported
Permit #:	Not Reported	Test Rate:	0
Draw Down:	0	Test Duration:	0
Surface Water Level:	9	Date Measured:	03-JAN-05
Casing Height:	0	Screen Length:	10
Total Depth:	14	Completion Date:	03-JAN-05
Depth to Bedrock:	0	Drill Year:	Not Reported
Well Seal Rpt #:	0	Screen Diameter:	0
Screen Type:	Not Reported	Screen Material:	Not Reported
Pump Type:	Not Reported	Pump Capacity:	0
Pump Installed By:	Not Reported	Water Level Elevation:	0
Well Drilled By:	Not Reported		

E22 **NW** **1/2 - 1 Mile** **Higher**	**OH WELLS**	**OHDM20000294265**

Database: Monitoring Water Wells Listing

Well Log #:	986685	Well Type:	Water Well
Drill Type:	AUGER	Test Type:	Not Reported
Well Use:	Monitor	Aquifer Type:	Not Reported
Permit #:	Not Reported	Test Rate:	0
Draw Down:	0	Test Duration:	0
Surface Water Level:	5.8	Date Measured:	03-JAN-05
Casing Height:	0	Screen Length:	10
Total Depth:	15	Completion Date:	03-JAN-05

Depth to Bedrock:	0	Drill Year:	Not Reported
Well Seal Rpt #:	0	Screen Diameter:	0
Screen Type:	Not Reported	Screen Material:	Not Reported
Pump Type:	Not Reported	Pump Capacity:	0
Pump Installed By:	Not Reported	Water Level Elevation:	0
Well Drilled By:	Not Reported		

E23
NW
1/2 - 1 Mile
Higher

OH WELLS **OHDM20000294264**

Database:	Monitoring Water Wells Listing		
Well Log #:	986684	Well Type:	Water Well
Drill Type:	AUGER	Test Type:	Not Reported
Well Use:	Monitor	Aquifer Type:	Not Reported
Permit #:	Not Reported	Test Rate:	0
Draw Down:	0	Test Duration:	0
Surface Water Level:	5	Date Measured:	03-JAN-05
Casing Height:	0	Screen Length:	10
Total Depth:	14	Completion Date:	03-JAN-05
Depth to Bedrock:	0	Drill Year:	Not Reported
Well Seal Rpt #:	0	Screen Diameter:	0
Screen Type:	Not Reported	Screen Material:	Not Reported
Pump Type:	Not Reported	Pump Capacity:	0
Pump Installed By:	Not Reported	Water Level Elevation:	0
Well Drilled By:	Not Reported		

E24
NW
1/2 - 1 Mile
Higher

OH WELLS **OHDM20000294269**

Database:	Monitoring Water Wells Listing		
Well Log #:	986683	Well Type:	Water Well
Drill Type:	AUGER	Test Type:	Not Reported
Well Use:	Monitor	Aquifer Type:	Not Reported
Permit #:	Not Reported	Test Rate:	0
Draw Down:	0	Test Duration:	0
Surface Water Level:	5	Date Measured:	03-JAN-05
Casing Height:	0	Screen Length:	10
Total Depth:	14	Completion Date:	03-JAN-05
Depth to Bedrock:	0	Drill Year:	Not Reported
Well Seal Rpt #:	0	Screen Diameter:	0
Screen Type:	Not Reported	Screen Material:	Not Reported
Pump Type:	Not Reported	Pump Capacity:	0
Pump Installed By:	Not Reported	Water Level Elevation:	0
Well Drilled By:	Not Reported		

25
SSW
1/2 - 1 Mile
Lower

OH WELLS **OHDM20000454305**

Database:	Monitoring Water Wells Listing		
Well Log #:	2062285	Well Type:	Water Well

Drill Type:	AUGER	Test Type:	Not Reported
Well Use:	Monitor	Aquifer Type:	SAND
Permit #:	Not Reported	Test Rate:	0
Draw Down:	0	Test Duration:	0
Surface Water Level:	.6	Date Measured:	24-FEB-17
Casing Height:	0	Screen Length:	10
Total Depth:	16	Completion Date:	24-FEB-17
Depth to Bedrock:	0	Drill Year:	Not Reported
Well Seal Rpt #:	0	Screen Diameter:	2
Screen Type:	MACHINE SLOTTED	Screen Material:	PVC
Pump Type:	Not Reported	Pump Capacity:	0
Pump Installed By:	Not Reported	Water Level Elevation:	0
Well Drilled By:	Not Reported		

E26
NW
1/2 - 1 Mile
Higher

OH WELLS **OHDM20000294268**

Database:	Monitoring Water Wells Listing		
Well Log #:	986682	Well Type:	Water Well
Drill Type:	AUGER	Test Type:	Not Reported
Well Use:	Monitor	Aquifer Type:	Not Reported
Permit #:	Not Reported	Test Rate:	0
Draw Down:	0	Test Duration:	0
Surface Water Level:	5	Date Measured:	03-JAN-05
Casing Height:	0	Screen Length:	10
Total Depth:	14	Completion Date:	03-JAN-05
Depth to Bedrock:	0	Drill Year:	Not Reported
Well Seal Rpt #:	0	Screen Diameter:	0
Screen Type:	Not Reported	Screen Material:	Not Reported
Pump Type:	Not Reported	Pump Capacity:	0
Pump Installed By:	Not Reported	Water Level Elevation:	0
Well Drilled By:	Not Reported		

27
East
1/2 - 1 Mile
Lower

OH WELLS **OHD800000045753**

Database:	Water Well Database	Well Log #:	422494
Well Type:	Water Well	Drill Type:	Not Reported
Test Type:	Not Reported	Well Use:	Not Reported
Aquifer Type:	SAND AND GRAVEL	Permit #:	Not Reported
Test Rate:	18	Draw Down:	0
Test Duration:	2	Surface Water Level:	12
Date Measured:	0	Casing Height:	0
Screen Length:	0	Total Depth:	95
Completion Date:	1972 6 8	Depth to Bedrock:	0
Drill Year:	Not Reported	Well Seal Rpt #:	0
Screen Diameter:	0	Screen Type:	Not Reported
Screen Material:	Not Reported	Pump Type:	Not Reported
Pump Capacity:	0	Pump Installed By:	Not Reported
Water Level Elevation:	718	Well Drilled By:	Not Reported

Map ID Direction Distance Elevation	Database	EDR ID Number
F28 **WNW** **1/2 - 1 Mile** **Higher**	**OH WELLS**	**OHDM20000440784**

Database:	Monitoring Water Wells Listing		
Well Log #:	986681	Well Type:	Water Well
Drill Type:	AUGER	Test Type:	Not Reported
Well Use:	Monitor	Aquifer Type:	Not Reported
Permit #:	Not Reported	Test Rate:	0
Draw Down:	0	Test Duration:	0
Surface Water Level:	3	Date Measured:	07-JAN-05
Casing Height:	0	Screen Length:	10
Total Depth:	14	Completion Date:	07-JAN-05
Depth to Bedrock:	0	Drill Year:	Not Reported
Well Seal Rpt #:	0	Screen Diameter:	0
Screen Type:	Not Reported	Screen Material:	Not Reported
Pump Type:	Not Reported	Pump Capacity:	0
Pump Installed By:	Not Reported	Water Level Elevation:	0
Well Drilled By:	Not Reported		

F29 **WNW** **1/2 - 1 Mile** **Higher**	**OH WELLS**	**OHDM20000294267**

Database:	Monitoring Water Wells Listing		
Well Log #:	986680	Well Type:	Water Well
Drill Type:	AUGER	Test Type:	Not Reported
Well Use:	Monitor	Aquifer Type:	Not Reported
Permit #:	Not Reported	Test Rate:	0
Draw Down:	0	Test Duration:	0
Surface Water Level:	3	Date Measured:	07-JAN-05
Casing Height:	0	Screen Length:	10
Total Depth:	15	Completion Date:	07-JAN-05
Depth to Bedrock:	0	Drill Year:	Not Reported
Well Seal Rpt #:	0	Screen Diameter:	0
Screen Type:	Not Reported	Screen Material:	Not Reported
Pump Type:	Not Reported	Pump Capacity:	0
Pump Installed By:	Not Reported	Water Level Elevation:	0
Well Drilled By:	Not Reported		

F30 **WNW** **1/2 - 1 Mile** **Higher**	**OH WELLS**	**OHDM20000294271**

Database:	Monitoring Water Wells Listing		
Well Log #:	986679	Well Type:	Water Well
Drill Type:	AUGER	Test Type:	Not Reported
Well Use:	Monitor	Aquifer Type:	Not Reported
Permit #:	Not Reported	Test Rate:	0
Draw Down:	0	Test Duration:	0
Surface Water Level:	3	Date Measured:	17-DEC-04
Casing Height:	0	Screen Length:	10
Total Depth:	14	Completion Date:	17-DEC-04

Depth to Bedrock:	0	Drill Year:	Not Reported
Well Seal Rpt #:	0	Screen Diameter:	0
Screen Type:	Not Reported	Screen Material:	Not Reported
Pump Type:	Not Reported	Pump Capacity:	0
Pump Installed By:	Not Reported	Water Level Elevation:	0
Well Drilled By:	Not Reported		

G31
NNW
1/2 - 1 Mile
Higher

OH WELLS **OHDM20000451462**

Database:	Monitoring Water Wells Listing		
Well Log #:	2062275	Well Type:	Water Well
Drill Type:	AUGER	Test Type:	Not Reported
Well Use:	Monitor	Aquifer Type:	SAND
Permit #:	Not Reported	Test Rate:	0
Draw Down:	0	Test Duration:	0
Surface Water Level:	7.8	Date Measured:	15-FEB-17
Casing Height:	0	Screen Length:	10
Total Depth:	16	Completion Date:	15-FEB-17
Depth to Bedrock:	0	Drill Year:	Not Reported
Well Seal Rpt #:	0	Screen Diameter:	2
Screen Type:	MACHINE SLOTTED	Screen Material:	PVC
Pump Type:	Not Reported	Pump Capacity:	0
Pump Installed By:	Not Reported	Water Level Elevation:	0
Well Drilled By:	Not Reported		

F32
WNW
1/2 - 1 Mile
Higher

OH WELLS **OHDM20000429535**

Database:	Monitoring Water Wells Listing		
Well Log #:	986678	Well Type:	Water Well
Drill Type:	AUGER	Test Type:	Not Reported
Well Use:	Monitor	Aquifer Type:	Not Reported
Permit #:	Not Reported	Test Rate:	0
Draw Down:	0	Test Duration:	0
Surface Water Level:	40	Date Measured:	17-DEC-04
Casing Height:	0	Screen Length:	10
Total Depth:	15	Completion Date:	17-DEC-04
Depth to Bedrock:	0	Drill Year:	Not Reported
Well Seal Rpt #:	0	Screen Diameter:	0
Screen Type:	Not Reported	Screen Material:	Not Reported
Pump Type:	Not Reported	Pump Capacity:	0
Pump Installed By:	Not Reported	Water Level Elevation:	0
Well Drilled By:	Not Reported		

H33
NNE
1/2 - 1 Mile
Higher

OH WELLS **OHDM20000453778**

Database:	Monitoring Water Wells Listing		
Well Log #:	2062279	Well Type:	Water Well

Drill Type:	AUGER	Test Type:	Not Reported
Well Use:	Monitor	Aquifer Type:	SAND
Permit #:	Not Reported	Test Rate:	0
Draw Down:	0	Test Duration:	0
Surface Water Level:	4.4	Date Measured:	17-FEB-17
Casing Height:	0	Screen Length:	10
Total Depth:	16	Completion Date:	17-FEB-17
Depth to Bedrock:	0	Drill Year:	Not Reported
Well Seal Rpt #:	0	Screen Diameter:	2
Screen Type:	MACHINE SLOTTED	Screen Material:	PVC
Pump Type:	Not Reported	Pump Capacity:	0
Pump Installed By:	Not Reported	Water Level Elevation:	0
Well Drilled By:	Not Reported		

F34
WNW
1/2 - 1 Mile
Higher

OH WELLS **OHDM20000294270**

Database:	Monitoring Water Wells Listing		
Well Log #:	986676	Well Type:	Water Well
Drill Type:	AUGER	Test Type:	Not Reported
Well Use:	Monitor	Aquifer Type:	Not Reported
Permit #:	Not Reported	Test Rate:	0
Draw Down:	0	Test Duration:	0
Surface Water Level:	4	Date Measured:	17-DEC-04
Casing Height:	0	Screen Length:	10
Total Depth:	15	Completion Date:	17-DEC-04
Depth to Bedrock:	0	Drill Year:	Not Reported
Well Seal Rpt #:	0	Screen Diameter:	0
Screen Type:	Not Reported	Screen Material:	Not Reported
Pump Type:	Not Reported	Pump Capacity:	0
Pump Installed By:	Not Reported	Water Level Elevation:	0
Well Drilled By:	Not Reported		

35
ESE
1/2 - 1 Mile
Higher

OH WELLS **OHD800000045758**

Database:	Water Well Database	Well Log #:	407320
Well Type:	Water Well	Drill Type:	Not Reported
Test Type:	Not Reported	Well Use:	Not Reported
Aquifer Type:	SAND AND GRAVEL	Permit #:	Not Reported
Test Rate:	15	Draw Down:	4
Test Duration:	1	Surface Water Level:	18
Date Measured:	0	Casing Height:	0
Screen Length:	0	Total Depth:	54
Completion Date:	1970 6 9	Depth to Bedrock:	0
Drill Year:	Not Reported	Well Seal Rpt #:	0
Screen Diameter:	0	Screen Type:	Not Reported
Screen Material:	Not Reported	Pump Type:	Not Reported
Pump Capacity:	0	Pump Installed By:	Not Reported
Water Level Elevation:	714	Well Drilled By:	Not Reported

G36
North
1/2 - 1 Mile
Higher

OH WELLS **OHDM20000449078**

Database:	Monitoring Water Wells Listing		
Well Log #:	2062272	Well Type:	Water Well
Drill Type:	AUGER	Test Type:	Not Reported
Well Use:	Monitor	Aquifer Type:	SAND
Permit #:	Not Reported	Test Rate:	0
Draw Down:	0	Test Duration:	0
Surface Water Level:	11.7	Date Measured:	15-FEB-17
Casing Height:	0	Screen Length:	10
Total Depth:	18	Completion Date:	15-FEB-17
Depth to Bedrock:	0	Drill Year:	Not Reported
Well Seal Rpt #:	0	Screen Diameter:	2
Screen Type:	MACHINE SLOTTED	Screen Material:	PVC
Pump Type:	Not Reported	Pump Capacity:	0
Pump Installed By:	Not Reported	Water Level Elevation:	0
Well Drilled By:	Not Reported		

G37
North
1/2 - 1 Mile
Higher

OH WELLS **OHDM20000451005**

Database:	Monitoring Water Wells Listing		
Well Log #:	2062274	Well Type:	Water Well
Drill Type:	AUGER	Test Type:	Not Reported
Well Use:	Monitor	Aquifer Type:	SAND
Permit #:	Not Reported	Test Rate:	0
Draw Down:	0	Test Duration:	0
Surface Water Level:	4.9	Date Measured:	15-FEB-17
Casing Height:	0	Screen Length:	10
Total Depth:	16	Completion Date:	15-FEB-17
Depth to Bedrock:	0	Drill Year:	Not Reported
Well Seal Rpt #:	0	Screen Diameter:	2
Screen Type:	MACHINE SLOTTED	Screen Material:	PVC
Pump Type:	Not Reported	Pump Capacity:	0
Pump Installed By:	Not Reported	Water Level Elevation:	0
Well Drilled By:	Not Reported		

F38
WNW
1/2 - 1 Mile
Higher

OH WELLS **OHDM20000294275**

Database:	Monitoring Water Wells Listing		
Well Log #:	986674	Well Type:	Water Well
Drill Type:	AUGER	Test Type:	Not Reported
Well Use:	Monitor	Aquifer Type:	Not Reported
Permit #:	Not Reported	Test Rate:	0
Draw Down:	0	Test Duration:	0
Surface Water Level:	6.2	Date Measured:	21-DEC-04
Casing Height:	0	Screen Length:	10
Total Depth:	15	Completion Date:	21-DEC-04

Depth to Bedrock:	0	Drill Year:	Not Reported
Well Seal Rpt #:	0	Screen Diameter:	0
Screen Type:	Not Reported	Screen Material:	Not Reported
Pump Type:	Not Reported	Pump Capacity:	0
Pump Installed By:	Not Reported	Water Level Elevation:	0
Well Drilled By:	Not Reported		

39
ESE
1/2 - 1 Mile
Higher

OH WELLS **OHD800000045757**

Database:	Water Well Database	Well Log #:	567663
Well Type:	Water Well	Drill Type:	Not Reported
Test Type:	Not Reported	Well Use:	Not Reported
Aquifer Type:	SAND AND GRAVEL	Permit #:	Not Reported
Test Rate:	12	Draw Down:	0
Test Duration:	2	Surface Water Level:	8
Date Measured:	0	Casing Height:	0
Screen Length:	0	Total Depth:	33
Completion Date:	1980 517	Depth to Bedrock:	0
Drill Year:	Not Reported	Well Seal Rpt #:	0
Screen Diameter:	0	Screen Type:	Not Reported
Screen Material:	Not Reported	Pump Type:	Not Reported
Pump Capacity:	0	Pump Installed By:	Not Reported
Water Level Elevation:	722	Well Drilled By:	Not Reported

F40
WNW
1/2 - 1 Mile
Higher

OH WELLS **OHDM20000294276**

Database:	Monitoring Water Wells Listing		
Well Log #:	986675	Well Type:	Water Well
Drill Type:	AUGER	Test Type:	Not Reported
Well Use:	Monitor	Aquifer Type:	Not Reported
Permit #:	Not Reported	Test Rate:	0
Draw Down:	0	Test Duration:	0
Surface Water Level:	2	Date Measured:	21-DEC-04
Casing Height:	0	Screen Length:	10
Total Depth:	15	Completion Date:	21-DEC-04
Depth to Bedrock:	0	Drill Year:	Not Reported
Well Seal Rpt #:	0	Screen Diameter:	0
Screen Type:	Not Reported	Screen Material:	Not Reported
Pump Type:	Not Reported	Pump Capacity:	0
Pump Installed By:	Not Reported	Water Level Elevation:	0
Well Drilled By:	Not Reported		

