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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
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December 4, 2020

Ms. Treva Bashore
Remedial Project Manager
Environmental Restoration
AFCEC/CZOM
1981 Monahan Way, Bldg 12
Wright-Patterson AFB OH 45433

Subject: **USEPA Concurrence: Final Fifth Five-Year Review Report, Wright-Patterson Air Force Base, Ohio, November 2020**

Dear Ms. Bashore:

The U.S. Environmental Protection Agency (USEPA) has completed its review of the Final Fifth Five-Year Review Report for the Wright-Patterson Air Force Base, Ohio, November 2020 (FYR Report). The FYR Report documents the following protectiveness determinations made by the U.S. Air Force (Air Force) for the remedies that have been implemented at the Wright-Patterson Air Force Base Superfund Site:

- Source Control Operable Unit – Short-term protective
- Off-Source Operable Unit – Short-term protective
- 21 No Action Sites – Protectiveness Deferred
- Spill Sites 2, 3 and 10 – Protective
- 41 No Action Sites – Protective
- Groundwater Operable Unit – Short-term protective

By this letter, USEPA concurs with the Air Force's protectiveness determinations for the Wright-Patterson Air Force Base Superfund Site remedies as documented in the FYR Report.

Sincerely,

X

Douglas Ballotti, Director
Superfund & Emergency Management Division
Signed by: DOUGLAS BALLOTTI

Revision 0

Final
Fifth Five-Year Review Report

Wright-Patterson Air Force Base

Prepared by:

Air Force Civil Engineer Center
Environmental Restoration Program
Wright-Patterson Air Force Base, Ohio

November 2020

Final

FIFTH FIVE-YEAR REVIEW REPORT

Wright-Patterson Air Force Base

November 2020

Prepared by:
Air Force Civil Engineer Center
Environmental Restoration Program
Wright-Patterson Air Force Base, Ohio

Approved by:
For the United States Air Force

Jeffrey Domm

JEFFREY P. DOMM, GS-15, DAF
Director, Environmental Management
Air Force Civil Engineer Center

1 Dec 2020
Date

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Acronyms and Abbreviations

µg/L	microgram(s) per liter
µg/m^3	microgram(s) per cubic meter
AF	Air Force
AFCEC	Air Force Civil Engineer Center
AFFF	aqueous film forming foam
ALM	Adult Lead Model
ARAR	applicable or relevant and appropriate requirement
ATSDR	Agency for Toxic Substances Disease Registry
B89CSP	Building 89 Coal Storage Pile
bgs	below ground surface
BMP	Basewide Monitoring Program
BS	Burial Site
BTEX	benzene, toluene, ethylbenzene, and xylenes
BUSTR	Bureau of Underground Storage Tank Regulations
CalEPA	California Environmental Protection Agency
CCRA	Current Conditions Human Health Risk Assessment
CCL	Contaminant Candidate List
CCSA	Coal and Chemical Storage Area
CDA	Chemical Disposal Area
CE	Civil Engineering
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CHP	Central Heating Plant
COC	chemical of concern
COD	chemical oxygen demand
CSM	Conceptual Site Model
CZO	Environmental Directorate Operations Division
1,1-DCA	1,1-dichloroethane
1,2-DCA	1,2-dichloroethane
1,2-DCE	1,2-dichloroethylene
DD	decision document
DERR	Division of Environmental Response and Revitalization
DoD	Department of Defense
EC	Engineering Control
EE/CA	Engineering Evaluation/Cost Analysis
EFDZ	Earthfill Disposal Zone
EIAP	Environmental Impact Analysis Process
EIS	Environmental Impact Statement
EOD	Explosive Ordnance Disposal
EPC	exposure point concentration
ERTR	East Ramp Tank Removal
ESD	Explanation of Significant Differences

Acronyms and Abbreviations (continued)

ESI	Expanded Site Inspection
EW	extraction well(s)
FAA	Further Action Area
FCRA	Future Conditions Human Health Risk Assessment
FFA	Federal Facility Agreement
ft	feet
FTA	Fire Training Area
GAC	granular activated carbon
GBT	gas barrier trench
GIS	Geographical Information System
GLTS	Gravel Lake Tank Site
gpm	gallons per minute
GWOU	Groundwater Operable Unit
GWTS	groundwater treatment system
HAL	Health Advisory Limit
HDPE	high-density polyethylene
HHRA	Human Health Risk Assessment
IC	Institutional Control
IDP	Installation Development Plan
IEUBK	Integrated Exposure Uptake Biokinetic
IRIS	Integrated Risk Information System
IRP	Installation Restoration Program
IUR	Inhalation Unit Risk
JP-4	jet petroleum grade 4
LEL	lower explosive limit
LF	Landfill
LFG	landfill gas
LTCSA	Long-Term Coal Storage Area
LTM	Long-Term Monitoring
LUC	Land Use Control
LUCIP	Land Use Control Implementation Plan
MCD	Miami Conservancy District
MCL	maximum contaminant level
MDC	maximum detected concentration
mg/m^3	milligram(s) per cubic meter
mg/kg	milligram(s) per kilogram
mg/L	milligram(s) per liter
MOA	Memorandum of Agreement
MP	monitoring probe
MW	monitoring well(s)
NA	No Action
ng/L	nanograms per Liter

Acronyms and Abbreviations (continued)

NCEA/ORD	National Center for Environmental Assessment/Office of Research and Development
NCP	National Contingency Plan
ND	non-detect
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NOAA	National Oceanic and Atmospheric Administration
NOV	Notice of Violation
NTU	Nephelometric Turbidity Units
O&M	operation and maintenance
OAC	Ohio Administrative Code
ODC	Ohio Department of Commerce
OEPA	Ohio Environmental Protection Agency
ORC	Ohio Revised Code
OSOU	Off-Source Operable Unit
OSWER	Office of Solid Waste and Emergency Response
OU	Operable Unit
PA	Preliminary Assessment
PAH	polycyclic aromatic hydrocarbons
PCB	polychlorinated biphenyl
PCE	tetrachloroethylene
PFAS	per- and polyfluoroalkyl substances
PFBS	perfluorobutane sulfonate
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PLC	programmable logic controller
POL	Petroleum, Oil, and Lubricants
POTW	Publicly Owned Treatment Works
PPRTV	Provisional Peer-Reviewed Toxicity Values
ppt	parts per trillion
PRG	preliminary remediation goal(s)
PVC	polyvinyl chloride
RAB	Restoration Advisory Board
RACR	Remedial Action Completion Report
RAO	remedial action objectives
RBC	risk-based concentration(s)
RCRA	Resource Conservation and Recovery Act
RfD	Reference Dose
RG	remediation goal(s)
RI	remedial investigation
ROD	Record(s) of Decision
ROV	Resolution of Violation
RPF	Relative Potency Factor
RPO	Remedial Process Optimization

Acronyms and Abbreviations (continued)

RSL	Regional Screening Level
SCOU	Source Control Operable Unit
SDWA	Safe Drinking Water Act
SI	Site Inspection
SP	Spill Site
SF	Slope Factor
SPMP	System Performance Monitoring Plan
SSL	soil screening level(s)
SVOC	semi-volatile organic compound
TAL	target analyte list
TAS	temporary packed-tower air stripper
TBC	to be considered
TCE	trichloroethylene
TCSP	Temporary Coal Storage Pile
TF	tank farm
THI	target hazard index
TM	Technical Memorandum
TR	Target Risk
TRH	Target Risk Hazard
TSCA	Toxic Substances Control Act
TSFD	Technical Site File Document
UCMR	Unregulated Contaminant Monitoring Rule
USAF	United States Air Force
U.S.C.	U.S. Code
USEPA	United States Environmental Protection Agency
UST	underground storage tank
VC	vinyl chloride
VISL	Vapor Intrusion Screening Level
VOC	volatile organic compound
WPAFB	Wright-Patterson Air Force Base

Executive Summary

In accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S. Code (U.S.C.) §§9620(c), the United States Air Force (USAF) has conducted a five-year review of the remedies implemented at the Installation Restoration Program (IRP) sites at Wright-Patterson Air Force Base (WPAFB). A five-year review is required because hazardous substances, pollutants, or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure. The purpose of the five-year review is to determine whether the remedies implemented at the site remain protective of human health and the environment.

This five-year review covers 68 IRP sites and Further Action Area (FAA) sites (FAA-A and FAA-B) currently identified at WPAFB. WPAFB has grouped all confirmed or suspected sites requiring investigation and characterization into 11 geographically based source Operable Units (OUs), designated OU 1 through 11, and one Groundwater Operable Unit (GWOU). Remedies for 11 source OUs and the groundwater OU were included in six separate Records of Decision (RODs).

The IRP sites and their remedies are described in the following six RODs and supporting documents:

- Record of Decision, Source Control Operable Unit (SCOU), Landfills 8 and 10, 24 May 1993 (WPAFB, 1993a)
- Record of Decision Off-Source Operable Unit (OSOU) and Final Remedial Action, Landfills 8 and 10, 30 June 1994 (WPAFB, 1994)
- Record of Decision for 21 No Action Sites, 26 August 1996 (WPAFB, 1996)
- Explanation of Significant Differences (ESD): SCOU Landfills 8 and 10, 26 March 1997 (WPAFB, 1997a)
- Record of Decision for Spill Sites 2, 3, and 10 within Operable Unit 2, 30 September 1997 (WPAFB, 1997b)
- Record of Decision for 41 No Action Sites, 20 August 1998 (WPAFB, 1998)
- Record of Decision for the Groundwater Operable Unit, 29 September 1999 (WPAFB, 1999), and Final Remedial Process Optimization (RPO) for the GWOU, 30 October 2009 (Shaw, 2009a)
- Memo to Site File for Monitoring, Sampling, and Reporting Revisions to the Groundwater Operable Unit, Record of Decision, January (Shaw, 2012)
- ESD: SCOU – Landfills 8 and 10; OSOU and Final Remedial Action Landfills 8 and 10;

21 No Action Sites; Spill Sites 2, 3, and 10 (Operable Unit 2); 41 No Action Sites; and GWOU, 27 August 2012 (WPAFB, 2012a).

This is the fifth five-year review for WPAFB. The period of review is September 2019 through December 2020. Analytical and other data reviewed in this document includes data collected as part of the Long-Term Groundwater Monitoring Program through April 2019 (CB&I, 2015; CB&I, 2016; APTIM, 2017-2019; APTIM, 2019b).

Prior to the selection of a remedy, preliminary assessments (PAs), site inspections (SIs), and remedial investigations (RIs) characterizing the nature and extent of contamination were conducted. Based on the results of these investigations, remedial action objectives (RAOs) were selected for each IRP site. These objectives were then used to select the remedial actions for the site. During the five-year review, the selected action is reviewed for its continued ability to achieve its goal of protection of human health and the environment. These criteria were evaluated in accordance with the U.S. Environmental Protection Agency (USEPA) guidance titled, Comprehensive Five-Year Review Guidance (USEPA, 2001).

During the course of this five-year period, the USEPA issued drinking water Health Advisory Limits (HALs) for perfluorooctanesulfonic acid (PFOS) and perfluorooctanoic acid (PFOA), which are included in the per- and polyfluoroalkyl substances (PFAS) chemical compounds group. USEPA's Office of Water established HALs of 70 parts per trillion (ppt) or 0.070 micrograms per liter (µg/L), or 70 nanograms per liter (ng/L) for PFOS and PFOA separately or combined. The establishment of USEPA's HALs prompted additional coordination between the Ohio Environmental Protection Agency (OEPA), communities, and WPAFB to gather more information on potential PFAS risks in drinking water. As a result, there has been ongoing data collection, assessment efforts and coordination between WPAFB, OEPA, and the City of Dayton to monitor impacts to public water systems that serve both WPAFB and the City of Dayton (OEPA, 2019a).

The AF has conducted extensive investigation at WPAFB to determine the presence of PFOS and PFOA and has identified actions to address drinking water health concerns with these compounds. For soils in particular, the presence of PFOS/PFOA at 2 of the 21 NA Sites (only Fire Training Areas [FTAs] 3 and 4) potentially affects the long-term protectiveness of the remedy. To address the PFAS that has been detected in the Area A Drinking Water, WPAFB Installed a granular activated carbon (GAC) unit in June 2017 to treat drinking water from two water supply wells.

Current data from the Long-Term Monitoring (LTM) Program and from operation and maintenance (O&M) programs were reviewed. In particular, these data were reviewed for exceedances of the RAOs, trends in contaminant concentrations, and changes in contaminant distribution. The institutional controls (ICs) and engineering controls (ECs) implemented at the IRP sites at WPAFB have achieved the primary RAO of preventing exposure to contaminated groundwater and soil. Based on the data reviewed, the following conclusions were reached:

Source Control Operable Unit ROD – The SCOU ROD (WPAFB, 1993a) addresses the remediation for Landfills (LFs) 8 and 10 within OU1. The remedy was determined to be functioning as intended and is short-term protective of human health and the environment due to a methane mitigation action being implemented outside of the ROD. Continued performance of the ECs of the existing remedy and ICs will prevent exposure to contaminated media that could result in an unacceptable risk to potential receptors and is likely to remain protective in the future. Private homes along Zink and National Roads have been connected to a public water supply. Therefore, the risk of exposure to groundwater during the infrequent, short-term loss of capture from potential extraction well pumping malfunctions is minimal and continuing hydraulic containment is not impacted. Due to the low groundwater flow rate of the compacted soil at LFs 8 and 10 that was estimated to have the hydraulic characteristics of silt (estimated hydraulic conductivity of 0.03 feet (ft)/day), the potential for off-site migration of contaminants is low during the relatively short time the wells were off-line for inspection, cleaning, maintenance, repair and testing and not capturing leachate. In addition, as shown in the cross-section and potentiometric surface maps in the annual LTM reports, the water table was below the base of the landfill material, thus reducing the likelihood of generating leachate. Also, there are very few monitoring wells (MWs) that show exceedances of the Drinking Water Maximum Contaminant Levels (MCLs). Recommendations for follow-up actions include continued evaluation of the performance of the extraction well network and maintenance as needed to improve effectiveness. In addition, arsenic and vinyl chloride concentrations will continue to be monitored and evaluated for potential additional investigation.

WPAFB prepared an ESD (WPAFB, 2012a) that revised the original compliance levels for OU1 water to be consistent with the MCLs presented in the GWOU ROD. These revisions were subsequently incorporated into the LTM Program. Changes to the MCLs, toxicity values, regional screening levels (RSLs), and risk assessment guidance do not affect the protectiveness of the remedy because the pathway is managed by controlling potential exposure to groundwater and monitoring groundwater conditions. The ESD also changed the requirement for deed restrictions as long as WPAFB remained an active military installation owned by the federal government. Land-use controls language was updated that included ECs (site controls) and ICs, which will be used to monitor and maintain the integrity of the selected remedy.

During this five-year period, elevated methane concentrations in the soil vapor near the residences at 5 and 7 DuPont Way triggered a Notice of Violation (NOV) response action that was initiated by the OEPA in accordance with Ohio Administrative Code (OAC) 3745-27-12 and Ohio Revised Code (ORC) 3734.041(C) that included the following:

- Installing methane monitors/alarms in the residences along southern DuPont Way
- Installing five additional permanent landfill gas (LFG) monitoring probes (MPs)
- Installing two passive soil vents in the exploratory trenches and near the impacted areas
- Installing a sub-slab soil vapor mitigation system at 7 DuPont Way
- Conducting daily, then reduced to weekly, and now monthly LFG monitoring at the new and existing MPs in this area.

At the request of OEPA and USEPA, the methane monitoring network at 5 and 7 DuPont Way will continue to be monitored monthly until methane levels consistently remain below 20 percent of the methane lower explosive limit (LEL [5 percent]). Subsequently, a reduction in monitoring to quarterly will be requested.

Installation of the passive soil vents and trenches have effectively mitigated the elevated methane concentrations near 5 and 7 DuPont Way resulting in a Resolution of Violation (ROV). Continued operation of the soil vents, monitoring the LFG MPs, and the home methane/explosive gas monitors will provide continued protection for the residences along the southern portion of DuPont Way.

To memorialize the actions conducted at 5 and 7 DuPont Way to mitigate the methane levels, a Memorandum to Site File is recommended.

Off-Source Operable Unit ROD – The ROD for the OSOU (the area outside of LFs 8 and 10 within OU1) presented the selection of the no action remedial alternative for the OSOU, and the adoption of the previously approved SCOU remedial action as the final cleanup remedy for the OSOU (WPAFB, 1994). It was agreed that the comprehensive site remedial action, described in the SCOU ROD (WPAFB, 1993a), would address all exposure pathways where a risk was identified (WPAFB, 1994). The remedy was determined to be functioning as intended. The remedy at the OSOU is short-term protective of human health and the environment. The ICs and ECs implemented under the SCOU ROD have prevented exposure to contaminated groundwater, and the SCOU remedial action has reduced the potential for migration of contaminants to the OSOU. In addition, ESD for the six WPAFB RODs (WPAFB, 2012a) clarifies the implementation of ICs at WPAFB. The ESD clarifies the specific controls to be implemented under the RODs and provides consistency among the six RODs issued to date. The ESD also clarifies the process and conditions necessary to effectuate a change to the land use.

During the previous review period a multimedia subsurface investigation (soil, soil vapor, and groundwater) was conducted at the houses along DuPont Way and Welcome Way in The Woods subdivision to determine the extent of volatile organic compounds (VOCs and methane) contamination in this area. Chloroform was the only VOC observed above the residential RSL (in one of the soil gas sub-slab samples). As a result of the investigation, a sub-slab soil vapor mitigation system was installed at a residence at 5 DuPont Way. The system's performance is monitored with annual sub-slab soil gas monitoring of the residence and quarterly manometer inspections. During this review period VOC concentrations were below USEPA RSLs for the five annual sampling events with the exception of concentrations of chloroform (6.5 µg/m^3 in January 2018 and 5.5 µg/m^3 in October 2019) that exceeded an RSL of 4.1 µg/m^3 based on a risk level of 1 x 10^{-6}. As these concentrations only slightly exceeded 1 x 10^{-6}, risks associated with chloroform are at the lower end of USEPA's acceptable risk range of 1 x 10^{-6} to 1 x 10^{-4}. In addition, these concentrations are below the Ohio Department of Health action level of 11 µg/m^3. There are no RAOs that specifically address vapor intrusion in the ROD; however, follow-up samples indicate that the mitigation system is protective and is operating as designed.

As discussed in the SCOU ROD subsection, as part of the SCOU remedial action, LFG monitoring is conducted semiannually at the LFs 8 and 10 LFG monitoring network. However, elevated methane concentrations in the soil vapor near the residences at 5 and 7 DuPont Way triggered an NOV, which required the response actions presented in the SCOU ROD subsection. As an NOV response action, wall-mounted methane monitors were installed in the residences along the southeastern portion of the DuPont Way from McClellan Drive to monitor for any potential methane intrusion. In addition, a subset of the LF8 LFG monitoring network in the vicinity of 5 and 7 DuPont Way are monitored monthly. As noted above for the SCOU ROD, a Memorandum to Site File is recommended to memorialize the mitigation efforts.

The ESD (WPAFB, 2012a) for the SCOU ROD also applies to the OSOU ROD. Thus, changes to the MCLs, toxicity values, RSLs, and risk assessment guidance do not affect the protectiveness of the remedy because the remedy manages the exposure pathway. In addition, deed restrictions will be placed on the property if it is ever transferred out of federal ownership.

21 No Action (NA) Sites ROD – The 21 No Action Sites ROD documents the selected remedy for soils at the subject 21 IRP sites to be "no action." However, ICs and ECs were already in place at the 21 IRP sites when the ROD was written in 1996. Therefore, the selected remedy is considered a "limited action" according to USEPA IC guidance document (USEPA, 2010a) rather than a "no action" remedy. However, the ESD for the six WPAFB RODs (WPAFB, 2012a) clarifies the implementation of ICs at WPAFB. The ESD clarifies the specific controls to be implemented under the RODs and provides consistency among the six RODs issued to date. The ESD also clarifies the process and conditions necessary to effectuate a change to the land use.

A remedy protectiveness determination for the 21 NA Sites ROD could not be made during the previous Five-Year Review (WPAFB, 2016a) due to concerns for the potential PFOS/PFOA contamination from the use of aqueous film forming foam (AFFF) at some of the sites. It was recommended that an SI be conducted to further evaluate the areas most likely to be impacted by PFOS/PFOA. Of the 21 NA Sites, only FTAs 3 and 4 were investigated under the SI of AFFF Areas at WPAFB (Aerostar, 2018) and were identified as having levels of PFOS/PFOA components exceeding the calculated screening levels for soils. FTAs 2 and 5 were carried over for further investigation in the Expanded SI of AFFF Areas at WPAFB (Aerostar, 2020). None of the other 21 NA sites or 41 NA sites were investigated under the AFFF SI or Expanded SI. The remedies for the remaining 19 of the 21 soils sites (non-FTA sites), which are not suspected of having PFOS/PFOA, remains protective.

Changes to the MCLs, toxicity values, RSLs, and risk assessment guidance do not currently affect the protectiveness of the remedy because the remedy manages the exposure pathway. Additionally, the USEPA RSLs for soils and HALs for groundwater (drinking water) currently only exist for perfluorobutanesulfonic acid (PFBS) and PFOS/PFOA, respectively. There were no issues noted.

However, because an RI is planned to further evaluate the extent of PFAS contamination in soils at 2 (FTAs 3 and 4 located in OU3) of the 21 NA Sites, this OU is determined to be protectiveness deferred.

Spill Sites (SP) 2, 3, and 10 (OU2) ROD – A Final Remedial Action Completion Report: Record of Decision for Spill Sites 2, 3, and 10 (Within Operable Unit 2) was completed in July 2018 that documented WPAFB completed all response actions at SPs 2, 3, and 10 in accordance with Close Out Procedures for National Priorities List (NPL) Sites. During performance of the Remedial Action Completion Report (RACR), WPAFB reviewed the remedy and determined the remediation criteria established in the ROD had been met and that the cleanup levels had been achieved as specified in the National Oil and Hazardous Substances Pollution Contingency Plan.

The remedy for SPs 2, 3, and 10 continues to be protective of human health and the environment.

The RACR was signed by OEPA on September 11, 2018, by the USEPA Remedial Program Manager on September 17, 2018, and the USEPA Region V Branch Chief on August 19, 2020, which makes the RACR a final USEPA approved document. The site is now going through the NPL deletion process.

41 No Action Sites ROD – The 41 No Action Sites ROD documents the selected remedy for soils at the subject 41 IRP sites to be "no action." However, ICs and ECs were already in place at the 41 IRP sites when the ROD was written in 1998. Therefore, the selected remedy is considered a "limited action" according to USEPA IC guidance document (USEPA, 2010a) rather than a "no action" remedy. However, the ESD for the six WPAFB RODs (WPAFB, 2012a) clarifies the implementation of ICs at WPAFB. The ESD clarifies the specific controls to be implemented under the RODs and provides consistency among the six RODs issued to date. The ESD also clarifies the process and conditions necessary to effectuate a change to the land use.

The remedy was determined to be functioning as intended. The remedy is protective of human health and the environment. ICs are in place to prevent exposure to contaminated media that could result in an unacceptable risk. There were some changes to RSLs, toxicity values, and risk assessment guidance but they do not affect the protectiveness because the remedy manages the pathway to exposure. The OU4 landfill gas probe LG-10 (at LF4) had elevated methane concentrations above the LEL (5 percent) and will continue to be monitored quarterly. No recommendations were made for follow-up actions.

GWOU ROD – Investigations conducted at the source OUs indicated the presence of several groundwater contaminants in various locations throughout the Base. These contaminants occur both as definable plumes and as isolated occurrences. Groundwater contaminants at WPAFB may be transported from one area to others, co-mingle, and may also move to remote portions of the Base. Therefore groundwater, surface water, and sediment contaminants from each of the 11 OUs, and groundwater contaminants that were not attributable to a known source on WPAFB, were combined to form the GWOU for removal activities under the LTM. The purpose of the LTM was to evaluate contaminant movements, assess the risks posed to human health and the environment, and design a remedy (primarily LTM). Sites that are not within an OU were also added to the LTM Program.

<u>Further Action Area Site A (FAA-A)</u>

To further delineate the extent of contamination in FAA-A and to better understand the transport of contaminants, groundwater investigations were conducted in 2013 and 2016 three monitoring wells were installed on Miami Conservancy District (MCD) property. These new wells (OU5/MCD-MW02, OU5/MCD-MW04, and OU5/MCD-MW05) have been added to the LTM Program for continued monitoring of the trichloroethylene (TCE) concentrations in the MCD area. However, the TCE concentration in well CW10-055 (11.8 micrograms/liter [µg/L]) in April 2019 at the downgradient boundary of FAA-A exceeds the MCL (5 µg/L). Upgradient of CW10-055, the TCE concentration in well OU5/MCD-MW02 (12.8 µg/L) also exceeds the MCL. A Memo to Site File to the GWOU ROD (CB&I, 2017b) has been prepared to document the Memorandum of Agreement (MOA) between the City of Dayton (Dayton) and the USAF (Dayton/USAF, 1994). The MOA includes information concerning the purchase and operation and maintenance of three air stripper systems located downgradient of FAA-A. Installation of the air stripper systems preceded the GWOU ROD; therefore, a Memo to Site File is necessary to demonstrate the agreement between Dayton and the USAF to be protective of the Dayton groundwater wellfield. This agreement was entered into under the authority of 10 U.S.C., Section 2701(d) for the purpose of alleviating off-site contamination possibly resulting from the release of hazardous substances at WPAFB. 10 U.S.C. 2701-2711 is the Defense Environmental Restoration Statute and follows the criteria of Section 120 (relating to federal facilities) of CERCLA (42 U.S.C. 9620). The Memo to Site File is currently in regulatory review.

Pursuant to discussions with Dayton representatives, OEPA, and USEPA, WPAFB installed monitoring wells OU5/MCD-MW04 and OU5/MCD-MW05 downgradient of CW10-055 for early detection of potential migration of the FAA-A TCE plume to the wellfield. To address a potential TCE migration pathway at the LF5-MCD boundary, it is recommended that additional investigations be conducted in the FAA-A area. To evaluate the fate and transport mechanisms of the FAA-A VOC plume, a conceptual site model (CSM) has been developed (Zapata, 2019). The CSM incorporates the findings of the FAA-A characterization field work and has developed a predictive groundwater flow pattern through FAA-A. Results from any additional FAA-A characterization investigations and the CSM will then be incorporated into the next Five-Year Review.

Quarterly groundwater PFAS sampling was conducted under the LTM Program in FAA-A (APTIM, 2019a) from June 2016 to November 2017. Over this period, a total of 16 FAA-A monitoring wells were sampled. Results from the LTM Program quarterly sampling indicate that only well CW08-085 had a combined PFOS/PFOA concentration of 75.2 ng/L that exceeded the

HAL (70 ng/L) during the initial quarter (February 2017) of sampling. Combined PFOS/PFOA concentrations from the following three quarters were below the HAL.

Based on the potential for PFAS contamination to migrate over the southwestern WPAFB boundary toward the City of Dayton wellfield, additional quarterly groundwater PFAS sampling was conducted under the U.S. Army Corps of Engineers (USACE) PFAS investigation contract. The USACE quarterly PFAS sampling was conducted for six quarters from March 2018 through June 2019 at eight FAA-A monitoring wells. Results from the USACE sampling indicated that no individual or combined concentrations of PFOS/PFOA exceeded the HAL, including well CW08-085 (Maximum PFOS/PFOA concentration: 30 ng/L). FAA-A was not investigated under the SI of AFFF Areas (Aerostar, 2018) or the Expanded SI of AFFF Areas (Aerostar, 2020).

Former Building 79/95

To further evaluate the continuing elevated concentrations of TCE in groundwater at the former Building 79/95 Complex, an RI is planned for fall 2020. Semi-annual sampling of monitoring well B79C/D-MW01 and downgradient wells B79C/D-MW06, and B79C/D-MW07 and annual monitoring of upgradient wells B79C/D-MW02, B79C/D-MW03, and B79C/D-MW04 will continue under the LTM Program and will be reported in the Annual LTM Reports.

Other Investigations

A PFAS RI is planned to investigate soils and groundwater at identified and susceptible locations. In addition, an RI is planned for Former Building 59 to further delineate VOC contamination above MCLs present in the groundwater at the former building location.

GWOU Summary

As PFOS/PFOA are emerging contaminants, a drinking water standard has not yet been proposed or promulgated. There are no Integrated Risk Information System (IRIS)-verified toxicity values or Provisional Peer-Reviewed Toxicity Values (PPRTVs) for derivation of screening levels or risk assessment. Therefore, a statement of protectiveness is deferred until sufficient information is obtained. The remedy for the GWOU is deemed to be short-term protective because ICs and ECs are in place to manage exposure pathways that could result in unacceptable risks. WPAFB has evaluated the TCE concentrations in FAA-A wells and found that, statistically, the TCE trends in wells MW132S, OU5/MCD-MW02, OU5/MCD-MW04, and OU5/MCD-MW05 are decreasing while the TCE trend in CW10-055 is stable within this five-year review period. In addition, well MW125S located downgradient of the TCE plume continues to be non-detect for TCE. TCE concentration fluctuations in this area appear to be a result of matrix diffusion as the aquifer system attempts to achieve chemical equilibrium. The groundwater treatment system (GWTS) for FAA-

A continued to operate and was determined to be functioning as intended by effectively controlling further off-site migration. However, given its age (placed on-line in 1992), the treatment system was upgraded in 2015 with a stacked tray air-stripper (Versar, 2015).

In order for the remedy to be protective in the long-term, additional actions may be necessary to address PFAS or other contaminants (such as TCE and tetrachloroethylene [PCE]) and ensure protectiveness. Furthermore, PFOS/PFOA are emerging contaminants and a drinking water standard has not yet been proposed or promulgated. USEPA's 2016 HAL is currently in effect as a measure of protectiveness; however, the evaluation of toxicity information on PFOS/PFOA is on-going.

Although there were changes to the MCLs, toxicity values, and RSLs for some chemicals, these changes do not affect the short-term protectiveness of the remedy because the new values are less stringent. Similarly, changes to the risk assessment guidance do not affect short-term protectiveness because the remedy manages the exposure pathway.

ROD Summaries

The following table provides a cross-reference of the RODs, selected remedies, OUs, and IRP sites. Five-Year Review summary tables (**Tables E-1** through **E-8**) provide a summary of each of the RODs included in this five-year review and issues/recommendations raised during the review process.

Summaries of the Selected Remedies by ROD, OUs, and IRP Sites

ROD	SCOU and OSOU	Spill Sites 2, 3, and 10	21 No Action Sites	41 No Action Sites	GWOU (Areas A & B)
Remedy	LUCs with ICs and ECs, RA-O phase, cap system, leachate and LFG collection, supplied public water; groundwater LTM	MNA of soil and groundwater hydrocarbons, O&M of removal actions, LUCs with ICs and ECs	No further action for soils except for LUCs with ICs and ECs; groundwater monitored under the GWOU ROD	No further action for soils except for LUCs with ICs and ECs; groundwater is monitored under the GWOU ROD	Long-term Groundwater Monitoring (LTM) except as indicated below
OU1	LFs 8 & 10				
OU2		SPs 2, 3, and 10	BS1, Long Term CS, Temporary CS, CS Bldg. 89, and CCSA		
OU3			EFDZs 11 and 12; SP 1; FTAs 2, 3, 4, and 5; and LF 14	EOD Range; and LFs 11 and 12	
OU4				LFs 3, 4, 6, and 7; and CHP2	
OU5			FTA1, BS4, and Gravel Lake Tank Site	LF 5	FAA-A: Continued O&M of the GWTS with LTM, RA-O phase
OU6			EFDZ 1	LFs 1 and 2	
OU7				LF 9	
OU8				CHP1, SPs 5, 6, 7, 9, and 11; and Storage Tank at Bldg. 71A	FAA-B: In situ chemical oxidation with LTM
OU9				BSs 5 and 6; EFDZs 2, 3, 4, 5, 6, 7, 8, 9, and 10; BS3; CHP5; RADB; and NUC	
OU10			LF 13, CHP3, Tank Farm 49A, and Storage Tank at Bldg. 30119	CHP4, SPs 4 and 8, and UST at East Ramp	
OU11				BS2, Storage Tank at Bldg. 4020, and Chemical Disposal Area	
GWOU					Areas A & B: LTM

Notes:

BS = Burial Site	FAA-A = Further Action Area A	LF = Landfill	OSOU = Off-Source Operable Unit
CCSA = Coal and Chemical Storage Area	FAA-B = Further Action Area B	LFG = Landfill gas	OU = Operable unit
CHP = Central Heating Plant	FTA = Fire Training Area	LTM = Long-term groundwater monitoring	RA-O = Remedial Action-Operation
CS = Coal Storage	GWOU = Groundwater Operable Unit	LUC = Land use control	RADB = Radioactive Waste Burial Site
ECs = Engineering controls	GWTS = Groundwater treatment system	MNA = Monitored natural attenuation	ROD = Record of Decision
EFDZ = Earthfill Disposal Zone	ICs = Institutional controls	NUC = Deactivated Nuclear Reactor	SCOU = Source Control Operable Unit
EOD = Explosive Ordnance Disposal	IRP = Installation Restoration Program	O&M = Operation and maintenance	SPs = Spill Sites

Table E-1
Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: **Wright-Patterson Air Force Base**		
EPA ID: OH 7571724312		
Region: 5	**State:** OH	**City/County:** WPAFB/Greene
SITE STATUS		
NPL Status: Final		
Multiple OUs? Yes	**Has the site achieved construction completion?** Yes	
REVIEW STATUS		
Lead agency: Other Federal Agency **If "Other Federal Agency" was selected above, enter Agency name:** Wright-Patterson Air Force Base		
Author name (Federal or State Project Manager): Treva Bashore		
Author affiliation: Air Force Civil Engineer Center (AFCEC)/CZO		
Review period: September 2019 – December 2020		
Date of site inspection: September and October 2019		
Type of review: Statutory		
Review number: 5		
Triggering action date: December 9, 2015		
Due date *(five years after triggering action date)*: December 9, 2020		

Table E-2
Five-Year Review Summary Form
Source Control Operable Unit (SCOU) ROD

Issues/Recommendations

OU(s) without Issues/Recommendations Identified in the Five-Year Review:
NA

Issues and Recommendations Identified in the Five-Year Review:

OU(s): SCOU (part of OU1)	**Issue Category:** Monitoring			
	Issue: Arsenic levels detected in the groundwater at Landfills (LFs) 8 and 10, and the vinyl chloride (VC) concentrations at LF8 only, are above their respective maximum contaminant levels (MCLs).			
	Recommendation: Arsenic concentrations were evaluated and determined to be naturally-occurring. Chemicals of concern will continue to be monitored in groundwater, in particular in LF8 monitoring wells (MWs) that have had VC MCL exceedances. If VC concentrations show an increasing trend in these wells, evaluate the need for additional investigation.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	Air Force	EPA/State	09/30/2051

OU(s): SCOU (part of OU1)	**Issue Category:** Monitoring and Remedy Performance			
	Issue: Historic elevated methane levels at the northeast LF8/DuPont Way boundary. Area has been investigated and remediated for elevated methane levels during field events conducted from April to September 2019.			
	Recommendation: 1) Continue semiannual monitoring of entire landfill gas (LFG) monitoring network and also continue monthly monitoring of the monitoring probes (MPs) at 5 and 7 DuPont Way installed as part of the investigation/remedial action. 2) Prepare a Memorandum to Site File to memorialize the remedial effort and installation of the MPs.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	Air Force	EPA/State	1) 09/30/2051 2) 09/30/2022

Table E-2 (continued)
Five-Year Review Summary Form
Source Control Operable Unit (SCOU) ROD

OU(s): SCOU (part of OU1)	**Issue Category:** Operations/Maintenance and Monitoring			
	Issue: Extraction well pump malfunctions caused short-term loss of capture; however, it is believed that these events did not affect continuing hydraulic containment provided by the extraction wells.			
	Recommendation: 1) Maintain the aggressive cleaning and maintenance schedule for the extraction wells (EWs). 2) Continue monitoring to evaluate whether hydraulic capture is being maintained. Continue water level monitoring monthly in LFs 8 and 10 EW network to provide quicker response to issues that affect the efficient operation of the extraction wells.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	No	Air Force	EPA/State	1) 03/31/2025 2) 09/30/2051

OU(s): SCOU (part of OU1)	**Issue Category:** Monitoring			
	Issue: Soil vapor concentrations of chloroform in sub-slab samples collected from the two monitoring points at 5 DuPont Way exceeded the calculated Regional Screening Level but were below the Ohio Department of Health action level during the five annual sampling events conducted during the review period.			
	Recommendation: Continue quarterly mitigation system operation checks and annual sub-slab soil vapor sampling at 5 DuPont Way to ensure soil vapor mitigation system is performing as designed.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	Air Force	EPA/State	09/30/2051

OU(s): SCOU (part of OU1)	**Issue Category:** Operations and Maintenance			
	Issue: Differential settlement is occurring on LF10 North. Due to the impermeable nature of the geotextile cap material, there is now a potential for ponding in settlement areas during rain events.			
	Recommendation: For fiscal year 2021, WPAFB has programmed an engineering evaluation of the caps on LFs 10 North and South to assess subsidence and potential ponding issues.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	Air Force	EPA/State	03/31/2024

Table E-2 (continued)
Five-Year Review Summary Form
Source Control Operable Unit (SCOU) ROD

Protectiveness Statement(s)	
Operable Unit: SCOU (part of OU1)	*Protectiveness Determination:* Short term Protective
Protectiveness Statement: The remedy at the SCOU is short-term protective of human health and the environment. Continued performance of the existing remedy, engineering controls (ECs), and institutional controls (ICs) will prevent exposure to contaminated media that could result in an unacceptable risk.	

Table E-3
Five-Year Review Summary Form
Off-Source Operable Unit (OSOU) ROD

OU(s): OSOU (part of OU1)	**Issue Category:** Monitoring and Remedy Performance			
	Issue: Historic elevated methane levels at the northeast LF8/DuPont Way boundary. Area has been investigated and remediated for elevated methane levels during field events conducted from April to September 2019.			
	Recommendation: 1) Continue semiannual monitoring of entire LFG monitoring network and also continue monthly monitoring of the MPs at 5 and 7 DuPont Way installed as part of the investigation/remedial action. 2) Prepare a Memorandum to Site File to memorialize the remedial effort and installation of the MPs.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	Air Force	EPA/State	1) 09/30/2051 2) 09/30/2022

OU(s): OSOU (part of OU1)	**Issue Category:** Monitoring			
	Issue: Soil vapor concentrations of chloroform in sub-slab samples collected from the two monitoring points at 5 DuPont Way exceeded the calculated Regional Screening Level but were below the Ohio Department of Health action level during the five annual sampling events conducted during the review period.			
	Recommendation: Continue quarterly mitigation system operation checks and annual sub-slab soil vapor sampling at 5 DuPont Way to ensure soil vapor mitigation system is performing as designed.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	Air Force	EPA/State	09/30/2051

Protectiveness Statement(s)	
Operable Unit: OSOU(part of OU1)	*Protectiveness Determination:* Short-term Protective
Protectiveness Statement: The remedy at the OSOU is short-term protective of human health and the environment. Continued performance of the existing remedy, ECs, and ICs will prevent exposure to contaminated groundwater and the remedial action implemented at the SCOU has reduced the potential for migration of contaminants to the OSOU.	

Table E-4
Five-Year Review Summary Form
21 No Action (NA) Sites ROD

Issues and Recommendations Identified in the Five-Year Review:				
OU(s): Multiple OUs: OU2, OU3, OU5, OU6, OU10	**Issue Category:** Emerging Contaminants			
	Issue: Firefighting agents containing PFAS – including perfluorooctanesulfonic acid (PFOS) and perfluorooctanoic acid (PFOA) may have been used at the current and former WPAFB Fire Training Areas (FTAs) or during actual firefighting emergencies. PFOS/PFOA has been detected in soil above calculated USEPA Regional Screening Levels (RSLs) at the current and former WPAFB Fire Training Areas (FTAs) or in areas where actual firefighting emergencies or other training has occurred and AFFF has been released. A Site Inspection (SI) and an Expanded Site Inspection (ESI) for PFOS/PFOA has been conducted, and the ESI report is being finalized. PFOS/PFOA have been detected in the soil at concentrations exceeding calculated screening levels only at FTA3 (FT037) and FTA4 (FT038).			
	Recommendation: Conduct a Remedial Investigation (RI) at locations identified in the SI (Aerostar, 2018) and ESI (Aerostar, 2020) that have elevated levels of the AFFF components, PFOS/PFOA.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
Yes	Yes	Air Force	EPA/State	12/31/2024

Table E-4 (continued)
Five-Year Review Summary Form
21 No Action (NA) Sites ROD

Protectiveness Statement(s)		
Operable Unit: Multiple OUs: OU2, OU3, OU5, OU6, OU10	*Protectiveness Determination:* Protectiveness Deferred	*Addendum Due Date (if applicable): 9/30/25*
Protectiveness Statement: Protective at 19 of the 21 sites. However, a statement of protectiveness is deferred at two FTA (FTA3 and FTA4 located in OU3) sites until sufficient information is obtained. This further information will be obtained by conducting an RI to evaluate the PFOS/PFOA contamination at selected sites. There are no proposed or promulgated cleanup levels for PFOS/PFOA in soil and no screening levels published in USEPA's Regional Screening Level (RSL) table. Although there are no Integrated Risk Information System (IRIS)-verified toxicity values or Provisional Peer-Reviewed Toxicity Values (PPRTVs), candidate toxicity values have been derived for PFOS/PFOA in support of USEPA's HAL. These values have been used to calculate RSLs using USEPA's RSL calculator. The calculated RSLs have been applied to SI data at the FTAs for screening purposes. As some concentrations of PFOS/PFOA at the FTAs have exceeded the calculated RSLs, further evaluation will be performed as part of on-going investigations. The RI is scheduled for FY21. There are no recommendations or follow-up actions pertaining to the chemicals of concern (COCs) identified in the 21 NA Sites ROD necessary at this time. (Note that the 21 NA Sites ROD addresses remedial actions for soils only; therefore, any groundwater investigations will be conducted as part of the Groundwater Operable Unit [GWOU].) In addition, the 21 NA Sites ROD documents that the selected remedy for soils contamination only at the subject 21 IRP sites to be "no action." However, ICs and ECs were already in place at the 21 IRP sites when the ROD was written in 1996. Therefore, the selected remedy is considered a "limited action" according to USEPA IC guidance document rather than a "no action" remedy.		

Table E-5
Five-Year Review Summary Form
Spill Sites (SPs) 2, 3, and 10 ROD

Issues and Recommendations Identified in the Five-Year Review:				
OU(s): OU2 (Spill Sites 2, 3, and 10)	**Issue Category:** No Issue			
	Issue: NA			
	Recommendation: A Final Remedial Action Completion Report: Record of Decision for Spill Sites 2, 3, and 10 (Within Operable Unit 2) was completed in July 2018 that documented WPAFB completed all response actions at SPs 2, 3, and 10 in accordance with Close Out Procedures for NPL Sites. During performance of the Remedial Action Completion Report (RACR), WPAFB reviewed the remedy and determined the remediation criteria established in the ROD had been met and that the cleanup levels had been achieved as specified in the National Oil and Hazardous Substances Pollution Contingency Plan. The RACR was signed by OEPA on September 11, 2018, by the USEPA Remedial Program Manager on September 17, 2018, and the USEPA Region V Branch Chief on August 19, 2020, which makes the RACR a final USEPA approved document. The site is now going through the National Priority List deletion process by the USEPA.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	No	Air Force	EPA/State	09/30/2021

Protectiveness Statement(s)	
Operable Unit: OU2 (Spill Sites 2, 3, and 10)	*Protectiveness Determination:* Protective
Protectiveness Statement: The remedy for SPs 2, 3, and 10 continues to be protective of human health and the environment.	

Table E-6
Five-Year Review Summary Form 41
41 No Action (NA) Sites ROD

<table>
<tr><th colspan="5">Issues and Recommendations Identified in the Five-Year Review:</th></tr>
<tr><td rowspan="3">OU(s): Multiple OUs: OU3, OU4, OU5, OU6, OU7, OU8, OU9, OU10, OU11</td><td colspan="4">Issue Category: Monitoring</td></tr>
<tr><td colspan="4">Issue: OU4 LFG probe LG-10 (at LF4) had elevated methane concentrations above the LEL (5 percent). The nearest occupied building, Building 10867, is approximately 500 feet to the southeast of LFG probe LG-10 and is not impacted by methane.</td></tr>
<tr><td colspan="4">Recommendation: Continue quarterly LFG monitoring at LG-10 (at LF4) and reduce the site inspection frequency for LFs 1-7, 9, and 11 from quarterly to semiannually (reduction approved by USEPA in August 2020).</td></tr>
<tr><td>Affect Current Protectiveness</td><td>Affect Future Protectiveness</td><td>Implementing Party</td><td>Oversight Party</td><td>Milestone Date</td></tr>
<tr><td>No</td><td>Yes</td><td>Air Force</td><td>EPA/State</td><td>09/30/2051</td></tr>
</table>

<table>
<tr><th colspan="2">Protectiveness Statement(s)</th></tr>
<tr><td>Operable Unit:
Multiple OUs:
OU3, OU4, OU5
OU6, OU7, OU8
OU9, OU10, OU11</td><td>Protectiveness Determination:
Protective</td></tr>
<tr><td colspan="2">Protectiveness Statement:
The remedy at the 41 NA Sites is protective of human health and the environment because ICs are in place to control exposure to contaminated media that could result in unacceptable risks.

Additionally, the 41 NA Sites ROD documents the selected remedy for soils contamination at the subject 41 IRP sites to be “no action.” However, ICs and ECs were already in place at the 41 IRP sites when the ROD was written in 1998. Therefore, the selected remedy is considered a “limited action” according to USEPA IC guidance document rather than a “no action” remedy.</td></tr>
</table>

Table E-7
Five-Year Review Summary Form
Groundwater Operable Unit (GWOU) ROD

Issues and Recommendations Identified in the Five-Year Review:				
OU(s): GWOU	**Issue Category:** Monitoring			
	Issue: Trichloroethylene (TCE) concentrations in Further Action Area A (FAA-A) continue to exceed the MCL. However, due to the decrease in production from the Huffman Dam Wellfield beginning in the summer 2016, the overall TCE concentrations in the FAA-A monitoring wells have decreased over the review period. Groundwater data from the spring 2019 LTM Program sampling event (Chapter 8) indicate that the downgradient boundary of the FAA-A TCE plume that exceeds the MCL is no longer downgradient of the Mad River. TCE concentrations in the downgradient portion of the FAA-A TCE plume at the Mad River have been stable above the MCL at well CW10-055, but have shown a decreasing trend since the fall 2017 in wells OU5/MCD-MW04 and OU5/MCD-MW05; TCE concentrations in well MW125S located downgradient of the FAA-A TCE plume continues to be non-detect and below the MCL for this five-year period.			
	Recommendation: Conduct additional investigations in the upgradient portion of FAA-A at the LF5/MCD boundary to evaluate potential migration pathways and the fate and transport mechanisms of the FAA-A VOC plume. Incorporate data from the WPAFB conceptual site model (CSM) in the planning for the investigation.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	Air Force	EPA/State	09/30/2022

OU(s): GWOU	**Issue Category:** Remedy Performance			
	Issue: A Memo to Site File to the GWOU ROD was prepared to document the MOA between the City of Dayton and the USAF. The MOA includes information concerning the purchase and operation and maintenance of three air stripper systems located downgradient of FAA-A. Installation of the air stripper systems preceded the GWOU ROD; therefore, a Memo to Site File was necessary to demonstrate the agreement between the City of Dayton and the USAF to be protective of the Dayton groundwater wellfield. The Memo to Site File is currently in regulatory review.			
	Recommendation: Finalize the Memo to Site File for the MOA between the City of Dayton and the USAF.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	No	Air Force	EPA/State	09/30/2021

Table E-7 (continued)
Five-Year Review Summary Form
Groundwater Operable Unit (GWOU) ROD

OU(s): GWOU	**Issue Category:** Monitoring			
	Issue: Elevated TCE concentrations in groundwater at the Former Building 79/95 Complex.			
	Recommendation: 1) Further evaluate the elevated concentrations of TCE in groundwater at the former Building 79/95 Complex via an additional soil investigation being planned for fall 2020. 2) Continue semi-annual sampling of monitoring well B79C/D-MW01 and downgradient wells B79C/D-MW06 and B79C/D-MW07 and annual monitoring of upgradient wells B79C/D-MW02, B79C/D-MW03, and B79C/D-MW04 under the LTM Program and report in the Annual LTM Reports.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	Air Force	EPA/State	1) 09/30/2022 2) 09/30/2051

OU(s): GWOU	**Issue Category:** Emerging Contaminants			
	Issue: AFFF has been used primarily in Area A for firefighting and at active and inactive Fire Training Areas (FTAs). The AFFF components PFOS and PFOA have been detected in groundwater at these usage areas. An SI and an ESI for PFOS/PFOA has been conducted, and the ESI report is being finalized. An RI has been programmed for FY21.			
	Recommendation: 1) Continue current quarterly PFOS/PFOA sampling program. 2) Conduct an RI at locations identified in the SI and ESI that have elevated levels of PFOS/PFOA components of AFFF.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
Yes	Yes	Air Force	EPA/State	1) 03/31/2030 2) 09/30/2021

OU(s): GWOU	**Issue Category:** Monitoring			
	Issue: An unknown off-site source of PCE in groundwater is believed to be present upgradient of BS5.			
	Recommendation: 1) Continue annual sampling at BS5 monitoring wells and evaluate the decreasing trend in on-site PCE concentrations in groundwater. 2) Follow-up on request for OEPA to conduct additional investigation in the vicinity of the former dry cleaners along Airway Road.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	Air Force	EPA/State	1) 09/30/2051 2) 03/31/2022

Table E-7 (continued)
Five-Year Review Summary Form
Groundwater Operable Unit (GWOU) ROD

OU(s): GWOU	**Issue Category:** Monitoring			
	Issue: The TCE plume in OU10 is not bounded in the upgradient direction (to the northeast) of groundwater flow; the PCE plume in OU10 is not bounded in the downgradient direction (to the southwest) of groundwater flow.			
	Recommendation: Sample existing wells side-gradient of wells OU10-MW-11S and OU10-MW-11D, and add a monitoring location downgradient of this well pair. In addition, to further delineate the Area A TCE plume, install and sample a new monitoring well to be located upgradient of monitoring well OU10-MW15S.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	Air Force	EPA/State	09/30/2022

OU(s): GWOU	**Issue Category:** Remedy Performance			
	Issue: A pilot-scale treatability test and source removal action was not memorialized in a decision document with regulatory agencies. In addition, FAA-B specific RAOs are not present in the GWOU ROD.			
	Recommendation: Prepare a Memo to Site File or ESD to document the excavation of approximately 200 cubic yards of contaminated soil that occurred in October 2000 as a source removal measure. Document the changes in the remedy (including groundwater monitoring, which is conducted annually under the LTM).			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	No	Air Force	EPA/State	09/30/2022

OU(s): GWOU	**Issue Category:** Monitoring			
	Issue: VOC contamination above MCLs is present in the groundwater at the former Building 59.			
	Recommendation: Conduct an RI at the former Building 59 in spring 2020 to further delineate the site.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	Air Force	EPA/State	09/30/2022

Table E-7 (continued)
Five-Year Review Summary Form
Groundwater Operable Unit (GWOU) ROD

Protectiveness Statement(s)	
Operable Unit: GWOU	*Protectiveness Determination:* Short-Term
Protectiveness Statement: The remedy for the GWOU is short-term protective of human health and the environment because ICs and ECs are in place to manage exposure pathways that could result in unacceptable risks. However, in order for the remedy to be protective in the long-term, additional actions may be necessary to address PFAS or other contaminants (such as TCE and PCE) and ensure protectiveness. Furthermore, PFOS/PFOA are emerging contaminants and a drinking water standard has not yet been proposed or promulgated. USEPA's 2016 HAL is currently in effect as a measure of protectiveness; however, the evaluation of toxicity information on PFOS/PFOA is on-going. In addition, WPAFB has evaluated the TCE concentrations in FAA-A and found that, statistically, the TCE trends are overall decreasing within this five-year review period. Fluctuations of TCE concentrations in this area appear to be a result of matrix diffusion as the aquifer system attempts to achieve chemical equilibrium and a result from a reduction in groundwater production from the City of Dayton Huffman Dam Wellfield.	

Table E-8
Five-Year Review Summary Form
Sitewide Protectiveness Statement

Sitewide Protectiveness Statement	
For sites that have achieved construction completion, enter a sitewide protectiveness determination and statement.	
Protectiveness Determination: Protectiveness Deferred	*Addendum Due Date:* 09/30/2025
Protectiveness Statement: Protectiveness Deferred based on the protectiveness statement for the 21 No Action Sites ROD where two sites (FTAs 3 and 4 located in OU3) have PFAS concentrations exceeding calculated screening levels for soils; see Table E-4.	

1.0 Introduction

In accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121 (c), 42 U.S. Code (U.S.C.) §§9621(c), the United States Air Force (USAF) has conducted a five-year review of the remedies implemented at Wright-Patterson Air Force Base (WPAFB), Ohio (**Figure 1-1**). This Five-Year Review was conducted for the period September 2019 through December 2020. Analytical and other monitored data collected as part of the Long-Term Groundwater Monitoring (LTM) Program extends through April 2019 (CB&I, 2015 - 2016; APTIM, 2017 - 2020).

This five-year review covers 68 IRP sites and Further Action Area (FAA) sites (FAA-A and FAA-B) currently identified at WPAFB. These sites were reviewed because hazardous substances, pollutants, or contaminants remaining at one or more of the sites are above levels that allow for unlimited use and unrestricted exposure. The IRP sites and their remedies are described in six RODs and supporting documents that include:

- Record of Decision, Source Control Operable Unit (SCOU), Landfills 8 and 10, 24 May 1993 (WPAFB, 1993a)
- Record of Decision Off-Source Operable Unit (OSOU) and Final Remedial Action, Landfills 8 and 10, 30 June 1994 (WPAFB, 1994)
- Record of Decision for 21 No Action Sites, 26 August 1996 (WPAFB, 1996)
- Explanation of Significant Differences (ESD): SCOU Landfills 8 and 10, 26 March 1997 (WPAFB, 1997a)
- Record of Decision for Spill Sites 2, 3, and 10 within Operable Unit 2, 30 September 1997 (WPAFB, 1997b)
- Record of Decision for 41 No Action Sites, 20 August 1998 (WPAFB, 1998)
- Record of Decision for the Groundwater Operable Unit (GWOU), 29 September 1999 (WPAFB, 1999), and Final Remedial Process Optimization (RPO) for the GWOU, 30 October 2009 (Shaw, 2009a)
- Memo to Site File for Monitoring, Sampling, and Reporting Revisions to the Groundwater Operable Unit, Record of Decision, January (Shaw, 2012)
- ESD: SCOU – Landfills 8 and 10; OSOU and Final Remedial Action Landfills 8 and 10; 21 No Action Sites; Spill Sites 2, 3, and 10 (Operable Unit 2); 41 No Action Sites; and GWOU, 27 August 2012 (WPAFB, 2012a).

The RODs and ESDs are provided as **Attachment 1** of this document.

The ROD for Spill Sites (SPs) 2, 3, and 10 within OU2 achieved remedial action completion in 2020. The Remedial Action Completion Report (RACR) was signed by Ohio Environmental Protection Agency (OEPA) on September 11, 2018, by the U.S. Environmental Protection Agency (USEPA) Remedial Program Manager on September 17, 2018, and the USEPA Region V Branch Chief on August 19, 2020, which makes the RACR a final USEPA approved document. The site is now going through the National Priorities (NPL) deletion process.

The review presented herein is the fifth five-year review for WPAFB. The first five-year review, which did not include the GWOU, was conducted in 1999 and finalized in March 2000. The GWOU was not included in the first five-year review because the remedy had not yet been implemented. The second five-year review was conducted and approved in 2005 and finalized in January 2006. The third five-year review was conducted and approved in 2010 and finalized in August 2011. The trigger date for the start of the first five-year review period at WPAFB was September 3, 1994, when remedial action began on the SCOU for Landfills (LF) 8 and 10. The fourth five-year review was conducted and approved in 2015 and finalized on December 9, 2016. The due date for the fifth review is December 9, 2020.

1.1 Purpose and Authority

The purpose of the five-year review is to determine whether the remedy implemented at each site remains protective of human health and the environment. The methods, findings, and conclusion of reviews are documented in Five-Year Review reports. In addition, Five-Year Review reports identify issues found during the review, if any, and recommendations to address them.

This Five-Year Review Report is being prepared pursuant to the CERCLA Section 120 and the National Contingency Plan (NCP). CERCLA in 42 U.S.C. §9620(a)(2) specifies the following for Federal facility sites that are listed on the National Priorities List (NPL):

> "All guidelines, rules, regulations, and criteria which are applicable to preliminary assessments (PA) carried out under this chapter for facilities at which hazardous substances are located, applicable to evaluations of such facilities under the NCP, applicable to inclusion on the NPL, or applicable to remedial actions at such facilities shall also be applicable to facilities which are owned or operated by a department, agency, or instrumentality of the United States in the same manner and to the extent as such guidelines, rules, regulations, and criteria are applicable to other facilities."

The NCP, Title 40 of the Code of Federal Regulations (CFR) Part 300, Subpart E, Section 300.430(f)(4)(ii) further states:

> "If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action."

1.2 Document Organization

This document was completed in accordance with the USEPA guidance titled Comprehensive Five-Year Review Guidance (USEPA, 2001, 2012a) and is organized as follows:

- Chapter 1.0 – Introduction: presents a brief overview of the six RODs included in this five-year review, the purpose and authority of the five-year review, and trigger date for the review.

- Chapter 2.0 – Background: presents a background of the site conditions and operable units (OU) to be evaluated at WPAFB.

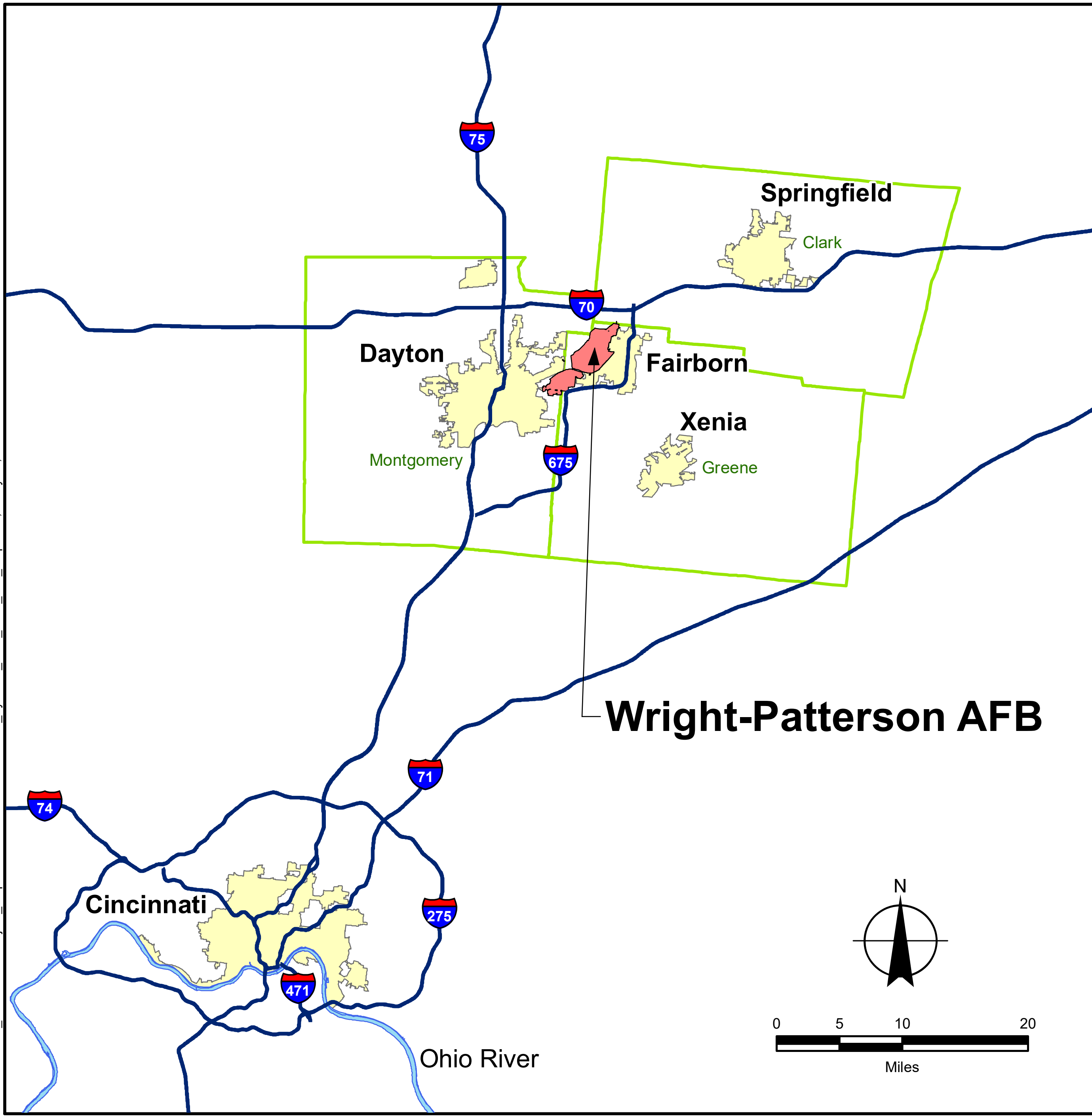
- Chapter 3.0 through 8.0 – these chapters of the document are organized by ROD, in chronological order, and include the major evaluation of the five-year review. Each chapter was prepared in stand-alone format so that it can be extracted. The format of each chapter is organized as follows:

  X.1 Background
  X.2 Remedial Actions
  X.3 Progress Since Last Five-Year Review
  X.4 Five-Year Review Process
  X.5 Technical Assessment
  X.6 Issues
  X.7 Recommendations and Follow-up Actions

- Chapter 9.0 – Protectiveness Statements: presents the protectiveness statements for each of the six RODs.

- Chapter 10.0 – Next Review: presents the anticipated date of the next five-year review.

- Chapter 11.0 – References.



WRIGHT-PATTERSON
AIR FORCE BASE,
OHIO

FIFTH FIVE-YEAR ROD REVIEW

FIGURE NUMBER
1-1

AREA LOCATION MAP

APTIM
5050 Section Avenue
Cincinnati, Ohio 45212

G:\WPAFB\GIS_Documents\Project_Maps\501363.03000000\WPAFB_5yrROD_01-1_Area_Loc_Map.mxd; Analyst: ; Date: 9/27/2019 7:28:48 AM

2.0 Background of WPAFB

WPAFB is an active Air Force (AF) base with a workforce of civilian and military personnel. Missions range from acquisition and logistics management, to research and development, education, flight operations, and many other defense related activities.

2.1 Background

WPAFB is located in southwestern Ohio, east of the city of Dayton, and adjacent to the city of Fairborn (**Figure 1-1**). The Base is approximately 60 miles north of Cincinnati and 50 miles west of Columbus and occupies approximately 8,200 acres of Greene and Montgomery Counties, immediately adjacent to Clark County. WPAFB employs approximately 26,000 civilian, military, and contractor personnel.

The Base is divided into two administrative areas: A and B (**Figure 2-1**). Area A surrounds Patterson Field, an active USAF airfield. Area B is located southwest of Area A, and contains Wright Field, an inactive airfield except for the southern-most runway, which is infrequently used for Air Force Museum aircraft activities and other special occasions. Areas A and B are separated by State Route 444 and railroad tracks. Area A encompasses approximately 5,700 acres. Area A is primarily comprised of building complexes and active runways and flight facilities. Area B encompasses approximately 2,400 acres, and contains a complex of buildings, which are predominantly used for research and development, training, and administrative activities. Current and historical operations are oriented more toward industrial usage in general, and research and development in particular. Current and historical operations that have occurred in Area A include:

- Aircraft and vehicle fueling
- Aircraft and vehicle maintenance
- Runway and aircraft deicing
- Munitions and explosive ordnance disposal
- Warehousing and storage
- Small arms training
- Steam and electrical generation
- General site maintenance (roads, mowing, etc.)
- Miscellaneous disposal
- Office operations and classroom instruction.

WPAFB's history as a military installation dates from World War I. When the United States entered World War I in 1917, three military installations were established in the Dayton area. Two were located at what is now WPAFB. Wilbur Wright Field was established as a pilot training school along the site of WPAFB's present flightline. Immediately adjacent to it was the Fairfield Aviation General Supply Depot, a centralized depot that provided logistical support for the Signal Corps aviation schools in the Midwest. After World War I, these two air bases became a single installation known as the Fairfield Air Depot. The highly skilled and specialized work force retained after World War I had a continuing effect in establishing the depot as a major center for testing and maintenance of military aircraft. The third military installation established in 1917 was McCook Field, located approximately 4 miles south of the other two installations. It served as the engineering division of the Army Air Service.

By 1924, the facilities and the runway space at McCook Field were becoming too small for the new, larger aircraft. In 1927, a new aerodrome and state-of-the-art research facilities were constructed at Wright Field on land purchased and donated by citizens of Dayton. Wright Field was an expanded home for research activities at McCook Field. In 1931, the Fairfield Air Depot was renamed Patterson Field. By 1948, Wright and Patterson Fields were merged to form WPAFB.

2.2 Environmental History

Environmental investigations at WPAFB are conducted under the IRP. The U.S. Department of Defense (DoD) developed the IRP to identify, assess, and control potential environmental contamination that may have resulted from past operations and waste disposal practices. The IRP, an element of the Defense Environmental Restoration Program, is a part of the environmental program at each DoD installation. At WPAFB, the IRP is administered by the Air Force Civil Engineer Center (AFCEC). The Base IRP is regulated under CERCLA, the Federal Facility Agreement (FFA) with the USEPA Region 5, and the Administrative Orders on Consent with the Ohio Environmental Protection Agency (OEPA). Locations of the IRP sites are shown on **Figures 2-2** and **2-3**.

WPAFB has grouped all confirmed or suspected sites requiring investigation and characterization into 11 geographically-based source Operable Units (OUs) (designated OU 1 through 11) and one GWOU. Remedies for 11 source OUs and the groundwater OU were included in six separate RODs.

This assessment is primarily focused on the chemicals of concern (COCs) as evaluated through risk assessment and identified in the RODs. For the purpose of this Five-Year Review, COCs are defined as chemicals that have been found to exceed the acceptable levels for cancer risk and/or noncancer hazards. When there are Drinking Water Maximum Contaminant Levels (MCLs) for hazardous substances, pollutants or contaminants at a WPAFB site, they are considered to be COCs for purposes of this Five-Year Review. These COCs were carried forward for further action as addressed in the RODs. Source control measures were implemented at those IRP sites that posed an unacceptable risk to human health and the environment. These measures either reduced the risk to acceptable levels or eliminated exposure pathways. Other IRP sites exhibited low, acceptable levels of risk. No cleanup action was warranted because of the low frequency of human exposure based on current land use. For those sites where the "No Action" (NA) alternative was determined to be the preferred remedy (as stated in their respective RODs), the remedy included access restrictions and institutional controls (ICs) and engineering controls (ECs) also referred to as site controls, to manage exposure to contaminants remaining on-site. The NA alternative also included monitoring of groundwater under the GWOU.

Investigations conducted at the source OUs indicated the presence of several groundwater contaminants in various locations throughout the Base. These contaminants occur both as definable plumes and as isolated occurrences. Groundwater contaminants at WPAFB may be transported from one area to others, co-mingle, and may also move to remote portions of the Base. Therefore groundwater, surface water, and sediment contaminants from each of the 11 OUs, and groundwater contaminants that were not attributable to a known source on WPAFB, were combined to form the GWOU for removal activities under the Basewide Monitoring Program (BMP). The purpose of the BMP was to evaluate contaminant movements, assess the risks posed to human health and the environment, and design a remedy (primarily LTM). The remedy for the GWOU was included in the sixth ROD prepared for IRP sites at WPAFB. The GWOU is currently monitored under the LTM Program. Lists and figures showing wells used as piezometers and those that are monitored for analytical parameters are presented in the LTM reports (CB&I, 2015-2016, APTIM 2017-2020).

As noted above, WPAFB has 11 geographically based OUs and one GWOU; **Figure 2-2** shows the locations of OUs 2, 3, 4, 5, 7, 10, and 11; and **Figure 2-3** shows the locations of OUs 1, 6, 8, and 9. **Table 2-1** presents a matrix showing the relationship of IRP sites, OUs, and RODs. The progress of all IRP projects at WPAFB – including ongoing Remedial Investigations (RIs) and Feasibility Studies (FSs) at sites not identified in any of the six RODs – are tracked in the WPAFB monthly IRP Reports that are submitted to the regulatory agencies.

The following presents a brief summary of the six RODs.

Source Control Operable Unit ROD – The SCOU ROD (WPAFB, 1993a) addresses the remediation for LFs 8 and 10 within OU1. WPAFB prepared an ESD (WPAFB, 2012a) that revised the original compliance levels for OU1 water to be consistent with the MCLs presented in the GWOU ROD. These revisions were subsequently incorporated into the LTM Program. The ESD also changed the requirement for deed restrictions as long as WPAFB remained an installation owned by the federal government. Land-use controls language was updated that included ECs and ICs, which will be used to monitor and maintain the integrity of the selected remedy.

Off-Source Operable Unit ROD – The ROD for the OSOU (the area outside of LFs 8 and 10 within OU1) presented the selection of the no action remedial alternative for the OSOU, and the adoption of the previously approved SCOU remedial action as the final cleanup remedy for the OSOU (WPAFB, 1994). It was agreed that the comprehensive site remedial action, described in the SCOU ROD (WPAFB, 1993a), would address all exposure pathways where a risk was identified (WPAFB, 1994). The ESD (WPAFB, 2012a) for the SCOU ROD also applies to the OSOU ROD. In addition, deed restrictions will be placed on the property if it is ever transferred out of federal ownership.

21 No Action (NA) Sites ROD – The 21 No Action Sites ROD documents the selected remedy for soils at the subject 21 IRP sites to be "no action." However, ICs and ECs were already in place at the 21 IRP sites when the ROD was written in 1996. Therefore, the selected remedy is considered a "limited action" according to USEPA IC guidance document (USEPA, 2010a) rather than a "no action" remedy.

Spill Sites (SP) 2, 3, and 10 (OU2) ROD – A Final Remedial Action Completion Report: Record of Decision for Spill Sites 2, 3, and 10 (Within Operable Unit 2) was completed in August 2020 that documented WPAFB achieved remedial action completion at SPs 2, 3, and 10 in accordance with Close Out Procedures for NPL Sites. During performance of the RACR, WPAFB reviewed the remedy and determined the remediation criteria established in the ROD had been met and that the cleanup levels had been achieved as specified in the National Oil and Hazardous Substances Pollution Contingency Plan.

The RACR was signed by OEPA on September 11, 2018, by the USEPA Remedial Program Manager on September 17, 2018, and the USEPA Region V Branch Chief on August 19, 2020, which makes the RACR a final USEPA approved document. The site is now going through the NPL deletion process.

41 No Action Sites ROD – The 41 No Action Sites ROD documents the selected remedy for soils at the subject 41 IRP sites to be "no action." However, ICs and ECs were already in place at the 41 IRP sites when the ROD was written in 1998. Therefore, the selected remedy is considered a "limited action" according to USEPA IC guidance document (USEPA, 2010a) rather than a "no action" remedy.

GWOU ROD – Investigations conducted at the source OUs indicated the presence of several groundwater contaminants in various locations throughout the Base. These contaminants occur both as definable plumes and as isolated occurrences. Groundwater contaminants at WPAFB may be transported from one area to others, co-mingle, and may also move to remote portions of the Base. Therefore groundwater, surface water, and sediment contaminants from each of the 11 OUs, and groundwater contaminants that were not attributable to a known source on WPAFB, were combined to form the GWOU for activities under the BMP. The purpose of the BMP was to evaluate contaminant movements, assess the risks posed to human health and the environment, and design a remedy (primarily LTM). The GWOU ROD also defined the following two Further Action Areas: FAA-A and FAA-B, which are shown on **Figures 2-2** and **2-3**, respectively.

2.3 Site Characteristics of WPAFB

The following sections present the geologic and hydrogeologic setting of WPAFB.

2.3.1 Generalized Geologic Setting

Geologically, WPAFB is located within the till plains section of the central lowlands physiographic province (Fenneman, 1938). The land surface of the region is generally flat to gently rolling with streams and rivers forming level flood plains. Topographic relief in the area of WPAFB is the result of glacial deposition activity from the Wisconsin glaciation of the Pleistocene Age. Land surface elevations range from approximately 950 feet (ft) on top of the ridge in the southern portion of Area B to approximately 790 ft along Springfield Street in the northern portion of Area B.

The geologic description and history of WPAFB is based on discussions presented in Norris and Spieker (1966), Dumouchelle and others (1993), data collected during the WPAFB RIs, and a series of Technical Memorandum (TM) prepared as part of the BMP for the GWOU. The TMs, which provide specific detailed information and analysis regarding the geology and hydrogeology found at WPAFB as it relates to contamination, are:

- BMP Background Technical Memorandum (IT, 1996a)
- BMP Field Activities Technical Memorandum (IT, 1996b)

- BMP Groundwater Flow Modeling Technical Memorandum (IT, 1997a).

2.3.2 Geologic and Hydrogeologic Description

WPAFB and the present-day Mad River overlie a buried Pleistocene valley. Bedrock underlying WPAFB consists primarily of fine-grained, soft, calcareous, fissile shale with thin beds of limestone deposited during late Ordovician time. Area B overlies a bedrock ridge in the eastern portion of the Area and a deep stage valley to the west. The bedrock ridge extends north and south from Huffman Dam through Area B toward the southeast. Upland hydrogeology is dominant in the area. The remainder of Area B overlays Richmondian Shale.

The bedrock valley in the region is filled with unconsolidated valley train type sediments consisting of glacial outwash, glacial till layers, and modern alluvial deposits. Valley train deposits consist predominantly of sand and pebble gravel mixtures with local discontinuous silt and clay layers.

Hydraulically, WPAFB is located within the Mad River valley of the Great Miami River Basin. The Mad River empties into the Great Miami River near downtown Dayton, approximately 3 miles downstream (southwest) of the site. Several surface water bodies are located within WPAFB and include:

- Hebble Creek
- Trout Creek
- Bass Lake
- Twin Lakes
- Gravel Lake
- Drainage ditches located adjacent to roads
- Wetlands.

Groundwater at the site is defined as part of the Mad River Aquifer, which is part of the Miami Buried Valley Aquifer, a sole source aquifer. The Buried Valley Aquifer is a prolific source of water and is highly utilized as a municipal and industrial source. High volume groundwater extraction in the vicinity of WPAFB occurs at the City of Dayton Huffman Dam wellfield and at the Rohrer's Island wellfield; two City of Fairborn wellfields; the WPAFB Springfield Street, Skeel Road, and Water Road wellfields; Wright-State University; and at the southwest boundary line of Area A for the groundwater removal action currently active on WPAFB.

The Buried Valley Aquifer within the area is a designated sole source aquifer under Section 1424(e) of the Safe Drinking Water Act (SDWA) and the Ohio Administrative Code (OAC) Rule 3745-27-07(B)(5). The aquifer is generally confined to the buried valleys.

Groundwater is recharged through infiltration of precipitation, groundwater flow into the area, and infiltration of surface water. Groundwater discharges from the area include groundwater flow out of the area; evapotranspiration from lakes, wetlands, and vegetated areas; groundwater extraction at numerous wellfields; and discharge into the Mad River. The BMP Groundwater Flow Modeling Technical Memorandum (IT, 1997a) details the water balance for the aquifer.

2.3.3 Groundwater Occurrence at WPAFB

Groundwater throughout associated OUs and the GWOU at WPAFB occurs at a wide range of depths and elevations. These variations can be attributed to the various aquifer types present in the region and individual site proximity to recharge areas. Aquifer types in the region include the water table aquifers that occur in the coarse-grained deposits found in most valley locations and in the fine-grained (silts and clays) and till deposits found in the hill regions. Groundwater can also be found in semi-confined aquifers and in bedrock. Bedrock, however, is not considered a viable water producing aquifer. Hydraulic permeability in the hill and valley regions of WPAFB varies widely and is especially limited within the upland areas of the Base.

Within OU1, depth to groundwater ranges from approximately 3 ft below ground surface (bgs) to approximately 35 ft bgs at LF8 in the monitoring wells and averages approximately 45 to 50 ft bgs in operating extraction wells. At LF10, depth to groundwater ranges from approximately 9 to 100 ft bgs. In LF10 extraction wells depth to water ranges from approximately 30 to 84 ft bgs, in operating extraction wells. Groundwater may be perched or intermittent within the upper portions of the operable unit while some locations are dry.

The sites that comprise the 21 NA sites are included in OUs 2, 3, 5, and 10 on **Figure 2-2** and OU 6 on **Figure 2-3**, and are located primarily in the coarse valley train deposits. Depth to water at the 21 NA sites range from approximately 7 to 33 ft bgs.

The 41 NA sites are located in both the hill and valley regions of the Base and are included in OUs 3 through 11. Depth to water at these sites ranges from approximately 6.5 ft bgs at Spill Site 11 in the Area B hill area to 25 ft bgs at LF5 in the valley region of Area A. Some sites located within the upper portion of the Base may have perched intermittent groundwater or dry conditions.

2.4 Land Use Control Procedures

The majority of the IRP sites addressed by the RODs in this Five-Year Review use some form of land use controls (LUCs) to monitor and maintain the integrity of the selected remedy. LUCs fall into two categories: ECs and ICs. According to the Land Use Controls Management Guidance (AFCEE, 2010), and Institutional Controls: A Guide to Planning, Implementing, Maintaining, and

Enforcing Institutional Controls at Contaminated Sites (USEPA, 2010a), ECs are physical mechanisms that encompass a variety of engineered remedies to contain or reduce contamination, or physical barriers to limit access to property, such as fences or signs.

ICs are non-engineered controls such as proprietary (e.g., easements, restrictive covenants) and administrative (e.g., base dig/drilling permit process) that minimize the potential for human exposure to contamination by limiting land or resource use. At several of the WPAFB IRP ROD sites, administrative ICs are used in conjunction with engineering measures.

ICs are normally used when waste is left on-site and when there is a limit to the activities that can safely take place at the site (e.g., the site cannot support unlimited use and unrestricted exposure or when cleanup equipment remains on-site). ICs may also be established to protect the integrity of a physical remedy. For those IRP sites with ICs in place, the ICs are part of the selected remedy.

WPAFB implements these ICs to ensure that the selected remedies at the IRP sites remain protective:

- Reviewing plans, designs, and specifications for on-Base construction by WPAFB IRP personnel.
- Submitting AF Form 103 (Base Civil Engineering [CE] Work Clearance Request) to the IRP personnel for review/approval prior to anyone excavating or digging anywhere within Base boundaries.
- Submitting AF Form 813 (Request for Environmental Impact Analysis Process [EIAP]) for review/approval to assess the potential environmental impact of any action proposed at WPAFB.
- Entering of all ROD use limitations and exposure restrictions and IRP site locations into the Installation Development Plan (IDP) and the Geographical Information System (GIS).

The following actions are identified in Section 2.3 of the ESD (WPAFB, 2012a) and will be implemented when the AF proposes to transfer real property that is subject to ECs and/or ICs under any ROD at the Site:

- Transfer to a non-federal entity: the AF will provide information to the non-federal entity concerning the deed and transfer documents regarding necessary resource use restrictions and ICs. The signed deed will include ICs and resource restrictions equivalent to those contained in the ROD and in compliance with Section 120(h) of CERCLA and any other applicable federal, state, or local law.

- Transfer to a federal entity: the transfer documents shall require that the federal transferee identify such controls and any applicable resource use restrictions in its resource use plan or equivalent resource use mechanism. The AF shall advise the recipient federal agency of all the obligations contained in the RODs, including the requirements to operate and maintain effective ECs and ICs.

In addition, the AF will provide notice to the USEPA and OEPA in a letter at least 6 months prior to any transfer or sale of property that is subject to any transfer or sale of property that is subject to ECs and/or ICs under any ROD at the Site. If it is not possible for the AF to notify the USEPA and OEPA at least 6 months prior to any transfer or sale, then the AF will notify the agencies as soon as possible but no later than 60 calendar days prior to the transfer or sale of any property subject to LUCs.

These ICs and site restrictions are currently summarized and documented in the ESD (WPAFB, 2012a).

2.5 Remedy Protectiveness Evaluation

WPAFB reviews the selected remedy and evaluates the protectiveness to human health and the environment through the Five-Year Review and the LUC Plan processes.

Five-Year Review

In addition to the ICs presented in **Section 2.4**, the WPAFB IRP ROD sites also undergo a Five-Year Review process (as presented in this document) in accordance with the requirements presented in CERCLA Section 121(c), §§9621(c) to ensure the selected remedies and ICs remain protective of human health and the environment and ensuring the integrity of any ECs implemented during the response action. For the NA remedy to continue to be protective of human health and the environment, specific ICs need to be maintained and reevaluated in every Five-Year Review.