F41
WNW
1/2 - 1 Mile
Higher

OH WELLS **OHDM20000435255**

Database:	Monitoring Water Wells Listing		
Well Log #:	986670	Well Type:	Water Well
Drill Type:	AUGER	Test Type:	Not Reported

Well Use:	Monitor	Aquifer Type:	Not Reported
Permit #:	Not Reported	Test Rate:	0
Draw Down:	0	Test Duration:	0
Surface Water Level:	4.7	Date Measured:	21-DEC-04
Casing Height:	0	Screen Length:	10
Total Depth:	15	Completion Date:	21-DEC-04
Depth to Bedrock:	0	Drill Year:	Not Reported
Well Seal Rpt #:	0	Screen Diameter:	0
Screen Type:	Not Reported	Screen Material:	Not Reported
Pump Type:	Not Reported	Pump Capacity:	0
Pump Installed By:	Not Reported	Water Level Elevation:	0
Well Drilled By:	Not Reported		

F42
WNW
1/2 - 1 Mile
Higher

OH WELLS **OHDM20000294274**

Database:	Monitoring Water Wells Listing		
Well Log #:	986673	Well Type:	Water Well
Drill Type:	AUGER	Test Type:	Not Reported
Well Use:	Monitor	Aquifer Type:	Not Reported
Permit #:	Not Reported	Test Rate:	0
Draw Down:	0	Test Duration:	0
Surface Water Level:	3.5	Date Measured:	21-DEC-04
Casing Height:	0	Screen Length:	10
Total Depth:	13	Completion Date:	21-DEC-04
Depth to Bedrock:	0	Drill Year:	Not Reported
Well Seal Rpt #:	0	Screen Diameter:	0
Screen Type:	Not Reported	Screen Material:	Not Reported
Pump Type:	Not Reported	Pump Capacity:	0
Pump Installed By:	Not Reported	Water Level Elevation:	0
Well Drilled By:	Not Reported		

G43
North
1/2 - 1 Mile
Higher

OH WELLS **OHDM20000451461**

Database:	Monitoring Water Wells Listing		
Well Log #:	2062273	Well Type:	Water Well
Drill Type:	AUGER	Test Type:	Not Reported
Well Use:	Monitor	Aquifer Type:	SAND
Permit #:	Not Reported	Test Rate:	0
Draw Down:	0	Test Duration:	0
Surface Water Level:	9.8	Date Measured:	15-FEB-17
Casing Height:	0	Screen Length:	10
Total Depth:	16	Completion Date:	15-FEB-17
Depth to Bedrock:	0	Drill Year:	Not Reported
Well Seal Rpt #:	0	Screen Diameter:	2
Screen Type:	MACHINE SLOTTED	Screen Material:	PVC
Pump Type:	Not Reported	Pump Capacity:	0
Pump Installed By:	Not Reported	Water Level Elevation:	0
Well Drilled By:	Not Reported		

Map ID Direction Distance Elevation	Database	EDR ID Number
I44 **ENE** **1/2 - 1 Mile** **Lower**	**OH WELLS**	**OHDM20000407377**

Database:	Monitoring Water Wells Listing		
Well Log #:	2043107	Well Type:	Water Well
Drill Type:	AUGER	Test Type:	O
Well Use:	Monitor	Aquifer Type:	SAND AND CLAY
Permit #:	Not Reported	Test Rate:	0
Draw Down:	0	Test Duration:	0
Surface Water Level:	9	Date Measured:	Not Reported
Casing Height:	0	Screen Length:	5
Total Depth:	13	Completion Date:	16-APR-13
Depth to Bedrock:	0	Drill Year:	Not Reported
Well Seal Rpt #:	0	Screen Diameter:	2
Screen Type:	MACHINE SLOTTED	Screen Material:	PVC
Pump Type:	Not Reported	Pump Capacity:	0
Pump Installed By:	Not Reported	Water Level Elevation:	0
Well Drilled By:	Not Reported		

I45 **ENE** **1/2 - 1 Mile** **Lower**	**OH WELLS**	**OHDM20000407378**

Database:	Monitoring Water Wells Listing		
Well Log #:	2043113	Well Type:	Water Well
Drill Type:	AUGER	Test Type:	O
Well Use:	Monitor	Aquifer Type:	SAND AND CLAY
Permit #:	Not Reported	Test Rate:	0
Draw Down:	0	Test Duration:	0
Surface Water Level:	11	Date Measured:	16-APR-13
Casing Height:	0	Screen Length:	5
Total Depth:	14	Completion Date:	16-APR-13
Depth to Bedrock:	0	Drill Year:	Not Reported
Well Seal Rpt #:	0	Screen Diameter:	2
Screen Type:	MACHINE SLOTTED	Screen Material:	PVC
Pump Type:	Not Reported	Pump Capacity:	0
Pump Installed By:	Not Reported	Water Level Elevation:	0
Well Drilled By:	Not Reported		

F46 **WNW** **1/2 - 1 Mile** **Higher**	**OH WELLS**	**OHDM20000294273**

Database:	Monitoring Water Wells Listing		
Well Log #:	986672	Well Type:	Water Well
Drill Type:	AUGER	Test Type:	Not Reported
Well Use:	Monitor	Aquifer Type:	Not Reported
Permit #:	Not Reported	Test Rate:	0
Draw Down:	0	Test Duration:	0
Surface Water Level:	4.8	Date Measured:	21-DEC-04
Casing Height:	0	Screen Length:	10
Total Depth:	15	Completion Date:	21-DEC-04

Depth to Bedrock:	0	Drill Year:	Not Reported
Well Seal Rpt #:	0	Screen Diameter:	0
Screen Type:	Not Reported	Screen Material:	Not Reported
Pump Type:	Not Reported	Pump Capacity:	0
Pump Installed By:	Not Reported	Water Level Elevation:	0
Well Drilled By:	Not Reported		

G47
NNW
1/2 - 1 Mile
Higher

OH WELLS **OHDM20000451065**

Database:	Monitoring Water Wells Listing		
Well Log #:	2062280	Well Type:	Water Well
Drill Type:	AUGER	Test Type:	Not Reported
Well Use:	Monitor	Aquifer Type:	SAND
Permit #:	Not Reported	Test Rate:	0
Draw Down:	0	Test Duration:	0
Surface Water Level:	4.3	Date Measured:	17-FEB-17
Casing Height:	0	Screen Length:	10
Total Depth:	16	Completion Date:	17-FEB-17
Depth to Bedrock:	0	Drill Year:	Not Reported
Well Seal Rpt #:	0	Screen Diameter:	2
Screen Type:	MACHINE SLOTTED	Screen Material:	PVC
Pump Type:	Not Reported	Pump Capacity:	0
Pump Installed By:	Not Reported	Water Level Elevation:	0
Well Drilled By:	Not Reported		

H48
NNE
1/2 - 1 Mile
Higher

OH WELLS **OHDM20000454342**

Database:	Monitoring Water Wells Listing		
Well Log #:	2062276	Well Type:	Water Well
Drill Type:	AUGER	Test Type:	Not Reported
Well Use:	Monitor	Aquifer Type:	SAND
Permit #:	Not Reported	Test Rate:	0
Draw Down:	0	Test Duration:	0
Surface Water Level:	8.8	Date Measured:	16-FEB-17
Casing Height:	0	Screen Length:	10
Total Depth:	16	Completion Date:	16-FEB-17
Depth to Bedrock:	0	Drill Year:	Not Reported
Well Seal Rpt #:	0	Screen Diameter:	2
Screen Type:	MACHINE SLOTTED	Screen Material:	PVC
Pump Type:	Not Reported	Pump Capacity:	0
Pump Installed By:	Not Reported	Water Level Elevation:	0
Well Drilled By:	Not Reported		

F49
WNW
1/2 - 1 Mile
Higher

OH WELLS **OHDM20000294272**

Database:	Monitoring Water Wells Listing		
Well Log #:	986671	Well Type:	Water Well

Drill Type:	AUGER	Test Type:	Not Reported
Well Use:	Monitor	Aquifer Type:	Not Reported
Permit #:	Not Reported	Test Rate:	0
Draw Down:	0	Test Duration:	0
Surface Water Level:	5	Date Measured:	21-DEC-04
Casing Height:	0	Screen Length:	10
Total Depth:	15	Completion Date:	21-DEC-04
Depth to Bedrock:	0	Drill Year:	Not Reported
Well Seal Rpt #:	0	Screen Diameter:	0
Screen Type:	Not Reported	Screen Material:	Not Reported
Pump Type:	Not Reported	Pump Capacity:	0
Pump Installed By:	Not Reported	Water Level Elevation:	0
Well Drilled By:	Not Reported		

H50
NNE
1/2 - 1 Mile
Higher

OH WELLS OHDM20000453542

Database:	Monitoring Water Wells Listing		
Well Log #:	2062277	Well Type:	Water Well
Drill Type:	AUGER	Test Type:	Not Reported
Well Use:	Monitor	Aquifer Type:	SAND
Permit #:	Not Reported	Test Rate:	0
Draw Down:	0	Test Duration:	0
Surface Water Level:	4.8	Date Measured:	16-FEB-17
Casing Height:	0	Screen Length:	10
Total Depth:	16	Completion Date:	16-FEB-17
Depth to Bedrock:	0	Drill Year:	Not Reported
Well Seal Rpt #:	0	Screen Diameter:	2
Screen Type:	MACHINE SLOTTED	Screen Material:	PVC
Pump Type:	Not Reported	Pump Capacity:	0
Pump Installed By:	Not Reported	Water Level Elevation:	0
Well Drilled By:	Not Reported		

J51
NW
1/2 - 1 Mile
Higher

AQUIFLOW 20246

Site ID:	2591164-01
Groundwater Flow:	SE
Shallow Water Depth:	Not Reported
Deep Water Depth:	Not Reported
Average Water Depth:	9.0
Date:	9/1990

J52
NW
1/2 - 1 Mile
Higher

AQUIFLOW 20248

Site ID:	2591164-03
Groundwater Flow:	SSE
Shallow Water Depth:	5.0
Deep Water Depth:	10.5
Average Water Depth:	Not Reported
Date:	8/1990

J53
NW
1/2 - 1 Mile
Higher

AQUIFLOW 16666

Site ID:	2591164-09
Groundwater Flow:	NOT REPORTED
Shallow Water Depth:	14.71
Deep Water Depth:	16.94
Average Water Depth:	Not Reported
Date:	2/1998

Map ID Direction Distance Elevation			Database	EDR ID Number
J54 **NW** **1/2 - 1 Mile** **Higher**	Site ID: Groundwater Flow: Shallow Water Depth: Deep Water Depth: Average Water Depth: Date:	2591164-20 E 7.0 8.0 Not Reported 6/1995	**AQUIFLOW**	**20074**
55 **NNW** **1/2 - 1 Mile** **Higher**			**OH WELLS**	**OHDM20000453544**

Database:	Monitoring Water Wells Listing		
Well Log #:	2062286	Well Type:	Water Well
Drill Type:	AUGER	Test Type:	Not Reported
Well Use:	Monitor	Aquifer Type:	SAND
Permit #:	Not Reported	Test Rate:	0
Draw Down:	0	Test Duration:	0
Surface Water Level:	.1	Date Measured:	24-FEB-17
Casing Height:	0	Screen Length:	10
Total Depth:	16	Completion Date:	24-FEB-17
Depth to Bedrock:	0	Drill Year:	Not Reported
Well Seal Rpt #:	0	Screen Diameter:	2
Screen Type:	MACHINE SLOTTED	Screen Material:	PVC
Pump Type:	Not Reported	Pump Capacity:	0
Pump Installed By:	Not Reported	Water Level Elevation:	0
Well Drilled By:	Not Reported		

K56 **ESE** **1/2 - 1 Mile** **Higher**	**OH WELLS**	**OHD800000045759**

Database:	Water Well Database	Well Log #:	441619
Well Type:	Water Well	Drill Type:	Not Reported
Test Type:	Not Reported	Well Use:	Not Reported
Aquifer Type:	SAND AND GRAVEL	Permit #:	Not Reported
Test Rate:	16	Draw Down:	0
Test Duration:	2	Surface Water Level:	29
Date Measured:	0	Casing Height:	0
Screen Length:	0	Total Depth:	63
Completion Date:	1973 215	Depth to Bedrock:	0
Drill Year:	Not Reported	Well Seal Rpt #:	0
Screen Diameter:	0	Screen Type:	Not Reported
Screen Material:	Not Reported	Pump Type:	Not Reported
Pump Capacity:	0	Pump Installed By:	Not Reported
Water Level Elevation:	705	Well Drilled By:	Not Reported

Map ID Direction Distance Elevation	Database	EDR ID Number
L57 **NNW** **1/2 - 1 Mile** **Higher**	**OH WELLS**	**OHDM20000362945**

Database:	Monitoring Water Wells Listing		
Well Log #:	2018016	Well Type:	Water Well
Drill Type:	AUGER	Test Type:	Not Reported
Well Use:	Monitor	Aquifer Type:	SAND AND GRAVEL
Permit #:	Not Reported	Test Rate:	0
Draw Down:	0	Test Duration:	0
Surface Water Level:	30	Date Measured:	27-JUN-08
Casing Height:	1.5	Screen Length:	5
Total Depth:	30	Completion Date:	27-JUN-08
Depth to Bedrock:	0	Drill Year:	Not Reported
Well Seal Rpt #:	0	Screen Diameter:	2
Screen Type:	MACHINE SLOTTED	Screen Material:	PVC
Pump Type:	Not Reported	Pump Capacity:	0
Pump Installed By:	Not Reported	Water Level Elevation:	0
Well Drilled By:	Not Reported		

Map ID Direction Distance Elevation	Database	EDR ID Number
L58 **NNW** **1/2 - 1 Mile** **Higher**	**OH WELLS**	**OHDM20000362944**

Database:	Monitoring Water Wells Listing		
Well Log #:	2018015	Well Type:	Water Well
Drill Type:	AUGER	Test Type:	Not Reported
Well Use:	Monitor	Aquifer Type:	SAND AND GRAVEL
Permit #:	Not Reported	Test Rate:	0
Draw Down:	0	Test Duration:	0
Surface Water Level:	26	Date Measured:	26-JUN-08
Casing Height:	0	Screen Length:	5
Total Depth:	26	Completion Date:	26-JUN-08
Depth to Bedrock:	0	Drill Year:	Not Reported
Well Seal Rpt #:	0	Screen Diameter:	2
Screen Type:	MACHINE SLOTTED	Screen Material:	PVC
Pump Type:	Not Reported	Pump Capacity:	0
Pump Installed By:	Not Reported	Water Level Elevation:	0
Well Drilled By:	Not Reported		

Map ID Direction Distance Elevation	Database	EDR ID Number
L59 **NNW** **1/2 - 1 Mile** **Higher**	**OH WELLS**	**OHDM20000377060**

Database:	Monitoring Water Wells Listing		
Well Log #:	2018019	Well Type:	Water Well
Drill Type:	AUGER	Test Type:	Not Reported
Well Use:	Monitor	Aquifer Type:	SAND AND GRAVEL
Permit #:	Not Reported	Test Rate:	0
Draw Down:	0	Test Duration:	0
Surface Water Level:	15.5	Date Measured:	30-JUN-08
Casing Height:	0	Screen Length:	5
Total Depth:	15.5	Completion Date:	30-JUN-08

Depth to Bedrock:	0	Drill Year:	Not Reported
Well Seal Rpt #:	0	Screen Diameter:	2
Screen Type:	MACHINE SLOTTED	Screen Material:	PVC
Pump Type:	Not Reported	Pump Capacity:	0
Pump Installed By:	Not Reported	Water Level Elevation:	0
Well Drilled By:	Not Reported		

L60
NNW
1/2 - 1 Mile
Higher

OH WELLS **OHDM20000362946**

Database:	Monitoring Water Wells Listing		
Well Log #:	2018018	Well Type:	Water Well
Drill Type:	AUGER	Test Type:	Not Reported
Well Use:	Monitor	Aquifer Type:	SAND AND GRAVEL
Permit #:	Not Reported	Test Rate:	0
Draw Down:	0	Test Duration:	0
Surface Water Level:	16	Date Measured:	30-JUN-08
Casing Height:	1.5	Screen Length:	5
Total Depth:	16	Completion Date:	30-JUN-08
Depth to Bedrock:	0	Drill Year:	Not Reported
Well Seal Rpt #:	0	Screen Diameter:	2
Screen Type:	MACHINE SLOTTED	Screen Material:	PVC
Pump Type:	Not Reported	Pump Capacity:	0
Pump Installed By:	Not Reported	Water Level Elevation:	0
Well Drilled By:	Not Reported		

61
SSE
1/2 - 1 Mile
Lower

OH WELLS **OHD800000267879**

Database:	Water Well Database	Well Log #:	923456
Well Type:	Water Well	Drill Type:	ROTARY
Test Type:	Air	Well Use:	Not Reported
Aquifer Type:	SAND AND GRAVEL	Permit #:	6540412
Test Rate:	1000	Draw Down:	0
Test Duration:	1	Surface Water Level:	10
Date Measured:	20001211	Casing Height:	1
Screen Length:	7	Total Depth:	138
Completion Date:	2001 2 2	Depth to Bedrock:	0
Drill Year:	Not Reported	Well Seal Rpt #:	0
Screen Diameter:	0	Screen Type:	Not Reported
Screen Material:	Not Reported	Pump Type:	Not Reported
Pump Capacity:	0	Pump Installed By:	Not Reported
Water Level Elevation:	0	Well Drilled By:	Not Reported

K62
ESE
1/2 - 1 Mile
Higher

OH WELLS **OHD800000045760**

Database:	Water Well Database	Well Log #:	544428
Well Type:	Water Well	Drill Type:	Not Reported
Test Type:	Not Reported	Well Use:	Not Reported

Aquifer Type:	SAND AND GRAVEL	Permit #:	Not Reported
Test Rate:	15	Draw Down:	2
Test Duration:	1	Surface Water Level:	19
Date Measured:	0	Casing Height:	0
Screen Length:	0	Total Depth:	55
Completion Date:	1979 329	Depth to Bedrock:	0
Drill Year:	Not Reported	Well Seal Rpt #:	0
Screen Diameter:	0	Screen Type:	Not Reported
Screen Material:	Not Reported	Pump Type:	Not Reported
Pump Capacity:	0	Pump Installed By:	Not Reported
Water Level Elevation:	716	Well Drilled By:	Not Reported

1G
NW
1/2 - 1 Mile
Lower

AQUIFLOW 20246

Site ID:	2591164-01
Groundwater Flow:	SE
Shallow Water Depth:	Not Reported
Deep Water Depth:	Not Reported
Average Water Depth:	9.0
Date:	9/1990

2G
NW
1/2 - 1 Mile
Lower

AQUIFLOW 20248

Site ID:	2591164-03
Groundwater Flow:	SSE
Shallow Water Depth:	5.0
Deep Water Depth:	10.5
Average Water Depth:	Not Reported
Date:	8/1990

3G
NW
1/2 - 1 Mile
Lower

AQUIFLOW 16666

Site ID:	2591164-09
Groundwater Flow:	NOT REPORTED
Shallow Water Depth:	14.71
Deep Water Depth:	16.94
Average Water Depth:	Not Reported
Date:	2/1998

4G
NW
1/2 - 1 Mile
Lower

AQUIFLOW 20074

Site ID:	2591164-20
Groundwater Flow:	E
Shallow Water Depth:	7.0
Deep Water Depth:	8.0
Average Water Depth:	Not Reported
Date:	6/1995

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS
RADON

AREA RADON INFORMATION

State Database: OH Radon

Radon Test Results

Zipcode	Num Tests	Maximum	Minimum	Arith Mean	Geo Mean
43125	145	86.9	0.1	13.65	8.17

Federal EPA Radon Zone for FRANKLIN County: 1

Note: Zone 1 indoor average level > 4 pCi/L.
: Zone 2 indoor average level >= 2 pCi/L and <= 4 pCi/L.
: Zone 3 indoor average level < 2 pCi/L.