Land Use Control Plan

The implementation, reevaluation, and maintenance of the LUCs for the IRP sites presented in this Five-Year Review will be updated as needed. The LUC Plan (Labat, 2012) was used to manage site LUCs consisting of both ECs and ICs. A Land Use Control Implementation Plan (LUCIP) was prepared in February 2019 to provide an update to the 2012 LUC Plan (TetraTech, Inc. [TetraTech], 2019). The LUCIP included updated site maps, updated IRP site location maps using WPAFB CE grid coordinates, updated tables, updated site photographs with captions, and 2017 site inspection reports. The LUCIP document (provided in Attachment 2) states it should be used to manage and enforce LUCs at WPAFB. The LUCIP provides current land use and restrictions of each IRP site listed by ROD. All ROD use limitations and exposure restrictions and site locations are entered in the IDP and the GIS, implemented by WPAFB CE.

2.6 Identified Emerging Contaminants

Emerging contaminants identified for further investigation at WPAFB include 1,4-dioxane and per- and polyfluoroalkyl substances (PFAS). The USEPA defines an emerging contaminant as a chemical or material that is characterized by a perceived, potential, or real threat to human health or the environment or by a lack of published health standards. A contaminant may also be “emerging” because a new source or a new pathway to humans has been discovered or a new detection method or treatment technology has been developed (USEPA, 2014a).

2.6.1 1,4-Dioxane

1,4-dioxane is a cyclic ether that was historically utilized as an additive to chlorinated solvent formulations to increase shelf life and prevent corrosion of metal surfaces during various degreasing operations. 1,4-dioxane is listed as a CERCLA hazardous substance that was identified as a high risk to DoD cleanup programs in 2007; however, 1,4-dioxane does not have an MCL. The USAF has evaluated the potential impact of 1,4-dioxane on WPAFB’s ERP sites.

The USAF issued interim guidance on sampling and response actions for 1,4-dioxane at operational and Base Realignment and Closure installations in August 2013. The guidance indicated 1,4-dioxane is considered an emerging contaminant based on changing health screening levels, and the USAF has an obligation to address environmental releases of 1,4-dioxane above acceptable risk levels. However, there is currently no federally promulgated regulatory cleanup level.

Sampling for 1,4-dioxane at WPAFB was conducted in 2014, 2015, 2017, and 2019, under the LTM Program. Per the Annual LTM Program Report: 2018, only three wells located at the northern end of OU10 (**Figure 2-2**) had 1,4-dioxane concentrations above the USEPA Tapwater Screening Level (0.46 micrograms per liter [µg/L]) and are located in a WPAFB Drinking Water Source Protection Area. Each well had only one detection above the Screening Level during the 2014, 2015, and 2017 LTM sampling events and a confirmation round of sampling was conducted in the fall 2019. Results from the fall 2019 sampling event indicate that 1,4-dioxane was not detected in the three wells identified for confirmation sampling. 1,4-dioxane was also detected in two wells at the Former Building 79/95 Complex in Area B. This portion of Area B is not in a Drinking Water Source Protection Area and will not be re-sampled under the GWOU or LTM Program. The Former Building 79/95 Complex is, however, programmed for a RI for fall 2020 that will include sampling for 1,4-dioxane among other site-specific parameters. Therefore, groundwater sampling for 1,4-dioxane is being proposed for deletion from the LTM Program.

2.6.2 Per- and Polyfluoroalkyl Substances

PFAS are a class of synthetic fluorinated chemicals used in many industrial and consumer products, including defense-related applications; they are persistent, found in low levels in the environment, and bioaccumulate. PFAS have demonstrated toxicity in peer-reviewed toxicological studies of animals as well as epidemiological studies of human populations (USEPA, 2016).

In 1970, the USAF began using Aqueous Film Forming Foam (AFFF) firefighting agents containing PFAS to extinguish petroleum fires. AFFF can contain and degrade into perfluorooctanesulfonic (PFOS) acid and perfluorooctanoic acid (PFOA) along with other PFAS compounds and precursors. During fire training, equipment maintenance, and use, AFFF was released directly to the environment.

Conventional technologies for in-situ and ex-situ treatment of PFAS in groundwater such as direct oxidation, air stripping, and vapor extraction are not effective. Granular activated carbon (GAC) is an effective method for treating drinking water wells. Reverse osmosis is effective for higher concentration industrial waste streams. The USAF issued interim guidance on sampling and response actions for PFAS at operational and Base Realignment and Closure installations in August 2012. The guidance indicated PFAS are considered an emerging contaminant based on increasing regulatory interest, potential risk to human health and the environment, and evolving regulatory standards. However, there is currently no federally promulgated regulatory cleanup level.

Although there are currently no promulgated standards for PFOS/PFOA, PFOS/PFOA are on the Contaminant Candidate List (CCL) for rulemaking under the SDWA. The SDWA, as amended in 1996, requires USEPA to publish a list of unregulated contaminants every five years that are not subject to any proposed or promulgated national primary drinking water regulations, are known or anticipated to occur in public water systems, and might require regulation under the SDWA. Such contaminants are listed on a CCL. USEPA must periodically publish the CCL and decide whether to regulate at least five or more contaminants on the list. A regulatory determination is a formal decision on whether to initiate the rulemaking process. PFOS/PFOA were originally included on the Final CCL3 (October 2009) and were carried forward to the Final CCL4 (November 2016).

USEPA must begin developing a national primary drinking water regulation when the Agency makes a determination to regulate based on three criteria:

- The contaminant may have an adverse effect on the health of persons.
- The contaminant is known to occur or there is substantial likelihood the contaminant will occur in public water systems with a frequency and at levels of public health concerns.
- In the sole judgment of the Administrator, regulating the contaminant presents a meaningful opportunity for risk reductions.

To make these determinations, USEPA uses data to analyze occurrence of these compounds in finished drinking water and data on human health effects. Both PFOS and PFOA were listed on Contaminant Candidate List 4 (CCL4). On March 10, 2020, USEPA announced its Preliminary Regulatory Determinations for contaminants on CCL4 (USEPA, 2020). As part of this process, USEPA announced its preliminary determination to regulate PFOS and PFOA under the Safe Drinking Water Act. The USEPA's determination underwent public review. The review period ended on June 10, 2020. If USEPA finalizes these determinations, the regulatory development process will begin.

As part of related responsibilities under SDWA, USEPA is required to implement a monitoring program for unregulated contaminants. USEPA selects contaminants for monitoring largely based on the CCL. In 2012, USEPA included PFOS/PFOA in its third Unregulated Contaminant Monitoring Rule (UCMR 3).

While there are currently no promulgated standards for PFAS in environmental media, the USEPA established a drinking water Health Advisory Limit (HAL) for PFOS and PFOA (and in combination) of 70 parts per trillion (ppt), or 0.070 µg/L, or 70 nanograms per liter (ng/L) (USEPA, 2016) in May 2016. According to the USEPA, the HAL for PFOS and PFOA was calculated to offer a margin of protection against adverse health effects to the most sensitive populations: fetuses during pregnancy and breastfed infants. The HAL also offers a margin of protection throughout a person's life from adverse health effects resulting from exposure to PFOS and PFOA in drinking water. No other PFAS have HALs. The USAF currently utilizes these values for screening values to determine if PFAS contamination is present at a site.

As part of the development of the HAL, USEPA applied candidate toxicity values in the derivation of toxicity values for PFOS/PFOA. The HAL was based on a candidate reference dose (RfD) of 2.0E-05 milligram per kilogram per day (mg/kg/day) and a slope factor (SF) of 7.0E-02 $(\text{mg/kg/day})^{-1}$. Although the RfD and SF are available in USEPA's on-line Regional Screening

Level (RSL) calculator (USEPA, 2019c), these values have not yet been verified for Integrated Risk Information System (IRIS) or further evaluated as Provisional Peer-Reviewed Toxicity Values (PPRTVs). With the exception of RSLs for a related compound (perfluorobutane sulfonic acid or PFBS), however, there are no RSLs for tap water or soil listed in the RSL table for PFOS, PFOA, or a combination of these compounds (USEPA, 2019a). The DoD issued guidance on October 15, 2019 to address investigations of sites with per- and polyfluoroalkyl substances within the DoD Cleanup Program (DoD, 2019). As part of this guidance, DoD derived conservative screening levels using USEPA's on-line RSL calculator (USEPA, 2019c). The resulting residential screening level for PFOS or PFOA in soil is 0.13 mg/kg while the industrial screening level is 1.6 mg/kg. For PFOS/PFOA in groundwater, the calculated tap water RSL is 0.040 μg/L. In accordance with the memo, these toxicity values and screening levels are recommended for use in site-specific risk assessments.

For chemicals with both cancer and noncancer endpoints, the RSL calculator simultaneously calculates screening levels based on the target risk (TR) and target risk hazard (TRH) as entered by the user. For screening purposes, the default values used to derive the RSLs are a TR = 1 x 10^{-6} for the cancer endpoint and a target hazard index (THI) = 0.1 for the noncancer endpoint. Separate noncancer screening levels are further calculated for adult and child receptors.

For PFOS/PFOA, all values are calculated and the lowest (and most conservative) value is selected to represent the screening level. For residential exposures to PFOS/PFOA in soil, the screening level (0.13 mg/kg) is based on a THI of 0.1 for the child resident. The screening level for industrial exposures to soil (1.6 mg/kg) is based on a THI of 0.1 for a worker. Similarly, the screening level of tap water (0.04 μg/L) is based on a THI of 0.1 for a child resident. Note that residential criteria are conservative values and that future land use for WPAFB is expected to remain industrial.

The following is a chronology of events related to management, investigation, and remediation of PFOS/PFOA contaminated groundwater at WPAFB:

- September 2015 – Preliminary Assessment Report (CH2M HILL, 2015) issued; the report identified 26 areas of potential PFOS/PFOA usage for further investigation

- Spring 2016 – Two WPAFB drinking water supply wells (#8 and #9) were sampled under USEPA's Unregulated Contaminant Monitoring Rule 3 (UCMR3) and detected concentrations above the HALs and subsequently taken off-line due to PFOS/PFOA impacts

- June 2016 – Quarterly PFOS/PFOA sampling initiated under the LTM Program

- Fall 2016 – Site Inspection initiated for AFFF areas
- February 2017 – Legacy AFFF removed/replaced in fire trucks
- June 2017 – GAC system brought on-line to treat Area A drinking water supply wells #8 and #9
- March 2018 through June 2019 – Quarterly PFOS/PFOA sampling in wells at the downgradient perimeter and within the boundaries of WPAFB as documented in quarterly letter reports (Aerostar)
- June 2018 – document entitled Final Site Inspection Report of Aqueous Film Forming Foam Areas at Wright-Patterson Air Force Base, Ohio (Aerostar SES LLC [Aerostar], 2018) issued
- June 2018 – Contract awarded for an expanded investigation of selected PFOS/PFOA impacted areas. Field work has been completed and the Expanded Site Inspection (ESI) Report of Aqueous Film Forming Foam Areas at Wright-Patterson Air Force Base (Aerostar, 2020) has been finalized. Results from the ESI are further discussed in **Chapter 5**. September 2018 – Legacy AFFF removed/replaced from nine hangars
- September 2019 – PFAS destruction pilot studies conducted at WPAFB.

Ongoing activities also include coordinated PFOS/PFOA sampling with the City of Dayton. Further information on the presence of PFOS and PFOA at WPAFB is presented in **Chapters 5** and **8** of this report.

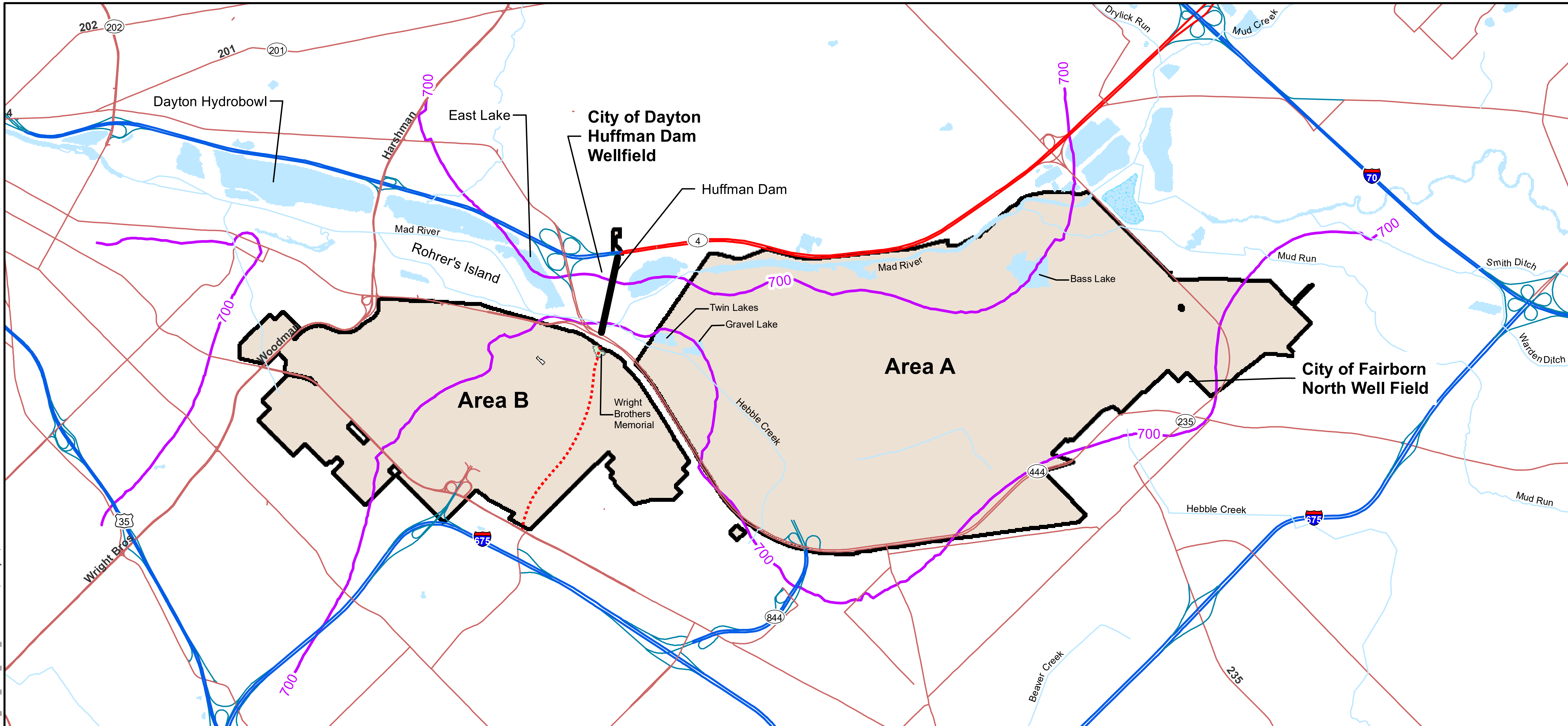
Table 2-1
Operable Unit Installation Restoration Program Sites with Associated Records of Decision
Wright-Patterson AFB, Ohio
Page 1 of 2

Operable Unit	Installation Restoration Program Identification	Site Description	Record of Decision
1	LF8	Landfill 8	SCOU & OSOU
	LF10	Landfill 10	
2	SP2	Spill Site 2	SPs 2, 3, & 10
	SP3	Spill Site 3	
	SP10	Spill Site 10	
	BS1	Burial Site 1	21 NA Sites
	LTCSP	Long Term Coal Storage	
	TCSP	Temporary Coal Storage	
	CSA Bldg 89	Coal Storage Bldg 89	
	CCSA	Coal and Chemical Storage Area	
3	LF11	Landfill 11	41 NA Sites
	LF12	Landfill 12	
	EFDZ11	Earthfill Disposal Zone 11	21 NA Sites
	EFDZ12	Earthfill Disposal Zone 12	
	SP1	Spill Site 1	
	FTA2	Fire Training Area 2	
	FTA3	Fire Training Area 3	
	FTA4	Fire Training Area 4	
	FTA5	Fire Training Area 5	
	LF14	Landfill 14	
4	LF3	Landfill 3	41 NA Sites
	LF4	Landfill 4	
	LF6	Landfill 6	
	LF7	Landfill 7	
	CHP1	Central Heating Plant 2	
5	LF5	Landfill 5	41 NA Sites
	FTA1	Fire Training Area 1	21 NA Sites
	BS4	Burial Site 4	
	GLTS	Gravel Lake Tank Site	
6	LF1	Landfill 1	41 NA Sites
	LF2	Landfill 2	
	EFDZ1	Earthfill Disposal Zone 1	21 NA Sites
7	LF9	Landfill 9	41 NA Sites
8	SP5	Spill Site 5	41 NA Sites
	SP6	Spill Site 6	
	SP7	Spill Site 7	
	SP9	Spill Site 9	
	SP11	Spill Site 11	
	UST71A	Storage Tank at Bldg. 71A	

Table 2-1
Operable Unit Installation Restoration Program Sites with Associated Records of Decision
Wright-Patterson AFB, Ohio
Page 2 of 2

Operable Unit	Installation Restoration Program Identification	Site Description	Record of Decision
9	EFDZ2	Earthfill Disposal Zone 2	41 NA Sites
	EFDZ3	Earthfill Disposal Zone 3	
	EFDZ4	Earthfill Disposal Zone 4	
	EFDZ5	Earthfill Disposal Zone 5	
	EFDZ6	Earthfill Disposal Zone 6	
	EFDZ7	Earthfill Disposal Zone 7	
	EFDZ8	Earthfill Disposal Zone 8	
	EFDZ9	Earthfill Disposal Zone 9	
	EFDZ10	Earthfill Disposal Zone 10	
	BS3	Burial Site 3	
	CHP5	Central Heating Plant 5	
10	LF13	Landfill 13	21 NA Sites
	CHP3	Central Heating Plant 3	
	TF49A	Tank Farm 49A	
	UST30119	Storage Tank at Bldg. 30119	
	SP4	Spill Site 4	41 NA Sites
	East Ramp UST	UST at East Ramp	
11	BS2	Burial Site 2	41 NA Sites
	UST4020	Storage Tank at Bldg. 4020	
	CDA	Chemical Disposal Area	
Other	SP8	Spill Site 8	41 NA Sites
	CHP1	Central Heating Plant 1	
	CHP4	Central Heating Plant 4	
	RADB	Radioactive Waste Burial Site	
	NUC	Deactivated Nuclear	
	EOD	Explosive Ordnance Disposal Range	
	BS5	Burial Site 5	
	BS6	Burial Site 6	
GWOU	OT069	Area A Groundwater	GWOU
	OT070	Area B Groundwater	

NA = No Action
GWOU = Groundwater Operable Unit
OSOU = Off-Source Operable Unit
OU = Operable Unit
SCOU = Source Control Operable Unit
SPs = Spill Sites



Legend

- Wright-Patterson AFB
- Top of Bedrock Elevation Contour (ft, msl) (Approximate Boundary of Buried Valley Aquifer)
- Bedrock ridge, groundwater divide
- Building 56 Investigation Area
- Wright Brothers Memorial

N

0 2,000 4,000 8,000
Feet

WRIGHT-PATTERSON AIR FORCE BASE, OHIO

FIFTH FIVE-YEAR ROD REVIEW

FIGURE NUMBER 2-1

WPAFB BOUNDARIES AND WATER RESOURCES

APTIM
5050 Section Avenue
Cincinnati, Ohio 45212

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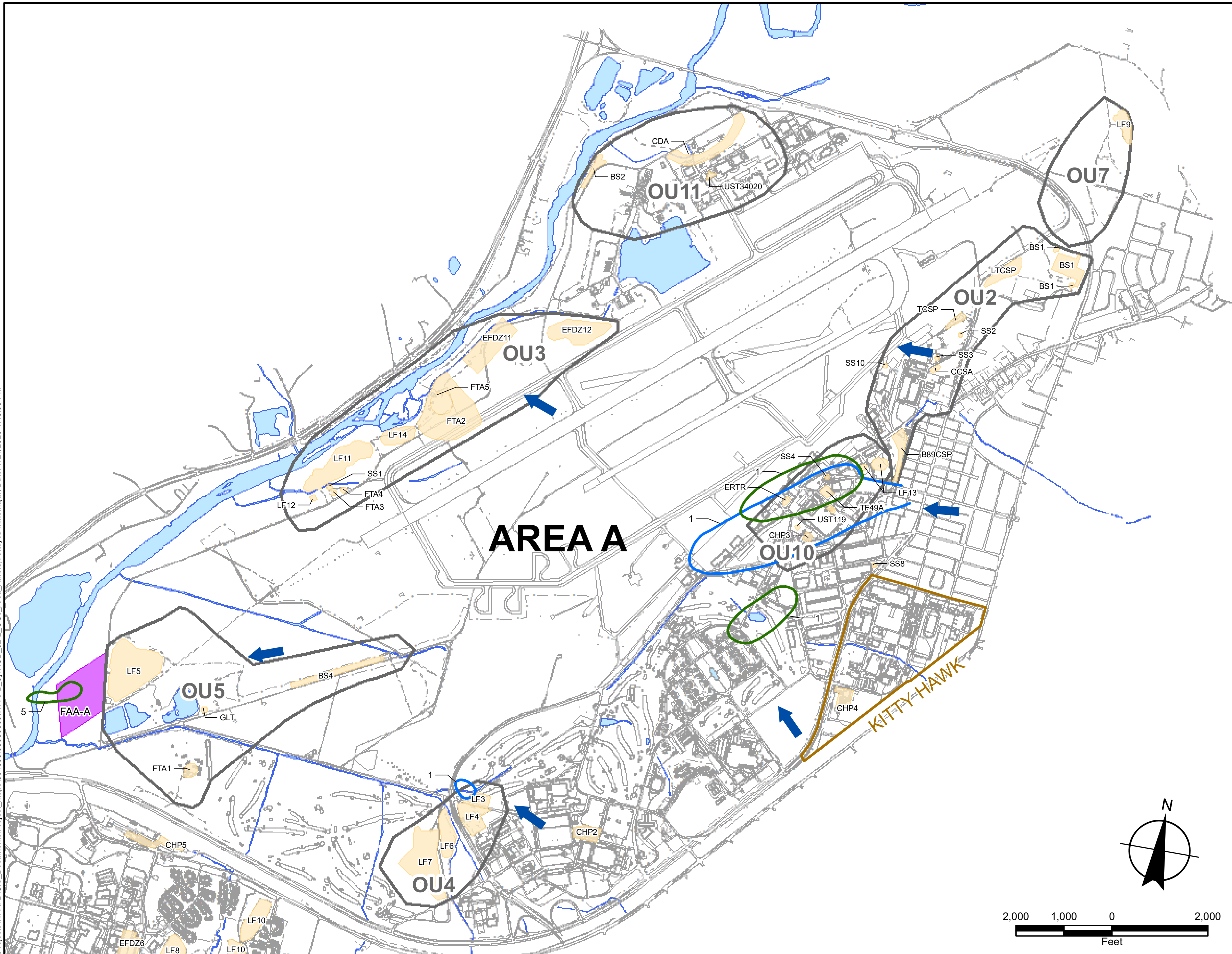

Legend

- TCE Isopleth (ppb)
- PCE Isopleth (ppb)
- Operable Unit
- Further Action Area
- Installation Restoration Program Site
- General Groundwater Flow Direction

BBS	Battery Burial Site
BS	Burial Site
CCSA	Coal and Chemical Storage Area
CDA	Chemical Disposal Area
CHP	Central Heating Plant
CSA	Coal Storage Area
CSA BLDG 89	Coal Storage Area (Bldg 89)
EFDZ	Earth Fill Disposal Zone
EOD	Explosive Ordnance Disposal
ERTR	East Ramp Tank Removal
FAA-A	Further Action Area A
FTA	Fire Training Area
GLT	Gravel Lake Tanks
IRP	Installation Restoration Program Site
LF	Landfill
LTCSP	Long Term Coal Storage Pile
OU	Operable Unit
SS	Spill Site
TCSP	Temporary Coal Storage Pile
TF49A	Tank Farm 49A
UST	Underground Storage Tank

WRIGHT-PATTERSON
AIR FORCE BASE,
OHIO

FIFTH FIVE-YEAR ROD REVIEW

FIGURE NUMBER 2-2

IRP SITES AND OUs - AREA A

APTIM
5050 Section Avenue
Cincinnati, Ohio 45212

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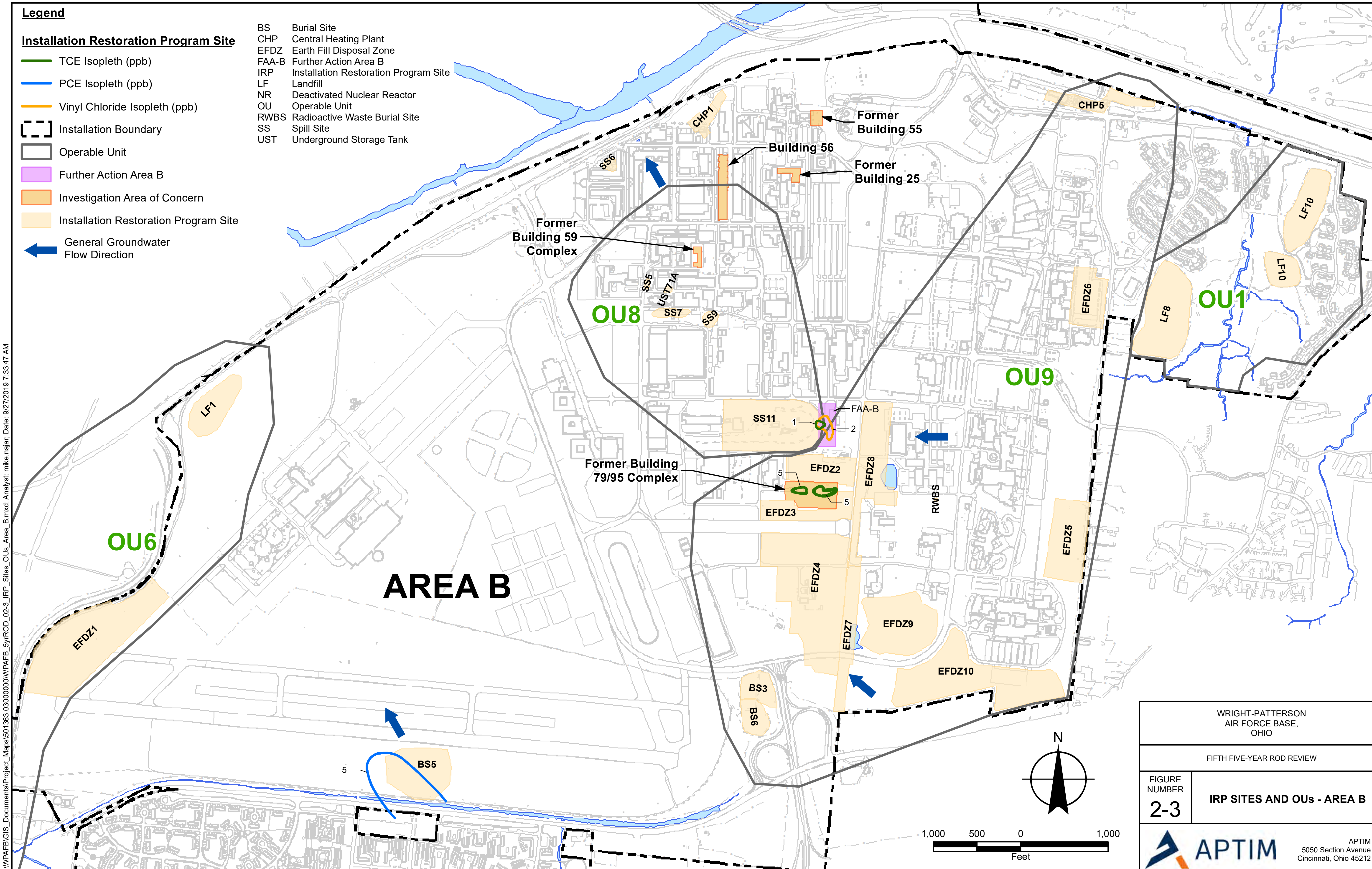

G:\WPAFB\GIS_Documents\Project_Maps\501363.03000000\WPAFB_5yrROD_02-3_IRP_Sites_OUs_Area_B.mxd; Analyst: mike.najar; Date: 9/27/2019 7:33:47 AM

3.0 Five-Year Review for SCOU, LFs 8 and 10

The SCOU ROD (WPAFB, 1993a) addresses the remediation for LFs 8 and 10 within the boundaries of the landfills as distinguished from the OSOU, which pertains to those areas outside the landfill boundaries but is affected by the landfills. The ROD addresses hazards posed by specific environmental media within the landfills. The SCOU ROD does not specifically address groundwater already affected by LFs 8 and 10 (i.e., downgradient); this potential hazard was addressed in the OSOU ROD (WPAFB, 1994). However, the OSOU ROD (discussed in **Chapter 4**) adopted the remedy presented in the SCOU ROD, which includes off-site monitoring as the final cleanup remedy for LFs 8 and 10, and determined that the NA alternative is protective of human health and the environment for those areas outside of LFs 8 and 10.

A five-year review for the SCOU is necessary to determine whether the remedial actions implemented remain protective of human health and the environment.

3.1 Background

LFs 8 and 10 are located in the northeast corner of Area B at WPAFB, in the area bounded by National, Kaufman, and Zink Roads (**Figure 3-1**). LF8 covers approximately 11 acres and LF10 (North and South) covers approximately 9 acres. Currently, the entire area encompassing the LFs are fenced and posted as “Off Limits.” This area is adjacent to The Woods (a privatized military housing area previously known as Woodland Hills), with private homes on Zink and National Roads, and a subdivision in the area south of the LFs. LFs 8 and 10 are separated by roughly 1,000 ft with an unnamed tributary to Hebble Creek running between the two LFs. Land use for the area between the LFs is restricted access and is enclosed by a gated fenceline.

Currently, both LFs have low permeability caps (that meet or exceed the requirements of RCRA Subtitle D [40 CFR 258.61]), are covered with low vegetation, and contain monitoring wells (MWs), leachate extraction wells (EWs), landfill gas (LFG) collection wells, and LFG monitoring probes (MPs). Access to the LFs is restricted via fencing and locked gates with signage. LF10 is split into two areas, LF10 North and South, with LF10 North covering approximately 6.5 acres and LF10 South covering approximately 2.8 acres. Current photographs of LFs 8 and 10 are presented in **Appendix B**.

3.1.1 History of Contamination

LF8 operated from about 1947 until the early 1970s and received waste from Area B. Both general refuse and hazardous materials were disposed in the LF using trench-and-cover methods. The total volume of waste material buried in LF8 is estimated at 187,300 cubic yards (WPAFB, 1993a). LF10 operated from 1965 until the early 1970s, and received waste from all areas of WPAFB. Like LF8, both general refuse and hazardous materials were disposed in LF10 using trench-and-cover methods. The total volume of waste material buried is estimated at 171,600 cubic yards (WPAFB, 1993a).

3.1.2 Initial Response

Initial response actions taken at LFs 8 and 10 included the following:

- June 1989 – Dirt, gravel and lime were placed over a leachate seep closest to the Woodland Hills residential area.
- 1990 – Military housing units north of LF8 and east of LF10 adjacent to the LFs were vacated to eliminate the possibility of exposing them to methane and to minimize disruption to the residents during the scheduled RI.
- March 1991 – A passive temporary leachate collection system was installed along the northern and eastern slopes of LF10.
- 1992 – Selected housing units were reoccupied. Reoccupied units were equipped with continuous methane monitors.

A chronology of other important and relevant dates for the SCOU, including the Focused RI and Focused FS, is provided in **Table 3-1**.

3.1.3 Basis for Taking Action

The basis for taking action (implementing a remedial action at LFs 8 and 10) was to control the then current and potential risks posed by contamination migrating from the LFs. Significant chemical contamination was detected in the soil, leachate, and LF gases of LFs 8 and 10. A qualitative risk assessment was conducted for the SCOU. COCs that exceeded preliminary remediation goal(s) (PRG) are summarized in **Table 3-2**.

3.2 Remedial Actions

3.2.1 Remedy Selection

The remedial actions implemented at the SCOU addresses a portion of the overall remediation for LFs 8 and 10. The implemented remedy addresses the following environmental media and potential hazards:

- LF wastes and soils
- Leachate
- LF gases
- Ambient (breathing) air
- Private water sources.

The SCOU ROD does not address groundwater already affected by LFs 8 and 10 (i.e., down gradient). This potential hazard was addressed in the OSOU ROD, discussed in **Chapter 4.**

3.2.2 SCOU Remedial Action Objectives

Significant chemical contamination was detected in the soil, leachate, and LF gases of LFs 8 and 10. The COCs detected in the soil, leachate, and LF gases were found to be unevenly distributed throughout both LFs, which is to be expected from a trench-and-cover burial operation. Based on historical data and data collected during the RI, no extremely high and isolated contaminant concentrations were found that would indicate leaking buried containers or localized hazardous waste disposal areas. Furthermore, LFs 8 and 10 were found to be essentially the same in terms of the types and concentrations of contaminants. This conclusion is important in that the clean-up alternative selected for the SCOU is the same at both LFs.

The overall goal of the SCOU for remedial response actions at LFs 8 and 10 was to protect human health and the environment. The principal media and general remedial action objectives (RAOs) for the SCOU were as follows:

Media	General RAO
Soil/LF Contents	To prevent direct contact with and dermal absorption and ingestion of the contaminated soils and LF contents; to control surface water runoff, ponding, and erosion; to prevent or reduce infiltration and production of leachate; and to control dust emissions to meet ambient air exposure criteria.
LF Gas	To prevent inhalation of gases and the potential for explosion by controlling LF gases, and to meet ambient air exposure criteria.
Leachate/Leachate Seeps	To prevent COCs in leachate from migrating to surface waters and ground waters; to prevent dermal absorption and ingestion of this leachate; and to reduce/eliminate on-site leachate generation.

Media	General RAO
Private Wells (Ground Water)	To prevent ingestion, dermal absorption, and inhalation of contaminants.

To achieve these goals, Alternative 3 from the ROD was selected for the SCOU of LFs 8 and 10. Components of Alternative 3, as given in the SCOU ROD, included:

- Clay cap to limit surface water infiltration, leachate generation, LFG emissions, erosion, and contact with LF contaminants.
- Leachate collection through a system of EWs installed within and surrounding the LFs.
- Leachate treatment including metals removal, aerobic biological treatment, and micro-pollutant removal by carbon adsorption.
- Discharge of treated leachate into surface waters (specifically, an unnamed tributary to Hebble Creek) under a National Pollutant Discharge Elimination System (NPDES) permit.
- LFG collection and treatment using an enclosed ground flare.
- Long-term monitoring of leachate and LFG collection and treatment systems.
- Public water supplied to all private homes along Zink and National Roads.
- Access restrictions including fencing, warning signs, security patrols, and ICs (i.e., land-use restrictions).

The following changes have been made to the selected remedy:

- The proposed clay cap was replaced with an alternate barrier layer consisting of a geosynthetic clay liner and geomembrane.
- Leachate EWs were installed only within the landfill boundaries.
- The leachate management was changed from treating the leachate on site and discharging the treated effluent under a NPDES permit into the unnamed tributary to Hebble Creek to discharging the leachate directly to the City of Fairborn Publicly Owned Treatment Works (POTW), pursuant to an agreement with the City of Fairborn. This was determined to be a significant change to the remedy stated in the ROD; therefore, an ESD (WPAFB, 1997a) was prepared and approved to allow for this remedy deviation.
- Compliance levels for OU1 water were changed to be consistent with the MCLs presented for the GWOU (WPAFB, 2012a).

- Eliminated deed restrictions per the ESD, as long as WPAFB remains a facility owned by the federal government (WPAFB, 2012a). Further land-use controls include ECs (site controls) and ICs, which will be used to monitor and maintain the integrity of the selected remedy.

3.2.3 Remedy Implementation

The current remedial system at LFs 8 and 10 includes the landfill cap, LFG collection and treatment, and leachate collection/discharge system based on the design presented in the Design Package Number 1 Source Control Operable Unit Three Systems Design, Landfills 8 and 10, Wright-Patterson Air Force Base, Ohio (IT, 1994a). The LF caps, LFG collection and treatment system, and the leachate collection/discharge system were installed between October 1994 and September 1997. Final certification of completion was dated June 16, 1998. The leachate discharge pipeline to the City of Fairborn POTW was installed during May through June 1997. The following sections provide a summary description of the remedial systems.

3.2.3.1 LF8 and LF10 Cap System

The cap system installed at LFs 8 and 10 consists of the LF cap and the drainage system as specified by OEPA regulations for sanitary LF closure (OAC 3745-27-12), which meet the requirements of RCRA, Subtitle D (40 CFR 258). Placement of this cap system reduces direct contact with on-site contaminants and minimizes on-site contamination from spreading, by diminishing rainwater infiltration and erosion.

Site preparation activities consisted of the following:

- Grading to a maximum slope of 4:1 and a minimum slope of 5 percent to promote runoff and prevent erosion.
- Compaction of waste present in the trenches to reduce long-term settlement.
- Removal of waste materials in trenches located outside the LF cap boundaries.

The cap consists of a geosynthetic clay liner and a synthetic geomembrane as the primary components to minimize infiltration. A perimeter drain was installed to route infiltration through the vegetative layer, to the lined surface channels. Swales convey the run-off to storm drains that discharge into the existing water courses.

Further information concerning the constructed LF cap system is presented in the Independent Engineer's Certification Report for Operable Unit 1, Phase I (IT, 1997b).

3.2.3.2 Landfill Gas Collection and Treatment System

The LFG collection and treatment systems installed at LFs 8 and 10 are designed to remove and dispose, in an environmentally sound manner, the gas generated within the LFs, and to collect the condensate produced from the gas extraction process. Installation and operation of LFG collection and treatment systems are necessary to comply with laws and regulations, and to mitigate concerns arising from LFG generation. Primary concerns regarding LFG generation include fire, explosion, health hazards, and odor.

The LFG collection and treatment systems consist of the following major components:

- Vertical gas EWs
- Horizontal gas vent layer
- LFG collection header and piping system
- Condensate collection lines and sumps
- Extraction blower and ancillary equipment
- Flare system
- Gas barrier trench (GBT), which runs along the eastern boundaries of LF10 North and South (the GBT is a secondary system to the primary LFG collection system).

Each of these major components is described in the Operable Unit 1 – Landfill 8 and 10 Final Operation and Maintenance Plan (Kelchner, 1997). In addition, the system is monitored via permanent monitoring probe and punchbar locations (one location at LF8 and 14 locations at LF10), which are shown on **Figures 3-2** and **3-3**. Punchbar locations provide added monitoring data in areas near utility lines or other potential vapor conduits.

3.2.3.3 Leachate Collection System

The leachate collection system installed at LFs 8 and 10 is designed to remove, in an environmentally sound manner, the leachate generated within the LFs. Installation and operation of the leachate collection system is necessary to comply with laws and regulations and to mitigate concerns arising from leachate generation and movement.

The leachate collection system consists of the following major components:

- Leachate collection wells (both within and along the perimeter of the LFs), as shown on **Figures 3-4** and **3-5**
- Well pumps
- Leachate transfer system

Each of these major components is described in the Operable Unit 1 – Landfill 8 and 10 Final Operation and Maintenance Plan (Kelchner, 1997).

3.2.3.4 Leachate Treatment and Disposal

Consistent with the ESD discussed in **Section 3.2.2**, a 2-inch-diameter high-density polyethylene (HDPE) force main was installed from the main leachate collection sump to a Fairborn sanitary sewer manhole along Zink Road, south of the site. The leachate then flows to the City of Fairborn POTW for treatment. Leachate going to the City of Fairborn POTW must comply with the water quality requirements specified in the City of Fairborn discharge approval letter to WPAFB (Fairborn, 2014).

3.2.3.5 Engineering and Institutional Controls

ECs limiting access to the LFs include fencing around the perimeter of each LF, with locked gates and signage (see site photographs, **Appendix B**). ECs are maintained by the LF operation and maintenance (O&M) contractor in accordance with a maintenance contract administered by the AF. In addition to the ECs, WPAFB implements various ICs to ensure that land use at LFs 8 and 10 remains restricted and to maintain the integrity of the remedial action. These ICs include:

- The land use of LFs 8 and 10 will remain as industrial use only.
- Review of plans, designs, and specifications for on-base construction by WPAFB IRP personnel.
- Submittal and approval of AF Form 103 (Base CE Work Clearance Request) to the IRP personnel prior to anyone excavating or digging anywhere within base boundaries.
- Submittal and approval of AF Form 813 (Request for EIAP) for review/approval to assess the potential environmental impact of any action proposed at WPAFB.
- Entering all ROD use limitations and exposure restrictions and IRP site locations into the Installation Development Plan (IDP) and the Geographic Information System (GIS) for WPAFB.
- Reevaluation of each IC during the five-year review period for continued protectiveness of human health and the environment.

- Inspection of sites to determine land use and condition of site controls in place, ensure that the land uses identified in the RODs are maintained, and verify that land use activities remain compatible with underlying risk assessment assumptions.