Federal Area Radon Information for Zip Code: 43125

Number of sites tested: 1

Area	Average Activity	% <4 pCi/L	% 4-20 pCi/L	% >20 pCi/L
Living Area - 1st Floor	2.700 pCi/L	100%	0%	0%
Living Area - 2nd Floor	Not Reported	Not Reported	Not Reported	Not Reported
Basement	2.700 pCi/L	100%	0%	0%

PHYSICAL SETTING SOURCE RECORDS SEARCHED

TOPOGRAPHIC INFORMATION

USGS 7.5’ Digital Elevation Model (DEM)
Source: United States Geologic Survey
EDR acquired the USGS 7.5’ Digital Elevation Model in 2002 and updated it in 2006. The 7.5 minute DEM corresponds to the USGS 1:24,000- and 1:25,000-scale topographic quadrangle maps. The DEM provides elevation data with consistent elevation units and projection.

Current USGS 7.5 Minute Topographic Map
Source: U.S. Geological Survey

HYDROLOGIC INFORMATION

Flood Zone Data: This data was obtained from the Federal Emergency Management Agency (FEMA). It depicts 100-year and 500-year flood zones as defined by FEMA. It includes the National Flood Hazard Layer (NFHL) which incorporates Flood Insurance Rate Map (FIRM) data and Q3 data from FEMA in areas not covered by NFHL.
Source: FEMA
Telephone: 877-336-2627
Date of Government Version: 2003, 2015

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002, 2005 and 2010 from the U.S. Fish and Wildlife Service.

HYDROGEOLOGIC INFORMATION

AQUIFLOW^R Information System
Source: EDR proprietary database of groundwater flow information
EDR has developed the AQUIFLOW Information System (AIS) to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted to regulatory authorities at select sites and has extracted the date of the report, hydrogeologically determined groundwater flow direction and depth to water table information.

GEOLOGIC INFORMATION

Geologic Age and Rock Stratigraphic Unit
Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - A digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

STATSGO: State Soil Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Service (NRCS)
The U.S. Department of Agriculture’s (USDA) Natural Resources Conservation Service (NRCS) leads the national Conservation Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. Soil maps for STATSGO are compiled by generalizing more detailed (SSURGO) soil survey maps.

SSURGO: Soil Survey Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Service (NRCS)
Telephone: 800-672-5559
SSURGO is the most detailed level of mapping done by the Natural Resources Conservation Service, mapping scales generally range from 1:12,000 to 1:63,360. Field mapping methods using national standards are used to construct the soil maps in the Soil Survey Geographic (SSURGO) database. SSURGO digitizing duplicates the original soil survey maps. This level of mapping is designed for use by landowners, townships and county natural resource planning and management.

PHYSICAL SETTING SOURCE RECORDS SEARCHED

LOCAL / REGIONAL WATER AGENCY RECORDS

FEDERAL WATER WELLS

PWS: Public Water Systems
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Public Water System data from the Federal Reporting Data System. A PWS is any water system which provides water to at least 25 people for at least 60 days annually. PWSs provide water from wells, rivers and other sources.

PWS ENF: Public Water Systems Violation and Enforcement Data
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Violation and Enforcement data for Public Water Systems from the Safe Drinking Water Information System (SDWIS) after August 1995. Prior to August 1995, the data came from the Federal Reporting Data System (FRDS).

USGS Water Wells: USGS National Water Inventory System (NWIS)
This database contains descriptive information on sites where the USGS collects or has collected data on surface water and/or groundwater. The groundwater data includes information on wells, springs, and other sources of groundwater.

STATE RECORDS

Public Water System Data
Source: Ohio Environmental Protection Agency
Telephone: 614-644-2752
The database includes community, transient noncommunity and noncommunity water wells; and source treatment unit locations.

Water Treatment Facilities
Source: Ohio Environmental Protection Agency
Telephone: 614-644-2752

Monitoring Water Wells Listing
Source: Department of Natural Resources
Telephone: 614-265-6740

Water Well Database
Source: Department of Natural Resources
Telephone: 614-265-6740

OTHER STATE DATABASE INFORMATION

Oil and Gas Wells Listing
Department of Natural Resources
A listing of oil and gas well locations in the state.

RADON

State Database: OH Radon
Source: Department of Health
Telephone: 614-644-2727
Radon Statistics for Zip Code Areas

Area Radon Information
Source: USGS
Telephone: 703-356-4020
The National Radon Database has been developed by the U.S. Environmental Protection Agency (USEPA) and is a compilation of the EPA/State Residential Radon Survey and the National Residential Radon Survey. The study covers the years 1986 - 1992. Where necessary data has been supplemented by information collected at private sources such as universities and research institutions.

PHYSICAL SETTING SOURCE RECORDS SEARCHED

EPA Radon Zones
Source: EPA
Telephone: 703-356-4020
Sections 307 & 309 of IRAA directed EPA to list and identify areas of U.S. with the potential for elevated indoor radon levels.

OTHER

Airport Landing Facilities: Private and public use landing facilities
Source: Federal Aviation Administration, 800-457-6656

Epicenters: World earthquake epicenters, Richter 5 or greater
Source: Department of Commerce, National Oceanic and Atmospheric Administration

Earthquake Fault Lines: The fault lines displayed on EDR’s Topographic map are digitized quaternary faultlines, prepared in 1975 by the United State Geological Survey

STREET AND ADDRESS INFORMATION

Rickenbacker AASF
8227 South Access Road
Groveport, OH 43125

Inquiry Number: 5457852.2s
October 18, 2018

EDR Summary Radius Map Report

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

TABLE OF CONTENTS

SECTION **PAGE**

GEOCHECK ADDENDUM

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc (EDR). The report was designed to assist parties seeking to meet the search requirements of EPA's Standards and Practices for All Appropriate Inquiries (40 CFR Part 312), the ASTM Standard Practice for Environmental Site Assessments (E 1527-13), the ASTM Standard Practice for Environmental Site Assessments for Forestland or Rural Property (E 2247-16), the ASTM Standard Practice for Limited Environmental Due Diligence: Transaction Screen Process (E 1528-14) or custom requirements developed for the evaluation of environmental risk associated with a parcel of real estate.

TARGET PROPERTY INFORMATION

ADDRESS

8227 SOUTH ACCESS ROAD
GROVEPORT, OH 43125

COORDINATES

Latitude (North):	39.8056720 - 39˚ 48' 20.41''
Longitude (West):	82.9284950 - 82˚ 55' 42.58''
Universal Tranverse Mercator:	Zone 17
UTM X (Meters):	334908.6
UTM Y (Meters):	4407758.5
Elevation:	729 ft. above sea level

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property:	TP
Source:	U.S. Geological Survey

AERIAL PHOTOGRAPHY IN THIS REPORT

Portions of Photo from:	20150716
Source:	USDA

MAPPED SITES SUMMARY

Target Property Address:
8227 SOUTH ACCESS ROAD
GROVEPORT, OH 43125

Click on Map ID to see full detail.

MAP ID	SITE NAME	ADDRESS	DATABASE ACRONYMS	RELATIVE ELEVATION	DIST (ft. & mi.) DIRECTION
1	SOUTH SKEET RANGE		UXO	Lower	1 ft.
A2	LOCKBOURNE AIR FORCE		FUDS	Higher	2201, 0.417, North
A3	FIRING-IN-BUTT/EOD A		UXO	Higher	2201, 0.417, North
A4	NORTH SKEET RANGE		UXO	Higher	2201, 0.417, North
A5	200 YD RIFLE/GRENADE		UXO	Higher	2201, 0.417, North
A6	WEST SKEET RANGE AND		UXO	Higher	2201, 0.417, North
A7	AIR SHOW DROP ZONE		UXO	Higher	2201, 0.417, North
A8	POSSIBLE CWM		UXO	Higher	2201, 0.417, North
B9	RICKENBACKER ANGB BU	7161 2ND ST	SEMS, RCRA-TSDF, US INST CONTROL, RCRA NonGen /...	Higher	4491, 0.851, NW
B10	RICKENBACKER ANGB BU	7161 2ND ST	CORRACTS, PADS, NY MANIFEST	Higher	4574, 0.866, NW
B11	RICKENBACKER ANGB 12	7370 MINUTEMAN WAY	OH DERR, OH SPILLS, OH NPDES, OH VAPOR, OH UIC	Higher	4574, 0.866, NW
12	RICKENBACKER ANG	7556 S PERIMETER RD	OH DERR, OH INST CONTROL, OH SPILLS, OH VAPOR	Higher	4628, 0.877, WNW

EXECUTIVE SUMMARY

TARGET PROPERTY SEARCH RESULTS

The target property was not listed in any of the databases searched by EDR.

SURROUNDING SITES: SEARCH RESULTS

Surrounding sites were identified in the following databases.

Elevations have been determined from the USGS Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified. Sites with an elevation equal to or higher than the target property have been differentiated below from sites with an elevation lower than the target property.
Page numbers and map identification numbers refer to the EDR Radius Map report where detailed data on individual sites can be reviewed.

Sites listed in ***bold italics*** are in multiple databases.

Unmappable (orphan) sites are not considered in the foregoing analysis.

STANDARD ENVIRONMENTAL RECORDS

Federal RCRA CORRACTS facilities list

CORRACTS: A review of the CORRACTS list, as provided by EDR, and dated 03/01/2018 has revealed that there is 1 CORRACTS site within approximately 1 mile of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
RICKENBACKER ANGB BU EPA ID:: OH3571924544	***7161 2ND ST***	***NW 1/2 - 1 (0.866 mi.)***	***B10***	***9***

State- and tribal - equivalent CERCLIS

OH DERR: A review of the OH DERR list, as provided by EDR, and dated 12/22/2017 has revealed that there are 2 OH DERR sites within approximately 1 mile of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
RICKENBACKER ANGB 12 DERR Id: 125002029 Activity: ER, SA, RR	***7370 MINUTEMAN WAY***	***NW 1/2 - 1 (0.866 mi.)***	***B11***	***10***
RICKENBACKER ANG DERR Id: 125000685 DERR Id: 125001255 DERR Id: 125001513 Activity: SA, RR	***7556 S PERIMETER RD***	***WNW 1/2 - 1 (0.877 mi.)***	***12***	***10***

ADDITIONAL ENVIRONMENTAL RECORDS

Other Ascertainable Records

FUDS: A review of the FUDS list, as provided by EDR, and dated 01/31/2015 has revealed that there is 1 FUDS site within approximately 1 mile of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
LOCKBOURNE AIR FORCE Federal Facility ID:: OH9799F3637 INST ID:: 55586		N 1/4 - 1/2 (0.417 mi.)	A2	8

ROD: A review of the ROD list, as provided by EDR, and dated 07/17/2018 has revealed that there is 1 ROD site within approximately 1 mile of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
RICKENBACKER ANGB BU EPA ID:: OH3571924544	***7161 2ND ST***	***NW 1/2 - 1 (0.851 mi.)***	***B9***	***9***

UXO: A review of the UXO list, as provided by EDR, and dated 09/30/2017 has revealed that there are 7 UXO sites within approximately 1 mile of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
FIRING-IN-BUTT/EOD A		N 1/4 - 1/2 (0.417 mi.)	A3	8
NORTH SKEET RANGE		N 1/4 - 1/2 (0.417 mi.)	A4	8
200 YD RIFLE/GRENADE		N 1/4 - 1/2 (0.417 mi.)	A5	8
WEST SKEET RANGE AND		N 1/4 - 1/2 (0.417 mi.)	A6	8
AIR SHOW DROP ZONE		N 1/4 - 1/2 (0.417 mi.)	A7	9
POSSIBLE CWM		N 1/4 - 1/2 (0.417 mi.)	A8	9

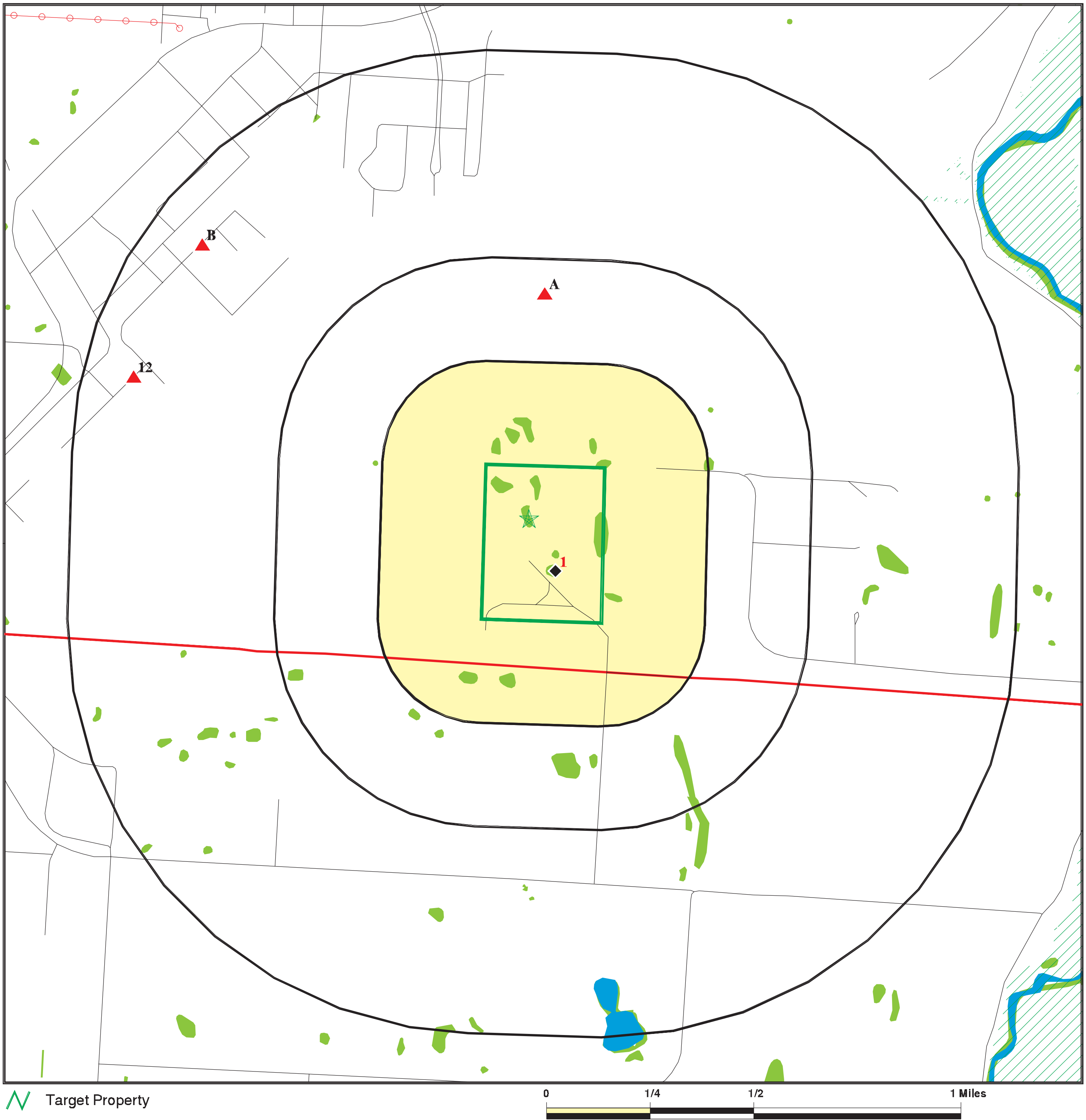
Lower Elevation	Address	Direction / Distance	Map ID	Page
SOUTH SKEET RANGE		0 - 1/8 (0.000 mi.)	1	8

Count: 0 records.

ORPHAN SUMMARY

City	EDR ID	Site Name	Site Address	Zip	Database(s)
		NO SITES FOUND			

OVERVIEW MAP - 5457852.2S



- ⋀ Target Property
- ▲ Sites at elevations higher than or equal to the target property
- ◆ Sites at elevations lower than the target property
- ♟ Manufactured Gas Plants
- ▨ National Priority List Sites
- ▨ Dept. Defense Sites
- ▨ Indian Reservations BIA
- ⋀ County Boundary
- ⋀ Power transmission lines
- ▨ 100-year flood zone
- ▨ 500-year flood zone
- 🟩 National Wetland Inventory

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME:	Rickenbacker AASF	CLIENT:	AECOM
ADDRESS:	8227 South Access Road Groveport OH 43125	CONTACT:	Brittany Kirchmann
		INQUIRY #:	5457852.2s
LAT/LONG:	39.805672 / 82.928495	DATE:	October 18, 2018 1:36 pm

DETAIL MAP - 5457852.2S

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME: Rickenbacker AASF
ADDRESS: 8227 South Access Road
Groveport OH 43125
LAT/LONG: 39.805672 / 82.928495

CLIENT: AECOM
CONTACT: Brittany Kirchmann
INQUIRY #: 5457852.2s
DATE: October 18, 2018 1:38 pm

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
STANDARD ENVIRONMENTAL RECORDS								
Federal NPL site list								
NPL	1.000		0	0	0	0	NR	0
Proposed NPL	1.000		0	0	0	0	NR	0
NPL LIENS	TP		NR	NR	NR	NR	NR	0
Federal Delisted NPL site list								
Delisted NPL	1.000		0	0	0	0	NR	0
Federal CERCLIS list								
FEDERAL FACILITY	0.500		0	0	0	NR	NR	0
SEMS	0.500		0	0	0	NR	NR	0
Federal CERCLIS NFRAP site list								
SEMS-ARCHIVE	0.500		0	0	0	NR	NR	0
Federal RCRA CORRACTS facilities list								
CORRACTS	1.000		0	0	0	1	NR	1
Federal RCRA non-CORRACTS TSD facilities list								
RCRA-TSDF	0.500		0	0	0	NR	NR	0
Federal RCRA generators list								
RCRA-LQG	0.250		0	0	NR	NR	NR	0
RCRA-SQG	0.250		0	0	NR	NR	NR	0
RCRA-CESQG	0.250		0	0	NR	NR	NR	0
Federal institutional controls / engineering controls registries								
LUCIS	0.500		0	0	0	NR	NR	0
US ENG CONTROLS	0.500		0	0	0	NR	NR	0
US INST CONTROL	0.500		0	0	0	NR	NR	0
Federal ERNS list								
ERNS	TP		NR	NR	NR	NR	NR	0
State- and tribal - equivalent CERCLIS								
OH SHWS	N/A		N/A	N/A	N/A	N/A	N/A	N/A
OH DERR	1.000		0	0	0	2	NR	2
State and tribal landfill and/or solid waste disposal site lists								
OH SWF/LF	0.500		0	0	0	NR	NR	0
State and tribal leaking storage tank lists								
OH LUST	0.500		0	0	0	NR	NR	0
INDIAN LUST	0.500		0	0	0	NR	NR	0
OH UNREG LTANKS	0.500		0	0	0	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
State and tribal registered storage tank lists								
FEMA UST	0.250		0	0	NR	NR	NR	0
OH UST	0.250		0	0	NR	NR	NR	0
OH AST	0.250		0	0	NR	NR	NR	0
INDIAN UST	0.250		0	0	NR	NR	NR	0
State and tribal institutional control / engineering control registries								
OH HIST INST CONTROLS	0.500		0	0	0	NR	NR	0
OH HIST ENG CONTROLS	0.500		0	0	0	NR	NR	0
OH ENG CONTROLS	0.500		0	0	0	NR	NR	0
OH INST CONTROL	0.500		0	0	0	NR	NR	0
State and tribal voluntary cleanup sites								
OH VCP	0.500		0	0	0	NR	NR	0
INDIAN VCP	0.500		0	0	0	NR	NR	0
State and tribal Brownfields sites								
OH BROWNFIELDS	0.500		0	0	0	NR	NR	0
ADDITIONAL ENVIRONMENTAL RECORDS								
Local Brownfield lists								
US BROWNFIELDS	0.500		0	0	0	NR	NR	0
Local Lists of Landfill / Solid Waste Disposal Sites								
OH HIST LF	0.500		0	0	0	NR	NR	0
OH SWRCY	0.500		0	0	0	NR	NR	0
INDIAN ODI	0.500		0	0	0	NR	NR	0
ODI	0.500		0	0	0	NR	NR	0
DEBRIS REGION 9	0.500		0	0	0	NR	NR	0
IHS OPEN DUMPS	0.500		0	0	0	NR	NR	0
Local Lists of Hazardous waste / Contaminated Sites								
US HIST CDL	TP		NR	NR	NR	NR	NR	0
OH CDL	TP		NR	NR	NR	NR	NR	0
US CDL	TP		NR	NR	NR	NR	NR	0
Local Lists of Registered Storage Tanks								
OH ARCHIVE UST	0.250		0	0	NR	NR	NR	0
Local Land Records								
LIENS 2	TP		NR	NR	NR	NR	NR	0
Records of Emergency Release Reports								
HMIRS	TP		NR	NR	NR	NR	NR	0
OH SPILLS	TP		NR	NR	NR	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
OH SPILLS 90	TP		NR	NR	NR	NR	NR	0
OH SPILLS 80	TP		NR	NR	NR	NR	NR	0
Other Ascertainable Records								
RCRA NonGen / NLR	0.250		0	0	NR	NR	NR	0
FUDS	1.000		0	0	1	0	NR	1
DOD	1.000		0	0	0	0	NR	0
SCRD DRYCLEANERS	0.500		0	0	0	NR	NR	0
US FIN ASSUR	TP		NR	NR	NR	NR	NR	0
EPA WATCH LIST	TP		NR	NR	NR	NR	NR	0
2020 COR ACTION	0.250		0	0	NR	NR	NR	0
TSCA	TP		NR	NR	NR	NR	NR	0
TRIS	TP		NR	NR	NR	NR	NR	0
SSTS	TP		NR	NR	NR	NR	NR	0
ROD	1.000		0	0	0	1	NR	1
RMP	TP		NR	NR	NR	NR	NR	0
RAATS	TP		NR	NR	NR	NR	NR	0
PRP	TP		NR	NR	NR	NR	NR	0
PADS	TP		NR	NR	NR	NR	NR	0
ICIS	TP		NR	NR	NR	NR	NR	0
FTTS	TP		NR	NR	NR	NR	NR	0
MLTS	TP		NR	NR	NR	NR	NR	0
COAL ASH DOE	TP		NR	NR	NR	NR	NR	0
COAL ASH EPA	0.500		0	0	0	NR	NR	0
PCB TRANSFORMER	TP		NR	NR	NR	NR	NR	0
RADINFO	TP		NR	NR	NR	NR	NR	0
HIST FTTS	TP		NR	NR	NR	NR	NR	0
DOT OPS	TP		NR	NR	NR	NR	NR	0
CONSENT	1.000		0	0	0	0	NR	0
INDIAN RESERV	1.000		0	0	0	0	NR	0
FUSRAP	1.000		0	0	0	0	NR	0
UMTRA	0.500		0	0	0	NR	NR	0
LEAD SMELTERS	TP		NR	NR	NR	NR	NR	0
US AIRS	TP		NR	NR	NR	NR	NR	0
US MINES	0.250		0	0	NR	NR	NR	0
ABANDONED MINES	0.250		0	0	NR	NR	NR	0
FINDS	TP		NR	NR	NR	NR	NR	0
UXO	1.000		1	0	6	0	NR	7
DOCKET HWC	TP		NR	NR	NR	NR	NR	0
ECHO	TP		NR	NR	NR	NR	NR	0
FUELS PROGRAM	0.250		0	0	NR	NR	NR	0
OH AIRS	TP		NR	NR	NR	NR	NR	0
OH COAL ASH	0.500		0	0	0	NR	NR	0
OH CRO	TP		NR	NR	NR	NR	NR	0
OH DRYCLEANERS	0.250		0	0	NR	NR	NR	0
OH Financial Assurance	TP		NR	NR	NR	NR	NR	0
OH HIST USD	0.500		0	0	0	NR	NR	0
OH LEAD	TP		NR	NR	NR	NR	NR	0
NY MANIFEST	0.250		0	0	NR	NR	NR	0
OH NPDES	TP		NR	NR	NR	NR	NR	0
OH VAPOR	0.500		0	0	0	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
OH TOWNGAS	1.000		0	0	0	0	NR	0
OH UIC	TP		NR	NR	NR	NR	NR	0
OH USD	0.500		0	0	0	NR	NR	0
EDR HIGH RISK HISTORICAL RECORDS								
EDR Exclusive Records								
EDR MGP	1.000		0	0	0	0	NR	0
EDR Hist Auto	0.125		0	NR	NR	NR	NR	0
EDR Hist Cleaner	0.125		0	NR	NR	NR	NR	0
EDR RECOVERED GOVERNMENT ARCHIVES								
Exclusive Recovered Govt. Archives								
OH RGA LF	TP		NR	NR	NR	NR	NR	0
OH RGA LUST	TP		NR	NR	NR	NR	NR	0
- Totals --		0	1	0	7	4	0	12

NOTES:

TP = Target Property

NR = Not Requested at this Search Distance

Sites may be listed in more than one database

N/A = This State does not maintain a SHWS list. See the Federal CERCLIS list.

Map ID Direction Distance Elevation	Site	Database(s)	EDR ID Number EPA ID Number
1 **< 1/8** **1 ft.** **Relative: Lower**	**SOUTH SKEET RANGE** **COLUMBUS, OH** Click here for full text details	**UXO**	**1023964250** **N/A**
A2 **North** **1/4-1/2** **0.417 mi.** **2201 ft.** **Relative: Higher**	**LOCKBOURNE AIR FORCE BASE** **COLUMBUS, OH** Click here for full text details **FUDS** Federal Facility ID:: OH9799F3637 INST ID:: 55586	**FUDS**	**1007211689** **N/A**
A3 **North** **1/4-1/2** **0.417 mi.** **2201 ft.** **Relative: Higher**	**FIRING-IN-BUTT/EOD AREA** **COLUMBUS, OH** Click here for full text details	**UXO**	**1018151584** **N/A**
A4 **North** **1/4-1/2** **0.417 mi.** **2201 ft.** **Relative: Higher**	**NORTH SKEET RANGE** **COLUMBUS, OH** Click here for full text details	**UXO**	**1018151586** **N/A**
A5 **North** **1/4-1/2** **0.417 mi.** **2201 ft.** **Relative: Higher**	**200 YD RIFLE/GRENADE/PRIME BEEF** **COLUMBUS, OH** Click here for full text details	**UXO**	**1018151587** **N/A**
A6 **North** **1/4-1/2** **0.417 mi.** **2201 ft.** **Relative: Higher**	**WEST SKEET RANGE AND 20MM DISCOVERY AREA** **COLUMBUS, OH** Click here for full text details	**UXO**	**1018151227** **N/A**

Map ID Direction Distance Elevation	Site	Database(s)	EDR ID Number EPA ID Number
A7 **North** **1/4-1/2** **0.417 mi.** **2201 ft.** **Relative:** **Higher**	**AIR SHOW DROP ZONE** **COLUMBUS, OH**	**UXO**	**1018151583** **N/A**

Click here for full text details

Map ID Direction Distance Elevation	Site	Database(s)	EDR ID Number EPA ID Number
A8 **North** **1/4-1/2** **0.417 mi.** **2201 ft.** **Relative:** **Higher**	**POSSIBLE CWM** **COLUMBUS, OH**	**UXO**	**1018151581** **N/A**

Click here for full text details

Map ID Direction Distance Elevation	Site	Database(s)	EDR ID Number EPA ID Number
B9 **NW** **1/2-1** **0.851 mi.** **4491 ft.** **Relative:** **Higher**	**RICKENBACKER ANGB BUILDING 560** **7161 2ND ST** **COLUMBUS, OH 43217**	**SEMS** **RCRA-TSDF** **US INST CONTROL** **RCRA NonGen / NLR** **ROD**	**1009968774** **OH3571924544**

Click here for full text details

SEMS
Site ID: 0506870
EPA Id: OH3571924544

RCRA-TSDF
EPA Id: OH3571924544

US INST CONTROL
EPA ID:: OH3571924544

RCRA NonGen / NLR
EPA Id: OH3571924544

ROD
EPA ID:: OH3571924544

Map ID Direction Distance Elevation	Site	Database(s)	EDR ID Number EPA ID Number
B10 **NW** **1/2-1** **0.866 mi.** **4574 ft.** **Relative:** **Higher**	**RICKENBACKER ANGB BUILDING 560** **7161 2ND ST** **COLUMBUS, OH 43217**	**CORRACTS** **PADS** **NY MANIFEST**	**1015757932** **OH3571924544**

Click here for full text details

CORRACTS
EPA ID:: OH3571924544

PADS

RICKENBACKER ANGB BUILDING 560 (Continued) **1015757932**

EPAID:: OH3571924544

NY MANIFEST

EPA ID: OH0000553826
EPA ID: OH3571924544

Map ID / Direction / Distance / Elevation	Site	Database(s)	EDR ID Number / EPA ID Number
B11 **NW** **1/2-1** **0.866 mi.** **4574 ft.** **Relative: Higher**	**RICKENBACKER ANGB 121ST** **7370 MINUTEMAN WAY** **COLUMBUS, OH 43217**	**OH DERR** **OH SPILLS** **OH NPDES** **OH VAPOR** **OH UIC**	**S105153725** **N/A**

Click here for full text details

OH DERR

DERR Id: 125002029
Activity: ER, SA, RR

OH SPILLS

Spill No.: 1012-25-3434
Spill No.: 1410-25-2164

OH NPDES

Facility Npdes Permit: 4GC03745*AG
Facility Npdes Permit: 4GC05123*AG

OH UIC

Facility Status: Temporarily Abandoned
Facility Status: Permenantly Abandoned

Map ID / Direction / Distance / Elevation	Site	Database(s)	EDR ID Number / EPA ID Number
12 **WNW** **1/2-1** **0.877 mi.** **4628 ft.** **Relative: Higher**	**RICKENBACKER ANG** **7556 S PERIMETER RD** **COLUMBUS, OH 43217**	**OH DERR** **OH INST CONTROL** **OH SPILLS** **OH VAPOR**	**S100752865** **N/A**

Click here for full text details

OH DERR

DERR Id: 125000685
DERR Id: 125001255
DERR Id: 125001513
Activity: SA, RR

OH INST CONTROL

Project Id: 125000685003
Project Id: 125000685008
Project Id: 125000685010
Project Id: 125000685013
Project Id: 125000685058
Project Id: 125000685089
Project Id: 125000685091
Project Id: 125000685093

RICKENBACKER ANG (Continued) **S100752865**

Project Id: 125000685095
Project Id: 125000685097
Project Id: 125000685098
Project Id: 125000685101
Project Id: 125000685114
Site Id: 125000685

OH SPILLS
Spill No.: 9601-25-0028

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

St	Acronym	Full Name	Government Agency	Gov Date	Arvl. Date	Active Date
OH	AIRS	Title V Permits Listing	Ohio EPA	09/25/2018	09/27/2018	10/17/2018
OH	ARCHIVE UST	Archived Underground Storage Tank Sites	Department of Commerce, Division of State Fir	08/08/2018	08/10/2018	09/19/2018
OH	AST	Above Ground Storage Tanks	Department of Commerce	08/01/2018	08/02/2018	08/15/2018
OH	BROWNFIELDS	Ohio Brownfield Inventory	Ohio EPA	09/10/2018	09/13/2018	10/16/2018
OH	CDL	Clandestine Drug Lab Locations	Ohio EPA	08/20/2018	08/22/2018	09/27/2018
OH	COAL ASH	Coal Ash Disposal Site Listing	Ohio EPA	04/13/2015	04/16/2015	05/29/2015
OH	CRO	Cessation of Regulated Operations Facility Listing	Ohio EPA	09/27/2017	11/09/2017	01/08/2018
OH	DERR	Division of Emergency & Remedial Response’s Database	Ohio EPA	12/22/2017	02/08/2018	03/02/2018
OH	DRYCLEANERS	Drycleaner Facility Listing	Ohio EPA	09/26/2018	09/28/2018	10/16/2018
OH	ENG CONTROLS	Sites with Engineering Controls	Ohio EPA	12/22/2017	02/08/2018	03/02/2018
OH	FINANCIAL ASSURANCE 3	Financial Assurance3 Information Listing	Ohio EPA	07/27/2018	07/31/2018	09/14/2018
OH	Financial Assurance	Financial Assurance Information Listing	Ohio EPA	12/05/2017	12/08/2017	01/08/2018
OH	HIST ENG CONTROLS	Operation & Maintenance Agreements Database	Ohio EPA	05/10/2005	04/04/2006	05/04/2006
OH	HIST INST CONTROLS	Institutional Controls Database	Ohio EPA	05/10/2005	04/06/2006	05/04/2006
OH	HIST LF	Old Solid Waste Landfill	Ohio EPA	09/08/2018	09/13/2018	10/16/2018
OH	HIST USD	Urban Setting Designations Database	Ohio EPA	05/10/2005	04/25/2006	05/11/2006
OH	INST CONTROL	Sites with Institutional Engineering Controls	Ohio Environmental Protection Agency	12/22/2017	02/08/2018	03/02/2018
OH	LEAD	Lead Inspections Listing	Department of Health	09/18/2018	09/19/2018	10/16/2018
OH	LUST	Leaking Underground Storage Tank File	Department of Commerce	08/08/2018	08/10/2018	09/24/2018
OH	NPDES	NPDES General Permit List	Ohio EPA	08/06/2018	08/08/2018	09/25/2018
OH	RGA LF	Recovered Government Archive Solid Waste Facilities List	Ohio Environmental Protection Agency		07/01/2013	01/13/2014
OH	RGA LUST	Recovered Government Archive Leaking Underground Storage Tan	Department of Commerce		07/01/2013	12/20/2013
OH	SHWS	This state does not maintain a SHWS list. See the Federal CE	Ohio EPA			
OH	SPILLS	Emergency Response Database	Ohio EPA	08/20/2018	08/22/2018	09/27/2018
OH	SPILLS 80	SPILLS80 data from FirstSearch	FirstSearch	04/24/2004	01/03/2013	03/01/2013
OH	SPILLS 90	SPILLS90 data from FirstSearch	FirstSearch	09/13/2012	01/03/2013	02/27/2013
OH	SWF/LF	Licensed Solid Waste Facilities	Ohio Environmental Protection Agency	07/09/2018	07/13/2018	08/15/2018
OH	SWRCY	Recycling Facility Listing	Ohio EPA	07/23/2018	07/25/2018	08/15/2018
OH	TOWNGAS	DERR Towngas Database	Ohio EPA	07/28/1992	02/21/2003	03/05/2003
OH	UIC	Underground Injection Wells Listing	Ohio EPA	07/11/2018	08/08/2018	09/24/2018
OH	UNREG LTANKS	Ohio Leaking UST File	Department of Commerce	08/25/1999	08/19/2003	08/26/2003
OH	USD	Urban Setting Designation Sites	Ohio EPA	06/21/2018	08/08/2018	09/24/2018
OH	UST	Underground Storage Tank Tank File	Department of Commerce	08/08/2018	08/10/2018	09/19/2018
OH	VAPOR	Vapor Intrusion	Ohio EPA	09/18/2018	09/20/2018	10/16/2018
OH	VCP	Voluntary Action Program Sites	Ohio EPA, Voluntary Action Program	12/22/2017	02/08/2018	03/02/2018
US	2020 COR ACTION	2020 Corrective Action Program List	Environmental Protection Agency	09/30/2017	05/08/2018	07/20/2018
US	ABANDONED MINES	Abandoned Mines	Department of Interior	09/10/2018	09/11/2018	09/14/2018
US	BRS	Biennial Reporting System	EPA/NTIS	12/31/2015	02/22/2017	09/28/2017
US	COAL ASH DOE	Steam-Electric Plant Operation Data	Department of Energy	12/31/2005	08/07/2009	10/22/2009
US	COAL ASH EPA	Coal Combustion Residues Surface Impoundments List	Environmental Protection Agency	07/01/2014	09/10/2014	10/20/2014
US	CONSENT	Superfund (CERCLA) Consent Decrees	Department of Justice, Consent Decree Library	06/30/2018	07/17/2018	10/05/2018
US	CORRACTS	Corrective Action Report	EPA	03/01/2018	03/28/2018	06/22/2018
US	DEBRIS REGION 9	Torres Martinez Reservation Illegal Dump Site Locations	EPA, Region 9	01/12/2009	05/07/2009	09/21/2009
US	DOCKET HWC	Hazardous Waste Compliance Docket Listing	Environmental Protection Agency	05/31/2018	07/26/2018	10/05/2018
US	DOD	Department of Defense Sites	USGS	12/31/2005	11/10/2006	01/11/2007
US	DOT OPS	Incident and Accident Data	Department of Transporation, Office of Pipeli	07/31/2012	08/07/2012	09/18/2012
US	Delisted NPL	National Priority List Deletions	EPA	07/17/2018	08/09/2018	09/07/2018