These ICs and ECs are currently summarized and documented in the ESD (WPAFB, 2012a).

3.2.4 System Operation and Maintenance

The three primary concerns regarding the long-term performance of the LFs 8 and 10 cover are erosion, settlement, and water ponding. This section describes the manner by which the LFs are monitored to detect and repair problems associated with these three conditions. A maintenance contractor inspects LFs, performs O&M activities, and reports on conditions in monthly status reports to WPAFB. The following sections summarize O&M requirements.

3.2.4.1 Erosion Control

Many erosion control materials are in place to help prevent or slow down the occurrences of erosion. These items are trees, bushes, berms, drainage control, and a well-established turf over the entire area of LFs 8 and 10. Along with natural erosion control, there have also been man-made features added to help prevent erosion including perimeter ditches lined with gravel, running entirely around LF10 North and LF10 South. LF8 has a lined perimeter ditch about two-thirds of the way around covering all sides, except for the west side. The west side of LF8 has an elevation higher than the remaining sides and a double diversion ditch. Inside the three perimeter ditches there are storm drains, which collect the water and distribute it to the drainage culverts.

3.2.4.2 Settlement Monitoring

The general fill and topsoil components of LFs 8 and 10 were placed and compacted in a manner designed to prevent settlement. To determine if post construction settlement has occurred, settlement monuments were installed on the LFs. A total of eight monuments were installed; three on LF8, two on LF10 South, and three on LF10 North. These monuments are periodically surveyed to determine if post construction settlement is occurring. The last settlement monitoring was conducted in September 2017. The results of the survey are discussed in **Section 3.4.4.1**.

3.2.4.3 Surface Water Management

The LFs and adjacent areas were graded to direct surface runoff toward the drains installed in the perimeter swale around each LF. Surface water runoff from LF8 is ultimately discharged into the unnamed tributary, between LF8 and LF10 South via storm drains and a rip-rap filled swale. Runoff from LF10 North is ultimately discharged into a drainage ditch on the west side of Shields Avenue, near the intersection of Shields Avenue and Kauffman Avenue. Runoff from LF10 South is ultimately discharged into the unnamed tributary between LFs 8 and 10. Down-drains take runoff from the top of each LF and divert it to the storm drain system for each LF. Perimeter drains take the water coming off the HDPE liner and route it to the perimeter swales. Rip-rap was placed at the outfall of each of the perimeter drains to prevent erosion.

3.2.4.4 Landfill Gas Collection and Treatment System

The purpose of the OU1 explosive gas monitoring is to determine the effectiveness of the LFG collection system in establishing a capture zone that extends outside the LF boundaries, so that migration of explosive gas beyond the LF boundaries is prevented (Kelchner, 1997; IT, 1998a). Methane is combustible at concentrations in air between 5 and 15 percent. As noted in the initial Five-Year Review (IT, 2000), additional monitoring points were installed at the northern limits of LF8 to verify gas limits, in response to the presence of combustible gases observed in several wells during monitoring in 1998. Additional punchbar monitoring locations were also selected for the vicinity of wells with elevated methane readings and adjacent to the surrounding houses. Punchbar monitoring is conducted by creating small-diameter boreholes, approximately 2-ft in depth, with a slide hammer and rod, then measuring the soil vapor in the open borehole with a hand-held gas analyzer.

The northern portion of the GBT, located along the eastern boundary of LF10, has, in the past, intermittently collected water. During these times methane levels were not monitored at this point. The southern portion of the GBT has consistently remained dry. The GBT was designed as a secondary system as a backup to the primary LFG collection system. Although it was intended as an additional protective measure and not as an LFG collection device, the GBT was connected to the LFG system in May 1999 due to high methane levels in LF10 MPs (IT, 2000). The GBT remains effective in collecting subsurface methane gas along the LF10 northeastern boundary and is evacuated twice per week by the LF O&M contractor. Over this five-year period, methane concentrations in the southern portion of the GBT have ranged from 7.9 to 53 percent and greater than 100 percent of the lower explosive limit (LEL) for methane (5 percent). Methane was not detected above the LEL at the northern GBT monitoring point during this five-year period (APTIM, 2019b).

3.2.4.5 Leachate Collection System

The leachate collection system is monitored by measuring groundwater levels, so as to evaluate the impact of the extraction system on the water levels in the vicinity of the LFs. The Design Package Number 1, Final (100%) Design (IT, 1994a) states that “the leachate collection system shall establish a capture zone that extends outside the LF boundaries, as determined by groundwater level measurements." These groundwater level measurements are taken quarterly, and reported as part of the LTM Program.

The goal of the extraction system at LF8 is to provide capture on the downgradient portion of the LF (east and northeast sides) that prevents migration of the dilute leachate and groundwater passing through and under LF8. As the regional groundwater flow direction in this area is from west to east, the EWs have been configured at the downgradient boundary of the LF, providing the necessary capture. As noted in the previous Five-Year Reviews (IT, 2000, Shaw, 2006, WPAFB, 2011, and WPAFB, 2016a), wells in the central portion of LF8 (EW-0810, EW-0812, EW-0816) occasionally become fouled with biomass that prevents adequate capture. WPAFB has increased operation and maintenance efforts on these wells to improve the effectiveness of the pumping system. As noted in the Draft Annual LTM Report: 2019 (APTIM, 2019b), the extraction wells at LF8 are working effectively and capture is occurring along the eastern and northern boundaries of LF8 (APTIM, 2019b). Effective capture was achieved during this five-year period.

The goal of the extraction system at LF10 is to maintain groundwater levels below the elevation of the bottom of the LF, in order to prevent groundwater from mixing with the waste at the LF. LF10 represents a local hydrologic high point, where groundwater from outside the LF does not contribute substantially to leachate generation. Therefore, by controlling the groundwater levels, the impact of the LF10 leachate on the environment is minimized. The effectiveness of the LF10 extraction system is evaluated by comparing the elevation of the water-table to the elevation of the LF bottom. The system is achieving the stated goal, as long as the water-table is below the LF bottom. The EWs serve the purpose of lowering the water-table rather than creating a uniform capture zone under LF10. During the past five years all LF10 extraction wells have maintained the groundwater level below the LF bottom.

3.2.4.6 Leachate Effluent Monitoring

To comply with the conditions specified in the City of Fairborn sewer discharge permit, one sample per quarter is collected from the discharge line of the effluent collection system and analyzed for volatile organic compounds (VOCs), inorganics, oil and grease, total suspended solids, chemical oxygen demand (COD), and pH.

3.3 Progress Since the Last Five-Year Review

Recommendations for LFs 8 and 10 presented in the previous Five-Year Review (WPAFB, 2016a) included:

- Evaluate if the elevated arsenic concentrations are naturally occurring by collecting dissolved (filtered) metals samples from the LFs 8 and 10 MWs that have historically exceeded the arsenic MCL. In addition, conduct a geochemical evaluation to determine if elevated concentrations of detected metals in groundwater are naturally occurring or COCs.

- Continue to monitor decreasing vinyl chloride (VC) concentrations in LF8 monitoring wells LF08-MW10B and 02-DM-83S-M that have historically exceeded the MCL. If VC concentrations should show an increasing trend in these wells, evaluate the need for additional investigation.

- Replace well 01-004-M (elevated iron oxide sludge and arsenic) with a polyvinyl chloride (PVC) well.

- Maintain the aggressive cleaning and maintenance schedule for the EWs. In addition, evaluate the performance of EW-0812 to improve effectiveness. Continue monitoring to evaluate whether hydraulic capture is being maintained.

- Continue water level monitoring bimonthly in problem wells to provide quicker response to issues that affect the efficient operation of the extraction wells.

- Monitor elevated methane concentrations in soil gas MPs LF8-MP009, LF8-MP010, and LF8-MP011 by sampling methane monitoring device and mitigation systems located in the vicinity of 5 and 7 DuPont Way.

- Continue quarterly vacuum pressure monitoring and annual sub-slab soil vapor monitoring at 5 DuPont Way to ensure the soil vapor mitigation system is performing as designed.

- Investigate the differential settlement of LF10 and make recommendations for a corrective remedy.

- Complete periodic surveys of the tops of casings and ground surface elevations for all OU1 EWs to establish any changes in well head elevations and to ensure accurate groundwater elevations.

- Place deed restrictions on the property if the property is ever transferred out of federal ownership. WPAFB will submit to the agencies a ‘Notification of Transfer’ at least 6 months prior to any transfer or sale of the property but no less than 60 days (WPAFB, 2012a).

Investigations, evaluations, and actions taken regarding LFs 8 and 10 since the preceding Five-Year Review (WPAFB, 2016a) include the following:

- Compared dissolved (filtered) arsenic concentrations from the spring 2013 LTM sampling event to total (unfiltered) arsenic concentrations. Based on the results of the two types of metals samples (**Table 3-4**), it was determined that the dissolved component of arsenic makes up the majority of the total arsenic concentration in all wells and is approximately equal to or greater than the groundwater concentration of 8.6 µg/L (IT, 1996a). Analytical data from the LTM Program sampling at LFs 8 and 10 (APTIM, 2019b) indicate that arsenic concentrations have a direct correlation with iron concentrations, likely due to adsorption by iron oxide (Pierce and Moore, 1980). According to the USEPA Science Inventory article *Mobility of Arsenic Containing Iron Oxides in Environmental Systems*, "Because arsenic is geologically correlated with iron, it is common to find elevated concentrations of iron in waters which exceed the arsenic MCL" (USEPA, 2008). It was therefore concluded that arsenic is considered naturally occurring throughout much of the LFs 8 and 10 area or is associated with deteriorating stainless-steel wells.

- Evaluated VC concentrations in LF8 monitoring well LF08-MW10B and 02-DM-83S-M. For this five-year period, VC concentrations in well LF08-MW10B have decreased and remained stable at approximately 3 µg/L (above the MCL of 2 µg/L). VC concentrations in well 02-DM-83S-M slightly increased over the last five-year reporting period (2.5 µg/L in April 2019), which is above the MCL. Therefore, additional investigation for VC contamination in this area is not required.

- Redeveloped well 01-004-M; during the spring 2018 LTM sampling event to evaluate the need for replacement. Results of the spring 2018 sampling event are shown in **Table 3-5** and indicated that arsenic is below detection levels and the well does not need to be replaced.

- Continued an aggressive cleaning and maintenance schedule to prevent biomass fouling and siltation problems within the EW system. This aggressive maintenance has been successful in maintaining capture at the landfills.

- Investigated and remediated elevated methane concentrations occurring in the vadose zone in the vicinity of landfill gas monitoring probe LF8-MP010 at the eastern end of DuPont Way (**Figure 3-2**). The investigation included the installation of: five additional landfill gas MPs, one soil vent (PSV-1 [abandoned]), and two exploration trenches with soil vapor vents (PSV-2 and PSV-3), near 5 and 7 DuPont Way (see **Section 3.4.4.5**); the MPs replaced punchbar landfill gas monitoring in the vicinity of 5 and 7 DuPont Way.

- Continued implementing land-use controls including ECs (site controls) and ICs, which will be used to maintain the integrity of the selected remedy.

- Conducted a settlement survey at LFs 8 and 10 on established settlement monuments at the landfills (September 2017). Issued Technical Memorandum relating to landfill settlement surveying inconsistencies (Versar, 2017).

- Regularly removed and repaired extraction pumps, to maintain performance.

- Refurbished extraction well screens.

- Measured water levels in LFs 8 and 10 extraction wells (**Figure 3-4**) monthly to ensure effective operation.

- Maintained erosion control measures.
- Maintained vegetation growth on the LFs and surrounding areas.
- Continued annual sub-slab soil vapor sampling at 5 DuPont Way to verify the sub-slab soil vapor mitigation system was working as intended. No other residences had VOC exceedances; therefore, mitigation at other locations was not warranted.
- Conducted sub-slab vacuum pressure testing at 5 DuPont Way to verify operation of sub-slab soil vapor mitigation system.
- Evacuated the GBT with the gas collection system as part of normal O&M practices to reduce the accumulated methane levels at the south end of the GBT.

3.4 Five-Year Review Process

The five-year review was completed following USEPA guidance in Comprehensive Five-Year Review Guidance (USEPA, 2001). This section provides a summary of the process used to complete the five-year review for the SCOU remedy.

3.4.1 Administrative Components

The five-year review process was initiated by WPAFB IRP AFCEC/Environmental Directorate Operations Division (CZO). The five-year review process is managed by AFCEC/CZO with regulatory oversight by USEPA and OEPA. The review schedule was established by the review team and included the following components:

- Community Involvement
- Document Review
- Data Review
- Five-Year Review Report Development and Review.

3.4.2 Community Involvement

The USEPA's Office of Solid Waste and Emergency Response (OSWER) guidance No. 9355.7-03B-P, Notification Requirements for Five Year Reviews, specifies a draft public notice of initiation of the review should be published initially identifying to the community that a five-year review will be conducted. An initiation notice was published in the Dayton Daily News legal section on June 4, 2020, notifying the community that the Fifth Five-Year Review for WPAFB is currently being conducted. The initiation notice was posted at the following online link: https://classifieds.daytondailynews.com/ads/public-notices/legal-notice/notice-of-initiation-of-the-five-year-record-626812.

After USEPA and OEPA concur on the final report, a notice for formal public review will be placed in the Dayton Daily News. A copy of the CERCLA Five-Year Review Report will be provided to the WPAFB Restoration Advisory Board (RAB) stakeholders and added to the Administrative Record at the WPAFB IRP office, as well as the Information Repository located at Wright State University, 3640 Colonel Glenn Highway, Dayton, Ohio.

3.4.3 Document Review

The five-year review for the SCOU at LFs 8 and 10 consisted of a review of the following documents:

- Record of Decision Source Control Operable Unit Landfills 8 and 10 (WPAFB, 1993a)
- Monthly Progress Reports, Operable Unit 1, Landfills 8 and 10 (CAM, 2015-2019b)
- Annual LTM Reports from 2015 to 2019 (CB&I, 2015–2016; APTIM, 2017–2019; APTIM, 2019b)
- Explanation of Significant Differences: Source Control Operable Unit – Landfills 8 and 10 (WPAFB, 1997a)
- Final Fourth Five-Year Record of Decision Review Report (WPAFB, 2016a)
- Final Technical Site File Document for Operable Unit 1 (Shaw, 2008)
- Explanation of Significant Differences: Source Control Operable Unit - Landfills 8 and 10; Off-Source Operable Unit and Final Remedial Action Landfills 8 and 10; 21 No Action Sites; Spill Sites 2, 3, and 10 (Operable Unit 2); 41 No Action Sites; and Groundwater Operable Unit (WPAFB, 2012a).

3.4.4 Data Review

3.4.4.1 LF8 and LF10 Cap System

Data presented in the monthly O&M reports for the LFs 8 and 10 were reviewed. There have been no sustained erosion problems on the LFs or surrounding areas that were not readily repaired. Some settlement has occurred on LF10-South and at the south end of LF10-North, but water ponding is not occurring. Settlement monuments at LFs 8 and 10 (shown on **Figure 3-1**) were surveyed in September 2017. These values were compared to the 1997, 2006, and 2010 survey data as shown below:

Monument	Top of Pin 1997	Top of Pin 2006	2006(1) Settlement (ft)	Top of Pin 2010	2010(1) Settlement (ft)	Top of Pin 2017	2017(1) Settlement (ft)
SM-08-01	950.72	950.68	0.04	950.63	0.09	950.59	0.13
SM-08-02	950.04	949.83	0.21	949.81	0.22	949.62	0.42
SM-08-03	939.27	938.77	0.50	938.69	0.58	938.41	0.86
SM-10-01	920.34	919.61	0.73	919.38	0.96	919.12	1.22
SM-10-02	920.18	919.25	0.93	919.13	1.05	918.77	1.41
SM-10-03	911.46	910.96	0.50	910.93	0.53	910.79	0.67
SM-10-04	895.49	895.21	0.28	895.33	0.16	895.31	0.18
SM-10-05	867.16	866.47	0.69	866.41	0.75	866.11	1.05

(1) = Total settlement since 1997.

These results were presented in a Technical Memorandum on the findings of LFs 8 and 10 Monthly Operating Reports (Versar, 2017). The technical memorandum concluded that the new settlement data is representative of normal LF settlement and that the previous set of elevation data was in error.

3.4.4.2 Leachate Collection System

The LF8 leachate collection system consists of seven extraction wells along the eastern side of the landfill, which collect groundwater traveling from west-to-east across the landfill. This system also helps to lower the groundwater table to beneath the landfill contents, thereby reducing leachate generation. Performance of the leachate collection system is determined by measuring groundwater levels to evaluate the effectiveness of the extraction system for lowering the water levels in the vicinity of the LFs. Water levels in the LFs 8 and 10 monitoring well network are measured on a quarterly basis, and are incorporated into a particle track model as part of the capture zone analysis. These results are then presented in the annual LTM reports. Quarterly results of the particle track modeling are summarized in the following table:

Landfill 8 Leachate Capture Evaluation: Spring 2015 to Fall 2019

Measurement Year and Quarter	Is Capture Occurring?						
	EW-0801	EW-0803	EW-0805	EW-0807	EW-08010	EW-0812	EW-0816
2015 Spring	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2015 Summer	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2015 Fall	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2016 Winter	Yes	Yes	Yes	Yes	No	Yes	Yes
2016 Spring	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2016 Summer	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2016 Fall	Yes	Yes	Yes	Yes	No	Yes	Yes
2017 Winter	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Measurement Year and Quarter	Is Capture Occurring?						
	EW-0801	EW-0803	EW-0805	EW-0807	EW-08010	EW-0812	EW-0816
2017 Spring	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2017 Summer	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2017 Fall	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2018 Winter	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2018 Spring	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2018 Summer	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2018 Fall	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2019 Winter	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2019 Spring	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2019 Summer	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2019 Fall	Yes	Yes	Yes	Yes	Yes	Yes	Yes

As shown in the chart above during this five year period, groundwater capture and hydraulic containment across the entire eastern boundary of LF8 was achieved during all quarters with the exception of two occasions at well EW-0810. On both occasions, the O&M contractor was notified and pumps were inspected, cleaned, repaired as needed, and returned to normal operation. During the winter 2016 quarter, the malfunction was due to an air leak, which was repaired 2 days later. The fall 2016 occurrence was due to sediments and biomass fouling of the pump. The EWs are monitored monthly by the LF O&M contractor to ensure effective operation.

The short-term loss of capture from the pumping malfunctions does not, however, affect continuing hydraulic containment provided by the LF8 extraction wells. Due to the low groundwater flow rate of the compacted soil at LFs 8 and 10 that was estimated to have the hydraulic characteristics of silt (estimated hydraulic conductivity of 0.03 ft/day), the potential for off-site migration of contaminants is low during the relatively short time the wells were off-line for inspection, cleaning, maintenance, repair and testing and not capturing leachate. In addition, as shown in the cross-section and potentiometric surface maps in the annual LTM reports, the water table was below the base of the landfill material, thus reducing the likelihood of generating leachate. Leachate water quality data are further discussed in **Section 3.2.3.3**.

To evaluate if there has been an increase in infiltration or leachate production that would suggest the cap system at LF8 is not performing as designed, **Figure 3-6** compares the yearly average water levels to the total precipitation in the area for the years 2015 through 2019. The yearly water level averages are based on the quarterly LTM Program monitoring and the precipitation totals obtained from the National Oceanic and Atmospheric Administration (NOAA) National Weather Service website. While there are some similarities in the trend lines, an overall correlation between precipitation and water levels is not apparent, thus suggesting that higher precipitation periods do not cause increased infiltration. Therefore, the LF8 cap system is functioning as designed.

At LF10, the objective of the leachate collection system is to keep groundwater below the bottom of the LF material. Review of the groundwater levels at LF10 indicates that EW performance consistently maintains water levels at the target levels with only intermittent interruptions. During this five-year period, water level rose above the bottom of the fill material in LF10 in wells EW-1003 (April and July 2019), EW-1011, (April 2015, April 2017, April 2019), and EW-1015 (April 2019). System problems periodically arise, causing well efficiency to decrease, resulting in insufficient water being pumped to keep groundwater below the LF material. To address these difficulties, WPAFB has embarked on aggressive maintenance program including pump and well cleaning. Based on observations since the last five-year review, the maintenance program is successful in meeting the leachate collection system objective.

3.4.4.3 Leachate Treatment and Disposal

Due to the nonhazardous quality of the leachate collected from LFs 8 and 10, no treatment was necessary prior to discharge off-site to the City of Fairborn POTW facility. To comply with the conditions specified in the City of Fairborn sewer discharge permit, one sample per quarter is collected from the effluent discharge line of the leachate collection system. The quarterly analytical data are presented to the Water Projects Coordinator for the City of Fairborn to confirm compliance with the discharge permit. Monitored discharge parameters consist of VOCs, inorganics, oil and grease, total suspended solids, COD, and pH. All concentrations of the detected parameters have been below City of Fairborn requirements with the exception of arsenic, which has infrequently and temporarily exceeded the discharge requirement. These temporary exceedances of arsenic are typically associated with low water levels in the leachate collection sump, which concentrates the suspended solids in the collected leachate. At times of low water in the sump, the sump pump must be manually activated. If an exceedance occurs it is first reported to WPAFB IRP personnel and the landfill maintenance contractor to verify that all extraction wells are operating effectively. When the system has been verified as operating properly, a confirmation leachate sample is collected. The quarterly City of Fairborn effluent sampling analytical results for this 5-year reporting period are provided in **Table 3-3**.

3.4.4.4 LTM Data

In accordance with the approved Technical Site File Document (TSFD) for OU1 (Shaw, 2008), groundwater sampling for remedial action monitoring is conducted annually in the spring. The

TSFD reduced the analyte list to VOCs and total target analyte list (TAL) metals. Every fifth year (last sampled in April 2017), the analytes for semi-volatile organic compounds (SVOCs), pesticides, and polychlorinated biphenyls (PCBs) are included. Dioxin sampling was eliminated in October 2007 (Shaw, 2008). Further, the ESD (WPAFB, 2012a) requires that LTM data for OU1 is now only compared to USEPA MCLs, which is consistent with the remainder of the LTM Program. There are no longer specific OU1 compliance levels.

LF8

Over the past five years of LTM at LF8, the only parameters to exceed MCLs in the MW network (**Figure 3-4**) were VC and the inorganic element arsenic (CB&I, 2015-2016, APTIM, 2017-2020, APTIM, 2019b). **Table 3-4** presents a summary of the LF8 sampling results. As seen in **Table 3-4**, VC has exceeded the MCL (2 μg/L) in two wells (LF8-MW10B and 02-DM-83S-M) during the last five years. VC exceeded the MCL in well LF8-MW10B during each of the past five years and VC exceeded the MCL in well 02-DM-83S-M during the spring 2019 LTM sampling event, the first time since April 2012.

Arsenic was detected above the MCL (10 μg/L) in six LF8 MWs with the highest concentration observed in the April 2019 monitoring event in well LF08-MW08A (66.6 μg/L). In April 2013 dissolved metals samples (filtered) were collected from selected wells to determine which phase the metals were primarily occurring in. It was determined from the results that highest concentrations of arsenic were occurring in the dissolved phase. The elevated arsenic concentrations are typically associated with elevated iron concentrations. Attachment of arsenic to an iron oxide surface is an example of an adsorption reaction. Therefore, the arsenic is thought to be naturally occurring and is not considered a COC.

During the spring LTM 2018 sampling event, arsenic and lead were detected at concentrations just over the MCLs of 10 µg/L and 15 µg/L, respectively, in OU1 monitoring well LF08-MW103, and lead only exceeded the MCL in well LF08-MW101. The cause of the elevated arsenic and lead is likely due to the high turbidity of the samples. During the spring 2019 LTM sampling event, additional and slower purging was conducted for both wells. Turbidity remained high in well LF08-MW101 (146 nephelometric turbidity units [NTUs]) but lead was reduced to 13.7 µg/L and just below the MCL (15 µg/L). In well LF08-MW103 turbidity was reduced from 164 NTUs in the spring 2018 LTM sampling event to 18 NTUs. As a result of the purging leading to lower turbidity, arsenic and lead concentrations in well LF08-MW103 were reduced from 12.9 and 17.1

µg/L, respectively, in the spring 2018 to 2.5J µg/L (estimated) and below detection limits, respectively, in the spring 2019.

LF10

Over the past five years of LTM at LF10, the only parameter to exceed the MCLs in the MW network (**Figure 3-5**) was the inorganic element arsenic. **Table 3-5** presents a summary of the LF10 sampling results. As seen in **Table 3-5**, arsenic was detected above the MCL (10 µg/L) in six LF10 wells over the past five years. The highest concentration of arsenic was detected during the April 2017 event at 181 µg/L in MW 01-004-M (**Table 3-5**). In addition, well 01-004-M is often fouled by a thick iron oxide sludge that prevents effective purging prior to sampling and may require replacement.

SVOCs, Pesticides, and Polychlorinated Biphenyls (PCBs)

SVOCs, pesticides, and PCBs were not detected in the April 2017 five-year monitoring event (APTIM, 2017-2020). Pesticides and PCBs have not been detected in any OU1 MWs since the LTM began in fall 1996.

3.4.4.5 Landfill Gas Collection and Treatment System

To verify the effectiveness of the LFG collection system, the LFs 8 and 10 LFG monitoring networks (**Figures 3-2** and **3-3**) are monitored semiannually. LFG monitoring data presented in the LTM reports were reviewed. Based on soil gas monitoring results, the LF8 LFG collection system continues to operate effectively over the LF. However, soil gas monitoring results at permanent soil gas probe LF8-MP010 (screened interval: 5 to 14 ft bgs) located outside the landfill boundary (**Figure 3-2**) had elevated methane levels at sustained concentrations of 11.8 and 10.5 percent in spring and fall 2018, which exceeded the LEL of 5 percent for methane (APTIM, 2019b). Adjacent monitoring points LF8-MP009 and LF8-MP011 are screened from 5 to 20 and 5 to 15 ft bgs, respectively, and have not had elevated methane detections.

To ensure that methane has not migrated to the sub-slab below the residential dwellings surrounding monitoring probe LF08-MP010, two permanent soil vapor probes were installed: LF08-MP010A was installed adjacent to the back wall of 7 DuPont Way in April 2018 and LF08-MP010B was installed near the western corner of 5 DuPont Way in September 2018. Methane was not detected in probe LF08-MP10A during the spring or fall 2019 LTM monitoring events, however, in the spring 2019 methane was detected in LF08-MP10B at a concentration of 7.9 percent, which exceeded the LEL. The elevated methane readings in LF08-MP10B initiated a Notice of Violation (NOV) from OEPA and additional permanent soil vapor probes were installed along the landfill perimeter as discussed in **Section 3.4.4.5**. Subsequently, a Resolution of Violation (ROV) was issued by OEPA upon successful completion of the response actions taken and sampling was reduced to monthly.

Punchbar locations LF08-PT10A, LF08-PT10B, and LF08-PT10C (located in the vicinity of the front of the house at 7 DuPont Way) are no longer monitored. Punchbar locations were sampled to a depth of approximately 1.5 and 2 ft bgs to provide added monitoring data in areas near utility lines or other potential shallow soil gas conduits. Methane/explosive gas has not been detected at any of the punchbar locations. Also, due to the proximity of LF8, a methane monitor was installed in 7 DuPont Way (**Figure 3-2**) and is inspected quarterly. In addition, a multimedia investigation was conducted in 2012 in and around the residences on DuPont Way (as well as Welcome Way) and no methane was detected in the sub-slab sampling (Shaw, 2013a).

Because chloroform was detected above the Ohio Department of Health (ODH) screening levels in sub-slab soil vapor and indoor air samples during the 2012 multimedia investigation, an indoor air (i.e., sub-slab soil vapor) mitigation system was installed at 5 DuPont Way. Its performance is monitored with annual sub-slab soil vapor monitoring within the residence. To verify that the mitigation system is creating a vacuum, the manometer is inspected on a quarterly basis. During this period, the chloroform concentrations from sub-slab sampling (**Table 3-6**) were below the ODH screening levels, which indicates the sub-slab soil vapor mitigation system has reduced VOC concentrations to below regulatory levels and is operating as designed.

The LF10 primary LFG collection system continues to operate effectively over the LF. The GBT, a secondary LFG collection system, is located along the eastern boundary of the LF (**Figure 3-3**) and was connected to the LFG system in May 1999 due to high methane levels in LF10 monitoring points (IT, 2000). Gas monitoring in the GBT conducted semiannually over this five-year period indicates that although methane was detected in the south end of the GBT, methane was not detected in the surrounding soil vapor monitoring points or the punchbar locations. Therefore, the GBT is performing its intended function of preventing methane migration away from the landfill.

Notice of Violation Response

On 17 April 2019, WPAFB notified OEPA of methane concentrations above 100 percent of the LEL near residential structures located at 5 and 7 DuPont Way, and adjacent to the LF8 northeastern boundary. On 17 April 2019, OEPA issued a NOV related to the methane exceedances and violation of ORC 3734.041(C) and OAC 3745-27-12. The following actions were taken by WPAFB in accordance with the NOV (OEPA, 2019b):

- Installed methane detectors with alarms in residences 1, 2 , 4, 6, 10, 11, 14, 15, 18, 19, 22, and 23 DuPont Way (19 April 2019).
- Submitted Draft DuPont Way Contingency Plan, near Landfill 8, Wright-Patterson AFB (WPAFB, 24 April 2019).
- Beginning 22 April 2019, conducted daily methane readings at test points LF08-MP10, LF08-MP10A, and LF08-MP10B. The daily readings were compiled in an Excel spreadsheet for distribution.
- Installed a sub-slab vapor extraction system at 7 DuPont Way. This was completed on 24 April 2019.
- Submitted Draft LF008 Methane Extraction System Evaluation Plan, DuPont Way Methane Excursion (WPAFB, 24 April 2019).
- Installed new test point LF08-MP10C between LF8 and LF08-MP10 (30 April 2019).
- Operated the LFG collection system blower (without the flare) continuously from 09 May to 27 May 2019 to reduce methane concentrations at LF8 and LF10. This was not effective for the DuPont Way locations.
- Installed passive soil vapor vent well (PSV-1) in vicinity of LF08-MP10B (30 May 2019). Soil vapor vent PSV-1 was abandoned and two additional soil vapor vents (PSV-2 and PSV-3) were subsequently installed in exploration trenches (**Figure 3-2**).
- Completed installation of new monitoring points MP010D and 010E, trench in backyard for 5 DuPont Way, and trench in backyard for 7 DuPont Way (7 through 8 August 2019).
- Completed five macro-core borings in backyard of 7 DuPont Way (12 August 2019).
- Collected methane readings at all test points, results were below LEL for methane (29 August 2019).
- Received an ROV from OEPA (27 September 2019).
- Submitted final report of the NOV investigation in the document entitled Versar Response Actions, Ohio EPA Notice of Violation, Landfill Gas Exceedances at Landfill 8 (dated 17 April 2019) Final Report (Versar, 2020).

The final report concluded that the absence of methane approaching the LEL in the three monitoring points (LF08-MP10C, LF08-MP10D, and LF08-MP10E) along the perimeter of LF008 and outside of the fence line is evidence that the landfill is not the source of the methane measured in the backyards at 5 and 7 DuPont Way. The data strongly suggest that source of methane is located in the backyards at 5 and 7 DuPont Way near LF08-MP010. This is supported by the presence of buried trash and debris (e.g., pieces of metal, glass, wire and plastic and lumber) found during excavation of the trenches at 5 and 7 DuPont Way.

Resolution of Violation Continued Monitoring

The OEPA Resolution of Violation letter dated September 27, 2019, stated that WPAFB had 'mitigated the methane gas in between the landfill boundary (LF8) and the residences' thus, resolving the Notice of Violation. To ensure that the DuPont Way residences remain protected and explosive gas is contained at the respective point of compliance (the LF boundary) as defined in the ROD, OEPA has required WPAFB to conduct the following actions as part of the ROV:

- Continue operating the sub-slab vapor extraction systems at 5 and 7 DuPont Way.
- Continue monthly monitoring of the methane MPs installed between the LF boundary and the residences (5 and 7 DuPont Way) until December 31, 2019. At that time, OEPA will address whether to decrease the frequency.
- Provide monthly monitoring results to the OEPA, as described above, plus other related activities at DuPont Way/ LF8, by the 7th of the following month. If any results measured during this timeframe increase to a concentration above 100 percent of the LEL, the OEPA must be notified immediately.

3.4.4.6 Changes to Monitoring

The ESD for the six RODs (WPAFB, 2012a) changed the compliance level for OU1 water quality and made it consistent with the remainder of the LTM program. The compliance levels are now the USEPA MCLs for the relevant COCs. No other significant changes were made during this five-year period.

3.4.5 Site Inspection

The LF O&M contractor routinely inspects the various components of the site remedy (cap, drainage system, leachate collection system, and LFG collection/treatment system) and ECs in place at LFs 8 and 10, in accordance with a maintenance contract administered by the IRP office at WPAFB. Site inspections were conducted during this review and summaries of the inspections and ECs in place are provided in **Table 3-7**. During the site inspection photographs were taken that show the LF fencing and signage in place (**Appendix B**). There has been no change to site conditions since the last five-year review.

3.4.6 Interviews

The following community members were interviewed regarding the status of the remedy at LFs 8 and 10, to determine if any additional actions or concerns had occurred:

- Jeff Jones, CAM
- Justin Hall, CAM

The records of the interviews are included in **Appendix B**. As indicated on the forms, no concerns were raised regarding LFs 8 and 10.

3.5 Technical Assessment

The primary goal of the five-year review is to determine whether the remedy at a site is protective of human health and the environment, to provide a framework for organizing, evaluating data and information, and to ensure that all relevant issues are considered when determining the protectiveness of the remedy. USEPA guidance lists three questions to consider. The questions are as follow:

> **Question A:** Is the remedy functioning as intended by the decision document (DD)?
>
> **Question B:** Are the exposure assumptions, toxicity data, cleanup levels and RAO used at the time of the remedy still valid?
>
> **Question C:** Has any other information come to light that could call into question the protectiveness of the remedy?

The following sections provide responses to the questions for the SCOU ROD review.

3.5.1 Question A: Is the remedy functioning as intended by the DDs?

The review of monthly maintenance reports, monitoring data, and interviews with the LF O&M contractor indicate that the remedy is functioning as intended by the SCOU ROD. The LF surface drainage system appeared to be operating as designed during the site visit. However, due to normal landfill subsidence some surface depressions have been created within the LFs. Due to the impermeable nature of the geotextile cap material there is now a potential for ponding to occur in these areas during rain events. For fiscal year 2021 WPAFB has programmed an engineering evaluation of the caps on LFs 10 North and South to assess subsidence and potential ponding issues.

Although there are intermittent performance issues with the EWs at LFs 8 and 10, the wells and pumps are subjected to a rigorous and aggressive maintenance program to bring them back in line quickly. Given the hydrogeology at OU1 and the management of pathways (i.e., public water is supplied to all nearby private homes and groundwater use restrictions are in place) for exposure to groundwater and monitoring of groundwater, the infrequent, local inconsistencies with hydraulic containment does not pose a threat to human health. EW pump malfunctions may cause short-term loss of capture; however, it is believed that these events do not affect continuing hydraulic containment provided by the extraction wells. In addition, there are very few MWs that show an exceedance of an MCL.

In 2012, WPAFB conducted a multimedia investigation of a wide area at the south end of DuPont Way. Because of soil vapor concentrations observed in the sub-slab at 5 DuPont Way (**Figure 3-2**), an indoor air mitigation system was installed. Results from the annual sub-slab soil vapor sampling conducted over this five-year period are presented in **Table 3-6**. As noted in **Section 3.4.4.5**, because chloroform was detected above the ODH screening levels in sub-slab soil vapor and indoor air samples during the 2012 multimedia investigation, an indoor air mitigation system (i.e., sub-slab soil vapor) was installed at 5 DuPont Way that is monitored on a quarterly basis with annual sub-slab soil vapor monitoring within the residence. During this five-year period, the chloroform concentrations from sub-slab sampling (**Table 3-6**) were below the ODH screening levels, which indicates the sub-slab soil vapor mitigation system has reduced VOC concentrations to below regulatory levels and is operating as designed.

As seen in the table, chloroform from sub-slab sampling were below the ODH screening levels, which indicates the sub-slab soil vapor mitigation system has reduced VOC concentrations to below regulatory levels and is performing as designed (see **Section 3.5.2.2**). Sub-slab soil vapor sampling to monitor performance of the system will continue annually. In addition, the elevated methane levels in and around LFG monitoring probe LF08-MP10 have been mitigated as discussed in **Section 3.4.4.5**.

3.5.2 Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?

Yes, the exposure assumptions, toxicity data, cleanup levels, and RAOs are still valid. Supporting documentation is provided in **Appendix A**, Section A.1. The rationale for each component of Question B is provided below.

3.5.2.1 Changes in Applicable or Relevant and Appropriate Requirements (ARARs) and To Be Considered (TBCs)

Although there have been changes to the ARARs and TBCs, these changes do not affect the protectiveness of the remedy. Stormwater protection for industrial activities are addressed by WPAFB's Stormwater Pollution Prevention Plan. The current permit for WPAFB (NPDES Permit No. 1IO00001*GD) is under revision. Storm water discharge at OU1 was monitored for the general stormwater monitoring requirements at Outfall 5. Therefore, stormwater discharge for OU1 is not currently being monitored. The ECs in place for the SCOU (**Section 3.2.3**, Remedy Implementation) remain protective of runoff water emanating from the site.

Chemical-specific ARARs were specified for purposes of the groundwater monitoring program. Monitoring requirements for groundwater compliance were established within the SCOU ROD (WPAFB, 1993a), which also defined COCs using a residential land use scenario that exceeded state or federal environmental regulations or a human health risk analysis (**Table 3-8**). These values consisted of MCLs. For those constituents without MCLs, risk-based PRGs were used. Some parameters (e.g., iron, zinc, ammonia, diethyl phthalate, 4-methylphenol and naphthalene) do not have compliance levels but are monitored based on the requirements of the SCOU ROD.

The SCOU ROD also included compliance levels for COCs in soil. Although the landfills are capped and there are no direct exposures to soil, the compliance levels for soil are provided and compared with TBCs in **Table 3-9**. The TBCs consist of USEPA's RSLs for residential and industrial soil (USEPA, 2019a). The RSLs for industrial soil are less stringent than the original compliance levels. Furthermore, the current RSL for benzo(a)pyrene is less stringent than the value cited in the previous Five-Year Review (WPAFB, 2016a). No other RSLs have changed.

As discussed in the introduction to **Appendix A**, WPAFB has since prepared an ESD for the six RODs that adjusted the OU1 groundwater compliance levels to MCLs and are now consistent with the GWOU ROD (WPAFB, 2012a). The MCLs have not changed since the Fourth Five-Year Review (WPAFB, 2016a) or since the ESD was signed in 2012 (WPAFB, 2012a). The current compliance levels for the SCOU (OU1) are provided in **Table 3-8**. The selected remedy for groundwater remains protective because exposure to groundwater is prevented and the cleanup levels are valid as amended in the ESD. As part of the remedial action for LFs 8 and 10, residents along National, Zink, and Kauffman Roads with private wells are connected to a public water supply.

The groundwater analytical data for the OU1 monitoring well network (**Figures 3-4** and **3-5**) was reevaluated in 2008. Based on the evaluation of the LTM compliance data from the TSFD and presentation in the revised Systems Performance Monitoring Plan (SPMP) (Shaw, 2009b), the monitoring program was adjusted by eliminating selected monitoring wells and the dioxin constituents entirely from the routine sampling, decreasing the monitoring frequency of wells, and analyzing certain parameters. In addition, as jointly agreed upon by WPAFB, OEPA, and USEPA, it was determined that reducing the sampling frequency of pesticides/PCBs and SVOCs from the annual monitoring requirements to a 5-year cycle still allowed for the selected remedial action to remain protective of human health and the environment. These revisions to the OU1 compliance monitoring program have been incorporated into the current SPMP. The 5-year monitoring cycle parameters were last sampled for in April 2017 with the next scheduled event occurring in the spring 2022. The ARARs for the remaining constituents in the sampling program are still valid.

3.5.2.2 Changes in Land-Use and Exposure Assumptions

Although the PRGs developed for the risk assessment were conservatively based on a residential land-use scenario (WPAFB, 1993a), there have been no changes to land use at LFs 8 and 10 since the remedy was implemented. There have been no significant changes to the exposure pathways that were evaluated for direct contact since the Fourth Five-Year Review (WPAFB, 2016a). Although USEPA updated the default exposure factors used in the derivation of the Regional Screening Levels (RSLs) in 2014 (USEPA, 2014b), these factors have not changed since the previous review (USEPA, 2019a). Changes in the RSLs and the default factors are discussed in the introduction to **Appendix A** and **Section A.1**. Therefore, the RSLs continue to address the land use and exposure assumptions of interest for the SCOU. Given that land use for the SCOU is industrial, the conclusions of the original Human Health Risk Assessment (HHRA) and previous Five-Year Reviews remain valid and the remedy for soil remains protective. In addition, groundwater use is restricted. Therefore, the remedy for groundwater remains protective.