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

St	Acronym	Full Name	Government Agency	Gov Date	Arvl. Date	Active Date
US	ECHO	Enforcement & Compliance History Information	Environmental Protection Agency	09/02/2018	09/05/2018	09/14/2018
US	EDR Hist Auto	EDR Exclusive Historical Auto Stations	EDR, Inc.			
US	EDR Hist Cleaner	EDR Exclusive Historical Cleaners	EDR, Inc.			
US	EDR MGP	EDR Proprietary Manufactured Gas Plants	EDR, Inc.			
US	EPA WATCH LIST	EPA WATCH LIST	Environmental Protection Agency	08/30/2013	03/21/2014	06/17/2014
US	ERNS	Emergency Response Notification System	National Response Center, United States Coast	06/18/2018	06/27/2018	09/14/2018
US	FEDERAL FACILITY	Federal Facility Site Information listing	Environmental Protection Agency	11/07/2016	01/05/2017	04/07/2017
US	FEDLAND	Federal and Indian Lands	U.S. Geological Survey	12/31/2005	02/06/2006	01/11/2007
US	FEMA UST	Underground Storage Tank Listing	FEMA	05/15/2017	05/30/2017	10/13/2017
US	FINDS	Facility Index System/Facility Registry System	EPA	08/07/2018	09/05/2018	10/05/2018
US	FTTS	FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fu	EPA/Office of Prevention, Pesticides and Toxi	04/09/2009	04/16/2009	05/11/2009
US	FTTS INSP	FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fu	EPA	04/09/2009	04/16/2009	05/11/2009
US	FUDS	Formerly Used Defense Sites	U.S. Army Corps of Engineers	01/31/2015	07/08/2015	10/13/2015
US	FUELS PROGRAM	EPA Fuels Program Registered Listing	EPA	08/22/2018	08/22/2018	10/05/2018
US	FUSRAP	Formerly Utilized Sites Remedial Action Program	Department of Energy	08/08/2017	09/11/2018	09/14/2018
US	HIST FTTS	FIFRA/TSCA Tracking System Administrative Case Listing	Environmental Protection Agency	10/19/2006	03/01/2007	04/10/2007
US	HIST FTTS INSP	FIFRA/TSCA Tracking System Inspection & Enforcement Case Lis	Environmental Protection Agency	10/19/2006	03/01/2007	04/10/2007
US	HMIRS	Hazardous Materials Information Reporting System	U.S. Department of Transportation	03/26/2018	03/27/2018	06/08/2018
US	ICIS	Integrated Compliance Information System	Environmental Protection Agency	11/18/2016	11/23/2016	02/10/2017
US	IHS OPEN DUMPS	Open Dumps on Indian Land	Department of Health & Human Serivces, Indian	04/01/2014	08/06/2014	01/29/2015
US	INDIAN LUST R1	Leaking Underground Storage Tanks on Indian Land	EPA Region 1	04/13/2018	05/18/2018	07/20/2018
US	INDIAN LUST R10	Leaking Underground Storage Tanks on Indian Land	EPA Region 10	04/12/2018	05/18/2018	07/20/2018
US	INDIAN LUST R4	Leaking Underground Storage Tanks on Indian Land	EPA Region 4	05/08/2018	05/18/2018	07/20/2018
US	INDIAN LUST R5	Leaking Underground Storage Tanks on Indian Land	EPA, Region 5	04/12/2018	05/18/2018	07/20/2018
US	INDIAN LUST R6	Leaking Underground Storage Tanks on Indian Land	EPA Region 6	04/01/2018	05/18/2018	07/20/2018
US	INDIAN LUST R7	Leaking Underground Storage Tanks on Indian Land	EPA Region 7	04/24/2018	05/18/2018	07/20/2018
US	INDIAN LUST R8	Leaking Underground Storage Tanks on Indian Land	EPA Region 8	04/25/2018	05/18/2018	07/20/2018
US	INDIAN LUST R9	Leaking Underground Storage Tanks on Indian Land	Environmental Protection Agency	04/10/2018	05/18/2018	07/20/2018
US	INDIAN ODI	Report on the Status of Open Dumps on Indian Lands	Environmental Protection Agency	12/31/1998	12/03/2007	01/24/2008
US	INDIAN RESERV	Indian Reservations	USGS	12/31/2014	07/14/2015	01/10/2017
US	INDIAN UST R1	Underground Storage Tanks on Indian Land	EPA, Region 1	04/13/2018	05/18/2018	07/20/2018
US	INDIAN UST R10	Underground Storage Tanks on Indian Land	EPA Region 10	04/12/2018	05/18/2018	07/20/2018
US	INDIAN UST R4	Underground Storage Tanks on Indian Land	EPA Region 4	05/08/2018	05/18/2018	07/20/2018
US	INDIAN UST R5	Underground Storage Tanks on Indian Land	EPA Region 5	04/12/2018	05/18/2018	07/20/2018
US	INDIAN UST R6	Underground Storage Tanks on Indian Land	EPA Region 6	04/01/2018	05/18/2018	07/20/2018
US	INDIAN UST R7	Underground Storage Tanks on Indian Land	EPA Region 7	04/24/2018	05/18/2018	07/20/2018
US	INDIAN UST R8	Underground Storage Tanks on Indian Land	EPA Region 8	04/25/2018	05/18/2018	07/20/2018
US	INDIAN UST R9	Underground Storage Tanks on Indian Land	EPA Region 9	04/10/2018	05/18/2018	07/20/2018
US	INDIAN VCP R1	Voluntary Cleanup Priority Listing	EPA, Region 1	07/27/2015	09/29/2015	02/18/2016
US	INDIAN VCP R7	Voluntary Cleanup Priority Lisitng	EPA, Region 7	03/20/2008	04/22/2008	05/19/2008
US	LEAD SMELTER 1	Lead Smelter Sites	Environmental Protection Agency	07/17/2018	08/09/2018	10/05/2018
US	LEAD SMELTER 2	Lead Smelter Sites	American Journal of Public Health	04/05/2001	10/27/2010	12/02/2010
US	LIENS 2	CERCLA Lien Information	Environmental Protection Agency	07/17/2018	08/09/2018	10/05/2018
US	LUCIS	Land Use Control Information System	Department of the Navy	05/14/2018	05/18/2018	07/20/2018
US	MLTS	Material Licensing Tracking System	Nuclear Regulatory Commission	08/30/2016	09/08/2016	10/21/2016
US	NPL	National Priority List	EPA	07/17/2018	08/09/2018	09/07/2018
US	NPL LIENS	Federal Superfund Liens	EPA	10/15/1991	02/02/1994	03/30/1994

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

St	Acronym	Full Name	Government Agency	Gov Date	Arvl. Date	Active Date
US	ODI	Open Dump Inventory	Environmental Protection Agency	06/30/1985	08/09/2004	09/17/2004
US	PADS	PCB Activity Database System	EPA	06/01/2017	06/09/2017	10/13/2017
US	PCB TRANSFORMER	PCB Transformer Registration Database	Environmental Protection Agency	05/24/2017	11/30/2017	12/15/2017
US	PRP	Potentially Responsible Parties	EPA	10/25/2013	10/17/2014	10/20/2014
US	Proposed NPL	Proposed National Priority List Sites	EPA	07/17/2018	08/09/2018	09/07/2018
US	RAATS	RCRA Administrative Action Tracking System	EPA	04/17/1995	07/03/1995	08/07/1995
US	RADINFO	Radiation Information Database	Environmental Protection Agency	07/02/2018	07/05/2018	10/05/2018
US	RCRA NonGen / NLR	RCRA - Non Generators / No Longer Regulated	Environmental Protection Agency	03/01/2018	03/28/2018	06/22/2018
US	RCRA-CESQG	RCRA - Conditionally Exempt Small Quantity Generators	Environmental Protection Agency	03/01/2018	03/28/2018	06/22/2018
US	RCRA-LQG	RCRA - Large Quantity Generators	Environmental Protection Agency	03/01/2018	03/28/2018	06/22/2018
US	RCRA-SQG	RCRA - Small Quantity Generators	Environmental Protection Agency	03/01/2018	03/28/2018	06/22/2018
US	RCRA-TSDF	RCRA - Treatment, Storage and Disposal	Environmental Protection Agency	03/01/2018	03/28/2018	06/22/2018
US	RMP	Risk Management Plans	Environmental Protection Agency	08/01/2018	08/22/2018	10/05/2018
US	ROD	Records Of Decision	EPA	07/17/2018	08/09/2018	10/05/2018
US	SCRD DRYCLEANERS	State Coalition for Remediation of Drycleaners Listing	Environmental Protection Agency	01/01/2017	02/03/2017	04/07/2017
US	SEMS	Superfund Enterprise Management System	EPA	07/17/2018	08/09/2018	09/07/2018
US	SEMS-ARCHIVE	Superfund Enterprise Management System Archive	EPA	07/17/2018	08/09/2018	09/07/2018
US	SSTS	Section 7 Tracking Systems	EPA	12/31/2009	12/10/2010	02/25/2011
US	TRIS	Toxic Chemical Release Inventory System	EPA	12/31/2016	01/10/2018	01/12/2018
US	TSCA	Toxic Substances Control Act	EPA	12/31/2016	06/21/2017	01/05/2018
US	UMTRA	Uranium Mill Tailings Sites	Department of Energy	06/23/2017	10/11/2017	11/03/2017
US	US AIRS (AFS)	Aerometric Information Retrieval System Facility Subsystem (	EPA	10/12/2016	10/26/2016	02/03/2017
US	US AIRS MINOR	Air Facility System Data	EPA	10/12/2016	10/26/2016	02/03/2017
US	US BROWNFIELDS	A Listing of Brownfields Sites	Environmental Protection Agency	06/18/2018	06/20/2018	09/14/2018
US	US CDL	Clandestine Drug Labs	Drug Enforcement Administration	05/18/2018	06/20/2018	09/14/2018
US	US ENG CONTROLS	Engineering Controls Sites List	Environmental Protection Agency	07/31/2018	08/28/2018	09/14/2018
US	US FIN ASSUR	Financial Assurance Information	Environmental Protection Agency	05/31/2018	06/27/2018	10/05/2018
US	US HIST CDL	National Clandestine Laboratory Register	Drug Enforcement Administration	05/18/2018	06/20/2018	09/14/2018
US	US INST CONTROL	Sites with Institutional Controls	Environmental Protection Agency	07/31/2018	08/28/2018	09/14/2018
US	US MINES	Mines Master Index File	Department of Labor, Mine Safety and Health A	08/01/2018	08/29/2018	10/05/2018
US	US MINES 2	Ferrous and Nonferrous Metal Mines Database Listing	USGS	12/05/2005	02/29/2008	04/18/2008
US	US MINES 3	Active Mines & Mineral Plants Database Listing	USGS	04/14/2011	06/08/2011	09/13/2011
US	UXO	Unexploded Ordnance Sites	Department of Defense	09/30/2017	06/19/2018	09/14/2018
CT	CT MANIFEST	Hazardous Waste Manifest Data	Department of Energy & Environmental Protecti	08/10/2018	08/10/2018	09/10/2018
NJ	NJ MANIFEST	Manifest Information	Department of Environmental Protection	12/31/2017	07/13/2018	08/01/2018
NY	NY MANIFEST	Facility and Manifest Data	Department of Environmental Conservation	07/01/2018	08/01/2018	08/31/2018
PA	PA MANIFEST	Manifest Information	Department of Environmental Protection	12/31/2016	07/25/2017	09/25/2017
RI	RI MANIFEST	Manifest information	Department of Environmental Management	12/31/2017	02/23/2018	04/09/2018
VT	VT MANIFEST	Hazardous Waste Manifest Data	Department of Environmental Conservation	08/23/2018	08/23/2018	09/18/2018
WI	WI MANIFEST	Manifest Information	Department of Natural Resources	12/31/2017	06/15/2018	07/09/2018

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

St	Acronym	Full Name	Government Agency	Gov Date	Arvl. Date	Active Date
US	AHA Hospitals	Sensitive Receptor: AHA Hospitals	American Hospital Association, Inc.			
US	Medical Centers	Sensitive Receptor: Medical Centers	Centers for Medicare & Medicaid Services			
US	Nursing Homes	Sensitive Receptor: Nursing Homes	National Institutes of Health			
US	Public Schools	Sensitive Receptor: Public Schools	National Center for Education Statistics			
US	Private Schools	Sensitive Receptor: Private Schools	National Center for Education Statistics			
OH	Daycare Centers	Sensitive Receptor: Licensed Child Day Care Facilities	Department of Job & Family Services			
US	Flood Zones	100-year and 500-year flood zones	Emergency Management Agency (FEMA)			
US	NWI	National Wetlands Inventory	U.S. Fish and Wildlife Service			
US	Topographic Map		U.S. Geological Survey			
US	Oil/Gas Pipelines		PennWell Corporation			
US	Electric Power Transmission Line Data		PennWell Corporation			

STREET AND ADDRESS INFORMATION

GEOCHECK ®- PHYSICAL SETTING SOURCE ADDENDUM

TARGET PROPERTY ADDRESS

RICKENBACKER AASF
8227 SOUTH ACCESS ROAD
GROVEPORT, OH 43125

TARGET PROPERTY COORDINATES

Latitude (North):	39.805672 - 39˚ 48’ 20.42’’
Longitude (West):	82.928495 - 82˚ 55’ 42.58’’
Universal Tranverse Mercator:	Zone 17
UTM X (Meters):	334908.6
UTM Y (Meters):	4407758.5
Elevation:	729 ft. above sea level

USGS TOPOGRAPHIC MAP

Target Property Map:	5964669 LOCKBOURNE, OH
Version Date:	2013

EDR’s GeoCheck Physical Setting Source Addendum is provided to assist the environmental professional in forming an opinion about the impact of potential contaminant migration.

Assessment of the impact of contaminant migration generally has two principle investigative components:

1. Groundwater flow direction, and
2. Groundwater flow velocity.

Groundwater flow direction may be impacted by surface topography, hydrology, hydrogeology, characteristics of the soil, and nearby wells. Groundwater flow velocity is generally impacted by the nature of the geologic strata.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW DIRECTION INFORMATION

Groundwater flow direction for a particular site is best determined by a qualified environmental professional using site-specific well data. If such data is not reasonably ascertainable, it may be necessary to rely on other sources of information, such as surface topographic information, hydrologic information, hydrogeologic data collected on nearby properties, and regional groundwater flow information (from deep aquifers).