Since the preparation of the ROD (WPAFB, 1993a), USEPA, DoD, and others published guidance regarding the evaluation of the vapor intrusion pathway (USEPA, 2002; DoD, 2009; ITRC, 2007). The OEPA revised their guidance for vapor intrusion in 2020 (OEPA, 2020) and the USEPA revised their guidance in 2015 (USEPA, 2015). These documents present methods for estimating potential exposures to VOCs from groundwater and soil that may migrate through building foundations via vapor intrusion. These guidance documents remain in effect. In addition, USEPA continues to maintain and update its vapor intrusion screening levels (VISLs) for the applicable media (indoor air, sub-slab soil gas, and groundwater). The VISLs are derived using USEPA's on-line VISL Calculator (USEPA, 2019c), which is based on USEPA's most recent vapor intrusion guidance (USEPA, 2015) and current RSLs (USEPA, 2019a).

As described in the introduction to **Appendix A**, USEPA issued recommendations for assessing protectiveness at sites for vapor intrusion in 2012 as a supplement to the Comprehensive Five-Year Review Guidance (USEPA, 2001, 2012b). The vapor intrusion pathway for the SCOU was evaluated by reviewing VOC results for soil gas and groundwater as discussed in the following paragraphs. As described in **Section 3.4.4.4**, semiannual monitoring is conducted to address potential health and safety risks associated with LFs 8 and 10 LFG to verify the effectiveness of the LFG collection system. Based on soil gas monitoring results, the LF8 LFG collection system continues to operate effectively over the LF. During this five-year period, soil gas monitoring results at a permanent soil gas probe located outside the landfill boundary (LF8-MP010) had elevated methane levels at sustained concentrations of 11.8 and 10.5 percent in spring and fall 2018, which exceeded the LEL of 5 percent for methane. Monitoring point LF08-MP010 (screened interval: 5 to 14 ft bgs) was the only location to have elevated methane readings during this five-year period (APTIM, 2019b). Adjacent monitoring points demonstrated that the elevated readings at LF8-MP010 are localized. The elevated methane levels in LFG monitoring probe LF08-MP10 have been mitigated as discussed in **Section 3.4.4.5**.

The LF10 primary LFG collection system continues to operate effectively over the LF. Gas monitoring in the GBT is conducted semiannually. Although methane was detected in the south end of the GBT, the results over this five-year period indicated that methane was not detected in the surrounding soil vapor monitoring points or the punchbar locations. Therefore, the GBT is performing its intended function of preventing methane migration away from the landfill.

To address the potential for vapor intrusion, WPAFB conducted a multimedia investigation of a wide area at the south end of DuPont Way in 2012. An indoor air mitigation system was installed at 5 DuPont Way because of soil vapor concentrations observed in the sub-slab at this location (**Figure 3-2**). Annual sub-slab soil vapor sampling was conducted over this five-year period. As seen in **Table 3-6**, VOC concentrations are below RSLs with the exception of concentrations of chloroform (6.5 $\mu g/m^3$ in January 2018 and 5.5 $\mu g/m^3$ in October 2019) that exceeded an RSL of 4.1 $\mu g/m^3$ based on a risk level of 1×10^{-6}. As these concentrations only slightly exceeded 1×10^{-6}, risks associated with chloroform are at the lower end of USEPA's acceptable risk range of 1×10^{-6} to 1×10^{-4}. Sub-slab soil vapor sampling to monitor performance of the system will continue annually. Therefore, the mitigation system is operating as designed. According to the guidelines for determining protectiveness (USEPA, 2012b), the measures for DuPont Way are considered to protective because a mitigation system was installed and has been shown to be functioning as intended to meet RAOs.

The measures specified in the ROD continue to prevent exposures via ingestion and inhalation of COCs associated with LFs 8 and 10. Although the PRGs used in the human health risk assessment did not account for exposures to COCs via dermal absorption, exposures via this pathway are also prevented by ongoing remediation activities.

The current land use at the SCOU is commercial/industrial (WPAFB, 2011). Land use has not changed since the remedy was implemented. As described in the introduction to **Appendix A**, the ESD clarified the implementation of ICs for each of the RODs (WPAFB, 2012a). The LUCIP (TetraTech, 2019), which replaced the LUC Plan (Labat, 2012), is the primary administrative mechanism employed by WPAFB to determine which ICs are protective for the site and ensures that current ICs remain environmentally compatible with future land use and are properly implemented. The ICs in place for the site include access restrictions that limit access to the site and uses of the site. There are no plans to transfer any portion of the SCOU; however, if a different land use were to be proposed, an amended risk assessment would be performed to evaluate the new land use. Therefore, the land-use assumptions are still valid.

3.5.2.3 Changes in Toxicity Values

The SCOU ROD addresses the remediation for LFs 8 and 10. The human health risk assessment for the SCOU was performed using a qualitative methodology, based on USEPA guidance for development of PRGs (WPAFB, 1993a; USEPA, 1991a). The PRGs were based on state and federal regulations and/or risk-based concentration(s) (RBCs) calculated for the SCOU risk assessment using specific exposure pathways and land-use scenarios. Contaminant concentrations from the site were then compared with the PRGs. The qualitative risk assessment for the SCOU ROD addressed only risk attributed to the actual LFs themselves, and was performed for screening purposes to determine if early remedial actions were necessary to reduce the human health risk.

Because USEPA's toxicity criteria were used to derive the PRGs, the IRIS (USEPA, 2019b) was reviewed to determine whether the toxicity data had changed since the qualitative risk assessment had been conducted. The IRIS database is considered to be the first tier in the USEPA's hierarchy of sources of toxicity values (USEPA, 2003b). A review of the toxicity values indicated the following:

- As discussed in the Fourth Five-Year Review (WPAFB, 2016a), the PRGs used in the original risk assessment have been replaced by RSLs. The RSLs are updated every 6 months and reflect changes in exposure factors and toxicity criteria.

- Several individual toxicity values have changed since the last review. Some criteria are now more stringent, while some are less stringent. Notably, most of the COCs in groundwater also have MCLs, so the impact due to changes in the toxicity values is not an issue. The compliance levels for groundwater are further discussed below.

- For the soil, the cumulative impact of the more stringent toxicity values would be expected to be offset by the effects of those values that are now less stringent. Moreover, LFs 8 and 10 are capped and there is no current contact with surface soil. The compliance levels for soil are discussed below.

- Polynuclear aromatic hydrocarbons (PAHs) were identified as COCs in soil at the SCOU. As discussed in the introduction to **Appendix A**, USEPA issued an updated Toxicological Review of Benzo(a)pyrene under the IRIS Program in January 2017 (USEPA, 2017). This review updated the previous IRIS assessment of benzo(a)pyrene, which had been used since 1987. It was based on studies conducted after 1987 and the 2011 recommendations for the improvement of IRIS toxicity assessments.

  Benzo(a)pyrene is now identified as “carcinogenic to humans” rather than the 1987 “probable human carcinogen” weight-of-evidence classification. USEPA (2019b, 2017) provided a verified oral cancer slope factor for benzo(a)pyrene of 1.0E+0 per mg/kg-day and a verified inhalation unit risk (IUR) of 6.0E-4 per $\mu g/m^3$ in 2017.

  Although the IRIS database currently indicates that the toxicity criteria for benzo(a)pyrene have been “suspended” (USEPA, 2019b), the updated oral cancer SF (1.0E+0 per mg/kg-day) and the IUR (6.0E-4 per $\mu g/m^3$) continue to be included in the current RSL table (USEPA, 2019a) and applied in the RSL calculator (USEPA, 2019d). When compared with the previous oral SF (7.30E+0 per mg/kg-day), the current toxicity value is a higher number and, therefore, is less stringent. It is noted, however, there was previously no IRIS-verified IUR for benzo(a)pyrene.

  There are no IRIS-verified toxicity values for the remaining carcinogenic PAHs; however, these values have been derived from the SF and IUR for benzo(a)pyrene using their corresponding relative potency factors (RPFs). The resulting values are used to develop RSLs for these compounds.

  In addition, the RSL table now includes an RfD (3.0E-4 mg/kg-day) and an RfC (2.0E-6 mg/m^3). Previously, there were no noncancer-based toxicity values available for benzo(a)pyrene. Both of these toxicity values are based on developmental effects.

- Toxicity values are available for some chemicals that did not have toxicity criteria at the time of the original quantitative risk assessment. In particular, trichloroethylene (TCE) did not have IRIS-verified toxicity values until the verified oral and inhalation toxicity criteria were posted in IRIS in September 2011 (USEPA, 2011b). This information did not change the conclusions of the original risk assessment for groundwater because TCE concentrations at the SCOU are ultimately compared with the MCL. In addition, TCE was not detected in wells for LF8 (**Table 3-4**) or LF10 (**Table 3-5**).

- The selection of toxicity criteria for PCBs is based on a tiered approach (USEPA, 1996a). The current slope factor for PCB (2 per mg/kg/day) is less conservative than the previous value (7.7 per milligrams per kilogram per day [mg/kg/day]).

Some of the values are considered provisional or PPRTVs. These values are obtained from Tier 2 sources according to USEPA's hierarchy because they have not undergone the required review process for the values to be placed in IRIS. In addition, some criteria are from Tier 3 sources, which are developed by other USEPA or non-USEPA sources, such as Agency for Toxic Substances Disease Registry (ATSDR) or California Environmental Protection Agency (CalEPA).

To determine whether changes in toxicity values result in any new COCs in the LTM program, the maximum detected concentrations (MDCs) of chemicals detected in groundwater samples collected in April 2019 were compared with current MCLs and RSLs. This comparison is shown in **Appendix A**, **Table A-7**. Three chemicals (chloromethane, trans-1,2-dichloroethene, and mercury) that had not been detected as part of the Fourth Five-Year Review were detected in April 2019 and evaluated for this review. Two chemicals (trans-1,2-dichloroethene and mercury) were below their respective MCLs. There is no MCL for chloromethane; however, the MDC was below the current tap water RSL. Therefore, no new COCs were identified during this five-year period. The remedy remains protective because the potential exposures to groundwater will continue to be managed through ICs.

As previously discussed, the SCOU ROD included compliance levels for COCs in soil. Although the landfills are capped and there are no direct exposures to soil, the compliance levels for soil are compared with current RSLs in **Table 3-9**. All of the current RSLs are below the compliance levels established in the SCOU ROD.

Because lead does not have a toxicity value, exposures to lead were evaluated using the Integrated Exposure Uptake Biokinetic (IEUBK) model (USEPA, 1994; 2007, 2010c). Since the time the original SCOU risk assessment was performed, the IEUBK model has been updated. USEPA has also developed the Adult Lead Model (ALM) to evaluate occupational exposures to lead (USEPA, 2003a). While the input parameters for the models for evaluating uptake of lead in children and adults have changed, the screening levels for lead in soil have not changed and are still considered to be protective.

Based on current guidance for dermal risk assessment (USEPA, 2004), there were changes to some of the exposure factors and assumptions used to calculate dermal toxicity values in the original risk assessment. In addition, USEPA issued OSWER Directive 9200.1-120 in 2014. Some of the updated factors would be used in a dermal risk assessment; however, the impacts of these changes would be expected to be minimal. There have been no changes to the default exposure factors during this five-year period. Therefore, the approach to evaluating dermal risk remains valid.

USEPA also developed the Soil Screening Guidance (USEPA, 1996b) as a framework for screening contaminated soils. This guidance presents methodologies to address the leaching of contaminants through soil to an underlying potable aquifer and the methodologies are still current. This methodology has not changed since the soil screening level (SSL) guidance was issued. Although it is possible that soil concentrations associated with the SCOU would exceed the SSLs for migration to groundwater, exceedance of the SSLs would have no effect on the remedy. Potential migration of contaminants to groundwater is prevented by the landfill cap. Use of the SSLs as an indicator of potential migration to groundwater is no longer necessary because groundwater is being monitored under the LTM program. Furthermore, there is no current exposure to groundwater due to ICs.

3.5.2.4 Changes in RAOs and Cleanup Goals

Based on the proximity of homes to LFs 8 and 10, WPAFB, OEPA, and USEPA jointly deemed that remedial actions aimed at controlling any current or potential risk posed by contamination migrating from the LFs was warranted. In general, the cleanup goals for the SCOU are to prevent direct contact with on-site contaminants. An additional goal was to manage the potential for exposure to site-related contaminants through the use of private sources for drinking water and showering. Exceedances of MCLs are captured in the LTM and reported in the LTM reports. Groundwater monitoring will be continued until the compliance levels are met. In addition, the remedy is protective because exposure to groundwater due to industrial or domestic water consumption is prevented by providing city water for the properties near the SCOU. The principal media and general RAOs for the SCOU are summarized in **Section 3.2.2**. The RAOs and cleanup goals remain valid.

Soil vapor media has been added to the medium to be addressed. The general RAO for LFG applies, ‘to prevent inhalation of gases and the potential for explosion by controlling soil vapor, and to meet ambient air exposure criteria.' There are currently no RAOs that specifically address vapor intrusion in the ROD; however, follow-up samples indicate that the mitigation system at 5 DuPont Way is protective because it is operating as designed.

3.5.3 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

There has been no additional information that would call into question the protectiveness of the remedy.

3.5.4 Technical Assessment Summary

Based on evaluations of the LTM analytical data and the maintenance records from CAM Management and Services, the remedy at LFs 8 and 10 is functioning as intended in the ROD. The remedy is currently protective because implemented ICs prevent exposure to contaminated groundwater.

As presented in **Section 3.2.2**, the general RAO for the landfill contents is to prevent direct contact with and dermal absorption and ingestion of the contaminated soils and LF contents; to control surface water runoff, ponding, and erosion; to prevent or reduce infiltration and production of leachate; and to control dust emissions to meet ambient air exposure criteria. Based on the data presented in **Section 3.4.4**, the general RAO is being met: the landfill caps are regularly maintained to prevent direct contact; the landfill caps are not ponding, thus controlling surface water runoff; there are no sustained erosion issues; and although the landfill caps are settling, there is no evidence of increased infiltration or leachate production (based on monthly inspections conducted by the LF O&M contractor) that would suggest the cap systems are not performing as designed.

There have been some changes to MCLs, toxicity values, RSLs (formerly PRGs), and changes to risk assessment guidance documents since the last five-year review as noted in **Section 3.5.2**. These changes do not affect the protectiveness of the remedy because the new values are less stringent, or the remedy eliminates the pathway of exposure.

In addition, soil vapor media have been added to the media to be addressed. The measures implemented to address vapor intrusion at 5 DuPont Way have been effective in reducing VOCs in sub-slab soil vapor to concentrations at or below the screening levels. The elevated concentrations of methane are considered to be localized and have been mitigated.

There is no additional information that calls into question the effectiveness of the remedy.

3.6 Issues

The following issues were identified during this five-year period for the SCOU:

- Arsenic was detected at concentrations above the MCL (10 µg/l) in 13 monitoring wells at LFs 8 and 10 (**Tables 3-4** and **3-5**).
- VC concentrations in LF8 monitoring well LF08-MW10B (**Figure 3-4**) have averaged approximately 3 µg/L and have exceeded the MCL (2 µg/L) (**Table 3-4**). VC concentrations in well 02-DM-83S-M only periodically exceeded the MCL.
- Arsenic concentrations in LF10 well 01-004-M have decreased to below the MCL after it was redeveloped prior to the spring 2018 LTM sampling event (**Table 3-5**).
- Soil gas methane concentrations in soil gas monitoring probe LF8-MP010 (approximately 8 ft bgs), located outside the landfill boundary (**Figure 3-2**), have historically exceeded the LEL (see **Section 3.4.4.5**).
- Soil vapor concentrations of chloroform in sub-slab samples collected from the two monitoring points at 5 DuPont Way (**Table 3-6**) twice exceeded the calculated USEPA RSL but were below the ODH action level during the five annual sampling events conducted during this five-year period; a mitigation system has been installed, sub-slab samples are collected annually, and the manometer is inspected quarterly.
- Extraction well pump malfunctions caused short-term loss of capture; however, it is believed that these events did not affect continuing hydraulic containment provided by the extraction wells.
- Differential settlement is occurring on LF10N, which creates the potential for ponding in these settlement areas during rain events.

3.7 Recommendations and Follow-up Actions

This five-year review concluded that the remedy for the SCOU is short-term protective of human health and the environment. It is recommended that current actions (LTM, O&M of the remedy, etc.) continue.

The following is recommended or have been implemented for the SCOU:

- Continue monitoring arsenic concentrations and evaluating if exceedances are naturally occurring. In addition, if elevated arsenic concentrations persist in a well, redevelop and reevaluate that well.
- Continue to monitor decreasing VC concentrations in LF8 monitoring wells LF08-MW10B and 02-DM-83S-M that have had MCL exceedances. If VC concentrations should show an increasing trend in these wells, evaluate the need for additional investigation.

- Maintain the aggressive inspection, cleaning, and maintenance schedule for the EWs. Continue monitoring to evaluate whether hydraulic capture is being maintained.
- Continue monitoring for soil gas methane in the vicinity of 5 and 7 DuPont Way in accordance with the ROV (OEPA, 2019c).
- Continue annual sub-slab soil vapor sampling at 5 DuPont Way to ensure the soil vapor mitigation system is performing as designed.
- Continue water level monitoring monthly in LFs 8 and 10 extraction well network to provide quicker response to issues that affect their efficient operation.
- Complete periodic surveys of the tops of casings and ground surface elevations for all OU1 EWs to establish any changes in well head elevations and to ensure accurate groundwater elevations.
- Conduct an engineering evaluation of the caps on LFs 10 North and South to assess subsidence and potential ponding issues.
- Place deed restrictions on the property if the property is ever transferred out of federal ownership. WPAFB will submit to the agencies a 'Notification of Transfer' at least 6 months prior to any transfer or sale of the property but no less than 60 days (WPAFB, 2012a).
- Prepare a Memorandum to Site File to memorialize remedial efforts conducted at 5 and 7 DuPont Way (remediated for elevated methane levels from April to September 2019) and installation of MPs at the northeast LF8/DuPont Way boundary.

With the recommendations in the TSFD (Shaw, 2008) and approval of the ESD for the six RODs (WPAFB, 2012a), SVOCs, pesticides, PCBs, cyanide, and ammonia are monitored every five years with the next cycle occurring in the spring 2022. VOCs and metals in groundwater will continue to be monitored annually in the spring. LFG (explosive gas) monitoring with hand-held meters is conducted semiannually in spring and fall. Additional changes in the groundwater monitoring frequency will be made following the 2022 sampling event.

Maintenance issues require ongoing upkeep to ensure the future protectiveness of the remedy.

Table 3-1
Site Chronology
Source Control Operable Unit
Wright-Patterson AFB, Ohio

Event	Date
Preliminary Assessment	February 25, 1981
Initial Response Actions	June 1989, 1990, and March 1991
Focused Remedial Investigation	1992
Focused Feasibility Study	March 1992
Record of Decision	May 1993
Remedial Design	1993-1994
Remedial Action Construction	September 1994 – September 1997
Engineer's Certification Report	March 1998
Explanation of Significant Differences – Leachate Discharge	1997
First Five-Year Record of Decision Review	March 2000
Second Five-Year Record of Decision Review	January 2006
Technical Site File Document for Operable Unit 1	April 2008
Operable Unit 1, LFs 8 and 10 Operation and Maintenance Plan	June 2009
Third Five-Year Record of Decision Review	August 2011
Explanation of Significant Differences (Multiple OUs)[1]	August 2012
Soil, Groundwater, Soil Gas, and Indoor Air Report, DuPont Way and Welcome Way Investigation Report	July 2013
Fourth Five-Year Record of Decision Review	April 2017
Notice of Violation – Landfill Gas Exceedances at LF8 (Ohio EPA)	April 2019
Methane Gas Investigation and Remediation at 5 and 7 DuPont Way	April 2019 to Present
Resolution of Violation for Landfill Gas Exceedances at LF8 (Ohio EPA)	September 2019

Notes:

1 – Source Control Operable Unit; Off-Source Operable Unit; 21 No Action Sites; Spill Sites 2, 3, and 10; 41 No Action Sites; and Groundwater Operable Unit.

Table 3-2
Chemicals of Concern
Source Control Operable Unit
Wright-Patterson AFB, Ohio

Chemical	Pathway
Benzo(a)pyrene	Soil/sediment
Dieldrin	Soil/sediment
PCBs	Soil/sediment
Beryllium	Soil/sediment
1,2-Dichloroethene	Leachate
4-Methylphenol	Leachate
Benzene	Leachate
Chloroform	Leachate
Diethylphthalate	Leachate
Ethylbenzene	Leachate
Methylene Chloride	Leachate
Naphthalene	Leachate
Toluene	Leachate
Trichloroethene	Leachate
Vinyl Chloride	Leachate
Arsenic	Leachate
Berylium	Leachate
Cadmium	Leachate
Copper	Leachate
Lead	Leachate
Zinc	Leachate
Cyanide	Leachate

Abbreviations:
PCBs = Polychlorinated biphenyls

Table 3-3
Landfills 8 and 10 Leachate Discharge Analytical Results
Wright-Patterson AFB, Ohio

Parameter	pH	Total Suspended Solids (mg/L)	Chemical Oxygen Demand (mg/L)	Oil and Grease[1] (mg/L)	Metals (µg/L) Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Molybdenum	Nickel	Selenium	Zinc
Compliance Criteria	--	**250**	**368**	--	**93**	**32**	**2,494**	**716**	**1,198**	**47**	**108**	**1,501**	**238**	**2,200**
January 2015	7.8	63	11	ND	15	0.37 J	1.5 J	1.9 J	ND	ND	9.5 J	16 J	ND	ND
April 2015	7.94	4	21	ND	6.2 J	0.16 J	1.3 J	ND	2.0 J	ND	5.1 J	17 J	ND	ND
August 2015	8.15	13	36	ND	8.1 J	ND	0.9 J	ND	ND	ND	1.4	22 J	ND	ND
October 2015	7.96	3.0 J	31	ND	6.5 J	ND	1.1 J	ND	ND	ND	8.8 J	26 J	ND	21 J
January 2016	8.07	ND	16	ND	1.9	8.0 J	ND	ND	ND	ND	7.5 J	17 J	ND	ND
April 2016	6.82	ND	23	2.0 J	1.8 J	0.50 J	ND	2.1 J	2.1 J	ND	7.6 D	24 J	3.5 J	ND
July 2016	7.69	6	22	ND	4.5 J	ND	ND	ND	2.1 J	ND	7.1 D	20 J	ND	ND
October 2016	6.8	ND	24	ND	6.3 J	ND	ND	ND	7.3 J	ND	9.0 D	21 J	ND	ND
January 2017	7.1	76	30	ND	23	ND	5.3 J	ND	24	ND	8.9 D	27 J	ND	11 J
April 2017	7.79	NS	25	ND	2.3 J	ND	ND	ND	3.8 J	0.037 J	NA	16.9 J	ND	4.4 J
July 2017	7.82	10.7	33.3	1.6 J	9.3 J	ND	ND	ND	ND	0.12 J	8.4 J	20.6 J	ND	5.6 J
October 2017	6.99	ND	28.2	ND	ND	ND	ND	ND	1.8 J	ND	NS	13.5 J	ND	ND
January 2018	7.24	28.3	20.3	ND	12.1	ND	ND	1.0 J	ND	ND	3.3 J	14 J	ND	ND
April 2018	7.55	ND	13.8 J	ND	ND	ND	ND	1.4 J	2.4 J	ND	NA	7.7 J	3.9 J	9.7 J
July 2018	6.97	ND	20.3	ND	1.4 J	ND	ND	2.5 J	1.1 J	ND	9.7 J	25.3 J	ND	9.3 J
October 2018	7.25	ND	25.6	ND	5.1 J	ND	ND	ND	ND	ND	7.2 J	13.8 J	ND	5.6 J
January 2019	7.79	4.5	13.7	ND	2.6 J	ND	1.2 J	ND	ND	ND	5.5 J	14 J	4.9 J	ND
April 2019	7.21	ND	28.4	ND	1.9 J	ND	ND	1.1 J	ND	ND	NA	9.2 J	ND	6.9 J
July 2019	7.87	4.7	25.6	ND	3.3 J	ND	ND	3.2 J	ND	ND	5.1 J	14.9 J	4.3 J	7.4 J
October 2019	7.87	4.7	25.6	ND	ND	ND	ND	ND	6.3	ND	7.1 JB	13.5 J	2.9 J	5.6 J

Notes:
J = Estimated concentration
[1] = Analyzed as N-Hexane Extractable Material
Bold concentrations exceed discharge compliance criteria

NA = Not analyzed
ND = Not detected
NS = Parameter sample not collected

Table 3-4
Landfill 8 Groundwater Analytical Results Summary: COCs
Wright-Patterson AFB, Ohio
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Location		Sample Date	VOCs			Inorganics
			Benzene	TCE	Vinyl Chloride	Arsenic
Units			µg/L	µg/L	µg/L	µg/L
Compliance Level - MCL*			5	5	2	10
LF08-MW02C		15-APR-10	ND	ND	ND	34
		02-MAY-11	ND	ND	ND	39
		12-APR-12	ND	ND	ND	26
		16-APR-13	ND	ND	ND	12
		16-APR-13	--	--	--	7.7[a] J
		13-MAY-14	ND	ND	ND	88
		13-APR-15	ND	ND	ND	64
		02-MAY-16	ND	ND	ND	33 JD
		25-APR-17	ND	ND	ND	12
		12-APR-18	ND	ND	ND	16.5
		17-APR-19	ND	ND	ND	19.7
LF08-MW05B		16-APR-10	ND	ND	ND	ND
		09-MAY-11	ND	ND	ND	ND
		12-APR-12	ND	ND	ND	7.0 J
		09-APR-13	ND	ND	ND	7.7 J
		07-MAY-14	ND	ND	ND	5.7 J
		16-APR-15	ND	ND	ND	5.1 J
		04-MAY-16	ND	ND	ND	5 J
		24-APR-17	ND	ND	ND	10.1
		12-APR-18	ND	ND	ND	4.4 J
		17-APR-19	ND	ND	ND	3.7 J
LF08-MW08A						
	Duplicate	13-APR-10	ND	ND	ND	84
		13-APR-10	ND	ND	ND	80
	Duplicate	27-APR-11	ND	ND	ND	150
		27-APR-11	ND	ND	ND	71
	Duplicate	12-APR-12	ND	ND	ND	75
		12-APR-12	ND	ND	ND	79
	Duplicate	12-APR-13	ND	ND	ND	14
	Duplicate	12-APR-13	--	--	--	9.0 J[a]
		12-APR-13	ND	ND	ND	12
		12-APR-13	--	--	--	13[a]
	Duplicate	06-MAY-14	ND	ND	ND	32
		06-MAY-14	ND	ND	ND	35
		13-APR-15	ND	ND	ND	22
		03-MAY-16	ND	ND	ND	27
		25-APR-17	ND	ND	ND	22
		12-APR-18	ND	ND	ND	27.2
		15-APR-19	ND	ND	ND	66.6
LF08-MW09B		13-APR-10	ND	ND	ND	ND
		28-APR-11	ND	ND	ND	ND
		10-APR-12	ND	ND	ND	ND
		08-APR-13	0.18 JB	ND	ND	3.2 J
		01-MAY-14	ND	ND	ND	7.0 J
		13-APR-15	ND	ND	ND	ND
		03-MAY-16	ND	ND	ND	ND
		26-APR-17	ND	ND	ND	ND
		12-APR-18	ND	ND	ND	ND
		15-APR-19	ND	ND	ND	ND
LF08-MW10B		19-APR-10	ND	ND	5.1	10
		05-MAY-11	ND	ND	4.1	ND
		16-APR-12	ND	ND	3.7	7.5 J
		09-APR-13	ND	ND	4.5	9.7 J
		07-MAY-14	ND	ND	3.5	7.9 J
		21-APR-15	ND	ND	2.8	7.3 J
	Duplicate	05-MAY-16	ND	ND	2.6	7.5
		05-MAY-16	ND	ND	2.6	7.8
	Duplicate	26-APR-17	ND	ND	2.9	15.2
		26-APR-17	ND	ND	3.2	17.2
		25-APR-18	ND	ND	3.3	7.4
	Duplicate	25-APR-18	ND	ND	3.2	5.2
		15-APR-19	ND	ND	3.3	5.3 J
	Duplicate	15-APR-19	ND	ND	3.4	5.9 J

Table 3-4
Landfill 8 Groundwater Analytical Results Summary: COCs
Wright-Patterson AFB, Ohio

		VOCs			Inorganics
Location	**Sample Date**	**Benzene**	**TCE**	**Vinyl Chloride**	**Arsenic**
Units		μg/L	μg/L	μg/L	μg/L
Compliance Level - MCL*		5	5	2	10
LF08-MW10C	19-APR-10	DRY	DRY	DRY	DRY
	05-MAY-11	ND	ND	1.0	ND
	16-APR-12	ND	ND	ND	ND
	09-APR-13	ND	ND	ND	ND
	07-MAY-14	ND	ND	0.47 J	ND
	21-APR-15	DRY	DRY	DRY	DRY
	05-MAY-16	ND	ND	0.34 J	ND
	26-APR-17	ND	ND	0.49 J	ND
	25-APR-18	ND	ND	0.83 J	ND
	15-APR-19	ND	ND	0.63 J	ND
LF08-MW101	27-APR-10	ND	ND	ND	ND
	28-APR-11	ND	ND	ND	ND
	10-APR-12	ND	ND	ND	7.9 J
	10-APR-13	ND	ND	ND	6.5 J
	06-MAY-14	ND	ND	ND	10
	16-APR-15	ND	ND	ND	18
	04-MAY-16	ND	ND	ND	2.3 J
	24-APR-17	ND	ND	ND	3.5 J
	12-APR-18	ND	ND	ND	2.7 J
	17-APR-19	ND	ND	ND	3.5 J
LF08-MW102	27-APR-10	ND	ND	ND	ND
	29-APR-11	ND	ND	ND	ND
	10-APR-12	ND	ND	ND	ND
	11-APR-13	ND	ND	ND	ND
	06-MAY-14	ND	ND	ND	ND
	23-APR-15	ND	ND	ND	ND
	04-MAY-16	ND	ND	ND	ND
	25-APR-17	ND	ND	ND	ND
	12-APR-18	ND	ND	ND	ND
	17-APR-19	ND	ND	ND	ND
LF08-MW103	27-APR-10	ND	ND	ND	ND
	28-APR-11	ND	ND	ND	ND
	12-APR-12	ND	ND	ND	4.7 J
	11-APR-13	ND	ND	ND	6.2 J
	06-MAY-14	ND	ND	ND	3.5 J
	16-APR-15	ND	ND	ND	4.3 J
	04-MAY-16	ND	ND	ND	ND
	25-APR-17	ND	ND	ND	2.8 J
	12-APR-18	ND	ND	ND	12.9
	17-APR-19	ND	ND	ND	2.5 J
02-DM-81S-M	29-APR-10	ND	ND	ND	ND
	29-APR-11	ND	ND	ND	ND
	12-APR-12	0.14 J	ND	ND	ND
	16-APR-13	ND	ND	ND	ND
	07-MAY-14	0.17 J	ND	ND	ND
	16-APR-15	ND	ND	ND	ND
	04-MAY-16	ND	ND	ND	ND
	25-APR-17	ND	ND	ND	ND
	12-APR-18	ND	ND	ND	ND
	17-APR-19	ND	ND	ND	ND
02-DM-81D-M	29-APR-10	ND	ND	ND	31
	29-APR-11	ND	ND	ND	24
	12-APR-12	ND	ND	ND	20
	16-APR-13	ND	ND	ND	31
	16-APR-13	--	--	--	20[a]
	07-MAY-14	ND	ND	ND	16
	16-APR-15	ND	ND	ND	28
	04-MAY-16	ND	ND	ND	25
	25-APR-17	ND	ND	ND	27.5
	12-APR-18	ND	ND	ND	21.6
	17-APR-19	ND	ND	ND	20.9

Table 3-4
Landfill 8 Groundwater Analytical Results Summary: COCs
Wright-Patterson AFB, Ohio

Location		Sample Date	VOCs: Benzene	VOCs: TCE	VOCs: Vinyl Chloride	Inorganics: Arsenic
Units			μg/L	μg/L	μg/L	μg/L
Compliance Level - MCL*			5	5	2	10
02-DM-82-M		28-APR-10	ND	ND	ND	ND
		05-MAY-11	ND	ND	ND	ND
		16-APR-12	ND	ND	ND	ND
		17-APR-13	ND	ND	ND	ND
		12-MAY-14	ND	ND	ND	ND
		13-APR-15	ND	ND	ND	3.9 J
		06-MAY-16	ND	ND	ND	ND
		26-APR-17	ND	ND	ND	1.3 J
		30-APR-18	ND	ND	ND	ND
		16-APR-19	ND	ND	ND	ND
02-DM-83S-M		28-APR-10	0.4 J	ND	3.4	ND
		05-MAY-11	ND D	ND D	2.2 D	ND
		17-APR-12	0.33 J	ND	2.1	ND
		09-APR-13	0.28 J	ND	1.7	ND
		07-MAY-14	0.19 J	ND	1.2	ND
		21-APR-15	ND	ND	1.2	ND
	Duplicate	05-MAY-16	0.26 J	ND	1.8 J	20 JD
		05-MAY-16	0.24 J	ND	1.8 J	ND
	Duplicate	26-APR-17	ND	ND	1.3	ND
		26-APR-17	ND	ND	1.4	ND
	Duplicate	30-APR-18	ND	ND	1.2	ND
		30-APR-18	ND	ND	1.3	ND
	Duplicate	18-APR-19	ND	ND	2.5	ND
		18-APR-19	ND	ND	2.4	ND
02-DM-83D-M		28-APR-10	ND	ND	ND	ND
		05-MAY-11	ND	ND	ND	ND
		17-APR-12	ND	ND	ND	ND
		09-APR-13	ND	ND	ND	ND
		07-MAY-14	ND	ND	ND	ND
		21-APR-15	ND	ND	ND	ND
		05-MAY-16	ND	ND	ND	ND
		26-APR-17	ND	ND	ND	ND
		30-APR-18	ND	ND	ND	ND
		18-APR-19	ND	ND	ND	ND
02-DM-84-M		15-APR-10	0.4 J	ND	ND	27
		02-MAY-11	ND	ND	ND	34
		16-APR-12	0.38 J	ND	ND	54
		12-APR-13	0.41 J	ND	ND	46
		12-APR-13	--	--	--	42[a]
		13-MAY-14	0.32 J	ND	ND	34
		13-APR-15	ND	ND	ND	59
		05-MAY-16	ND	ND	ND	ND
		26-APR-17	ND	ND	ND	ND
		30-APR-18	ND	ND	ND	ND
		18-APR-19	ND	ND	ND	ND

Notes:
Concentration exceeds a compliance level
[a] = Dissolved metals result

Abbreviations:
B = Method blank contamination
COC = Chemical of concern
D = Sample diluted for analysis
J = Estimated value
MCL = Maximum Contaminant Level
* = Based on Regional Screening Level (RSL), April 2019
μg/L = micrograms/Liter
ND = Not detected
TCE = Trichloroethylene
VOC = Volatile organic compound

Table 3-5
Landfill 10 Groundwater Analytical Results Summary: COCs
Wright-Patterson AFB, Ohio
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Location	Sample Date	VOCs		Inorganics
		Benzene	Vinyl Chloride	Arsenic
Units		µg/L	µg/L	µg/L
Compliance Level - MCL*		5	2	10
LF10-MW06B	14-APR-10	ND	ND	16
	28-APR-11	ND	ND	12
	10-APR-12	ND	ND	17
	08-APR-13	0.2 JB	ND	18
	01-MAY-14	ND	ND	17
	14-APR-15	ND	ND	15
	05-MAY-16	ND	ND	11
	28-APR-17	ND	ND	11.7
	11-APR-18	ND	ND	11.6
	17-APR-19	ND	ND	12.4
LF10-MW07C	16-APR-10	ND	ND	ND
	05-MAY-11	ND	ND	ND
	16-APR-12	ND	ND	ND
	09-APR-13	ND	ND	ND
	12-MAY-14	ND	ND	3.6 J
	16-APR-15	ND	ND	ND
	05-MAY-16	ND	ND	ND
	27-APR-17	ND	ND	ND
	12-APR-18	ND	ND	ND
	16-APR-19	ND	ND	ND
LF10-MW08A-2	19-APR-10	ND	ND	ND
	26-APR-11	ND	ND	ND
	12-APR-12	ND	ND	ND
	08-APR-13	0.14 JB	ND	ND
	01-MAY-14	ND	ND	ND
	16-APR-15	ND	ND	ND
	05-MAY-16	ND	ND	ND
	27-APR-17	ND	ND	ND
	12-APR-18	ND	ND	ND
	15-APR-19	ND	ND	ND
	05-MAY-16	ND	ND	ND
	28-APR-17	ND	ND	ND
	11-APR-18	ND	ND	ND
	16-APR-19	ND	ND	ND
LF10-MW08B	14-APR-10	ND	ND	ND
	26-APR-11	ND	ND	ND
	12-APR-12	ND	ND	ND
	08-APR-13	ND	ND	4.7 J
	01-MAY-14	ND	ND	5.2 J
	20-APR-15	ND	ND	8.1 J
	05-MAY-16	ND	ND	ND
	28-APR-17	ND	ND	1.4 J
	11-APR-18	ND	ND	ND
	16-APR-19	ND	ND	ND
LF10-MW09B	13-APR-10	DRY	DRY	DRY
	26-APR-11	ND	ND	11
	09-APR-12	ND	ND	13
	08-APR-13	ND	0.3 J	13
	01-MAY-14	ND	ND	14
	14-APR-15	ND	ND	13
	06-MAY-16	ND	ND	20 JD
	27-APR-17	ND	ND	12.7
	11-APR-18	ND	ND	11.7
	15-APR-19	ND	ND	15.4

Table 3-5
Landfill 10 Groundwater Analytical Results Summary: COCs
Wright-Patterson AFB, Ohio
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		VOCs		Inorganics
Location	**Sample Date**	**Benzene**	**Vinyl Chloride**	**Arsenic**
Units		µg/L	µg/L	µg/L
Compliance Level - MCL*		5	2	10
LF10-MW09C	13-APR-10	ND	ND	ND
	27-APR-11	ND	ND	ND
	09-APR-12	ND	ND	15
	08-APR-13	ND	ND	12
	01-MAY-14	ND	ND	12
	14-APR-15	ND	ND	18
	05-MAY-16	ND	ND	19 JD
	27-APR-17	ND	ND	1.4 J
	11-APR-18	ND	ND	ND
	15-APR-19	ND	ND	10.1
LF10-MW10C				
Duplicate	14-APR-10	ND	ND	ND
	14-APR-10	ND	ND	ND
Duplicate	26-APR-11	ND	ND	ND
	26-APR-11	ND	ND	ND
Duplicate	09-APR-12	ND	ND	ND
	09-APR-12	ND	ND	ND
Duplicate	08-APR-13	0.28 JB	ND	ND
	08-APR-13	ND	ND	ND
Duplicate	01-MAY-14	ND	ND	ND
	01-MAY-14	ND	ND	ND
Duplicate	20-APR-15	ND	ND	3.4 J
	20-APR-15	ND	ND	3.4 J
Duplicate	05-MAY-16	ND	ND	ND
	05-MAY-16	ND	ND	ND
Duplicate	27-APR-17	ND	ND	ND
	27-APR-17	ND	ND	ND
Duplicate	11-APR-18	ND	ND	ND
	11-APR-18	ND	ND	ND
Duplicate	15-APR-19	ND	ND	ND
	15-APR-19	ND	ND	ND
LF10-MW11B	14-APR-10	ND	ND	ND
	26-APR-11	ND	ND	ND
	09-APR-12	ND	ND	7.9 J
	08-APR-13	0.22 JB	ND	7.1 J
	01-MAY-14	ND	ND	8.0 J
	14-APR-15	ND	ND	12
	05-MAY-16	ND	ND	22 JD
	28-APR-17	ND	ND	4.8 J
	11-APR-18	ND	ND	2.9 J
	15-APR-19	ND	ND	2.8 J
LF10-MW102	16-APR-10	DRY	DRY	DRY
	27-APR-11	DRY	DRY	DRY
	17-APR-12	DRY	DRY	DRY
	09-APR-13	DRY	DRY	DRY
	12-MAY-14	DRY	DRY	DRY
	16-APR-15	DRY	DRY	DRY
LF10-MW103	16-APR-10	ND	ND	ND
	27-APR-11	ND	ND	ND
	17-APR-12	ND	ND	7.3 J
	09-APR-13	ND	ND	57
	12-MAY-14	ND	ND	49
	16-APR-15	ND	ND	17
	06-MAY-16	DRY	DRY	DRY
	28-APR-17	ND	ND	24
	12-APR-18	ND	ND	4.6 J
	18-APR-19	ND	ND	52.3