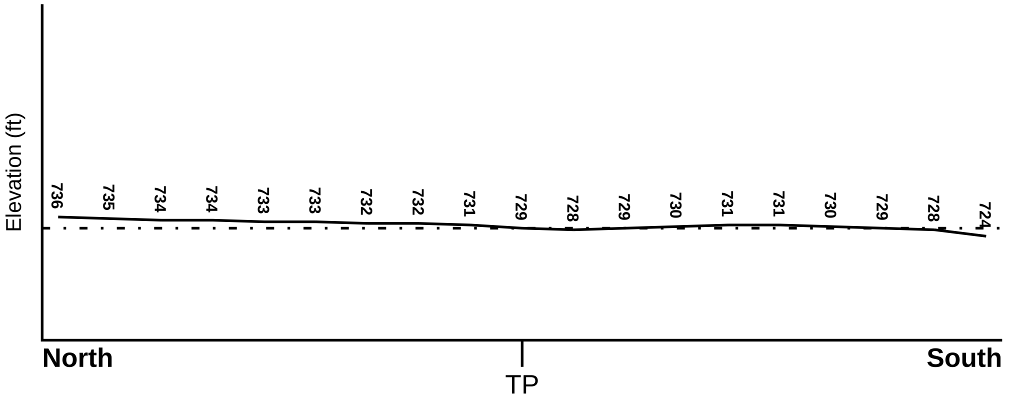
TOPOGRAPHIC INFORMATION

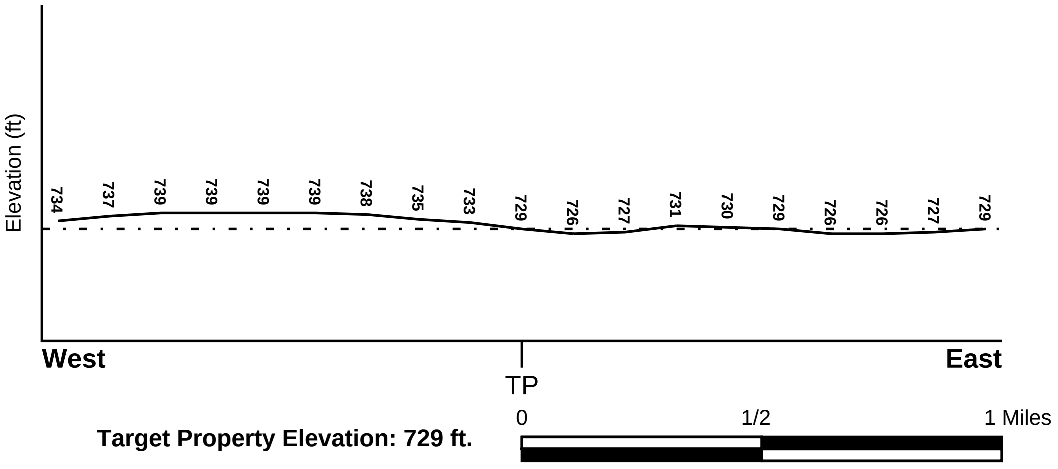
Surface topography may be indicative of the direction of surficial groundwater flow. This information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

TARGET PROPERTY TOPOGRAPHY

General Topographic Gradient: General East

SURROUNDING TOPOGRAPHY: ELEVATION PROFILES





Target Property Elevation: 729 ft.

Source: Topography has been determined from the USGS 7.5' Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

HYDROLOGIC INFORMATION

Surface water can act as a hydrologic barrier to groundwater flow. Such hydrologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

Refer to the Physical Setting Source Map following this summary for hydrologic information (major waterways and bodies of water).

FEMA FLOOD ZONE

Flood Plain Panel at Target Property	FEMA Source Type
39129C0075J	FEMA FIRM Flood data

Additional Panels in search area:	FEMA Source Type
Not Reported	

NATIONAL WETLAND INVENTORY

NWI Quad at Target Property	NWI Electronic Data Coverage
LOCKBOURNE	YES - refer to the Overview Map and Detail Map

HYDROGEOLOGIC INFORMATION

Hydrogeologic information obtained by installation of wells on a specific site can often be an indicator of groundwater flow direction in the immediate area. Such hydrogeologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

AQUIFLOW®

Search Radius: 1.000 Mile.

EDR has developed the AQUIFLOW Information System to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted by environmental professionals to regulatory authorities at select sites and has extracted the date of the report, groundwater flow direction as determined hydrogeologically, and the depth to water table.

MAP ID	LOCATION FROM TP	GENERAL DIRECTION GROUNDWATER FLOW
J51	1/2 - 1 Mile NW	SE
J52	1/2 - 1 Mile NW	SSE
J54	1/2 - 1 Mile NW	E
1G	1/2 - 1 Mile NW	SE
2G	1/2 - 1 Mile NW	SSE
4G	1/2 - 1 Mile NW	E

For additional site information, refer to Physical Setting Source Map Findings.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW VELOCITY INFORMATION

Groundwater flow velocity information for a particular site is best determined by a qualified environmental professional using site specific geologic and soil strata data. If such data are not reasonably ascertainable, it may be necessary to rely on other sources of information, including geologic age identification, rock stratigraphic unit and soil characteristics data collected on nearby properties and regional soil information. In general, contaminant plumes move more quickly through sandy-gravelly types of soils than silty-clayey types of soils.

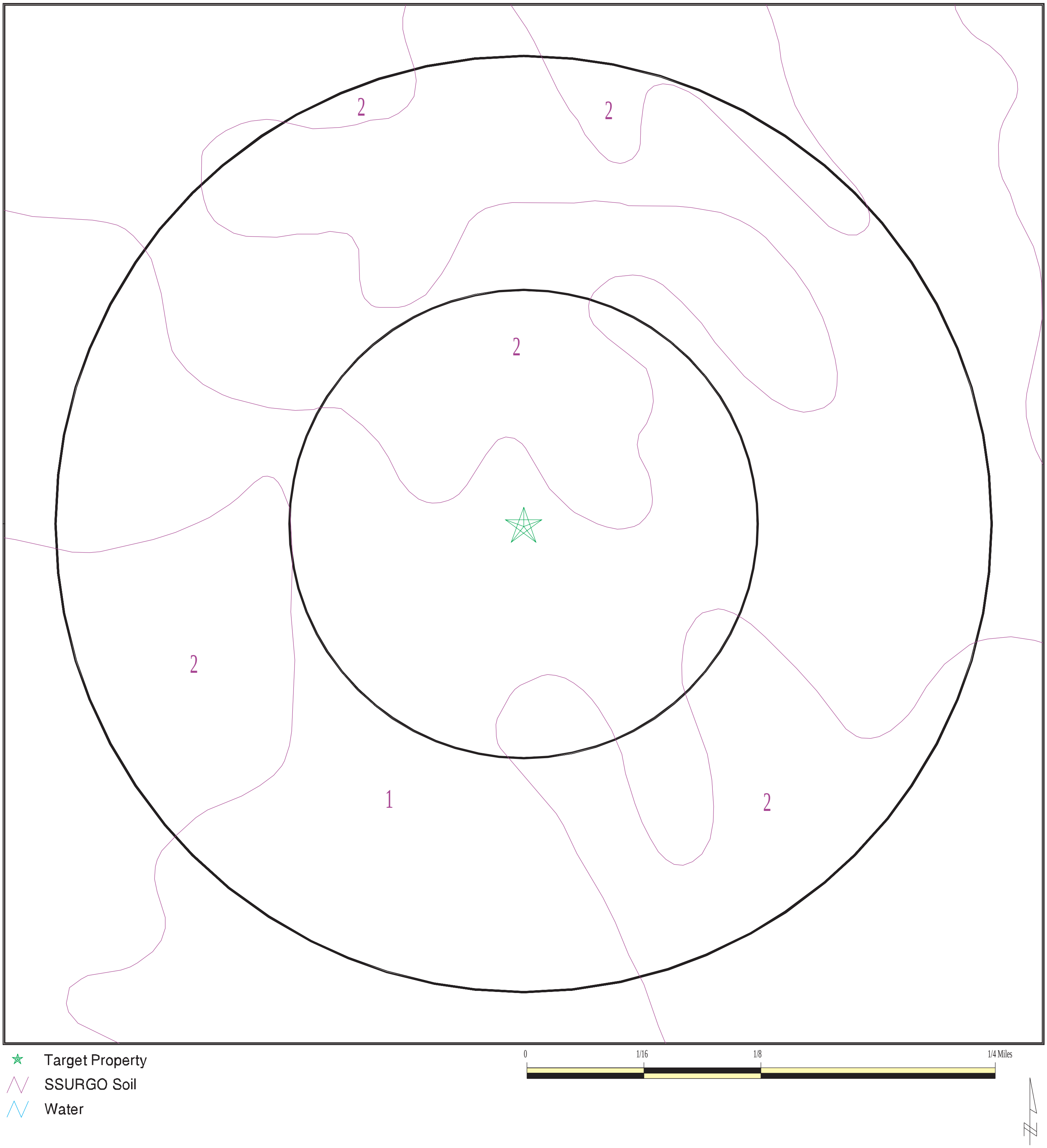
GEOLOGIC INFORMATION IN GENERAL AREA OF TARGET PROPERTY

Geologic information can be used by the environmental professional in forming an opinion about the relative speed at which contaminant migration may be occurring.

ROCK STRATIGRAPHIC UNIT		GEOLOGIC AGE IDENTIFICATION	
Era:	Paleozoic	Category:	Stratified Sequence
System:	Devonian		
Series:	Upper Devonian		
Code:	D3 *(decoded above as Era, System & Series)*		

Geologic Age and Rock Stratigraphic Unit Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - a digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

SSURGO SOIL MAP - 5457852.2s



SITE NAME: Rickenbacker AASF
ADDRESS: 8227 South Access Road
Groveport OH 43125
LAT/LONG: 39.805672 / 82.928495

CLIENT: AECOM
CONTACT: Brittany Kirchmann
INQUIRY #: 5457852.2s
DATE: October 18, 2018 1:38 pm

DOMINANT SOIL COMPOSITION IN GENERAL AREA OF TARGET PROPERTY

The U.S. Department of Agriculture’s (USDA) Soil Conservation Service (SCS) leads the National Cooperative Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. The following information is based on Soil Conservation Service SSURGO data.

Soil Map ID: 1

Soil Component Name:	Kokomo
Soil Surface Texture:	silty clay loam
Hydrologic Group:	Class B/D - Drained/undrained hydrology class of soils that can be drained and are classified.
Soil Drainage Class:	Very poorly drained

Hydric Status: Partially hydric

Corrosion Potential - Uncoated Steel:	High
Depth to Bedrock Min:	> 0 inches
Depth to Watertable Min:	> 15 inches

Soil Layer Information

	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	
Layer	**Upper**	**Lower**	**Soil Texture Class**	**AASHTO Group**	**Unified Soil**		**Soil Reaction (pH)**
1	0 inches	9 inches	silty clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 4.23 Min: 1.41	Max: 8.4 Min: 7.4
2	9 inches	42 inches	silty clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 4.23 Min: 1.41	Max: 8.4 Min: 7.4
3	42 inches	70 inches	clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 4.23 Min: 1.41	Max: 8.4 Min: 7.4

Soil Map ID: 2

Soil Component Name: Crosby

Soil Surface Texture: silt loam

Hydrologic Group: Class B/D - Drained/undrained hydrology class of soils that can be drained and are classified.

Soil Drainage Class:
Hydric Status: Partially hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 61 inches

Soil Layer Information

	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	
Layer	**Upper**	**Lower**	**Soil Texture Class**	**AASHTO Group**	**Unified Soil**		**Soil Reaction (pH)**
1	0 inches	9 inches	silt loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 4.23 Min: 0.42	Max: 8.4 Min: 7.9
2	9 inches	35 inches	silty clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 4.23 Min: 0.42	Max: 8.4 Min: 7.9
3	35 inches	70 inches	loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Silty Soils.	FINE-GRAINED SOILS, Silts and Clays (liquid limit less than 50%), Lean Clay	Max: 4.23 Min: 0.42	Max: 8.4 Min: 7.9

LOCAL / REGIONAL WATER AGENCY RECORDS

EDR Local/Regional Water Agency records provide water well information to assist the environmental professional in assessing sources that may impact ground water flow direction, and in forming an opinion about the impact of contaminant migration on nearby drinking water wells.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

WELL SEARCH DISTANCE INFORMATION

DATABASE	SEARCH DISTANCE (miles)
Federal USGS	1.000
Federal FRDS PWS	Nearest PWS within 1 mile
State Database	1.000

FEDERAL USGS WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
No Wells Found		

FEDERAL FRDS PUBLIC WATER SUPPLY SYSTEM INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
No PWS System Found		

Note: PWS System location is not always the same as well location.

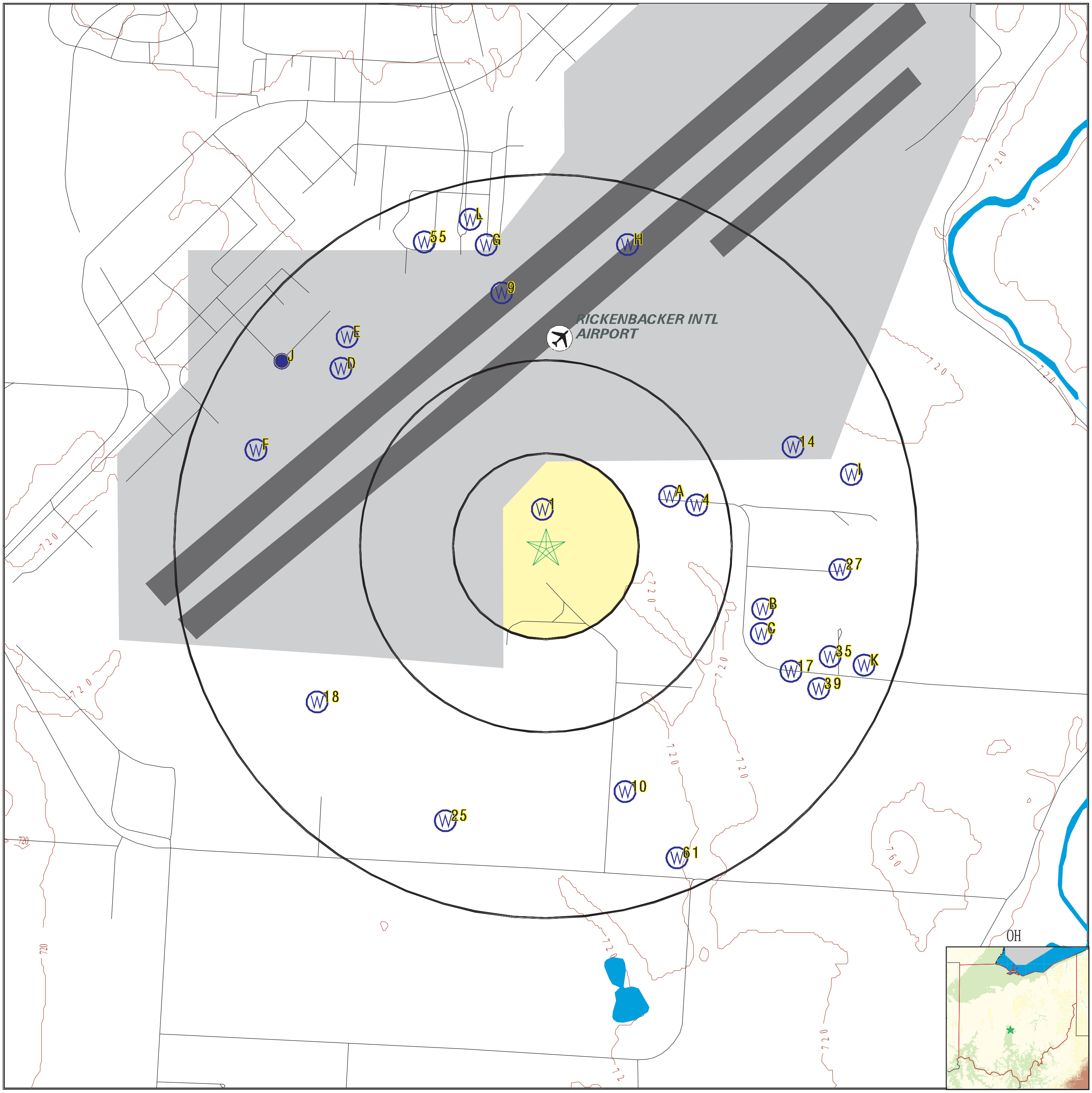
STATE DATABASE WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
1	OHDM20000451086	0 - 1/8 Mile North
A2	OHD800000045833	1/4 - 1/2 Mile ENE
A3	OHD800000235077	1/4 - 1/2 Mile ENE
4	OHD800000413138	1/4 - 1/2 Mile ENE
B5	OHD800000045754	1/2 - 1 Mile ESE
C6	OHD800000342666	1/2 - 1 Mile ESE
B7	OHD800000045755	1/2 - 1 Mile ESE
C8	OHD800000045756	1/2 - 1 Mile ESE
9	OHDM20000256044	1/2 - 1 Mile North
10	OHD800000239202	1/2 - 1 Mile SSE
D11	OHDM20000294258	1/2 - 1 Mile NW
D12	OHDM20000294245	1/2 - 1 Mile NW
D13	OHDM20000294259	1/2 - 1 Mile NW
14	OHDM20000407072	1/2 - 1 Mile ENE
D15	OHDM20000294244	1/2 - 1 Mile NW
D16	OHDM20000294257	1/2 - 1 Mile NW
17	OHD800000378317	1/2 - 1 Mile ESE
18	OHD800000123361	1/2 - 1 Mile SW
D19	OHDM20000294263	1/2 - 1 Mile NW
D20	OHDM20000294260	1/2 - 1 Mile NW
D21	OHDM20000294266	1/2 - 1 Mile NW
E22	OHDM20000294265	1/2 - 1 Mile NW
E23	OHDM20000294264	1/2 - 1 Mile NW
E24	OHDM20000294269	1/2 - 1 Mile NW
25	OHDM20000454305	1/2 - 1 Mile SSW

STATE DATABASE WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
E26	OHDM20000294268	1/2 - 1 Mile NW
27	OHD800000045753	1/2 - 1 Mile East
F28	OHDM20000440784	1/2 - 1 Mile WNW
F29	OHDM20000294267	1/2 - 1 Mile WNW
F30	OHDM20000294271	1/2 - 1 Mile WNW
G31	OHDM20000451462	1/2 - 1 Mile NNW
F32	OHDM20000429535	1/2 - 1 Mile WNW
H33	OHDM20000453778	1/2 - 1 Mile NNE
F34	OHDM20000294270	1/2 - 1 Mile WNW
35	OHD800000045758	1/2 - 1 Mile ESE
G36	OHDM20000449078	1/2 - 1 Mile North
G37	OHDM20000451005	1/2 - 1 Mile North
F38	OHDM20000294275	1/2 - 1 Mile WNW
39	OHD800000045757	1/2 - 1 Mile ESE
F40	OHDM20000294276	1/2 - 1 Mile WNW
F41	OHDM20000435255	1/2 - 1 Mile WNW
F42	OHDM20000294274	1/2 - 1 Mile WNW
G43	OHDM20000451461	1/2 - 1 Mile North
I44	OHDM20000407377	1/2 - 1 Mile ENE
I45	OHDM20000407378	1/2 - 1 Mile ENE
F46	OHDM20000294273	1/2 - 1 Mile WNW
G47	OHDM20000451065	1/2 - 1 Mile NNW
H48	OHDM20000454342	1/2 - 1 Mile NNE
F49	OHDM20000294272	1/2 - 1 Mile WNW
H50	OHDM20000453542	1/2 - 1 Mile NNE
55	OHDM20000453544	1/2 - 1 Mile NNW
K56	OHD800000045759	1/2 - 1 Mile ESE
L57	OHDM20000362945	1/2 - 1 Mile NNW
L58	OHDM20000362944	1/2 - 1 Mile NNW
L59	OHDM20000377060	1/2 - 1 Mile NNW
L60	OHDM20000362946	1/2 - 1 Mile NNW
61	OHD800000267879	1/2 - 1 Mile SSE
K62	OHD800000045760	1/2 - 1 Mile ESE