Table 3-5
Landfill 10 Groundwater Analytical Results Summary: COCs
Wright-Patterson AFB, Ohio
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Location	Sample Date	VOCs		Inorganics
		Benzene	Vinyl Chloride	Arsenic
Units		µg/L	µg/L	µg/L
Compliance Level - MCL*		5	2	10
LF10-MW104	16-APR-10	DRY	DRY	DRY
	27-APR-11	DRY	DRY	DRY
	17-APR-12	DRY	DRY	DRY
	09-APR-13	DRY	DRY	DRY
	12-MAY-14	DRY	DRY	DRY
	16-APR-15	DRY	DRY	DRY
LF10-MW105	29-APR-10	ND	ND	ND
	09-MAY-11	ND	ND	ND
	17-APR-12	ND	ND	6.7 J
	17-APR-13	ND	ND	ND
	13-MAY-14	ND	ND	ND
	23-APR-15	ND	ND	7.2 J
	06-MAY-16	ND	ND	ND
	27-APR-17	ND	ND	2.1 J
	01-MAY-18	ND	ND	ND
01-DM-102S-M	14-APR-10	DRY	DRY	DRY
	26-APR-11	DRY	DRY	DRY
	16-APR-12	DRY	DRY	DRY
	09-APR-13	ND	ND	ND
	01-MAY-14	DRY	DRY	DRY
	16-APR-15	ND	ND	ND
	05-MAY-16	ND	ND	ND
	28-APR-17	ND	ND	ND
	11-APR-18	DRY	DRY	DRY
	16-APR-19	ND	ND	DRY
01-DM-102D-M	14-APR-10	DRY	DRY	DRY
	26-APR-11	DRY	DRY	DRY
	16-APR-12	DRY	DRY	DRY
	08-APR-13	ND	ND	3.5 J
	01-MAY-14	ND	ND	ND
	14-APR-15	ND	ND	4 J
	04-MAY-16	ND	ND	ND
	27-APR-17	ND	ND	ND
	11-APR-18	ND	ND	ND
	22-APR-19	ND	ND	ND
01-004-M	27-APR-10	ND	ND	62
	26-APR-11	DRY	DRY	DRY
	09-MAY-11	ND	ND	24
	16-APR-12	ND	ND	140
	17-APR-13	ND	ND	19
	12-MAY-14	ND	ND	1400
	16-APR-15	ND	ND	240
	05-MAY-16	ND	ND	34 JD
	28-APR-17	ND	ND	181
	12-APR-18	ND	ND	ND
	16-APR-19	ND	ND	5.3 J

Notes:
Concentration exceeds MCL

Abbreviations:
B = Method blank contamination
COC = Chemical of concern
J = Estimated value
MCL = Maximum Contaminant Level
* = Based on Regional Screening Level (RSL), April 2019
µg/L = Micrograms per liter
ND = Not detected
VOC = Volatile organic compound

Table 3-6
5 DuPont Way Sub-slab Soil Vapor Sampling
Analytical Results: VOCs
Wright-Patterson AFB, Ohio

Volatile Organic Compounds EPA Method TO15	2015 Residential Sub-Slab Soil Vapor Screening Levels[a] (µg/m³)[b]	2019 Residential Sub-Slab Soil Vapor Screening Levels[c] (µg/m³)[b]	ODH Sub-Slab Soil Gas Screening Levels[d] (µg/m³)	5DW-SV01					5DW-SV02				
				February 2016	November 2016	January 2018	November 2018	October 2019	February 2016	November 2016	January 2018	November 2018	October 2019
Acetone	110,000	107,000	NSL	37	21	16	77	42	77	17	32	8.6	76
Benzene	12	12	10	0.94	0.81	0.57	0.59	0.56	0.8	0.30 J	0.84	0.19 J	0.69
Bromodichloromethane	2.5	2.5	NSL	ND	ND	0.29 J	0.46 J	0.75 J	ND	0.22 J	0.43 J	0.92 J	1.9
1,3-Butadiene	3.1	3.1	NSL	0.22 J	ND	ND	ND	ND	0.17 J	ND	ND	ND	ND
2-Butanone (MEK)	17,000	17,400	50,000	2.1 J	1.9	1.1 J	ND	2.2 J	1.4 J	1.2	3.4	ND	3.1
Carbon disulfide	2,400	2,430	9,000	0.87 J	1.9	ND	ND	ND	0.86 J	0.17 J	0.38 J	ND	ND
Carbon tetrachloride	16	15.6	NSL	0.47 J	ND	0.48 J	ND	0.54 J	0.43 J	ND	0.46 J	ND	0.70 J
Chloroform	4.1	4.1	11	ND	0.27 J	**6.5**	0.96	2.1	ND	0.66	2.8	2.7	**5.5**
Cyclohexane	21,000	20,900	NSL	ND	ND	0.16 J	ND	ND	ND	ND	1.6	ND	ND
Chloromethane	310	313	NSL	1.6 J	1.3	1.2 J	1.4 J	1.4 J	1.7 J	0.69 J	0.30 J	ND	2.8
1,4-Dichlorobenzene	8.5	8.5	NSL	0.34 J	ND	ND	ND	ND	0.21 J	ND	ND	ND	ND
Dibromochloromethane	3.5	NSL	NSL	ND	ND	ND	0.36 J	ND	ND	0.14 J	ND	0.77 J	1.0 J
Dichlorodifluoromethane (Freon 12)	350	348	NSL	2.0	0.53 J	2.1	1.5 J	ND	2.0	0.47 J	1.9	2.0 J	2.2 J
1,2-Dichloroethane (1,2-DCA)	3.6	3.6	NSL	0.11 J	ND	0.11	ND	0.35	0.094 J	ND	0.036 J	0.066J	0.13 J
1,1-Dichloroethene	700	695	NSL	ND	ND	0.025 J	ND	ND	ND	ND	ND	ND	ND
Freon 114	NSL	NSL	NSL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethyl benzene	37	37	3,000	0.51	0.30 J	0.33	0.45	0.45	0.31	0.067 J	2	0.10 J	0.67
Ethanol	NA	NA	NSL	410 E	ND	310 E	810 E	110	590 E	ND	61	13	1,400 E
4-Ethyltoluene	NA	NA	NSL	0.45 J	ND	0.26 J	0.31 J	0.46 J	0.24 J	ND	1.4	ND	0.74 J
Heptane	NA	* 1,390	NSL	0.90	ND	0.69	1.3	ND	0.86	ND	4.3	0.52 J	ND
Hexane	2,400	2,430	NSL	1.1	ND	0.66	0.73	0.69 J	0.72	ND	4.4	0.45 J	0.75 J
2-Hexanone	100	104	NSL	ND	0.26 J	ND	ND	ND	ND	ND	1.4 J	ND	ND
Methylene chloride	2,100	2,090	NSL	0.38 J	0.24 J	0.91 J	0.70 J	ND	0.38 J	0.21 J	0.27 J	0.49 J	ND
4-Methyl-2-pentanone (MIBK)	10,000	10,400	30,000	0.26 J	ND	ND	0.53 J	ND	ND	ND	ND	ND	ND
Propylbenzene	3,500	3,480	NSL	ND	ND	0.14 J	ND	ND	ND	ND	0.78 J	ND	ND
2-Propanol	700	695	NSL	31	ND	17	53	42	38	ND	8.9	5.5	240 E
Styrene	3,500	3,480	NSL	0.57 J	0.28 J	0.56 J	1.2	2.2	0.32 J	ND	ND	ND	3.30 J
Tetrachloroethene (PCE)	140	139	400	0.087 J	0.087 J	0.060 J	0.072 J	0.11 J	0.080 J	ND	0.062 J	0.058 J	0.17 J
Toluene	17,000	17,400	3,000	2.8	2.0	1.4	2.3	2.3	2	0.56	3.4	0.54	2.5
1,1,1-Trichloroethane	17,000	17,400	NSL	0.021 J	ND	ND	0.020 J	ND	0.018 J	ND	0.083 J	ND	ND
Trichloroethene (TCE)	7.0	7.0	20	0.041 J	ND	0.020 J	ND	0.035 J	0.038 J	ND	0.093 J	ND	0.03 J
Trichlorofluoromethane (Freon 11)	2,400	* NSL	NSL	1.1	0.31 J	1.2	1.1	1.4	1.1	0.28 J	1	0.98	1.6
Freon 113	100,000	* 17,400	NSL	0.46 J	ND	0.47 J	0.49 J	0.59 J	0.44 J	ND	0.39 J	0.44 J	ND
1,2,4-Trimethylbenzene	24	* 209	60	0.53 J	0.285 J	0.34 J	0.49 J	0.35 J	0.32 J	ND	2.6	ND	0.76 J
1,3,5-Trimethylbenzene	NA	* 209	60	0.18 J	ND	ND	ND	ND	ND	ND	0.66 J	ND	ND
m,p-Xylene	350	348	2,000	1.5	1.3	0.93	1.2	1.2	0.86	0.17 J	2.8	0.38	1.6
o-Xylene	350	348	2,000	0.54	0.63	0.37	0.47	0.47	0.31	0.066 J	1.4	0.15	0.65
Vinyl Chloride	ND	* 6	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methane (%)				0.00034	NA	0.00034	NA	0.00018	0.00031	NA	0.00042	NA	0.00019

Notes:

[a] VISL obtained from USEPA VISL calculator (Version 3.4, June 2015 RSLs), accessed on-line June 17, 2015. Value is the target sub-slab soil vapor concentration based on a total cancer risk = 1E-06 and Hazard Quotient = 0.1. An attenuation factor of 0.03 is assumed for sub-slab soil vapor. Differences between some of the 2015 and 2019 values are due to differences in rounding of calculator output.

[b] µg/m³ = microgram per cubic meter (gas).

[c] VISL obtained from USEPA VISL calculator (November RSLs), accessed on-line November 20, 2019. Value is the target sub-slab soil vapor concentration based on a total cancer risk = 1E-06 and Hazard Quotient = 0.1. An attenuation factor of 0.03 is assumed for sub-slab soil vapor. Differences between some of the 2015 and 2019 values are due to differences in rounding of calculator output.

[d] Ohio Department of Health (ODH) screening levels (SL) from letter dated April 25, 2012 from Robert Frey (Chief, Health Assessment Section, ODH) to Donna Bohannon (OEPA). SLs derived from USEPA OSWER 2002 Vapor Intrusion Guidance, ATSDR's chronic-duration (more than 1 year) minimal risk levels (MRLs) and cancer risk evaluation guides (CREGs), and USEPA's reference concentrations (RfCs).

* Change in value since previous Five-Year Review.

Bold = Results exceed a calculated screening level.

Abbreviations:

B - analyte detected in blank
E - Result exceeds instrument calibration range
J - result below reporting limit
NSL - No screening level available
ND - Not detected
VISL - Vapor Intrusion Screening Level

Table 3-7
Site Inspection Summary and Land Use
Source Control and Off-source Operable Units
Wright-Patterson AFB, Ohio
Page 1 of 2

Inspect. Date	Former Land Use	Current Land Use and Site Controls	Allowable Land Use – Restrictions(1)	Is Current Land Use Consistent with Allowable Land Use?
Landfill 8				
10/10/2019	Active landfill from approximately 1947 until the early 1970's. Disposal materials; general refuse and hazardous materials from Area B. Capping of the approximately 13-acre landfill was completed in October 1996.	Current Land Use: Inactive, capped landfill. Land surface is partially maintained grassy area with extraction well vaults along eastern boundary. Site Controls: Perimeter fence with two locked gates along western boundary, the northern-most gate accesses McClellan Drive, and one locked gate along the eastern landfill boundary that accesses the secured area between Landfills 8 and 10. Signage is placed at all gates around perimeter fence. Perimeter fence is in good condition.	Restricted Use - 1	Yes – no change from previous Five-Year Review
Landfill 10				
10/10/2019	Active landfill from approximately 1965 until the early 1970. Disposal materials; general refuse and hazardous materials from all areas of the Base. Landfill 10 is divided into two discrete sections, LF10 North (approximately 7 acres) and LF10 South (approximately 3.5 acres). Capping of the landfill was completed in October 1996.	Current Land Use: Inactive, capped landfill. Land surface is partially maintained grassy area with extraction well vaults along the approximate perimeter of LF10 North and South. Site Controls: LF10 North: Perimeter fence with one locked gate at the southeastern landfill corner that accesses Weitzel Way. This area contains the leachate collection system and methane treatment facility. Signage is placed at all gates around perimeter fence. Perimeter fence is in good condition. LF10 South: Perimeter fence with one locked gate along western boundary, one locked gate along the eastern boundary with access to Shields Avenue, and one locked gate at the southeastern landfill corner that accesses Mosby Lane. Signage is placed at all gates around perimeter fence. Perimeter fence is in good condition.	Restricted Use - 1	Yes – no change from previous Five-Year Review

Table 3-7
Site Inspection Summary and Land Use
Source Control and Off-source Operable Units
Wright-Patterson AFB, Ohio

Inspect. Date	Former Land Use	Current Land Use and Site Controls	Allowable Land Use – Restrictions[1]	Is Current Land Use Consistent with Allowable Land Use?
Area Between Landfills 8 and 10				
10/10/2019	Wooded area with one unnamed drainage stream to Hebble Creek.	Current Land Use: Still predominantly a wooded area with one unnamed drainage stream to Hebble Creek. Several gravel/dirt roads now provide access to service landfills LF8 and LF10 North and South. The central portion of area contains the facility which houses the leachate collection system, air compressors, and methane treatment system.	Restricted Use - 2	Yes – no change from previous Five-Year Review
		Site Controls: Perimeter fence with one gate that accesses Longstreet Lane, one gate to access LF8, and one gate to access southeast wooded area and remote well cluster. The majority of this fence is in good condition. The exception being several points along the fence line where trees fell on the fence and reduced the fence height. This finding was reported to WPAFB IRP personnel, the trees were subsequently removed, and the fence was repaired.		

[1] Land Use Key:
1 – No digging, building, construction, etc. or otherwise disturbing landfill covers.
2 – Digging, construction and other soil disturbances allowable after approval by CE and Environmental Branch personnel; area subject to use restriction.

Table 3-8
Comparison of Groundwater Compliance Levels
Source Control Operable Unit
Wright-Patterson AFB, Ohio
Page 1 of 2

Chemical of Concern(1)	ROD Compliance Level(2) (µg/L)	Current Compliance Level (3) (µg/L)	Source of Compliance Level (4) (µg/L)	Reporting Limit (5) (µg/L)
Inorganics				
Arsenic	11.0	10	MCL	10
Beryllium	0.02	4	MCL	4
Cadmium	NA	5	MCL	5
Copper	NA	1,300	MCL	25
Iron	NA	NA	MCL	100
Lead	NA	15	MCL	3
Zinc	NA	NA	MCL	50
Cyanide(6)	NA	200	MCL	10
Ammonia(6)	NA	NA	MCL	200
Volatile Organic Compounds (VOC)				
Benzene	0.62	5	MCL	1
Chloroform	0.26	80(7)	MCL	1
1,2-dichloroethene (total)	0.0677	NA	MCL	0.5
cis-1,2-dichloroethene(8)	NA	70	MCL	0.5
trans-1,2-dichloroethene(8)	NA	100	MCL	1
Ethylbenzene	NA	700	MCL	1
Methylene Chloride	6.22	5	MCL	1
Toluene	NA	1,000	MCL	1
Trichloroethene	3.03	5	MCL	2
Vinyl chloride	0.0283	2	MCL	1
Semivolatile Organic Compounds (SVOC)(6)				
Diethyl phthalate	NA	NA	NA	9.5
4-Methylphenol	NA	NA	NA	9.5
Naphthalene	NA	NA	NA	9.5

Table 3-8
Comparison of Groundwater Compliance Levels
Source Control Operable Unit
Wright-Patterson AFB, Ohio
Page 2 of 2

Notes:

1 – Chemicals listed as chemicals of concern in the Source Control Operable Unit (SCOU) ROD.

2 – Groundwater compliance levels as listed in the SCOU ROD (WPAFB, 1993).

3 – Current compliance levels are based on the MCLs as described in the *Explanation of Significant Differences* (ESD) (WPAFB, 2012).

4 – Maximum Contaminant Levels (MCLs). MCLs are promulgated under the Safe Drinking Water Act (USEPA, 2019).

5 – Source: Test America OU1 analytical results from the Long-Term Monitoring (LTM) Program, April 2019.

6 – Ammonia, cyanide, and SVOCs are sampled and analyzed on a five-year cycle (WPAFB, 2012).

7 – Compliance level shown is the MCL for total trihalomethanes.

8 – The congeners for 1,2-DCE were not originally identified as COCs in the SCOU ROD. These individual congeners are currently captured under the LTM Program.

.

Abbreviations:

MCL = Maximum Contaminant Level

μg/L = micrograms per liter

NA = Not applicable

ROD = Record of Decision

Table 3-9
Compliance Levels for Chemicals of Concern in Soil
Source Control Operable Unit
Wright-Patterson AFB, OH

Chemical of Concern	Soil Compliance Level[a] (µg/kg)	2019 Residential Soil RSL[b] (µg/kg)	2019 Industrial Soil RSL[b] (µg/kg)
2,3,7,8-TCDD	0.00427	0.00480	0.022
Arochlor 1242	83.1	230	950
Arochlor 1248	83.1	230	940
Arochlor 1254	83.1	120	970
Arochlor 1260	83.1	240	990
Benzo(a)pyrene	55.7	110	2,100
Dieldrin	40.0	34.0	140
Beryllium	149	16,000	230,000

Notes:

[a] Values taken from Record of Decision (ROD): Source Control Operable Unit - Landfills 8 and 10 (WPAFB, 1993).

[b] Values derived from USEPA Regional Screening Levels Tables for soil at risk level of $1x10^{-6}$ and a Hazard Quotient of 0.1 (November, 2019).

µg/kg = micrograms per kilogram

Legend

- 300 ft (Disturbance) Restriction Area
- WPAFB Building with Building Numbers
- Restoration Site (Access and Restriction Area)
- Source Control and Off-Source Operable Unit (OU) Boundary
- WPAFB Base Boundary
- Fence

N

300 150 0 300

Feet

Source: WPAFB Land Use Control Plan (Labat, 2012)

WRIGHT-PATTERSON AIR FORCE BASE, OHIO

FIFTH FIVE-YEAR ROD REVIEW

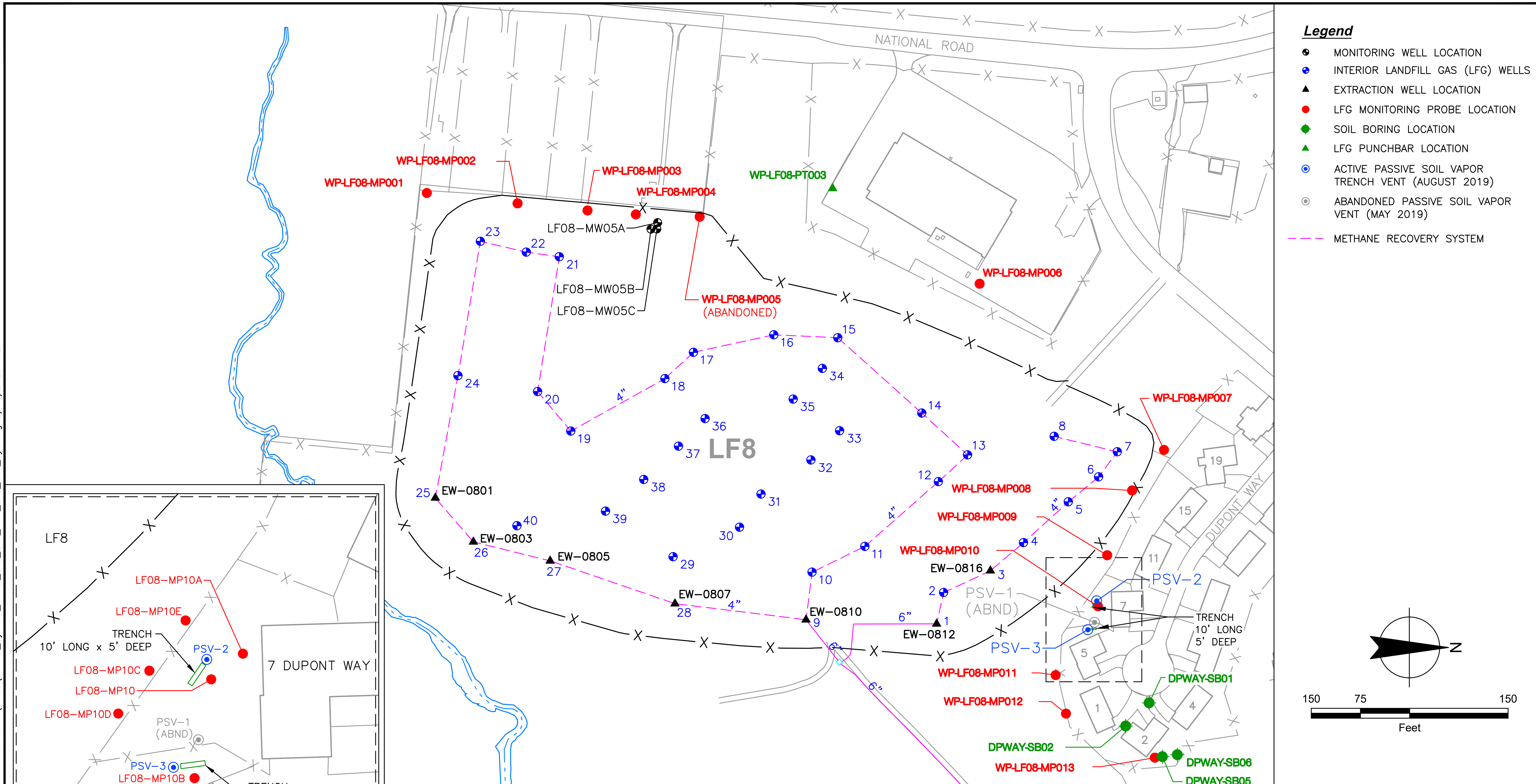
FIGURE NUMBER 3-1

Landfills 8 and 10 Source Control and Off-Source Operable Units Boundary

APTIM

APTIM
5050 Section Avenue
Cincinnati, Ohio 45212

G:\WPAFB\GIS_Documents\Project_Maps\501363.03000000\WPAFB_5yROD_03-1_LF8_10_OU_Bndry.mxd; Analyst: ; Date: 10/1/2019 10:48:43 AM



WRIGHT-PATTERSON AIR FORCE BASE, OHIO

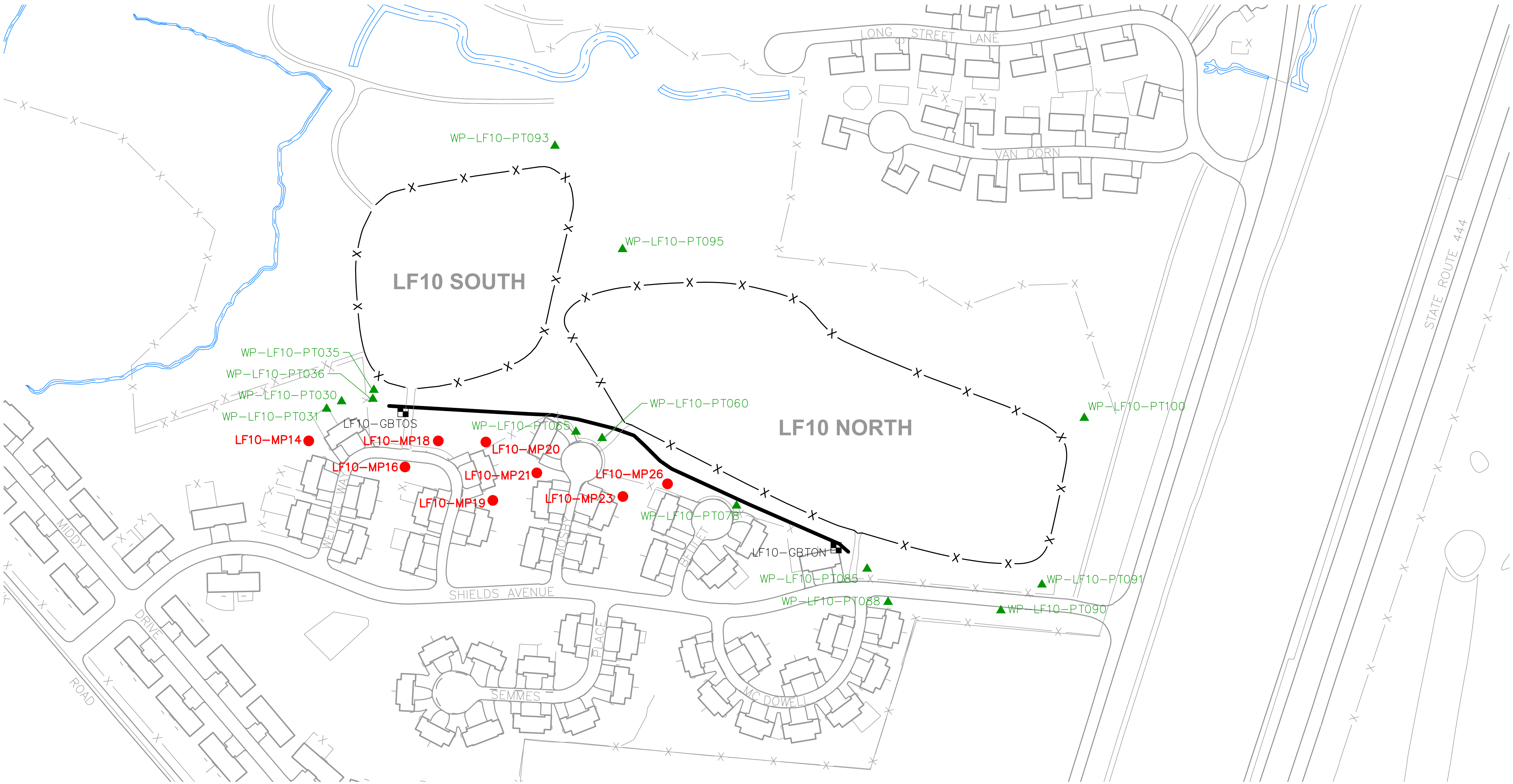
FIFTH FIVE-YEAR ROD REVIEW

FIGURE NUMBER 3-2

LANDFILL 8 LANDFILL GAS MONITORING LOCATIONS

APTIM
5050 Section Avenue
Cincinnati, Ohio 45212

G:\WPAFB\GIS_Documents\Project_Maps\501363.03000000\DWGs\WPAFB_5yrROD_03-2_LF8_LFG_Mon_LFG_Coll_Sys.dwg 2/10/2020 5:20 PM



Legend

- GAS BARRIER TRENCH MONITORING POINT
- LFG PUNCHBAR LOCATION
- LFG MONITORING PROBE LOCATION
- GAS BARRIER TRENCH

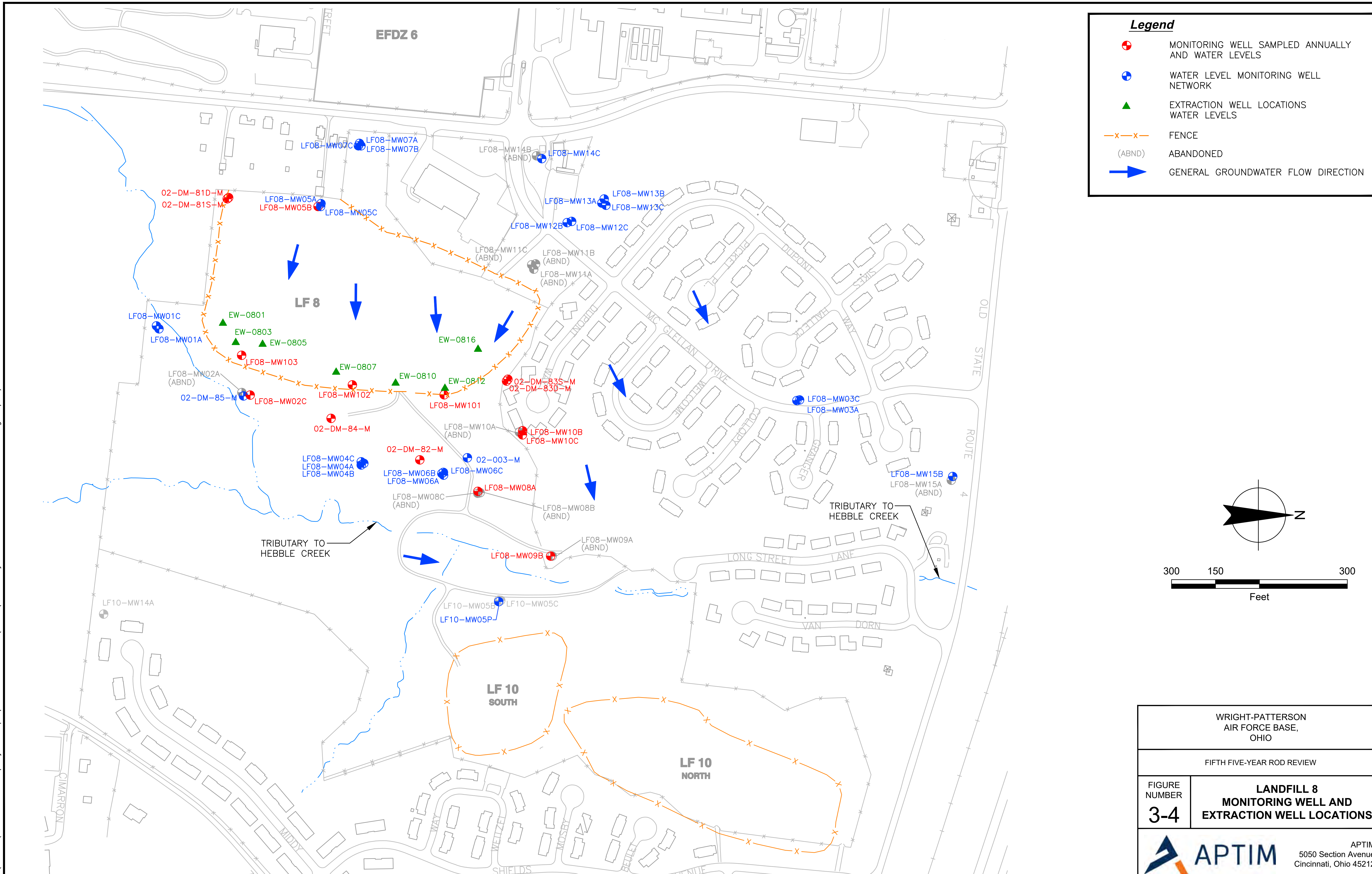
WRIGHT-PATTERSON
AIR FORCE BASE,
OHIO

FIFTH FIVE-YEAR ROD REVIEW

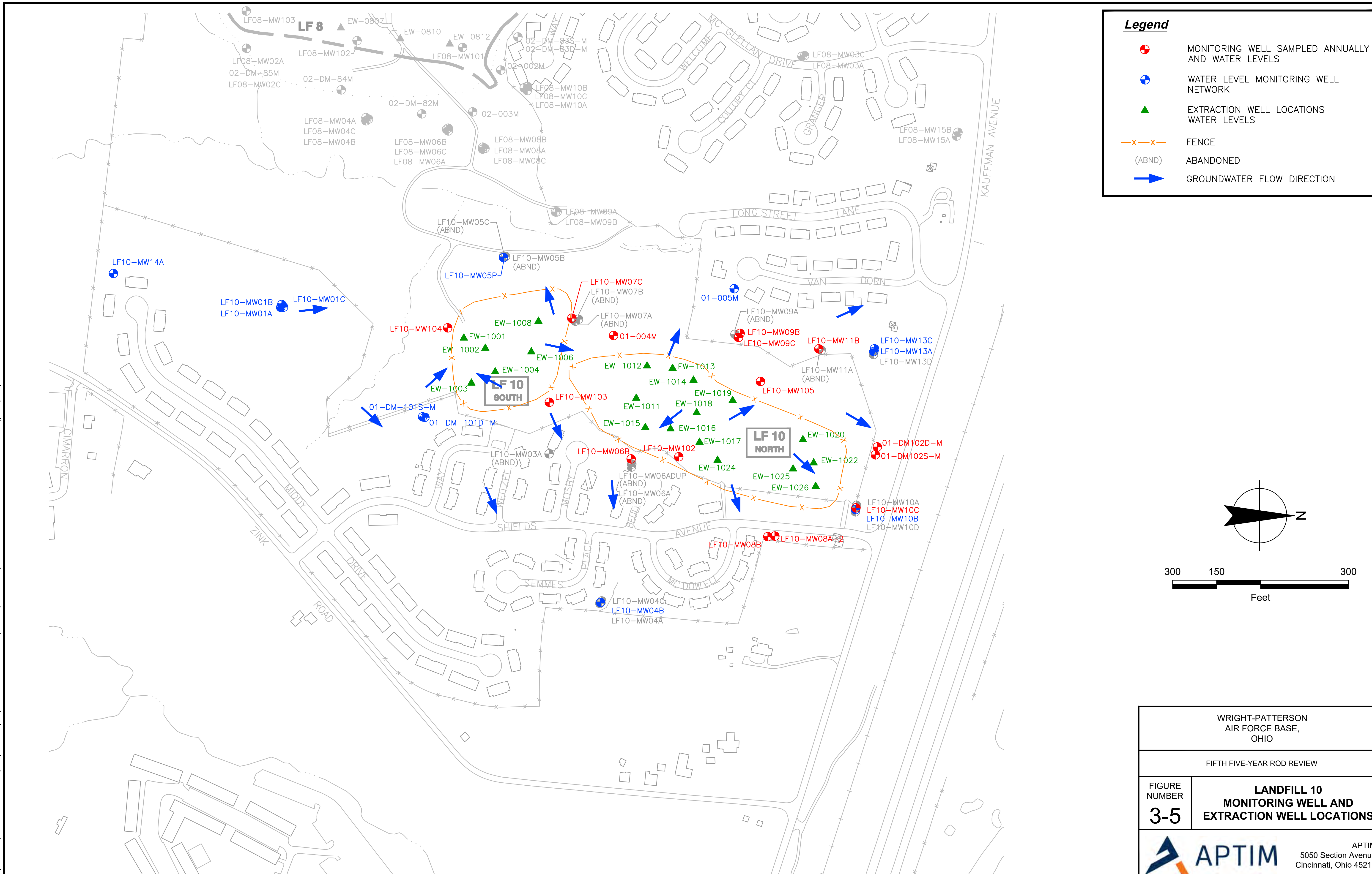
FIGURE NUMBER 3-3

LANDFILL 10
LANDFILL GAS
MONITORING LOCATIONS

APTIM
5050 Section Avenue
Cincinnati, Ohio 45212



G:\WPAFB\GIS_Documents\Project_Maps\501363.03000000\DWGs\WPAFB_5yrROD_03-4_LF8_MW_EW_Locs.dwg 12/13/2019 1:38 PM



WRIGHT-PATTERSON AIR FORCE BASE, OHIO

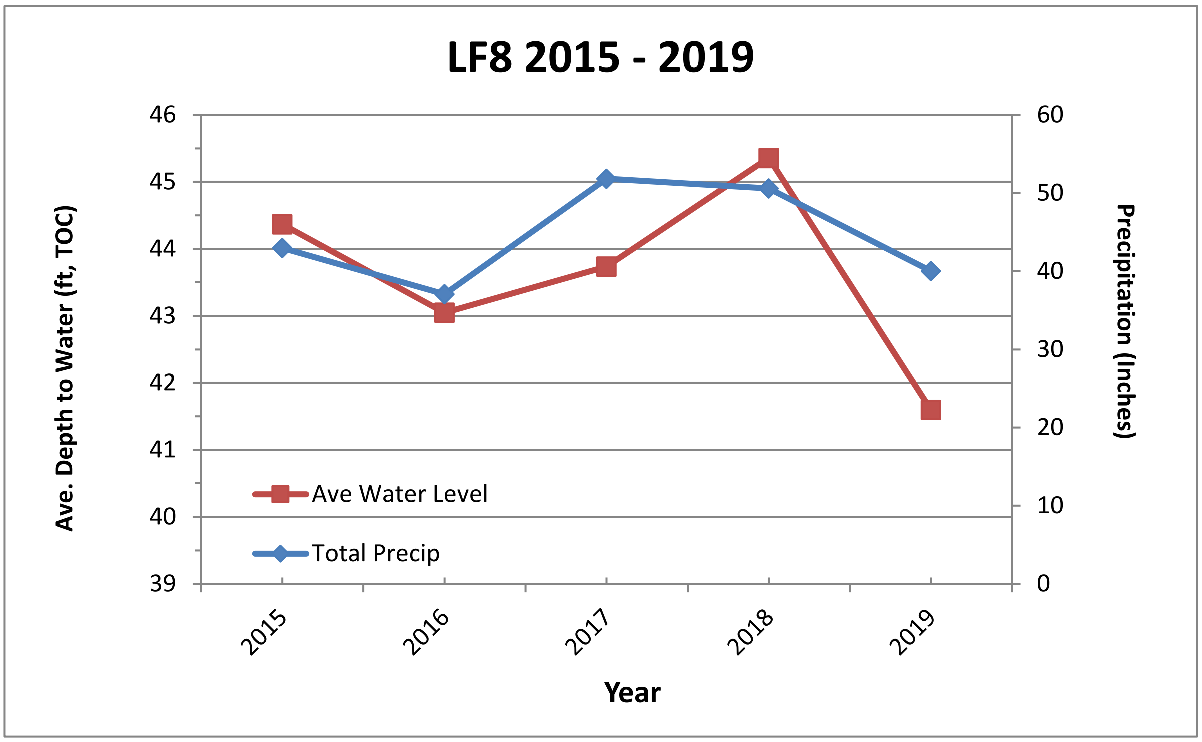
FIFTH FIVE-YEAR ROD REVIEW

FIGURE NUMBER	
3-5	**LANDFILL 10 MONITORING WELL AND EXTRACTION WELL LOCATIONS**

APTIM
5050 Section Avenue
Cincinnati, Ohio 45212

G:\WPAFB\GIS_Documents\Project_Maps\501363.03000000\DWGs\WPAFB_5yrROD_03-5_LF10_MW_EW_Locs.dwg 12/13/2019 1:40 PM

FIGURE 3-6
LF8 Total Precipitation vs Average Water Levels in Extraction Wells Graph: 2015 - 2019



Sources: Precipitation - National Weather Service Forecast Office, Wilmington, Ohio.
Water levels - WPAFB LTM Program

4.0 Five-Year Review for OSOU and Final Remedial Action LFs 8 and 10

The OSOU ROD (WPAFB, 1994) presents the final remedial action for OU1. The OSOU ROD adopts the previously approved SCOU remedial action (**Chapter 3**) as the final cleanup remedy for LFs 8 and 10, and determines that the NA alternative is protective of human health and the environment for those areas outside of LFs 8 and 10.

A five-year review for the OSOU ROD is necessary to determine whether the remedial actions implemented remains protective of human health and the environment. In the future, if portions of WPAFB are sold for residential development, for example, the appropriate land use would need to be evaluated for those specific applications.

4.1 Background

LFs 8 and 10 are located in the northeast corner of Area B at WPAFB, in the area bounded by National, Kaufman, and Zink Roads (**Figure 3-1**). The OSOU is comprised of areas outside but potentially affected by LFs 8 and 10 (**Figure 3-1**). LFs 8 and 10 and the surrounding areas were initially used for military training; the area was then converted to fill areas for refuse disposal. LF8 began operation in 1947 and LF10 began operation in 1965. Military housing units ("The Woods", formerly known as Woodland Hills) were constructed adjacent to the LFs from 1971 to 1973. Following closure of the LFs in the early 1970's, the LFs and the surrounding area were used for recreation until April 1985. At that time, WPAFB designated the area off-limits, and restricted access to both LFs and the intervening valley in response to concerns by OEPA and USEPA over potential exposure of local residents to hazardous waste. Included in this response was creating a 300 ft boundary from the limits of the landfill in accordance with the OAC 3745-27-13(B)(2), which includes portions of the on-base housing and private housing along National Road (**Figure 3-1**).

Currently, the entire area encompassing the landfills is fenced and signs are posted indicating the area is "Off Limits." This area is adjacent to The Woods, military housing, with private homes on Zink and National Roads, and a subdivision in the area south of the landfills. LFs 8 and 10 are separated by roughly 1,000 ft with an unnamed tributary to Hebble Creek running through the area.

4.1.1 History of Contamination

Other than the activities at the landfills themselves, there were no known activities noted in the supporting documentation that caused contamination in the OSOU. In general, the limited contamination outside the boundaries of LFs 8 and 10 originated from the landfills. Knowledge of contamination potentially occurring outside the boundaries of LFs 8 and 10 first occurred when leachate seeps were noted on the eastern slope of LF10. Additional seeps along the northern slope of LF10 were subsequently noted and addressed. Selected military housing units, adjacent to the landfills located north of LF8 and east of LF10, were vacated in 1990, partially due to the detection of subsurface migration of methane gas toward the housing units.