PHYSICAL SETTING SOURCE MAP - 5457852.2s



- County Boundary
- Major Roads
- Contour Lines
- Airports
- ◎ Earthquake epicenter, Richter 5 or greater
- Ⓦ Water Wells
- Ⓟ Public Water Supply Wells
- ● Cluster of Multiple Icons

- ↑ Groundwater Flow Direction
- (GI) Indeterminate Groundwater Flow at Location
- (GV) Groundwater Flow Varies at Location
- ● Oil, gas or related wells

SITE NAME: Rickenbacker AASF
ADDRESS: 8227 South Access Road
Groveport OH 43125
LAT/LONG: 39.805672 / 82.928495

CLIENT: AECOM
CONTACT: Brittany Kirchmann
INQUIRY #: 5457852.2s
DATE: October 18, 2018 1:38 pm

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID Direction Distance Elevation		Database	EDR ID Number
1 **North** **0 - 1/8 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHDM20000451086**
A2 **ENE** **1/4 - 1/2 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHD800000045833**
A3 **ENE** **1/4 - 1/2 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHD800000235077**
4 **ENE** **1/4 - 1/2 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHD800000413138**
B5 **ESE** **1/2 - 1 Mile** **Lower**	Click here for full text details	**OH WELLS**	**OHD800000045754**
C6 **ESE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHD800000342666**
B7 **ESE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHD800000045755**
C8 **ESE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHD800000045756**
9 **North** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHDM20000256044**

Map ID Direction Distance Elevation		Database	EDR ID Number
10 **SSE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHD800000239202**
D11 **NW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHDM20000294258**
D12 **NW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHDM20000294245**
D13 **NW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHDM20000294259**
14 **ENE** **1/2 - 1 Mile** **Lower**	Click here for full text details	**OH WELLS**	**OHDM20000407072**
D15 **NW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHDM20000294244**
D16 **NW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHDM20000294257**
17 **ESE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHD800000378317**
18 **SW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHD800000123361**

Map ID Direction Distance Elevation		Database	EDR ID Number
D19 **NW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHDM20000294263**
D20 **NW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHDM20000294260**
D21 **NW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHDM20000294266**
E22 **NW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHDM20000294265**
E23 **NW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHDM20000294264**
E24 **NW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHDM20000294269**
25 **SSW** **1/2 - 1 Mile** **Lower**	Click here for full text details	**OH WELLS**	**OHDM20000454305**
E26 **NW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHDM20000294268**
27 **East** **1/2 - 1 Mile** **Lower**	Click here for full text details	**OH WELLS**	**OHD800000045753**

Map ID Direction Distance Elevation		Database	EDR ID Number
F28 **WNW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHDM20000440784**
F29 **WNW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHDM20000294267**
F30 **WNW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHDM20000294271**
G31 **NNW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHDM20000451462**
F32 **WNW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHDM20000429535**
H33 **NNE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHDM20000453778**
F34 **WNW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHDM20000294270**
35 **ESE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHD800000045758**
G36 **North** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHDM20000449078**

Map ID Direction Distance Elevation		Database	EDR ID Number
G37 **North** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHDM20000451005**
F38 **WNW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHDM20000294275**
39 **ESE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHD800000045757**
F40 **WNW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHDM20000294276**
F41 **WNW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHDM20000435255**
F42 **WNW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHDM20000294274**
G43 **North** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHDM20000451461**
I44 **ENE** **1/2 - 1 Mile** **Lower**	Click here for full text details	**OH WELLS**	**OHDM20000407377**
I45 **ENE** **1/2 - 1 Mile** **Lower**	Click here for full text details	**OH WELLS**	**OHDM20000407378**

Map ID Direction Distance Elevation		Database	EDR ID Number
F46 **WNW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHDM20000294273**
G47 **NNW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHDM20000451065**
H48 **NNE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHDM20000454342**
F49 **WNW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHDM20000294272**
H50 **NNE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHDM20000453542**
J51 **NW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**AQUIFLOW**	**20246**
J52 **NW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**AQUIFLOW**	**20248**
J53 **NW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**AQUIFLOW**	**16666**
J54 **NW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**AQUIFLOW**	**20074**

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID Direction Distance Elevation		Database	EDR ID Number
55 **NNW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHDM20000453544**
K56 **ESE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHD800000045759**
L57 **NNW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHDM20000362945**
L58 **NNW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHDM20000362944**
L59 **NNW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHDM20000377060**
L60 **NNW** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHDM20000362946**
61 **SSE** **1/2 - 1 Mile** **Lower**	Click here for full text details	**OH WELLS**	**OHD800000267879**
K62 **ESE** **1/2 - 1 Mile** **Higher**	Click here for full text details	**OH WELLS**	**OHD800000045760**
1G **NW** **1/2 - 1 Mile** **Lower**	Click here for full text details	**AQUIFLOW**	**20246**

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID Direction Distance Elevation		Database	EDR ID Number
2G **NW** **1/2 - 1 Mile** **Lower**	**Click here for full text details**	**AQUIFLOW**	**20248**
3G **NW** **1/2 - 1 Mile** **Lower**	**Click here for full text details**	**AQUIFLOW**	**16666**
4G **NW** **1/2 - 1 Mile** **Lower**	**Click here for full text details**	**AQUIFLOW**	**20074**

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS
RADON

AREA RADON INFORMATION

State Database: OH Radon

Radon Test Results

Zipcode	Num Tests	Maximum	Minimum	Arith Mean	Geo Mean
43125	145	86.9	0.1	13.65	8.17

Federal EPA Radon Zone for FRANKLIN County: 1

Note: Zone 1 indoor average level > 4 pCi/L.
: Zone 2 indoor average level >= 2 pCi/L and <= 4 pCi/L.
: Zone 3 indoor average level < 2 pCi/L.

Federal Area Radon Information for Zip Code: 43125

Number of sites tested: 1

Area	Average Activity	% <4 pCi/L	% 4-20 pCi/L	% >20 pCi/L
Living Area - 1st Floor	2.700 pCi/L	100%	0%	0%
Living Area - 2nd Floor	Not Reported	Not Reported	Not Reported	Not Reported
Basement	2.700 pCi/L	100%	0%	0%

PHYSICAL SETTING SOURCE RECORDS SEARCHED

TOPOGRAPHIC INFORMATION

USGS 7.5’ Digital Elevation Model (DEM)
Source: United States Geologic Survey
EDR acquired the USGS 7.5’ Digital Elevation Model in 2002 and updated it in 2006. The 7.5 minute DEM corresponds to the USGS 1:24,000- and 1:25,000-scale topographic quadrangle maps. The DEM provides elevation data with consistent elevation units and projection.

Source: U.S. Geological Survey

HYDROLOGIC INFORMATION

Flood Zone Data: This data was obtained from the Federal Emergency Management Agency (FEMA). It depicts 100-year and 500-year flood zones as defined by FEMA. It includes the National Flood Hazard Layer (NFHL) which incorporates Flood Insurance Rate Map (FIRM) data and Q3 data from FEMA in areas not covered by NFHL.
Source: FEMA
Telephone: 877-336-2627
Date of Government Version: 2003, 2015

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002, 2005 and 2010 from the U.S. Fish and Wildlife Service.

HYDROGEOLOGIC INFORMATION

AQUIFLOW^R Information System
Source: EDR proprietary database of groundwater flow information
EDR has developed the AQUIFLOW Information System (AIS) to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted to regulatory authorities at select sites and has extracted the date of the report, hydrogeologically determined groundwater flow direction and depth to water table information.

GEOLOGIC INFORMATION

Geologic Age and Rock Stratigraphic Unit
Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - A digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

STATSGO: State Soil Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Service (NRCS)
The U.S. Department of Agriculture’s (USDA) Natural Resources Conservation Service (NRCS) leads the national Conservation Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. Soil maps for STATSGO are compiled by generalizing more detailed (SSURGO) soil survey maps.

SSURGO: Soil Survey Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Service (NRCS)
Telephone: 800-672-5559
SSURGO is the most detailed level of mapping done by the Natural Resources Conservation Service, mapping scales generally range from 1:12,000 to 1:63,360. Field mapping methods using national standards are used to construct the soil maps in the Soil Survey Geographic (SSURGO) database. SSURGO digitizing duplicates the original soil survey maps. This level of mapping is designed for use by landowners, townships and county natural resource planning and management.

PHYSICAL SETTING SOURCE RECORDS SEARCHED

LOCAL / REGIONAL WATER AGENCY RECORDS

FEDERAL WATER WELLS

PWS: Public Water Systems
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Public Water System data from the Federal Reporting Data System. A PWS is any water system which provides water to at least 25 people for at least 60 days annually. PWSs provide water from wells, rivers and other sources.

PWS ENF: Public Water Systems Violation and Enforcement Data
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Violation and Enforcement data for Public Water Systems from the Safe Drinking Water Information System (SDWIS) after August 1995. Prior to August 1995, the data came from the Federal Reporting Data System (FRDS).

USGS Water Wells: USGS National Water Inventory System (NWIS)
This database contains descriptive information on sites where the USGS collects or has collected data on surface water and/or groundwater. The groundwater data includes information on wells, springs, and other sources of groundwater.

STATE RECORDS

Public Water System Data
Source: Ohio Environmental Protection Agency
Telephone: 614-644-2752
The database includes community, transient noncommunity and noncommunity water wells; and source treatment unit locations.

Water Treatment Facilities
Source: Ohio Environmental Protection Agency
Telephone: 614-644-2752

Monitoring Water Wells Listing
Source: Department of Natural Resources
Telephone: 614-265-6740

Water Well Database
Source: Department of Natural Resources
Telephone: 614-265-6740

OTHER STATE DATABASE INFORMATION

Oil and Gas Wells Listing
Department of Natural Resources
A listing of oil and gas well locations in the state.

RADON

State Database: OH Radon
Source: Department of Health
Telephone: 614-644-2727
Radon Statistics for Zip Code Areas

Area Radon Information
Source: USGS
Telephone: 703-356-4020
The National Radon Database has been developed by the U.S. Environmental Protection Agency (USEPA) and is a compilation of the EPA/State Residential Radon Survey and the National Residential Radon Survey. The study covers the years 1986 - 1992. Where necessary data has been supplemented by information collected at private sources such as universities and research institutions.

PHYSICAL SETTING SOURCE RECORDS SEARCHED

EPA Radon Zones
Source: EPA
Telephone: 703-356-4020
Sections 307 & 309 of IRAA directed EPA to list and identify areas of U.S. with the potential for elevated indoor radon levels.

OTHER

Airport Landing Facilities: Private and public use landing facilities
Source: Federal Aviation Administration, 800-457-6656

Epicenters: World earthquake epicenters, Richter 5 or greater
Source: Department of Commerce, National Oceanic and Atmospheric Administration

Earthquake Fault Lines: The fault lines displayed on EDR's Topographic map are digitized quaternary faultlines, prepared in 1975 by the United State Geological Survey

STREET AND ADDRESS INFORMATION

Appendix B

Preliminary Assessment Documentation

Appendix B.1
Interview Records

PA Interview Questionnaire - Environmental Manager

Facility: Rickenbacker
Interviewer: [redacted]
Date/Time:

⊕ [redacted] /Env. Branch Chief Manager

Interviewee: [redacted]
Title: Env. Supervisor/Env. Specialist
Phone Number:
Email:

Can your name/role be used in the PA Report? [✓ Y] or N
Can you recommend anyone we can interview? [✓ Y] or N [redacted]

1. Roles or activities with the Facility/years working at the Facility.

[redacted] -employed since 1996
-1984
-2010 (handles all env. related activity including energy, waste, ~~+ env~~ activity +training

2. Where can I find previous facility ownership information?

Lease + permit documents
(will be sent to me by [redacted])

3. What can you tell us about the history of PFAS including aqueous film forming foam (AFFF) at the Facility? Was it used for any of the following activities, circle all that apply and indicate years of active use, if known? Identify these locations on a facility map.

Maintenance N/A
Fire Training Areas N/A
Firefighting (Active Fire) N/A
Crash N/A
Fire Suppression Systems (Hangers/Dining Facilities) - @ C26 Hangar; 1 initial release
Fire Protection at Fueling Stations N/A
Non-Technical/Recreational/ Pest Management N/A
Metals Plating Facility N/A
Waterproofing Uniforms (Laundry Facilities) N/A
Other

4. Fill out CSM Information worksheet with the Environmental Manager.

5. Are any current buildings constructed with AFFF dispensing systems or fire suppression systems? What are the AFFF/suppression system test requirements? What is the frequency of testing the AFFF/suppression system? Do you have "As Built" drawings for the buildings?

Yes, C26 Hangar (HEF only)
constructed ~2005; initial testing/release
quantity - unsure
foam down sanitary sewer

PA Interview Questionnaire - Environmental Manager

Facility:_______________
Interviewer:_______________
Date/Time:_______________

6. Are fire suppression systems currently charged with AFFF or have they been retrofitted for use of high expansion foam? If retrofitted, when was that done?

↳ HEF only since construction ~2005

7. How is AFFF procured? Do you have an inventory/procurement system that tracks use?

-unsure
-Don't use AFFF so no procurement; how historical/potential AFFF was procured also unknown

8. What type of AFFF has been/is being used (3%, 6%, Mil Spec Mil-F-24385, High Expansion)? Manufacturer (3M, Dupont, Ansul, National Foam, Angus, Chemguard, Buckeye, Fire Service Plus)?

Only Jet X HEF

9. Where is the AFFF stored? How is it stored (tanks, 55-gallon drums, 5-gallon buckets)? What size are the storage tanks? Is the AFFF stored as a mixed solution (3% or 6%) or concentrated material?

Previous AFFF believed to be stored in/around Hangar (C26); now disposed of; interviewee states ~20-25 5-gallon buckets disposed; unsure how procured/how long stored/how they got there

10. How many FTAs are/were on this facility and where are they? Locate on a map. How many FTAs are active and inactive? For inactive FTAs, when was the last time that fire training using AFFF was conducted at them?

None / no knowledge

PA Interview Questionnaire - Environmental Manager

Facility:_______________
Interviewer:_______________
Date/Time:_______________

11. When a release of AFFF occurs during a fire training exercise, now and in the past, how is the AFFF cleaned and disposed of? Were retention ponds built to store discharged AFFF? Was the AFFF trickled to the sanitary sewer or left in the pond to infiltrate?

N/A

12. Can you recall specific times when city, county, and/or state personnel came on-post for training? If so, please state which state/county agency or military entity? Do you have any records, including photographs to share with us?

No knowledge

13. Did military routinely or occasionally fire train off-post? List the units that you can recall used/trained at various areas.

No

14. Did individual units come with their own safety personnel, did they also bring their own AFFF? Was training with AFFF part of these exercises? How were emergencies handled under these circumstances?

N/A

15. Are there specific emergency response incident reports (i.e., aircraft or vehicle crash sites and fires)? If so, may we please copy these reports? Who (entity) was the responder?

Unaware of any emergency response incidents

PA Interview Questionnaire - Environmental Manager

Facility:____________
Interviewer:____________
Date/Time:____________

16. Do you have records of fuel spill logs? Was it common practice to wash away fuel spills with AFFF? Is/was AFFF used as a precaution in response to fuel releases or emergency runway landings to prevent fires?

AFFF never used for fuel spills
only absorbent pads/spill kits used

17. Was AFFF used for forest fires or fire management on-post/off-post? If so, please describe what happened and who was involved?

No

18. Are there mutual aid/use agreements between county, city, and local fire department? Please list, even if informal. If formalized, may we have a copy of the agreement?

Verbal agreements only

19. Can you provide any other locations where AFFF has been stored, released, or used (i.e. hangars, buildings, fire stations, firefighting equipment testing and maintenance areas, emergency response sites, storm water/surface water, waste treatment plants, and AFFF ponds)?

Hangar 883 - used/owned/operated by Air ~~Guard~~ Guard
Built ~1999 w/ AFFF FSS; initial release w/
8 ft. foam in 3 minutes ⊕ annual nozzle testing (unsure of locati
of testing)
converted to HEF ~2015; no known release

20. Are you aware of any other creative uses of AFFF? If so, how was AFFF used? What entities were involved?

No

⊕ one tank outside C26 - believed to be AFFF?
No knowledge on timeframe of tank
[Further investigation shows tank is 30-gallon Purple

PA Interview Questionnaire - Environmental Manager

Facility:_______________
Interviewer:_______________
Date/Time:_______________

21. Are there past studies you are aware of with environmental information on plants/animals/ groundwater/soil types, etc., such as Integrated Cultural Resources Management Plans or Integrated Natural Resources Management Plans?

yes, will send if available

22. What other records might be helpful to us (environmental compliance, investigation records, admin record) and where can we find them?

AFFF was not documented so unsure if additional records exist

23. Do you have or did you have a chrome plating shop on base? What were/are the years of operation of that chrome plating shop?

No

24. Do you know whether the shop has/had a foam blanket mist suppression system or used a fume hood for emissions control? If foam blanket mist suppression was used, where was the foam stored, mixed, applied, etc.?

N/A

25. How is off-spec AFFF disposed (used for training, turned in, or given to a local Fire Station)? If applicable, do you know the name of the vendor that removes off-spec AFFF? Do you have copies of the manifest or B/L?

N/A

PA Interview Questionnaire - Environmental Manager

Facility:_______________
Interviewer:_______________
Date/Time:_______________

26. Do you recommend anyone else we can interview? If so, do you have contact information for them?

PA Interview Questionnaire - Other

Facility: Rickenbacker
Interviewer: [redacted]
Date/Time: 12/6/18 @ 1PM

Interviewee: see below
Title: "
Phone Number: "
Email: "

Can your name/role be used in the PA Report? Y or N
Can you recommend anyone we can interview?
Y or N

Roles or activities with the Facility/Years working at the Facility:

Joint phone interview w/ client [redacted] + following OHARNG personnel:
- [redacted] (unit safety officer)
- (AASF 2 Commander)
- [redacted] (aircraft main. mechanic)
- [redacted] (operations officer)
- nd (standardization officer)
- (shop supervisor)

PFAS Use: Identify accidental/intentional release locations, time frame of release, frequency of releases, storage container size (maintenance, fire training, firefighting, buildings with suppression systems (as builts), fueling stations, crash sites, pest management, recreational, dining facilities, metals plating, or waterproofing). How are materials ordered/purchased/disposed/shared with others?

no old
storage
from
013 to
isposal
→ in 2017

- Between ~2002-2013, twelve TriMax tanks	**Known Uses**
(~2 in hangar, ~10 on ramp) throughout ramp/	Use
parking area; never used; one tank was	Procurement
not operational so emptied + used for training	Disposition
↳ unsure where emptied / what year	Storage (Mixed)
- No fueling point on site; tanker brings in	Storage (Solution)
fuel as needed; fueling occurs on parking pad	Inventory, Off-Spec
- No firetrucks; emergency response activities	Containment
supplied by 121st Air Wing division	SOP on Filling
- C26: no helicopter operations occur here	Leaking Vehicles
- Building 918 is hangar; maint. occurs here	Nozzle and Suppression System Testing
- confirmed storm drains flow from ANG property	Dining Facilities
to ARNG → offsite	Vehicle Washing
- within hangars, drains → OWS → sanitary sewer	Ramp Washing
- Bulk storage of AFFF @ B.918	Fuel Spill Washing and Fueling Stations
↳ unsure of disposal, but estimated in	Chrome Plating or Waterproofing

2017

PA Interview Questionnaire - Other

Facility:________________
Interviewer:________________
Date/Time:________________

- One emergency response incident ~2010; on airport property but unsure if AFFF used
- Provided 2 names of other personnel to contact

[redacted]

Appendix B.2
Visual Site Inspection Checklists

Visual Site Inspection Checklist

Names(s) of people performing VSI [redacted]
Recorded by
ARNG Contact
Date and Time: 7/26/2018
Method of visit (walking, driving, adjacent): walking + driving

Source/Release Information

Site Name / Area Name / Unique ID: C26 Hangar
Site / Area Acreage: several thousand square feet
Historic Site Use (Brief Description): Built in 2004/2005 as aviation support
Current Site Use (Brief Description): Hangar to hold/store aircraft; conduct minor maintenance
Physical barriers or access restrictions: Must be let in through main gate; hangar is open-access

1. Was PFAS used (or spilled) at the site/area? [✓ Y] N

1a. If yes, document how PFAS was used and usage time (e.g., fire fighting training 2001 to 2014):
Initial release of Jet-X HEF; contained within hangar; all residual went down drain

2. Has usage been documented? Y [✓ N]

2a. If yes, keep a record (place electronic files on a disk):
only ~~s~~ verbal documentation

3. What types of businesses are located near the site? **Industrial / [✓ Commercial] / Plating / Waterproofing / [✓ Residential]**

3a. Indicate what businesses are located near the site
commercial airport located adjacent to facility; residents located ~4,000 ft NW

4. Is this site located at an airport/flightline? Y [✓ N]

4a. If yes, provide a description of the airport/flightline tenants:
Adjacent to airport/flightline; property owned by Air National Guard + Rickenbacker Port Authority

Visual Survey Inspection Log

Other Significant Site Features:

1. Does the facility have a fire suppression system? [✓ Y] N

1a. If yes, indicate which type of AFFF has been used:

C26 Hangar has HEF system w/ 2.75% Jet-X foam; one Purple K fire extinguisher outside bay doors

1b. If yes, describe maintenance schedule/leaks:

yearly nozzle testing; interviewees state no foam is released during testing

1c. If yes, how often is the AFFF replaced:

Replaced every few years (as needed)

1d. If yes, does the facility have floor drains and where do they lead? Can we obtain an as built drawing?

yes! Floor drains lead to sanitary sewer → City of columbus WWTP

Transport / Pathway Information

Migration Potential:

1. Does site/area drainage flow off installation? [✓ Y] N

1a. If so, note observation and location:

surface water flows NW; small bodies of water located slightly NW w/ some surface water potentially draining here

2. Is there channelized flow within the site/area? Y [✓ N]

2a. If so, please note observation and location:

3. Are monitoring or drinking water wells located near the site? [✓ Y] N

3a. If so, please note the location:

Yes, domestic + monitoring wells nearby; locations on figures; data given from OHARNG

4. Are surface water intakes located near the site? Y [✓ N]

4a. If so, please note the location:

5. Can wind dispersion information be obtained? Y [✓ N]

5a. If so, please note and observe the location.

6. Does an adjacent non-ARNG PFAS source exist? [✓ Y] N

6a. If so, please note the source and location.

old FTA owned/operated by Air National Guard SE of facility

6b. Will off-site reconnaissance be conducted? [✓ Y] N

Visual Survey Inspection Log

Significant Topographical Features:

1. Has the infrastructure changed at the site/area? Y / [✓ N]

1a. If so, please describe change (ex. Structures no longer exist):

2. Is the site/area vegetated? Y / [✓ N]

2a. If not vegetated, briefly describe the site/area composition:

3. Does the site or area exhibit evidence of erosion? Y / [✓ N]

3a. If yes, describe the location and extent of the erosion:

4. Does the site/area exhibit any areas of ponding or standing water? Y / [✓ N]

4a. If yes, describe the location and extent of the ponding:

Receptor Information

1. Is access to the site restricted? [✓ Y] / N

1a. If so, please note to what extent:

Gated access into facility

2. Who can access the site? [✓ **Site Workers**] / [✓ **Construction Workers**] / [✓ **Trespassers**] / **Residential / Recreational Users / Ecological**

2a. Circle all that apply, note any not covered above:

3. Are residential areas located near the site? [✓ Y] / N

3a. If so, please note the location/distance:

Residential areas less than 1 mile away

4. Are any schools/day care centers located near the site? Y / [✓ N]

4a. If so, please note the location/distance/type:

5. Are any wetlands located near the site? Y / [✓ N]

5a. If so, please note the location/distance/type:

Visual Survey Inspection Log

Additional Notes

* HEF release seemed to be well-contained; no other releases have been reported

Off-site hangar release on ANG property @ hangar ④ old FTA

Photographic Log

Photo ID/Name	Date & Location	Photograph Description
Photo 1-6	C26 Hangar 7/26/18	1-2: Hangar w/ floor drains 3-5: HEF system w/ Jet-X foam 6: Purple K extinguisher

Appendix B.3

Conceptual Site Model Information

Preliminary Assessment – Conceptual Site Model Information

Site Name: Rickenbacker AASF #2

Why has this location been identified as a site?

Fire suppression system in main hangar; close proximity to surrounding airfield and runways

Are there any other activities nearby that could also impact this location?

Not current activities, no; only historical adjacent sources.

Training Events

Have any training events with AFFF occurred at this site? No

If so, how often? N/A

How much material was used? Is it documented? N/A

Identify Potential Pathways: Do we have enough information to fully understand over land surface water flow, groundwater flow, and geological formations on and around the facility? Any direct pathways to larger water bodies?

Surface Water:

Surface water flow direction? West/Northwest

Average rainfall? 40.11 inches/year

Any flooding during rainy season? No

Direct or indirect pathway to ditches? Direct pathway to drainage ditches

Direct or indirect pathway to larger bodies of water? Yes, Big Walnut Creek

Does surface water pond any place on site? Small wetland on southern end of facility

Any impoundment areas or retention ponds? No

Any NPDES location points near the site? No

How does surface water drain on and around the flight line? Surface water flows west/northwest towards Big Walnut Creek, a tributary of the Scioto River

Preliminary Assessment – Conceptual Site Model Information

Groundwater:

Groundwater flow direction? West/Northwest

Depth to groundwater? 30-200 feet bgs

Uses (agricultural, drinking water, irrigation)? Drinking water, industrial, irrigation

Any groundwater treatment systems? No

Any groundwater monitoring well locations near the site? Yes, see Figure 1-2 and 1-3

Is groundwater used for drinking water? Yes

Are there drinking water supply wells on installation? No

Do they serve off-post populations? N/A

Are there off-post drinking water wells downgradient? Yes

Waste Water Treatment Plant:

Has the installation ever had a WWTP, past or present? No. Waste transferred to off-site WWTP

If so, do we understand the process and which water is/was treated at the plant? N/A

Do we understand the fate of sludge waste? Yes. Sludge from OWS evaporator is disposed of as hazardous waste

Is surface water from potential contaminated sites treated? Unknown

Equipment Rinse Water

1. Is firefighting equipment washed? Where does the rinse water go? N/A (no fire station within the facility)

2. Are nozzles tested? How often are nozzles tested? Where are nozzles tested? Are nozzles cleaned after use? Where does the rinse water flow after cleaning nozzles?
N/A

3. Other? N/A

Preliminary Assessment – Conceptual Site Model Information

Identify Potential Receptors:

Site Worker: Surface water/sediment ingestion

Construction Worker: Surface water/sediment ingestion

Recreational User: Surface water, sediment and shallow groundwater ingestion

Residential: Surface water, sediment, and shallow groundwater ingestion

Child: Surface water, sediment, and shallow groundwater ingestion

Ecological: Fish/marine life within Big Walnut Creek and nearby tributaries

Note what is located near by the site (e.g. daycare, schools, hospitals, churches, agricultural, livestock)?

Residents downgradient to west/northwest of facility, agricultural areas to north, east, and south

Documentation

Ask for Engineering drawings (if applicable).

Has there been a reconstruction or changes to the drainage system? When did that occur?

N/A

Appendix C
Photographic Log

APPENDIX C – Photographic Log

Army National Guard, Preliminary Assessment for PFAS	Rickenbacker AASF #2	Columbus, Ohio

Photograph No. 1

Description:

Facing southwest. One of the two fan blowers connected to the high expansion foam (HEF) fire suppression system, located inside of the C26 Hangar. These fans dispersed foam throughout the hangar during testing, sometime between 2007 and , which was contained and captured in the floor drains Two of the three floor drains leading to the local sanitary sewer can be seen in this picture.

26 July 2018

APPENDIX C – Photographic Log

Army National Guard, Preliminary Assessment for PFAS	Rickenbacker AASF #2	Columbus, Ohio

Photograph No. 2

Description:

Facing northwest. One of the two fan blowers connected to the high expansion foam (HEF) fire suppression system, located inside of the C26 Hangar. These fans dispersed foam throughout the hangar during testing, sometime between 2007 and, which was contained and captured in the floor drains One of the three floor drains leading to the local sanitary sewer can be seen in this picture.

26 July 2018

Photograph No. 3

Description:

900-gallon capacity holding tank containing 2.75% Jet-X High Expansion Foam. This tank is located in a climate controlled room outside the C26 Hangar as part of the fire suppression system.

26 July 2018

APPENDIX C – Photographic Log

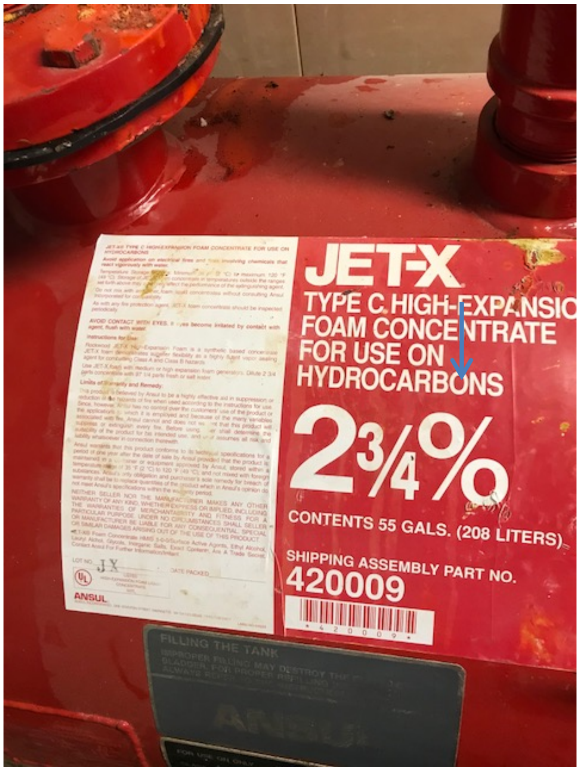
Army National Guard, Preliminary Assessment for PFAS	Rickenbacker AASF #2	Columbus, Ohio

Photograph No. 4

Description:

Close-up of the Jet-X tank located outside of the C26 Hangar which connects to the fire suppression system within the hangar.

26 July 2018

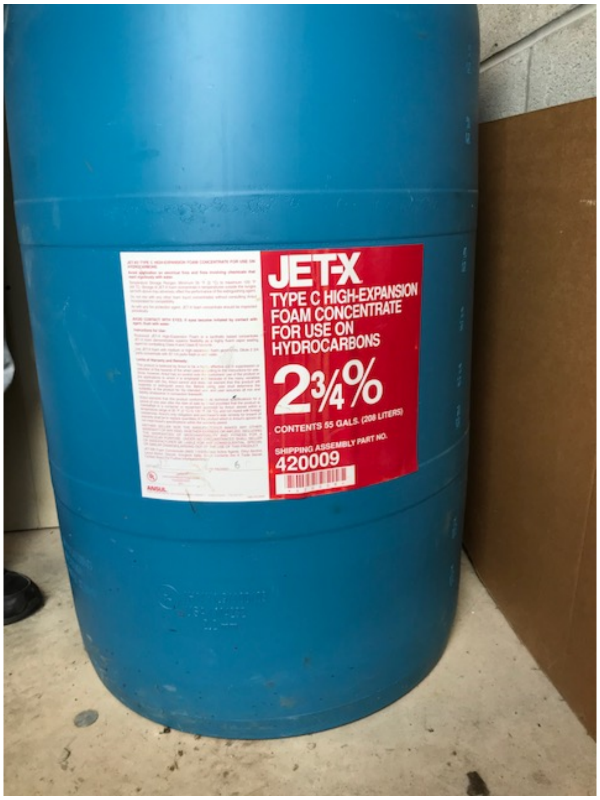


Photograph No. 5

Description:

55-gallon drum of Jet-X High Expansion Foam located within the same climate controlled room as the 900-gallon holding tank outside of the C26 hangar.

26 July 2018



APPENDIX C – Photographic Log

Army National Guard, Preliminary Assessment for PFAS	Rickenbacker AASF #2	Columbus, Ohio

Photograph No. 6

Description:

One mobile tank containing 125 pounds of Purple K dry chemical directly outside the bay door to the C26 hangar. Purple K dry chemical is non-PFAS containing.

26 July 2018

APPENDIX C – Photographic Log

Army National Guard, Preliminary Assessment for PFAS	Rickenbacker AASF #2	Columbus, Ohio

APPENDIX C – Photographic Log

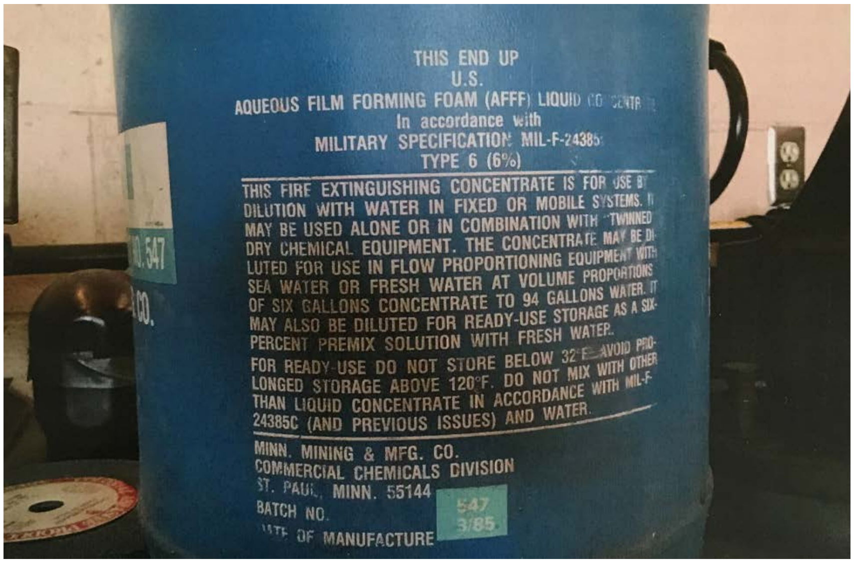
Army National Guard, Preliminary Assessment for PFAS	**Rickenbacker AASF #2**	**Columbus, Ohio**

Photograph No. 7

Description:

One of the nine 5-gallon buckets that were disposed of approximately 3 months before the site visit was conducted. These buckets were located inside the ground handling section of Building 918.

26 July 2018



THIS END UP
U.S.
AQUEOUS FILM FORMING FOAM (AFFF) LIQUID CO CENTR
In accordance with
MILITARY SPECIFICATION MIL-F-24385
TYPE 6 (6%)

THIS FIRE EXTINGUISHING CONCENTRATE IS FOR USE B DILUTION WITH WATER IN FIXED OR MOBILE SYSTEMS. I MAY BE USED ALONE OR IN COMBINATION WITH "TWINNED DRY CHEMICAL EQUIPMENT. THE CONCENTRATE MAY BE DILUTED FOR USE IN FLOW PROPORTIONING EQUIPMENT WITH SEA WATER OR FRESH WATER AT VOLUME PROPORTIONS OF SIX GALLONS CONCENTRATE TO 94 GALLONS WATER. IT MAY ALSO BE DILUTED FOR READY-USE STORAGE AS A SIX-PERCENT PREMIX SOLUTION WITH FRESH WATER.

FOR READY-USE DO NOT STORE BELOW 32°F. AVOID PROLONGED STORAGE ABOVE 120°F. DO NOT MIX WITH OTHER THAN LIQUID CONCENTRATE IN ACCORDANCE WITH MIL-F-24385C (AND PREVIOUS ISSUES) AND WATER.

MINN. MINING & MFG. CO.
COMMERCIAL CHEMICALS DIVISION
ST. PAUL, MINN. 55144
BATCH NO. 547
ATE OF MANUFACTURE 3/85