4.1.2 Initial Response

Initial response actions taken at LFs 8 and 10 include the following:

- June 1989 – Placement of dirt, gravel and lime over a leachate seep closest to the Woodland Hills residential area.
- March 1991 – Installation of a passive temporary leachate collection system along the northern and eastern slopes of LF10.
- 1990 – Military housing units north of LF8 and east of LF10 adjacent to the LFs were vacated. Selected housing units were reoccupied in 1992. Reoccupied units were equipped with continuous methane monitors.

A chronology of important and relevant dates for the OSOU is provided in **Table 4-1**.

4.1.3 Basis for Taking Action

The OSOU ROD does not require any further action other than that stated in the SCOU ROD. The Declaration Statement in the OSOU ROD states:

> "… no further remedial action is necessary at the site. The previously approved Source Control remedial action is comprehensive and eliminates the need to conduct additional remedial action…."

A baseline or quantitative risk assessment was performed in conjunction with the Off-Source Remedial Investigation (RI) (ES, 1993). This risk assessment addressed risk associated with the LFs as well as risk from any contaminants that may have migrated beyond the LF boundaries. This baseline risk assessment identified contaminated groundwater, soil, and sediment as posing an unacceptable risk through both ingestion and dermal exposure (direct contact) routes (WPAFB, 1994). Inhalation of indoor and outdoor air, and direct contact with surface water and leachate seeps were also identified as potential sources of elevated risk. The primary media of concern for the OSOU were surface water and sediment. Results of this risk assessment for these media are provided in **Table 4-2**. Ecological effects associated with surface water and sediment were subsequently addressed by monitoring under the GWOU ROD.

Any groundwater that might not be captured by the extraction well network located along the eastern boundary of LF8 would ultimately flow toward an unnamed tributary to Hebble Creek (**Figure 3-4**). The original monitoring well network was revised per the findings in the TSFD for OU1 (Shaw, 2008) and the revised system performance monitoring plan to the OU1 O&M Plan (Shaw, 2009b). Various monitoring wells provide a network of coverage between the landfill and creek. The current LF8 monitoring network consists of wells LF8-MWs 02C, 05B, 08A, 09B, 10B, 10C, 101, 102, 103, 02-DM-81S-M, 02-DM-81D-M, 02-DM-82-M, 02-DM83S-M, 02-DM-83D-M, and 02-DM-84-M. The monitoring results for these wells for the five-year period (**Table 3-4**) indicate that potential contaminants are not migrating or impacting the tributary. All analytical results are within the initial investigative ranges or non-detect, and substantiate no impact to surface streams.

LF8-MP013, a soil gas monitoring point, was incorporated into the LF8 groundwater monitoring network when soil vapors were sampled and found to have TCE contamination. A 2011 investigation determined that TCE was found in what is presently considered perched and sporadic groundwater (Shaw, 2013). TCE contamination migration is not apparent from LF8, and there are no apparent associated surface water impacts. LF08-MP013 is no longer monitored for groundwater impacts.

4.2 Remedial Actions

The OSOU ROD presents the final remedial action for OU1. The findings of the Off-Source RI Report (ES, 1993) indicated that there were no new pathways of exposure presenting a risk that had not already been identified during the previous Focused RI (ES, 1992a), precluding the need for any additional feasibility studies. In addition, as discussed in **Chapter 3**, the elevated methane concentrations that had been observed in LFG monitoring probe LF8-MP10 (**Figure 4-1**) have been remediated.

4.2.1 Remedy Selection

The ROD for the OSOU presented the selection of the NA remedial alternative for the OSOU, and the adoption of the previously approved SCOU remedial action as the final cleanup remedy for LFs 8 and 10 (WPAFB, 1994). It was agreed that the comprehensive site remedial action, described in the SCOU ROD (WPAFB, 1993a), would ultimately address all exposure pathways where a risk was identified (WPAFB, 1994).

4.2.2 OSOU RAO

Cleanup goals for the site as a whole were to prevent direct contact with on-site contaminants, to prevent on-site contamination from spreading, to monitor contaminated groundwater that has already migrated from the site, and to eliminate the potential exposure to site-related contaminants during use of private water sources for drinking and showering. There were no RAOs selected for the OSOU in particular. In the ROD for the OSOU, the NA alternative was selected as remedy for this site (i.e., the USAF determined that no remedial action was necessary to ensure protection of human health and the environment at these sites). This selection was based on several factors:

1. No new pathways of exposure presenting a risk were identified in the Off-Source RI Report which had not already been identified during the previous Focused RI, precluding the need for any additional feasibility studies.
2. The previously approved Source Control remedial action was comprehensive and addressed all exposure pathways where a risk was identified.
3. Migration of contaminants beyond the boundaries of the LFs was found to be limited, and contaminants were present at relatively low levels.

4.2.3 Remedy Implementation

As noted in **Section 4.2.2**, the NA alternative was selected for the OSOU and was based on the fact that the previously approved SCOU remedial action was comprehensive and addressed all exposure pathways where a risk was identified. Thus, a separate remedy for the OSOU was not necessary.

The comprehensive elements of the SCOU selected remedy are presented in Table 1 of the OSOU ROD and include the following:

- Cover both LFs with clay caps
- Collect and treat LFG, leachate, and contaminated groundwater
- Connect residents of National and Zink Roads and Kauffman Avenue to a public water supply
- Remove asphalt slabs in the Hebble Creek tributary
- Conduct LTM of soil gas, groundwater, and air to ensure effectiveness of the remedial action
- Implement LUCs on construction, mining, drilling, and well installation
- Implement site access restrictions.

A complete description of the remedy for the SCOU is provided in **Chapter 3**. Site controls limiting access to the OSOU include fencing around the perimeter of OU (as shown in **Figure 3-1**) with locked gates and signage. ECs are maintained by the LF contractor, in accordance with a maintenance contract administered by the IRP office at WPAFB. In addition to the ECs, WPAFB implements various ICs to ensure that digging or excavation at the OSOU remains restricted. These ICs include:

- Review of plans, designs, and specifications for on-base construction by WPAFB IRP personnel.
- Submittal and approval of AF Form 103 to IRP personnel prior to anyone excavating or digging anywhere within base boundaries.
- Submittal and approval of AF Form 813 for review/approval to assess the potential environmental impact of any action proposed at WPAFB.
- Entering all ROD use limitations and exposure restrictions and IRP site locations into the IDP and the GIS.
- Reevaluation of each IC during the five-year review period for continued protectiveness of human health and the environment.
- Inspection of sites to identify land use and condition of site controls in place, ensure that the land uses identified in the RODs are maintained, and verify that land use activities remain compatible with underlying risk assessment assumptions.

These ICs and ECs are currently summarized and documented in the ESD (WPAFB, 2012a).

4.2.4 OSOU O&M

O&M activities for the OSOU are limited to LTM of groundwater and soil gas, and maintenance of ECs. LTM of the OSOU is addressed in the SCOU ROD and is discussed here for continuity. As previously discussed, the monitoring frequency was modified to an annual basis, and samples are collected in the spring.

4.3 Progress Since the Last Five-Year Review

Recommendations for the OSOU presented in the previous Five-Year ROD Review (WPAFB, 2016a) included:

- Continue sampling punchbar locations along utility corridors, and testing and calibration of the methane monitoring device located at 7 DuPont Way.
- Continue quarterly vacuum pressure monitoring and annual sub-slab soil vapor monitoring at 5 DuPont Way to ensure the soil vapor mitigation system is performing as designed.
- Continue the current LTM Program.
- Place deed restrictions on the property if the property is ever transferred out of federal ownership. WPAFB will submit to the agencies a ‘Notification of Transfer’ at least six

months prior to any transfer or sale of the property but no less than 60 days (WPAFB, 2012).

Investigations, evaluations, and actions taken regarding OSOU since the preceding Five-Year Review (WPAFB, 2016a) include the following:

- Investigated and remediated elevated methane concentrations occurring in the vadose zone in the vicinity of landfill gas monitoring probe LF8-MP010 at the eastern end of DuPont Way (**Figure 3-2**). The investigation included the installation of: five additional landfill gas MPs, one soil vent (PSV-1 [abandoned]), and two exploration trenches with soil vapor vents (PSV-2 and PSV-3), near 5 and 7 DuPont Way (see **Section 3.4.4.5**); the MPs replaced punchbar landfill gas monitoring in the vicinity of 5 and 7 DuPont Way.
- Continued annual sub-slab soil vapor sampling at 5 DuPont Way to verify the sub-slab soil vapor mitigation system was working as intended. No other residences had VOC exceedances; therefore, mitigation at other locations was not warranted.
- Continued the LTM Program; groundwater and LFG monitoring results are discussed in **Section 4.4.4**.
- Continued implementing land-use controls including ECs (site controls) and ICs, which will be used to maintain the integrity of the selected remedy.

4.4 Five-Year Review Process

The five-year review was completed following USEPA guidance in Comprehensive Five-Year Review Guidance (USEPA, 2001, 2012a). This section provides a summary of the process used to complete the five-year review for the OSOU remedy.

4.4.1 Administrative Components

The five-year review process was initiated by the WPAFB IRP AFCEC/CZO. The five-year review process is managed by AFCEC/CZO with regulatory oversight by USEPA and OEPA. The review schedule was established by the review team and included the following components:

- Community Involvement
- Document Review
- Data Review
- Five-year Review Report Development and Review.

4.4.2 Community Involvement

The USEPA's OSWER guidance requirements for five year reviews specifies a draft public notice of initiation of the Five-Year Review should be published initially identifying to the community that a five-year review will be conducted. An initiation notice was published in the Dayton Daily News legal section on June 4, 2020, notifying the community that the Fifth Five-Year Review for

WPAFB is currently being conducted. The initiation notice was posted at the following online link: https://classifieds.daytondailynews.com/ads/public-notices/legal-notice/notice-of-initiation-of-the-five-year-record-626812.

After USEPA and OEPA concur on the final CERCLA Five-Year Review Report, a notice for formal public review will be placed in the Dayton Daily News. A copy of the report will be provided to the WPAFB RAB stakeholders and added to the Administrative Record at the WPAFB IRP office, as well as the Information Repository located at Wright State University, 3640 Colonel Glenn Highway, Dayton, Ohio.

4.4.3 Document Review

The five-year review consisted of a review of the following documents:

- Record of Decision Off-Source Operable Unit and Final Remedial Action Landfills 8 and 10 (WPAFB, 1994)
- Off-Source Remedial Investigation Report (ES, 1993)
- Phase II Environmental Assessment for Page Manor and Woodland Hills Housing Complexes (IT, 2002)
- Final Third Five-Year Record of Decision Review Report (WPAFB, 2011)
- Annual LTM Reports through 2019 (CB&I, 2015-2016; APTIM, 2017-2020)
- Final Technical Site File Document for OU1 (Shaw, 2008)
- Explanation of Significant Differences: Source Control Operable Unit - Landfills 8 and 10; Off-Source Operable Unit and Final Remedial Action Landfills 8 and 10; 21 No Action Sites; Spill Sites 2, 3, and 10 (Operable Unit 2); 41 No Action Sites; and Groundwater Operable Unit (WPAFB, 2012a)
- Final Fourth Five-Year Record of Decision Review Report (WPAFB, 2016a).

4.4.4 Data Review

Since the signing of the OSOU ROD, actions directly related to the OSOU are the groundwater and LFG monitoring affiliated with the SCOU and conducted under the LTM Program. A separate soil investigation (no groundwater was encountered) was conducted as part of the Phase II Site Assessment for Page Manor and Woodland Hills Housing Complexes (IT, 2002). Also, a comprehensive multimedia investigation was conducted in 2012 in and around the residences on DuPont Way and Welcome Way (Shaw, 2013a). The investigation was previously described in **Section 3.4.4.5**.

Results from the annual OU1 groundwater sampling for this five-year period were compiled in the annual LTM reports to give a comprehensive summary of the water quality for the perimeter LF MWs. The current OU1 monitoring well network is presented on **Figures 3-4** and **3-5**. As previously noted, the monitoring results of the perimeter wells are primarily indicative of the SCOU remedy performance, these results also impact the OSOU. If contaminants migrate from the SCOU to the OSOU, the NA remedy for the OSOU may no longer be valid. Monitoring results for the SCOU perimeter wells are discussed thoroughly in **Section 3.4.4.4**. These results indicate that the remedial action at the SCOU has achieved the objective of reducing the potential for migration of LF contaminants to the OSOU.

Monitoring of additional wells at OU1, other than the SCOU perimeter wells, was also conducted. As noted in **Section 3.4.4.4**, VC has been detected above the MCL in the wells 02-DM-83S-M and LF08-MW10B near the northeast corner of LF8, in the vicinity of the east end of DuPont Way. The presence of VOCs in this area may be historical artifacts unrelated to LF8 or may be artifacts of contaminants that migrated from LF8 prior to implementation of remedial action. No further conclusions were drawn from the multimedia investigation conducted in the area (Shaw, 2013). Over the last five years, VC concentrations have averaged just above the MCL of 2.0 μg/L in this area (**Table 3-4**). **Figure 4-1** presents the well locations and location of geologic cross-section line A-A'. The VOC concentrations shown on cross-section A-A' (**Figure 4-2**) indicate that the vicinity of extraction well EW-0816, located upgradient of the wells impacted by VC, is potentially hydraulically connected to this area. **Tables 3-4** and **3-5** also present summaries of the arsenic concentrations that have exceeded the MCL of 10 μg/L during this five-year period. As discussed in **Section 3.4.4.4**, arsenic is considered to be naturally occurring throughout OU1.

4.4.4.1 Changes to Monitoring

The ESD for the six RODs (WPAFB, 2012) changed the compliance level for OU1 MWs and made it consistent with the remainder of the LTM Program. The compliance levels are now the USEPA MCLs for the relevant COCs. The ESD also changed the requirement for deed restrictions as long as WPAFB remains an installation owned by the federal government. Land-use controls language was updated that included ECs (site controls) and ICs, which will be used to monitor and maintain the integrity of the selected remedy.

4.4.5 Site Inspection

WPAFB personnel or contractor personnel routinely inspect the various components of the site remedy and ECs in place at OU1, in accordance with a maintenance contract administered by the IRP office at WPAFB. Site inspections were conducted during this review and summaries of the inspections are provided in **Table 3-7**. Site photographs for LFs 8 and 10 are presented in **Appendix B**.

4.4.6 Interviews

The following community members were interviewed regarding the status of the remedy at the OSOU to determine if any additional actions or concerns had occurred:

- Mr. Justin Hall, CAM

The results of the interviews are included in **Appendix B**. As indicted on the forms no concerns were raised regarding the SCOU and OSOU.

4.5 Technical Assessment

The primary goal of the five-year review is to determine whether the remedy at a site is protective of human health and the environment, to provide a framework for organizing, evaluating data and information, and to ensure that all relevant issues are considered when determining the protectiveness of the remedy. USEPA guidance lists three questions to consider. The questions are as follows:

> **Question A:** Is the remedy functioning as intended by the decision document?
>
> **Question B:** Are the exposure assumptions, toxicity data, cleanup levels and RAOs used at the time of the remedy still valid?
>
> **Question C:** Has any other information come to light that could call into question the protectiveness of the remedy?

The following sections provide responses to the questions for the OSOU ROD review.

4.5.1 Question A: Is the remedy functioning as intended by the DDs?

The review of documents and the results of interviews with WPAFB IRP personnel indicate that the remedy is functioning as intended by the OSOU ROD. As noted in **Section 3.5.1**, WPAFB conducted an investigation in 2012 at the south end of DuPont Way, resulting in soil vapor concentrations being detected in the sub-slab at 5 DuPont Way resulting in an indoor air mitigation system being installed. Results from the annual sub-slab soil vapor sampling conducted over this five-year period are presented in **Table 3-6**. As seen in the table, chloroform from sub-slab sampling were below the ODH screening levels, which indicates the sub-slab soil vapor mitigation system has reduced VOC concentrations to below regulatory levels and is performing as designed. Implemented ECs and ICs along with implementation of the remedial action at the SCOU have achieved the objective of preventing exposure of contaminants and reducing the potential for migration of LF contaminants to the OSOU. Given the hydrogeology at OU1 and the lack of pathways for exposure to groundwater, the presence of VC in the area adjacent to the northeast corner of LF8 does not pose a threat to human health.

4.5.2 Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?

Yes, the exposure assumptions, toxicity data, cleanup levels, and RAOs are still valid. Supporting documentation is provided in **Appendix A**, **Section A.2**. The rationale for each component of Question B is provided below.

4.5.2.1 Changes in ARARs and TBCs

Because the NA alternative was selected as the remedy for the OSOU, there were no ARARs specified in the OSOU ROD (WPAFB, 1994). The recommended action was to continue monitoring groundwater under the LTM Program. Therefore, groundwater monitoring has continued in the SCOU with implications to the OSOU. As stated in **Appendix A**, **Section A.1**, monitoring requirements for groundwater compliance were established within the SCOU ROD and the compliance levels listed in the SCOU ROD were considered to be the final cleanup standards for OU1 groundwater.

An ESD was approved in 2012 to address the six RODs, including the ROD for the OSOU (WPAFB, 2012a). The purpose of this ESD was to clarify the implementation of ICs at WPAFB and to document a change in compliance levels for COCs in groundwater at OU1. The ESD modified the compliance levels for the SCOU in line with the regulatory limits MCLs for the COCs (WPAFB, 2012a). The MCLs have not changed since the ESD was signed in 2012. The current compliance levels for the SCOU (OU1) are provided in **Table 3-8**. Therefore, the cleanup levels are valid as amended in the ESD.

As stated in **Section 3.4.4.4**, the OU1 monitoring program was modified with the TSFD (Shaw, 2008) to an annual frequency for all wells. The remedy described in the SCOU ROD (WPAFB, 1993a) continues to be protective for the OSOU because exposure to groundwater is prevented. In addition, groundwater monitoring data downgradient of LFs 8 and 10 are collected annually as part of the LTM Program, as described in **Section 4.3**. The ARARs for the remaining constituents in the sampling program are still valid.

As discussed in **Section A.1** for the SCOU, the monitoring data were subsequently reevaluated. The compliance levels for groundwater are summarized in **Table 3-8** and **Table A-1.** Exceedances of MCLs are captured in the LTM and reported in the LTM reports. Groundwater monitoring will be continued until the compliance levels are met. In addition the remedy is protective because exposures to groundwater due to industrial or domestic water use consumption are prevented (for example, by providing city water for the properties near the SCOU and treatment for groundwater downgradient of FAA-A).

4.5.2.2 Changes in Land Use and Exposure Assumptions

A baseline or quantitative risk assessment was performed in conjunction with the Off-Source RI (ES, 1993). This risk assessment addressed risk associated with the landfills, as well as risk from any contaminants that may have migrated beyond the landfill boundaries. The baseline risk assessment evaluated risks using current and future residential land-use scenarios. For the human health risk assessment, 13 exposure pathways were quantified using adult and child receptors for 30-year residential exposure duration. Ecological effects associated with surface water and sediment were subsequently addressed under the GWOU ROD (WPAFB, 1999).

The quantitative risk assessment identified contaminated groundwater, sediment, and soil as posing an unacceptable risk through both the ingestion and dermal exposure (direct contact) routes (WPAFB, 1994). Inhalation of indoor and outdoor air and direct contact with surface water and leachate seeps were also identified as potential sources of elevated risk.

For purposes of the risk assessment, the exposed individual (the most at risk) was assumed to be a current resident who lives adjacent to the LFs for a period of 30 years, and spends a certain amount of time trespassing on the LFs, resulting in direct contact with, and ingestion of, contaminated soil, sediment, and surface water. For the future land-use scenario, the individual at most risk was a hypothetical future resident who might build a home in such close proximity to the LFs as to be in direct contact via ingestion, inhalation of VOCs or particulates, or dermal absorption of contaminated soil, sediment, surface water, and/or groundwater, and live in the residence for 30 years. There have been no changes to land use or exposure pathways at the OSOU since the remedy was implemented.

There have been no significant changes to the exposure pathways that were evaluated for direct contact since the Fourth Five-Year Review (WPAFB, 2016a). Although the USEPA updated the default exposure factors used in the derivation of the RSLs and in quantitative human health risk assessments in 2014 (USEPA, 2011a, 2014b), these factors have not changed since the previous review (USEPA, 2019a). Changes in the RSLs and the default factors are discussed in the **Appendix A** introduction and **Section A.2**. Therefore, the RSLs continue to address the land use and exposure assumptions of interest for the SCOU. Given that land use for the SCOU is industrial, the conclusions of the original HHRA and previous Five-Year Reviews remain valid and the remedy for soil remains protective. In addition, groundwater use is restricted. Therefore, the remedy for groundwater remains protective.

Since the preparation of the ROD (WPAFB, 1994), USEPA, DoD, and others have published guidance regarding the evaluation of vapor intrusion (USEPA, 2002; DoD, 2009; ITRC, 2007). In addition, the OEPA finalized their guidance for vapor intrusion (OEPA, 2010) and USEPA updated their guidance (USEPA, 2015). These guidance documents remain in effect. In addition, USEPA continues to maintain and update its VISLs for the applicable media (indoor air, sub-slab soil gas, and groundwater). The VISLs are derived using USEPA's on-line VISL Calculator (USEPA, 2019c), which is based on USEPA's most recent vapor intrusion guidance (USEPA, 2015) and current RSLs (USEPA, 2019a).

Migration of VOCs toward on-site buildings or off-site residences and the potential vapor intrusion continued to be monitored during this five-year period. Because of its proximity to LF8, 7 DuPont Way has a methane monitor, which is inspected quarterly. In addition, VOCs were observed in some of the soil gas sub-slab samples and an indoor air mitigation system was installed at a residence located on 5 DuPont Way (**Section 3.3**). The system's performance is monitored with annual sub-slab soil gas monitoring of the residence. Follow-up samples collected had low level detections (i.e., below their respective screening levels) of several chemicals present (**Table 3-6**). As seen in **Table 3-6**, VOC concentrations are below RSLs with the exception of concentrations of chloroform (6.5 $\mu g/m^3$ in January 2018 and 5.5 $\mu g/m^3$ in October 2019) that exceeded an RSL of 4.1 $\mu g/m^3$ based on a risk level of 1×10^{-6}. As these concentrations only slightly exceeded 1×10^{-6}, risks associated with chloroform are at the lower end of USEPA's acceptable risk range of 1×10^{-6} to 1×10^{-4}. Sub-slab soil vapor sampling to monitor performance of the system will continue annually. Therefore, the mitigation system is operating as designed. According to the guidelines for determining the protectiveness of vapor intrusion, the measures implemented for DuPont Way are considered to be protective because a mitigation system was installed and has been shown to be functioning as intended to meet RAOs.

The measures specified in the ROD continue to prevent exposures via ingestion and inhalation of COCs associated with LFs 8 and 10. Although the PRG used in the human health risk assessment did not account for exposures to COCs via dermal absorption, exposures via this pathway are also prevented by ongoing remediation activities.

As described in the introduction to **Appendix A**, the ESD clarified the implementation of ICs for each of the RODs (WPAFB, 2012a). The LUCIP (TetraTech, 2019), which replaced the LUC Plan (Labat, 2012), is the primary administrative mechanism employed by WPAFB to determine which ICs are protective for the site and ensure that the current ICs remain environmentally compatible with future land use and are properly implemented. The ICs in place for the site include access and land use restrictions that limit potential exposure to contaminated media. There are no plans to transfer any portion of the SCOU or to use the groundwater at the site for any purpose. If a change in use were to be proposed, an amended risk assessment would be performed to evaluate the new land use and associated exposure pathways for the OSOU. Therefore, the land-use assumptions are still valid.

4.5.2.3 Changes in Toxicity Values

Because USEPA's toxicity criteria were used to derive the original PRGs, IRIS was reviewed to determine whether the toxicity data had changed since the qualitative risk assessment had been conducted. The IRIS database is considered to be the first tier in the USEPA's hierarchy of sources of toxicity values (USEPA, 2003b). A review of the toxicity values indicated the following:

- As discussed in the Fourth Five-Year Review (WPAFB, 2016a), the PRGs used in the original risk assessment have been replaced by RSLs. The RSLs are updated every 6 months and reflect changes in exposure factors and toxicity criteria.

- Several individual toxicity values have changed since the last review. Some criteria are now more stringent, while some are less stringent. Notably, most of the COCs in groundwater also have MCLs, so the impact due to changes in the toxicity values is not an issue. The compliance levels for groundwater are discussed below.

- For the soil, the cumulative impact of the more stringent toxicity values would be expected to be offset by the effects of those values that are now less stringent. Moreover, LFs 8 and 10 are capped and there is no current contact with surface soil. The compliance levels for soil are provided in **Appendix A**, **Table A-3** and discussed below.

- As discussed in the introduction to **Appendix A**, toxicity values are available for some chemicals that did not have toxicity criteria at the time of the original quantitative risk assessment. For example, TCE did not have IRIS-verified toxicity values until the final version of the Toxicological Review of Trichloroethylene was issued in September 2011 (USEPA, 2011b). The verified oral and inhalation toxicity criteria were posted in IRIS in September 2011 (USEPA, 2011b. This information did not change the conclusions of the original risk assessment for groundwater because TCE concentrations at the OSOU are ultimately compared with the MCL. In addition, TCE was not detected in wells for LF8 (**Table 3-4**) or LF10 (**Table 3-5**). Although TCE was detected in recent soil gas samples, the concentrations in soil gas samples collected since the Fourth Five-Year Review have been below the screening levels.

- The selection of toxicity criteria for PCBs is based on a tiered approach (USEPA, 1996a). The current slope factor for PCB (2 per mg/kg/day), is less conservative than the previous value (7.7 per mg/kg/day).

- Some of the values are considered provisional or PPRTVs. These values are obtained from Tier 2 sources according to USEPA's hierarchy because they have not undergone the required review process for the values to be placed in IRIS. In addition, some criteria are from Tier 3 sources, which are developed by other USEPA or non-USEPA sources, such as ATSDR or CalEPA.

With respect to the toxicity information that was used in the risk assessment, the conclusions of the original risk assessment are still considered to be valid. To determine whether changes in toxicity values result in any new COCs in the LTM program, the MDCs of chemicals detected in groundwater samples collected in April 2019 were compared with current MCLs and RSLs. This comparison is shown in **Appendix A**, **Table A-7**. Three chemicals (chloromethane, trans-1,2-dichloroethene, and mercury) that had not been detected as part of the Fourth Five-Year Review were detected in April 2019 and evaluated for this review. Two chemicals (trans-1,2-dichloroethene and mercury) were below their respective MCLs. There is no MCL for chloromethane; however, the MDC was below the current tap water RSL. Therefore, no new COCs were identified during this five-year period.

The remedy remains protective because the potential exposures to groundwater will continue to be managed through ICs. As previously discussed, the SCOU ROD included compliance levels for COCs in soil. Although the landfills are capped and there are no direct exposures to soil, the compliance levels for soil are compared with current RSLs in **Table 3-9**. As stated in **Section 3.5.2.1**, all of the current industrial RSLs are less stringent than the compliance levels established in the SCOU ROD.

Because lead does not have a toxicity value, exposures to lead were evaluated using the IEUBK model. The IEUBK model has been updated since the original risk assessment was performed and the current version of the model is IEUBKwin V1.1-Build 11 (USEPA, 2010c). The conclusions of the original lead evaluation, however, are not affected. USEPA has also developed the ALM to evaluate occupational exposures to lead (USEPA, 2003a). While the input parameters for the models evaluating uptake of lead in children and adults have been updated, the action level for water and screening level for soil have not changed and are still considered to be protective. Furthermore, the selected remedy prevents exposure to LF8 soil, therefore, the remedial efforts at LF8 are still considered to be protective.

The guidance for dermal risk assessment (USEPA, 2004) has not changed since the Fourth Five-Year Review. Although there were changes to some of the exposure factors and assumptions used to calculate dermal toxicity values in the original risk assessment (USEPA, 2011a, 2014b), these changes were not expected to change the overall conclusions of the quantitative risk assessment.

Given the remedial actions taken for the SCOU, however, there is no direct human contact with the media evaluated for the OSOU (i.e., groundwater, sediment, and soil).

The USEPA developed the Soil Screening Guidance (USEPA, 1996b) as a framework for screening contaminated soils. Had the SSL values for groundwater migration been applied in the quantitative risk assessment, it is likely that soil concentrations of some constituents would have exceeded the SSLs. This methodology has not changed since the SSL Guidance was issued. The presence of the LF caps that were installed as part of the remedy, however, reduces infiltration of water through soil associated with the LF. In addition, constituents that leach to groundwater would be addressed under the LTM Program.

4.5.2.4 Changes in RAOs and Cleanup Levels

The NA alternative was selected for the OSOU because the SCOU remedial action was considered to be comprehensive and would address all exposure pathways where a risk was identified; therefore, there are no RAOs or cleanup levels for the OSOU. The remedy described in the OSOU ROD (WPAFB, 1994) continues to be protective because exposure to groundwater is managed. The mitigation system implemented to address vapor intrusion at 5 DuPont Way has been effective in reducing VOCs in sub-slab soil vapor to concentrations at or below the screening levels (**Section 3.5.2.4**).

4.5.3 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

There has been no additional information that would call into question the protectiveness of the remedy.

4.5.4 Technical Assessment Summary

Based on evaluations of the LTM analytical data, maintenance records from CAM Management and Services, and results of additional investigations in the OSOU, the remedy at the OSOU is functioning as intended in the ROD. The remedy is currently short-term protective of human health and the environment because implemented ICs prevent exposure to contaminated groundwater and the remedial action implemented at the SCOU has reduced the potential for migration of contaminants to the OSOU.

There have been some changes to MCLs, toxicity values, and changes to risk assessment guidance documents since the last five-year review as noted in **Section 4.5.2**. The remedy at OSOU currently protects human health and the environment because the new values are less stringent and because exposure to groundwater is managed. The remedy described in the OSOU ROD

(WPAFB, 1994) continues to be short-term protective because exposure to groundwater is managed and the remedy addresses the pathway of exposure.

In addition, soil vapor has been added to the media to be addressed. Soil vapor investigations have been conducted for specific locations (Shaw, 2013), as noted in **Section 3.4**. The mitigation system implemented to address vapor intrusion at 5 DuPont Way has been effective in reducing VOCs in sub-slab soil vapor to concentrations at or below the screening levels.

There is no additional information that calls into question the effectiveness of the remedy.

4.6 Issues

VOCs continue to be detected in groundwater adjacent to the northeast corner of LF8 in the vicinity of DuPont Way. As summarized in **Section 3.3**, a multimedia investigation was conducted in the area (Shaw, 2013), which identified a soil vapor issue at the 5 DuPont Way residence and provided the basis for an indoor air mitigation system. The system's performance is monitored with annual sub-slab soil gas monitoring of the residence. Follow-up samples indicated that the mitigation system is operating as designed. Additional information on the active mitigation system and monitoring is presented in **Chapter 3**.

The following issues were identified during the review for the OSOU:

- Soil gas methane concentrations in soil gas monitoring probe LF8-MP010 (approximately 8 ft bgs), located outside of and adjacent to the LF8 boundary, have historically exceeded the LEL. This area has been further investigated and remediated as discussed in **Sections 3.4.4.5**.
- Soil vapor concentrations of chloroform in two sub-slab samples collected from the two monitoring points at 5 DuPont Way (**Table 3-6**) twice exceeded the calculated USEPA RSL but were below the ODH action level during the five annual sampling events conducted during this five-year period; a mitigation system has been installed, sub-slab samples are collected annually, and the manometer is inspected quarterly.

4.7 Recommendations and Follow-up Actions

This five-year review concluded that the remedy for the OSOU is short-term protective of human health and the environment. Although VOCs have historically been detected in groundwater at the northeast corner of LF8, the remedy is currently protective of human health because implemented ICs (including a public drinking water supply) prevent exposure to contaminated groundwater.

It is recommended that the following actions be continued or implemented during the next review period:

- Prepare a Memorandum to Site File to memorialize remedial efforts conducted at 5 and 7 DuPont Way (remediated for elevated methane levels from April to September 2019) and installation of MPs at the northeast LF8/DuPont Way boundary.

- Continue semiannual methane monitoring of entire LFG monitoring network and also continue monthly monitoring of the MPs at 5 and 7 DuPont Way installed as part of the investigation/remedial action.

- Continue quarterly inspection of the sub-slab soil vapor monitoring at 5 DuPont Way to ensure the soil vapor mitigation system is performing as designed.

- Continue the current LTM Program.

- Place deed restrictions on the property if the property is ever transferred out of federal ownership. WPAFB will submit to the agencies a 'Notification of Transfer' at least six months prior to any transfer or sale of the property but no less than 60 days (WPAFB, 2012a).

Table 4-1
Site Chronology
Off-Source Operable Unit
Wright-Patterson AFB, Ohio

Event	Date
Preliminary Assessment	February 25, 1981
Initial Response Actions	June 1989, 1990, and March 1991
Focused Remedial Investigation	October 1993
Focused Feasibility Study	March 1992
Record of Decision	June 1994
First Five-Year Record of Decision Review	March 2000
Second Five-Year Record of Decision Review	January 2006
Technical Site File Document for Operable Unit 1	April 2008
Operable Unit 1, LFs 8 and 10 Operation and Maintenance Plan	June 2009
Third Five-Year Record of Decision Review	August 2011
Explanation of Significant Differences (Multiple OUs)[1]	August 2012
Soil, Groundwater, Soil Gas, and Indoor Air Report, DuPont Way and Welcome Way Investigation Report	July 2013
Fourth Five-Year Record of Decision Review	April 2017
Notice of Violation (NOV) – Landfill Gas Exceedances at LF8 (Ohio EPA)	April 2019
Methane Gas Investigation and Remediation at 5 and 7 DuPont Way	April to December 2019[2]
Resolution of Violation (ROV) for Landfill Gas Exceedances at LF8 (Ohio EPA)	September 2019

Notes:

1 – Source Control Operable Unit; Off-Source Operable Unit; 21 No Action Sites; Spill Sites 2, 3, and 10; 41 No Action Sites; and Groundwater Operable Unit.

2 – Methane remediation verification monitoring to continue until December 31, 2019 as a condition of the ROV.

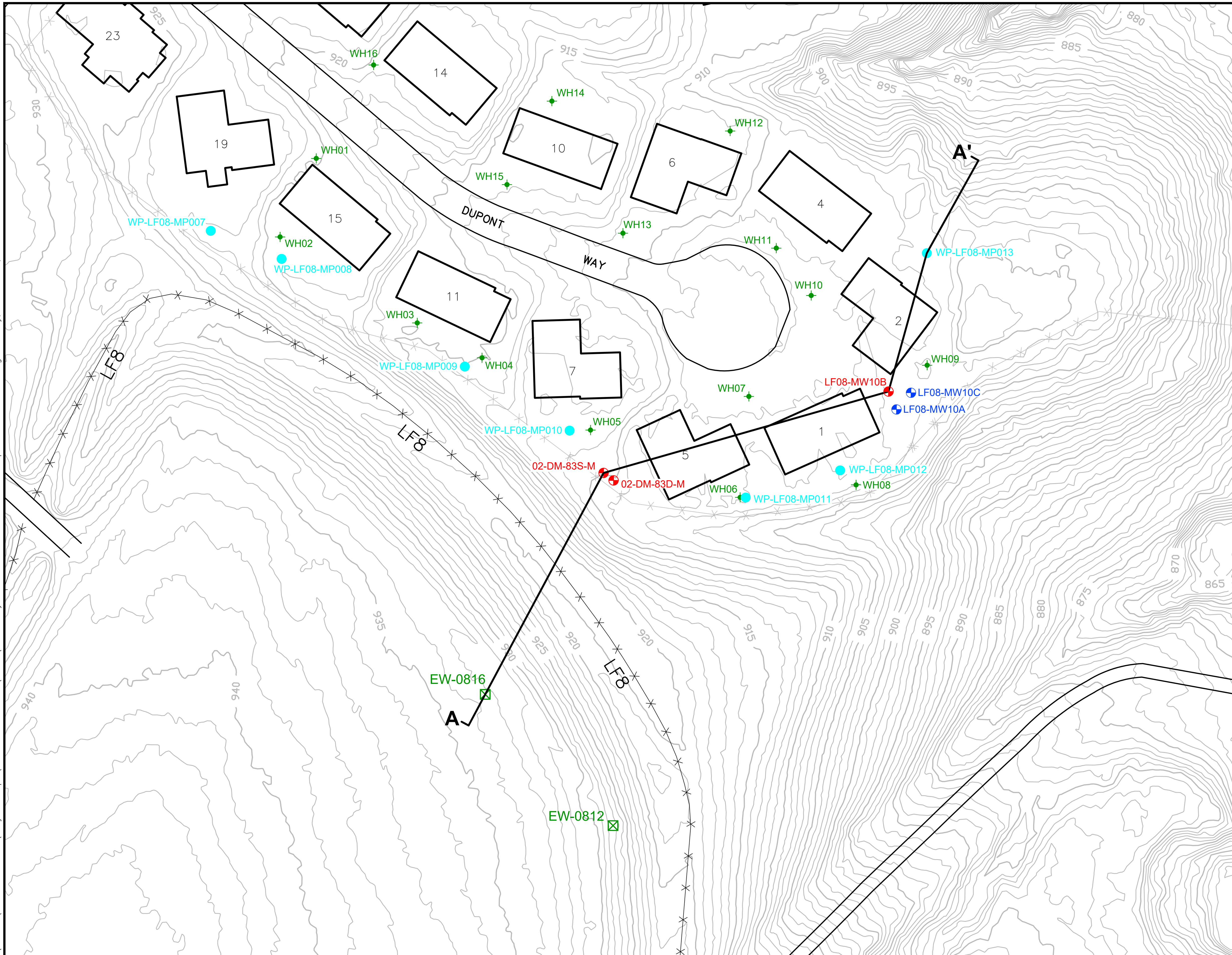
Table 4-2
Summary of Human Health Risk Assessment Results
Off-Source Operable Unit
Wright-Patterson AFB, Ohio

Pathway	Current		Hypothetical Future (1)	
	Cumulative Risk	Hazard Index	Cumulative Risk	Hazard Index
Surface Water	9E-05	HI = 0.006(2)	4E-04	HI = 0.1(2)
Sediment	6E-06	HI = 0.3	1E-04	HI = 5

Notes:

1 – based on hypothetical future residential scenario.

2 – Hazard index for non-cancerous effects.



Legend

- MONITORING WELL LOCATION WITH VOC CONTAMINATION IN GROUNDWATER
- MONITORING WELL LOCATION
- LFG MONITORING PROBE LOCATION
- PHASE II GEOPROBE LOCATION
- EXTRACTION WELL
- A A' GEOLOGIC CROSS SECTION

LFG LANDFILL GAS

N

60 30 60

Feet

WRIGHT-PATTERSON
AIR FORCE BASE,
OHIO

FIFTH FIVE-YEAR ROD REVIEW

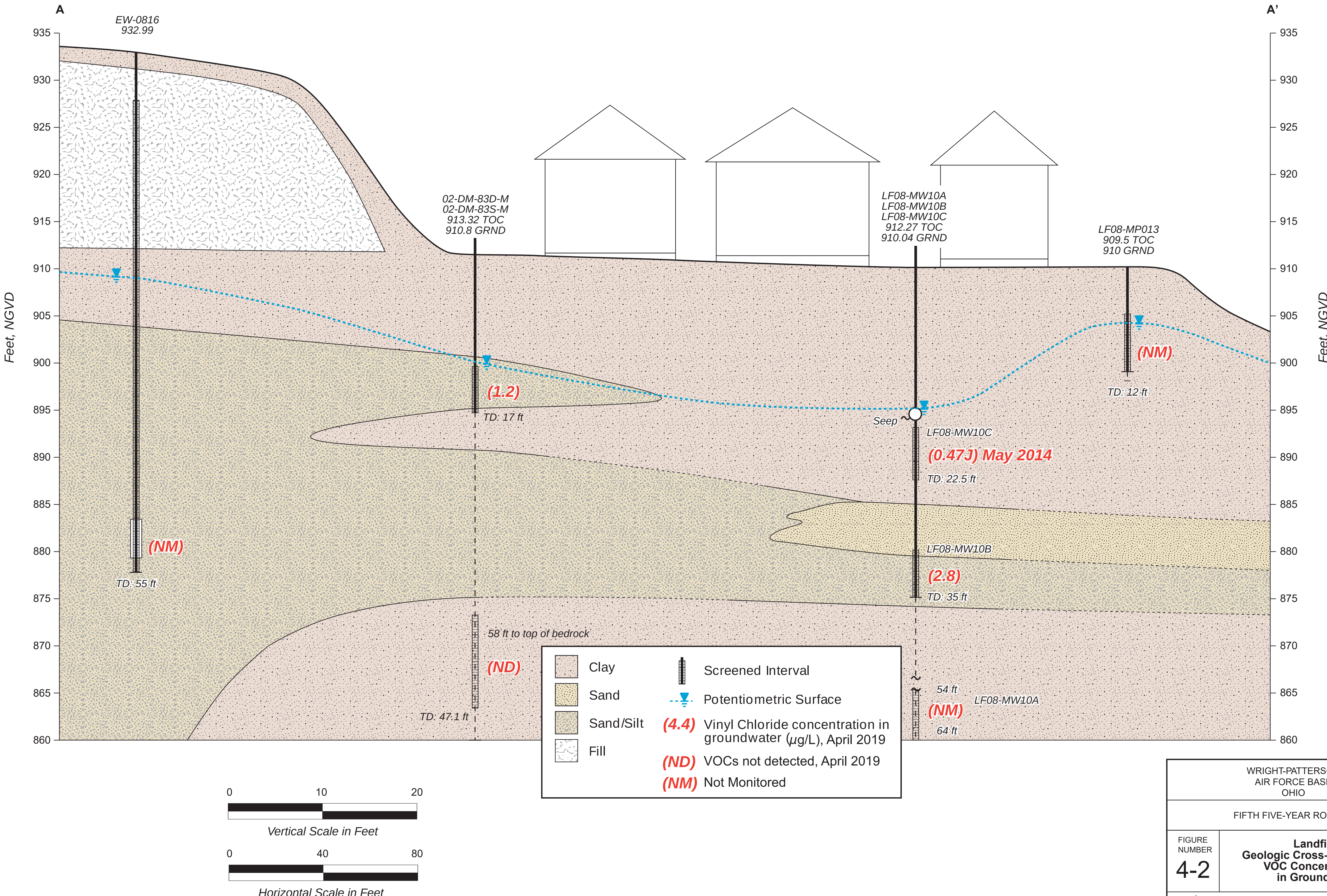
FIGURE NUMBER
4-1

The Woods Subdivision Sampling Locations and Geologic Cross-Section A-A'

APTIM

APTIM
5050 Section Avenue
Cincinnati, Ohio 45212

G:\WPAFB\GIS_Documents\Project_Maps\501363.03000000\DWGs\WPAFB_5yrROD_04-1_WoodlandHills_Samp_Locs_CS_Locs.dwg Tuesday, October 1, 2019 2:59:47 PM



WRIGHT-PATTERSON
AIR FORCE BASE
OHIO

FIFTH FIVE-YEAR ROD REVIEW

FIGURE NUMBER
4-2

Landfill 8
Geologic Cross-Section with VOC Concentrations in Groundwater

APTIM
APTIM
5050 Section Avenue
Cincinnati, Ohio 45212

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5.0 Five-Year Review for 21 NA Sites

The 21 NA Sites ROD (WPAFB, 1996) addresses remedial actions for soils only at 21 IRP sites at the Base. The sites included in this ROD are listed below by their respective OU:

- OU2 – Burial Site (BS1) 1, Long-Term Coal Storage Area (LTCSA), Temporary Coal Storage Pile (TCSP), Coal and Chemical Storage Area (CCSA), Building 89 Coal Storage Pile (B89CSP) (**Figure 5-1**)
- OU3 – LF14, Fire Training Areas (FTAs) 2 through 5, SP 1, Earthfill Disposal Zone (EFDZ)11, EFDZ12 (**Figure 5-2**)
- OU5 – BS4, FTA1, Gravel Lake Tank Site (GLTS) (**Figure 5-3**)
- OU6 – EFDZ1 (**Figure 5-4**)
- OU10 – Central Heating Plant (CHP) 3, LF13, Tank Farm (TF) 49A, Underground Storage Tank (UST) 30119 (**Figure 5-5**).

The ROD only addresses soils at these sites. The remedy for groundwater at WPAFB is included in the GWOU ROD (discussed in **Chapter 8**). The remedy selected in the 21 NA Sites ROD was the no remedial action alternative; the USAF determined that this action was appropriate to ensure protection of human health and the environment at these sites. This decision was based on analytical data, restricted land uses at each of the 21 sites, and the assumption that these restrictions would remain in place. (Because ICs and ECs were already in place at the 21 IRP sites when the ROD was written in 1996, the selected remedy is considered a "limited action" according to USEPA IC guidance document [USEPA, 2010a] rather than a "no action" remedy.)

A five-year review of the selected remedial alternative of NA for soil is necessary to determine whether land-use restrictions, as presented in the ROD, remain at each of the 21 NA sites. In accordance with the LUCIP (TetraTech, 2019) and the ESD (WPAFB, 2012a), land use for all of the 21 NA Sites remains either industrial or recreational and unrestricted land use remains prohibited. These land uses will remain in effect until otherwise allowed under a revised LUC Plan. If, in the future, portions of WPAFB are transferred or sold to either a federal or non-federal entity, the provisions specified in **Section 2.4** (Land Use Control Procedure) will be followed.

5.1 Background

A site by site description of the 21 NA Sites, by OU, is presented in the ROD for the 21 NA sites (WPAFB, 1996). **Figures 5-1** through **5-5** show the location of the sites addressed in the 21 NA

Sites ROD. A chronology of important and relevant dates for the 21 NA sites is provided in **Table 5-1**.

5.1.1 History of Contamination

The 21 NA sites had a variety of former uses. **Table 5-2** provides a listing of the former and current land uses for each site as determined during site inspections for this review. In addition, as further discussed in **Section 5.3**, an SI to investigate AFFF was conducted at the FTAs in OU3, and OU5 (Aerostar, 2018). AFFF contain PFOS/PFOA, which are not included in the COCs for the 21 NA Sites ROD and do not currently have a drinking water MCL.

5.1.2 Initial Response

No initial response actions were taken at 18 of the 21 NA sites. The following response actions were taken at the remaining three sites:

- FTA5 – Following a fuel spill of approximately 2,700 gallons in 1986, a scavenger pump system was used to recover fuel, followed by in situ biological treatment to biodegrade fuel that was not recovered. WPAFB discontinued use of jet petroleum grade 4 (JP-4) in 1995 and switched to a propane-based fire control system to simulate aircraft fires. The UST used to store JP-4, the oil/water separator, piping system, a 25,000 gallon wastewater tank, and contaminated soil were removed according to State of Ohio Bureau of Underground Storage Tank Regulations (BUSTR) guidelines. This site was further investigated under OU3.

- TF49A – The site was closed in accordance with BUSTR and documented by the State Fire Marshal's letter dated September 15, 1994. Closure activities were conducted in September 1993, and included the removal of 16 USTs, 10,018 cubic yards of contaminated soil, and several thousand gallons of residual product/pit water and tank rinsate. The excavation was filled and graded. Site TF49A was originally included on the list of IRP sites to be investigated, and was therefore included in the 21 Sites ROD. However, the site was remediated and closed under the BUSTR program, and was not included in IRP investigation activities.

- UST30119 – This site was closed in accordance with BUSTR and documented by the State Fire Marshal's letter dated September 14, 1994. Closure activities were conducted in 1993 and included the removal of five USTs, approximately 1,200 cubic yards of contaminated soil, and residual product. The excavations were then filled and graded. Site UST30119 was originally included on the list of IRP sites to be investigated, and was therefore included in the 21 NA Sites ROD. However, the site was remediated and closed under the BUSTR program and was not included in IRP investigation activities.

5.1.3 Basis for Taking Action

The basis for taking action (implementing restrictions on land use) was due to the presence of hazardous substances above levels that would allow for unrestricted use of the site. **Table 5-3** provides a summary of COCs detected at each site and a summary of the risk assessment results.

5.2 Remedial Actions

Each of the sites was considered for appropriate remedial actions based on the COCs detected and the hazards presented.

5.2.1 Remedy Selection

The 21 NA Sites ROD documents the selected remedy for soils at the subject 21 IRP sites to be "no action." However, ICs and ECs were already in place at the 21 IRP sites when the ROD was written in 1996. Therefore, the selected remedy is considered a "limited action" according to USEPA IC guidance document (USEPA, 2010a) rather than a "no action" remedy. The 21 NA Sites ROD requires the following:

- Limited access to the general public due to the location within an active military installation.
- Further access restrictions at FTA1 and FTA5 due to gated and locked entries for specialized military training activities at these sites.
- Restrictions on digging or excavation at any of these sites.

The 21 NA Sites ROD states that the NA decision for these sites deals only with soils; remedies for groundwater, surface water, and sediments at the sites are addressed under the BMP. As noted in **Section 2.2**, these monitoring activities were combined to form the GWOU (**Chapter 8**).

5.2.2 21 No Action Sites RAO

The USEPA, OEPA, and WPAFB determined that soil conditions at the 21 NA sites posed no current or potential threat to human health and the environment at levels that would warrant remedial action. Thus, the RAO for these sites is to prevent exposure to hazardous substances until and unless unlimited use and unrestricted exposure levels are attained at each individual site.

5.2.3 Remedy Implementation

The ICs and ECs required by the 21 NA Sites ROD were in place and functioning prior to the effective date of the ROD. **Table 5-4** provides a listing of the current ECs for each of the 21 NA sites. Points of contact for these sites (as applicable) can be found in the LUCIP (TetraTech, 2019).

In addition to the ECs, WPAFB implements various ICs to ensure that digging or excavation at these sites remains restricted. These ICs include:

- Review of plans, designs, and specifications for on-Base construction by WPAFB IRP personnel.
- Submittal and approval of AF Form 103 to the IRP personnel prior to anyone excavating or digging anywhere within Base boundaries.
- Submittal and approval of AF Form 813 to assess the potential environmental impact of any action proposed at WPAFB.
- Entering all ROD use limitations and exposure restrictions and site locations into the IDP and the GIS.
- Reevaluation of each IC during the five-year review period for continued protectiveness of human health and the environment.
- Inspection of sites to identify land use and condition of site controls in place, ensure that the land uses identified in the RODs are maintained, and verify that land use activities remain compatible with underlying risk assessment assumptions.

These ICs and ECs are currently summarized and documented in the ESD (WPAFB, 2012a) and the LUCIP (TetraTech, 2019).

5.2.4 System O&M

ECs (such as fencing, gates, and locks) are maintained by various entities at WPAFB. **Table 5-5** provides a listing of the entities responsible for maintaining the ECs at the 21 NA sites.

5.3 Progress Since the Last Five-Year Review

A protectiveness determination for the 21 NA Sites ROD could not be made during the previous Five-Year Review (WPAFB, 2016a) until further information was obtained concerning PFOS/PFOA contamination in soils from the use of AFFF. The PFOS/PFOA in the soil at the FTAs are a source of groundwater contamination and the presence of PFOS/PFOA in the groundwater is an indication that these compounds have leached from the soil. It was recommended that an SI be conducted to further evaluate the areas most likely to be impacted. The SI of Aqueous Film Forming Foam Areas at WPAFB (Aerostar, 2018) identified the FTAs where concentrations of PFOS/PFOA in the soil were slightly above the residential RSL.

The SI to investigate AFFF (Aerostar, 2018) included the following sites under the 21 NA Sites ROD:

OU3 – FTAs 2 and 5, included in AFFF Area 21 in the SI Report; and Former FTAs 3 and 4, included in AFFF Area 22 in the SI Report (Aerostar, 2018)

OU5 – FTA1, referred to as "Former Riverview Road FTA and EOD Range" and included in AFFF Area 23 in the SI Report (Aerostar, 2018); the EOD Range site is shown on **Figure 7-1**.

The SI Report (Aerostar, 2018) concluded that groundwater and surface water had been impacted by AFFF activities at the FTAs and this is further discussed under the GWOU (**Chapter 8**). The conclusions from the SI regarding surface and subsurface soils at these sites are as follows:

- FTAs 2 and 5: "The results of the surface soil and subsurface soil samples indicate that no concentrations of the target analytes remain in the soils exceeding the screening criteria.."
- Former FTAs 3 and 4: "the results for the analyses of the surface soil and subsurface soil, PFAS compounds are at concentrations exceeding the screening criteria. Based on the analytical results, a release of AFFF has been confirmed at AFFF Area 22 and the soils have been impacted to an extent that could create a potential hazard to human health. Due to the PFAS concentrations exceeding screening levels and the close proximity of potential drinking water sources, an expanded SI to be followed by an RI is recommended."
- Former Riverview Road FTA: "The results of the surface soil and subsurface soil samples indicate that no concentrations of the target analytes remain in the soils exceeding the screening criteria."

There were no other issues or recommendations in the previous Five-Year Review (WPAFB, 2016a) for any sites included in the 21 NA Sites ROD. In addition, no actions other than the maintenance of ECs described in **Section 5.2.4** have been performed at the sites since the last Five-Year Review.

5.4 Five-Year Review Process

The five-year review was completed following USEPA guidance in Comprehensive Five-Year Review Guidance (USEPA, 2001). This section provides a summary of the process used for the five-year review for the IRP sites contained in the 21 NA Sites ROD.

5.4.1 Administrative Components

The five-year review process was initiated by the WPAFB IRP AFCEC/CZO. The five-year review process is managed by AFCEC with regulatory oversight by USEPA and OEPA. The review schedule was established by the review team and included the following components:

- Community Involvement
- Document Review
- Data Review

- Five-year Review Report Development and Review.

5.4.2 Community Involvement

The USEPA's OSWER guidance requirements for five year reviews specifies a draft public notice of initiation of the Five-Year Review should be published initially identifying to the community that a five-year review will be conducted. An initiation notice was published in the Dayton Daily News legal section on June 4, 2020, notifying the community that the Fifth Five-Year Review for WPAFB is currently being conducted. The initiation notice was posted at the following online link: https://classifieds.daytondailynews.com/ads/public-notices/legal-notice/notice-of-initiation-of-the-five-year-record-626812.

After USEPA and OEPA concur on the final CERCLA Five-Year Review Report, a notice for formal public review will be placed in the Dayton Daily News. A copy of the Report will be provided to the WPAFB RAB stakeholders and added to the Administrative Record at the WPAFB IRP office, as well as the Information Repository located at Wright State University, 3640 Colonel Glenn Highway, Dayton, Ohio.

5.4.3 Document Review

The Five-Year Review consisted of a review of the following documents:

- Record of Decision for 21 No Action Sites (WPAFB, 1996)
- Operable Unit 3 Final Remedial Investigation Report (SAIC, 1995)
- No Action Proposed Plan for EFDZ1 (Metcalfe & Eddy, 1996b)
- Operable Unit 10 Decision Document, Central Heating Plant 3 (CH2M HILL, 1995a)
- Operable Unit 10 Decision Document, Bldg. 30119 (CH2M HILL, 1995b)
- Decision Document, Earth Fill Disposal Zones 10, 11, 12 (SAIC 1992a)
- Decision Document, Landfill 14 (SAIC, 1994)
- Technical Document to Support No Further Action, Tank Farm 49A (CH2M HILL, 1995c)
- Operable Unit 10 Final Remedial Investigation Report (CH2M HILL, 1995d)
- Operable Unit 5 Final Remedial Investigation Report (IT, 1995b)
- Final Remedial Investigation Report for Operable Unit 2 (ES, 1995)
- No Action Proposed Plan for Sites Within or Near Operable Unit 10 (CH2M HILL, 1996)

- Final Fourth Five-Year Record of Decision Review Report (WPAFB, 2016a)
- Long Term Groundwater Monitoring Reports (CB&I, 2015-2016, APTIM, 2017-2020)
- Explanation of Significant Differences: Source Control Operable Unit – Landfills 8 and 10; Off-Source Operable Unit and Final Remedial Actions Landfills 8 and 10; 21 No Actions Sites; Spill Sites 2, 3, and 10 (Operable Unit 2); 41 No Action Sites; and Groundwater Operable Unit (WPAFB, 2012a)
- Final Site Inspection Report of Aqueous Film Forming Foam Areas at Wright-Patterson Air Force Base, Ohio (Aerostar, 2018).

5.4.4 Data Review

No actions related to the COCs identified in the soils at the 21 NA sites has occurred since the signing of the 21 NA Sites ROD, with the exception of groundwater monitoring under the LTM Program and maintenance of ECs (such as fencing, signs, and gates). Groundwater monitoring results under the LTM Program and recommended changes to groundwater monitoring at the 21 NA sites are provided in **Chapter 8**.

As noted in **Section 5.1.1**, a site inspection to investigate AFFF was conducted at various sites in OU2, OU3, and OU10 (Aerostar, 2018). AFFF contain PFOS/PFOA, which are not included in the COCs for the 21 NA Sites ROD and do not currently have a drinking water MCL. The conclusions of the SI for the sites included in the 21 NA Sites ROD are summarized in **Section 5.3**. Groundwater analytical results from the quarterly PFOS/PFOA sampling program are presented in **Chapter 8**.

5.4.5 Site Inspection

Personnel at WPAFB routinely inspect the ECs in place at the various sites. Site inspections were conducted during this review and summaries of the inspections are provided in **Table 5-2**.

5.4.6 Interviews

The following community members were interviewed regarding the status of the 21 NA sites, to determine if any additional actions or concerns had occurred:

- Mr. Justin Hall, CAM

The results of the interviews are included in **Appendix B**. As indicated on the forms no concerns were raised.

5.5 Technical Assessment

The primary goal of the five-year review is to determine whether the remedy at a site is protective of human health and the environment, to provide a framework for organizing, evaluating data and information, and to ensure that all relevant issues are considered when determining the protectiveness of the remedy. USEPA guidance lists three questions to consider. The questions are as follows:

> **Question A:** Is the remedy functioning as intended by the DD?
>
> **Question B:** Are the exposure assumptions, toxicity data, cleanup levels and RAOs used at the time of the remedy still valid?
>
> **Question C:** Has any other information come to light that could call into question the protectiveness of the remedy?

The following sections provide responses to the questions for each of the sites being reviewed.

5.5.1 Question A: Is the remedy functioning as intended by the DDs?

The review of documents and the results of interviews with WPAFB IRP office personnel indicate that the remedy is functioning as intended by the 21 NA Sites ROD for the COCs identified in the ROD. Land-use restrictions and ECs required under the 21 NA Sites ROD are currently being implemented in accordance with the WPAFB LUCIP (TetraTech, 2019). The LUCIP, which replaced the LUC Plan (Labat, 2012), were provided to OEPA, USEPA, WPAFB personnel responsible for maintaining the ECs, implementing ICs on excavating, digging and construction, and entities at WPAFB responsible for ensuring that land usage remains consistent with the ROD requirements. Groundwater monitoring is conducted under the LTM Program and is discussed in **Chapter 8**.

5.5.2 Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?

Yes, the exposure assumptions, toxicity data, cleanup levels, and RAOs are still valid. The 21 NA sites were evaluated using semi-quantitative risk assessment (i.e., screening-level risk assessment) and quantitative risk assessment methods. As a result of these evaluations, no action was required. Supporting documentation is provided in **Appendix A**, **Section A.3**. The rationale for each component of Question B is provided below and in **Table 5-6**.

5.5.2.1 Changes in ARARs and TBCs

Three of the NA sites were closed under BUSTR (FTA5 in 1996, TF49A in September 1994, and UST30119 in September 1994) in accordance with OAC 1301:7-9-13. The BUSTR regulations have been revised five times since the closures (Ohio Department of Commerce [ODC] 1999, 2001, 2005, 2014, 2017), and as part of the revisions to these regulations, the action levels for protection of human health were expanded to address specific exposure pathways. Because Corrective Actions completed prior to March 31, 1999 are not affected by the updated rules, the NA alternative is still protective. The ARARs for these three sites are still valid.

No ARARs were listed in the ROD for the remaining 18 sites; however, information to be considered such as the Region 9 PRGs and USEPA toxicity criteria were used in the semi-quantitative and quantitative risk assessments, respectively. These values are discussed in **Section 5.5.2.3**. The remedy selected for each of the 21 sites addressed in the ROD is the NA alternative, which is based on restricted land use and ICs.

As discussed in **Section 2.6**, PFAS are considered emerging contaminants. PFOS/PFOA have been detected in soil and groundwater at WPAFB. As mentioned previously, there are currently no promulgated standards for PFOS/PFOA in either soil or groundwater. Toxicity values have been derived for PFOS/PFOA in support of the development of the HAL for drinking water. Although these values have not been verified in IRIS or made available as PPRTVs, they have been used in USEPA's RSL calculator to estimate a soil screening level of 0.13 mg/kg. In addition, PFOS/PFOA in soil at the FTAs are a source of groundwater contamination due to leaching. Groundwater associated with the 21 NA sites is monitored as part of the LTM program and is addressed in **Section 8.0** of this Five-Year Review under the GWOU.

5.5.2.2 Changes in Land-Use and Exposure Assumptions

Land use of the 21 NA sites includes industrial, industrial-training areas, commercial, and recreational (TetraTech, 2019). Although land use remains unchanged at all of the sites covered in the 21 NA Sites ROD, several of the land use designations have changed since the last Five-Year Review. The designations used in the previous Land Use Controls (LUC; Labat, 2012) were changed in the updated Land Use Control Implementation Plan (LUCIP; TetraTech, 2019). In particular, land use previously designated as "open space" is now referred to as "industrial". The LTCSA and BS1 sites have been excavated/developed since the Fourth FYR Review. These areas have recently undergone excavation and construction for development of a new entry control point/Gate 26A, which is also referred to as a commercial truck inspection gate. This commercial truck inspection facility recently relocated from State Route 444 and Communications Boulevard. The relocation of this inspection function associated with WPAFB's former Gate 16A is included in an Environmental Impact Statement (EIS) titled, Environmental Impact Statement for Entry Control Reconfiguration and Base Perimeter Fence Relocation in Area A, with a ROD signed on

June 21, 2012 (WPAFB 2012b). The inspection facility and paved roadways leading to and from the facility cover most of BS1 and part of the northeastern corner of the LTCSA.

Exposure scenarios and assumptions are varied by site. In general, commercial/industrial land-use scenarios were assumed for sites being evaluated by a semi-quantitative risk assessment. A potential recreational scenario was also assumed for some of the sites. Because land use for these sites had remained unchanged, the exposure scenarios remain valid.

With regard to exposure assumptions in the quantitative risk assessment, there have been no changes to the exposure pathways that were evaluated for direct contact since the Fourth Five-Year Review (WPAFB, 2016a). Although the USEPA updated the default exposure factors used in the derivation of the RSLs and in quantitative human health risk assessments in 2014 (USEPA, 2011a, 2014a), these factors have not changed since the previous review (USEPA, 2019a). Changes in the RSLs and the default factors are discussed in the introduction to **Appendix A** and **Section A.3**. Therefore, the RSLs continue to address the land use and exposure assumptions of interest for the 21 NA Sites. In summary, although some of the land use designations for the 21 NA Sites have changed since the previous Five-Year Review, the allowable land uses that were originally evaluated at these sites are essentially the same. The industrial exposure scenario used in the original HHRA was sufficiently conservative to cover the current mix of industrial use at the 21 No Action Sites. Similarly, land uses at those sites that included a recreational exposure scenario have not changed since the previous review. Therefore, the conclusions of the original HHRA and previous Five-Year Reviews remain valid.

Although guidance regarding some exposure assumptions was updated in 2004 (i.e., new guidance for dermal risk assessment [USEPA, 2004]), these revisions would not affect the protectiveness of the remedy because the implementation of LUCs at these sites have rendered the dermal exposure pathway incomplete. The approach to evaluating dermal risk remains valid.

With respect to potential exposures to VOCs in soil and groundwater during construction or excavation work, the areas associated with residual contamination from these compounds are restricted from digging. The only change that has occurred since the Fourth Five-Year Review is the construction and operation of Gate 26A and the commercial truck inspection facility. The appropriate notification and approvals for digging and excavation for the structure and associated roads were addressed in the EIS for the project (WPAFB, 2012b).

The exposure scenarios continue to remain valid for the foreseeable future because the land use for these sites will continue to be classified as industrial. There are no current exposures resulting from the migration of VOCs from groundwater into buildings via vapor intrusion. With the exception of the new commercial truck inspection facility at Gate 26A, there are currently no buildings or structures located at these sites. It is also likely that concentrations of VOCs at these sites have continued to decline over the past several years and the remedy remains effective.

For Gate 26A, it is noted that the monitoring wells have been abandoned because there has been no groundwater contamination found in this area (**Figure 5-1**). Prior to developing this area, BS1 and the LTCSA were investigated under the OU2 RI/FS (ES, 1995) where it was concluded that no further action for soils were required at this site. Under the Basewide Monitoring Program (BMP) Groundwater Monitoring Plan, a component of the Engineering Evaluation/Cost Analysis (EE/CA) (IT, 1999a), groundwater at BS1 and the LTCSA was sampled for metals only, no VOCs were detected. Therefore, exposures due to vapor intrusion are not expected to occur at BS1 and LTSCA because the Gate 26A facility was constructed slab on grade. The facility consists of a 6,100 sf pre-engineered metal building. No more than approximately 11 personnel occupy the building during the hours of operation from Monday/Friday starting at 0600 until 1800 and Saturday at 0600 until 1400.

The current land use at each of the 21 NA Sites is commercial/industrial (TetraTech, 2019). Land use has not changed since the remedy was implemented. An ESD (WPAFB, 2012a) was approved in 2012 to address six RODs at WPAFB including the 21 NA Sites. As described in the introduction to **Appendix A**, this ESD formalized the implementation of ICs for each of the RODs. The LUCIP (TetraTech, 2019), which replaced the LUC Plan (Labat, 2012), is the primary administrative mechanism employed by WPAFB to determine which ICs are protective for the site and ensure that current ICs remain environmentally compatible with future land use and are properly implemented. The ICs in place for these sites include access restrictions that limit access to the site and uses of the site. The exposure assumptions are still valid. There are no current plans to transfer any of the sites addressed in the ROD; however, if a different land use were to be proposed, an amended risk assessment would be performed to evaluate the new land use. In accordance with the LUCIP (TetraTech, 2019), and the ESD (WPAFB, 2012a), land use for all of the 21 NA Sites remains either industrial or recreational and unrestricted land use remains prohibited.

Exposure to impacted groundwater is prevented because water pumped from on-Base production wells is treated prior to distribution. Furthermore, groundwater is monitored in accordance with the GWOU ROD (WPAFB, 1999).

5.5.2.3 Changes in Toxicity Values

The IRIS database (USEPA, 2019b) was reviewed to determine whether the toxicity data had changed since the original risk assessments had been conducted. The review of toxicity values indicated that a number of individual toxicity values had changed. In other cases, toxicity values are now available for some chemicals that did not have toxicity criteria at the time of the risk assessments. The IRIS database is considered to be the first tier in the USEPA's hierarchy of sources of toxicity values (USEPA, 2003b). A review of the toxicity values indicated the following:

- The PRGs used in the original risk assessments at the 21 NA sites have since been replaced by the RSLs. Therefore, several individual toxicity values have changed. Some criteria are now more stringent, while some are less stringent. For the soil, the cumulative impact of the more stringent toxicity values would be expected to be offset by the effects of those values that are now less stringent.

- Toxicity values are now available for some chemicals that did not have toxicity criteria at the time of the risk assessment. In particular, several toxicity values are now available for the inhalation pathway.

- As described in **Section 2.6**, PFAS are considered emerging contaminants. As part of the development of the HAL, USEPA applied candidate toxicity values in the derivation of toxicity values for PFOS/PFOA. The HAL was based on a candidate RfD of 2.0E-05 mg/kg/day and a SF of 7.0E-02 $(mg/kg/day)^{-1}$. Although the RfD and SF are available in USEPA's on-line RSL calculator (USEPA, 2019c), these values have not yet been verified for IRIS or further evaluated as PPTRVs. With the exception of RSLs for a related compound (perfluorobutane sulfonic acid or PFBS), however, there are no RSLs for tap water or soil listed in the RSL table for PFOS, PFOA, or a combination of these compounds (USEPA, 2019a). The DoD issued guidance on October 15, 2019 to address investigations of sites with per- and polyfluoroalkyl substances within the DOD Cleanup Program (DoD, 2019). As discussed in **Section 2.6.2**, DoD derived conservative screening levels using USEPA's on-line RSL calculator as part of this guidance. The resulting residential screening level for PFOS and PFOA in soil is 0.13 mg/kg while the industrial screening level is 1.6 mg/kg. These values were applied in the SI conducted at AFFF areas at WPAFB (Aerostar, 2018).

- PAHs were identified as COCs in soil at BS1, LTCSA, TCSP, FTA2, FTA3, FTA4, FTA5, LF14, SP1, FTA1, and EFDZ1. As discussed in the introduction to **Appendix A**, USEPA issued an updated Toxicological Review of Benzo(a)pyrene under the IRIS Program in January 2017 (USEPA, 2017). This review updated the previous IRIS assessment of benzo(a)pyrene, which had been used since 1987. It was based on studies conducted after 1987 and the 2011 recommendations for the improvement of IRIS toxicity assessments.

  Benzo(a)pyrene is now identified as "carcinogenic to humans" rather than the 1987 "probable human carcinogen" weight-of-evidence classification. USEPA (2019b, 2017) provided a verified oral cancer SF for benzo(a)pyrene of 1.0E+0 per mg/kg-day and a verified IUR of 6.0E-4 per μg/m^3 in 2017.

Although the IRIS database currently indicates that the toxicity criteria for benzo(a)pyrene have been "suspended" (USEPA, 2019b), the updated oral cancer SF (1.0E+0 per mg/kg-day) and the IUR (6.0E-4 per μg/m^3) continue to be included in the current RSL table USEPA, 2019a) and applied in the RSL calculator (USEPA, 2019d). When compared with the previous oral SF (7.30E+0 per mg/kg-day), the current toxicity value represents less potency and, therefore, is less stringent. It is noted, however, that there was previously no IRIS-verified IUR for benzo(a)pyrene.

There are no IRIS-verified toxicity values for the remaining carcinogenic PAHs; however, these values have been derived from the SF and IUR for benzo(a)pyrene using their corresponding RPFs. The resulting values are used to develop RSLs for these compounds.

In addition, the RSL table now includes an RfD (3.0E-4 mg/kg-day) and an RfC (2.0E-6 mg/m^3). Previously, there were no noncancer-based toxicity values available for benzo(a)pyrene. Both of these toxicity values are based on developmental effects.

- Some of the values are considered provisional or PPRTVs. These values are obtained from Tier 2 sources according to USEPA's hierarchy because they have not undergone the required review process for the values to be placed in IRIS. In addition, some criteria are from Tier 3 sources, which are developed by other USEPA or non-USEPA sources, such as ATSDR and CalEPA.

As described in **Appendix A**, **Section A.3**, Changes in Toxicity Values, the "no action" sites were evaluated to determine whether additional measures would be needed if changes in toxicity values resulted in exceedances of acceptable limits for cancer risk or noncancer hazard for the industrial/commercial scenario. Although the soil at the "No Action" sites is subject to the provisions of the LUCIP, the screening levels and/or toxicity values were evaluated at sites where exposures to surface soil could occur. Sites at which removal actions had been taken or soil had been capped were not included. In addition, sites where semi-quantitative risk assessment had indicated very low levels of contamination were not further assessed. For the subset of sites evaluated, the screening levels used in the semi-quantitative risk assessments were compared with current screening levels. The cancer and noncancer toxicity values used in the risk assessment for the oral/dermal and inhalation routes were compared with current toxicity values. In cases where the current values were more stringent than those used in the original risk assessment, the exposure point concentrations (EPCs) from the original risk assessments were used to proportionally estimate the current cancer risk and noncancer hazard based on the current RSL (**Table A-14**). These calculations indicate that the more stringent toxicity values cumulatively resulted in cancer risks within or below the acceptable risk range. All noncancer hazard quotients were below 1.

Therefore, with respect to the toxicity information used in the risk assessment, the conclusions of the original risk assessments are still considered to be valid.

Based on current guidance for dermal risk assessment (USEPA, 2004), there were changes to some of the factors and assumptions used to calculate dermal toxicity values for the original risk assessments. No changes have been made to the dermal assessment guidance since the Fourth Five-Year Review (WPAFB, 2016a). The human health risk assessments were performed using a semi-quantitative or qualitative methodology and comparing site concentrations with Region 9 PRGs. For this evaluation, maximum contaminant concentrations were compared with the most current industrial and/or residential soil RSLs (USEPA, 2019a).

For several sites, exposures to lead in soil were evaluated using the IEUBK Model, Version 0.99 (USEPA, 1994), which does not address adult exposures to lead. Since the 21 NA sites risk assessments were performed, the IEUBK model has been updated to the IEUBKwin V1.1, Build 11 (USEPA, 2007, 2010c). In addition, the USEPA has since developed the ALM to evaluate occupational exposures to lead (USEPA, 2003a). The use of ALM would not impact the remedy because the IEUBK model conservatively addresses potential exposures to the most sensitive population.

USEPA also developed the Soil Screening Guidance (USEPA, 1996b) as a framework for screening contaminated soils that encompasses both simple (i.e., screening-level) and more detailed approaches for calculating site-specific SSLs. In particular, this guidance presents methodologies to address the leaching of contaminants through soil to an underlying potable aquifer. These methodologies have not changed since the Third Five-Year Review (WPAFB, 2011). Given the period of time the sites have existed, migration of chemicals from the sites has most likely occurred. The use of the SSLs would have no effect on the remedy. Groundwater is being monitored under the LTM Program.

5.5.2.4 Changes in RAOs and Cleanup Goals

There were no specific RAOs for any of the 21 NA sites; however, the overall RAO is to prevent exposures to COCs in soil at these sites as identified in the ROD. The NA alternative was selected as remedy for all 21 NA sites (i.e., the USAF determined that no remedial action was necessary to ensure protection of human health and the environment at these sites). This decision was based on the evaluation of analytical data and current site conditions at the time of the site inspections. (Because ICs and ECs were already in place at the 21 IRP sites when the ROD was written in 1996, the selected remedy is considered a “limited action” according to USEPA IC guidance document [USEPA, 2010a] rather than a “no action” remedy.) The 21 NA Sites ROD states that groundwater, surface water, and sediment would be monitored under the LTM Program. Thus, the RAO for these sites is to prevent exposure to hazardous substances until and unless unlimited use and unrestricted exposure levels are attained at each individual site.

To prevent exposure to soil, ICs and access/land-use restrictions are in place at all of the sites (e.g., most are located within an active military installation with limited access). Additionally, some sites have fencing around them, further limiting access. Digging or excavation at any of the 21 sites, especially those with waste/contamination left in place (e.g., LF13, CHP3, FTA5), is currently restricted because digging can only occur after Base IRP officials review the proponent's dig permit and if and how digging would be permitted. Therefore, the RAO is still valid. If portions of WPAFB are sold, the proposed land use would need to be evaluated to determine if it was consistent with the ROD requirements.

5.5.3 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

The AF is in the process of evaluating PFAS at all AF installation properties. Firefighting agents (AFFF) containing PFAS were used at the current or former WPAFB FTAs or during actual firefighting emergencies. PAs were conducted in 2014 and 2015. An SI to investigate AFFF was conducted at the FTAs in OU3 and OU5 (Aerostar, 2018). **Section 2.6.2** outlines the chronology of events related to management, investigation, and remediation of PFOS/PFOA contaminated groundwater at WPAFB. These compounds are not included in the COCs for the 21 NA Sites ROD and do not currently have a drinking water MCL. As these compounds are considered to be emerging contaminants, further research is on-going.

5.5.4 Technical Assessment Summary

The review of documents, ARARs, risk assessment assumptions, and the results of interviews with WPAFB IRP office personnel indicate that the remedy for soils is functioning as intended by the 21 NA Sites ROD. The LUCIP (TetraTech, 2019) is the primary administrative mechanism employed at WPAFB that ensures that land usage remains consistent with the ROD, and that ECs and ICs are maintained. Since groundwater is addressed in another OU, groundwater monitoring under the LTM Program is discussed in **Chapter 8**.

There have been some changes to RSLs (formerly PRGs), toxicity values, and changes to risk assessment guidance documents since the last Five-Year Review (WPAFB, 2016a) as noted in **Section 5.5.2.3**. These changes do not affect the protectiveness of the remedy because the new values are less stringent, or the remedy eliminates the pathway of exposure. There is no additional information that calls into question the effectiveness of the remedy.

5.6 Issues

Firefighting agents containing PFAS may have been used at the current or former WPAFB FTAs or during actual firefighting emergencies. As discussed in **Section 5.3**, the SI conducted at AFFF areas at WPAFB (Aerostar, 2018) concluded that elevated levels of the PFOS/PFOA are present in the soil at two FTAs that are included in the 21 NA Sites ROD. There were no other issues noted during the review of the 21 NA Sites ROD.

5.7 Recommendations and Follow-up Actions

It was recommended in the Fourth Five-Year Review that an SI be conducted to further evaluate the areas most likely to be impacted by PFOS/PFOA associated with use of AFFF at the fire training areas. As discussed in **Section 5.3**, the SI conducted at AFFF areas at WPAFB (Aerostar, 2018) concluded that elevated levels of the PFOS/PFOA are present in the soil in two FTAs that are included in the 21 NA Sites ROD. There are no proposed or promulgated cleanup levels for PFOS/PFOA in soil and no screening levels published in USEPA's RSL table. Furthermore, there are no IRIS-verified toxicity values or PPRTVs. To evaluate these soil concentrations, screening levels were calculated for PFOS/PFOA using toxicity values derived by the Office of Water in support of the HAL and default exposure assumptions for potential receptor scenarios as contained in USEPA's on-line RSL calculator (DoD, 2019). The calculated RSL for soil was applied to the SI data at the FTAs for screening purposes. As some concentrations of PFOS/PFOA at two of the FTAs have exceeded the calculated RSL for soil (0.13 mg/kg), further evaluation will be performed through risk assessment as part of on-going investigations. The remedy continues to be protective at 19 of the 21 sites. However, since two sites have PFOS/PFOA in soils above screening levels, a statement of protectiveness for those sites is deferred until sufficient information is obtained. An ESI was conducted in 2019 at seven sites including AFFF Area 21 (FTAs 2 and 5), which has not been finalized, and an RI is programmed for FY21 to evaluate the potential PFOS/PFOA contamination at these sites. Based on soils exceeding calculated screening levels at two of the FTAs (FTAs 3 and 4) included in the 21 NA Sites ROD, it is recommended that an RI be conducted at locations identified in the SI (Aerostar, 2018) and ESI (Aerostar, 2020) that have elevated levels of the AFFF component, PFOS/PFOA.

Table 5-1
Site Chronologies
21 No Action Sites
Wright-Patterson AFB, Ohio

Event	OU2	OU3	OU5	OU6	OU10
Associated Sites	B89CSP, BS1, CCSA, LTCSA, TCSP	EFDZ11, EFDZ12, FTA2, FTA3, FTA4, FTA5, LF14, SP1	BS4, FTA1, GLTS	EFDZ1	CHP-3, LF13, TF49A, UST30119
Preliminary Assessment	May 1988 – BS1, LTSCA August 1988 – CCSA April 1989 – B89CSP, TCSP	May 1988 – SP1, FTA2-FTA5 January 1989 – EFDZ11 February 1989 – EFDZ12 October 1989 – LF14	May 1988 – FTA1 March 1989 – BS4 April 1989 – GLTS	May 1988 – EFDZ1	May 1988 – CHP-3 December 1988 – TF49A July 1990 – UST 30119
Initial Response Activities	None	FTA5- UST closure – 1995 Bioremediation – 1986 Bioventing test project – 1996	None	None	TF49A – UST closure in September 1993, approved September 1994. UST30119 – UST closure in 1993, approved September 1994.
Remedial Investigation Report	August 1995	July 1995	August 1995	December 1995	December 1995
Proposed Plan	May 1996	October 1995	May 1996	April 1996	May 1996
Record of Decision	August 1996	August 1996	August 1996	August 1996	August 1996
AFFF SI	Nov. 2016 – Jan. 2017	Nov. 2016 – Jan. 2017	No wells installed	No wells installed	Nov. 2016 – Jan. 2017

<u>Abbreviations:</u>

AFFF = Aqueous film forming foam
B89CSP = Building 89 Coal Storage Pile
BS = Burial Site
CCSA = Coal and Chemical Storage Area
CHP = Central Heating Plant
EFDZ = Earthfill and Disposal Zone
FTA = Fire Training Area
GLTS = Gravel Lake Tank Site
LF = Landfill
LTCSA = Long-Term Coal Storage Area
OU = Operable Unit
SI = Site Inspection
SP = Spill Site
TCSP = Temporary Coal Storage Pile
TF49A = Tank Farm 49A
UST = Underground Storage Tank

Table 5-2
Site Inspection Summary and Land Use
21 No Action Sites
Wright-Patterson AFB, Ohio
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IRP Site	OU	Inspect. Date	Former Land Use	Current Land Use Observed During 5th Five-Year Review	Allowable Land Use - Restrictions(1)	Is Current Land Use Consistent with Allowable Land Use?
B89CSP	2	October 2019	Coal storage activities from 1940 or 1942, to about 1974.	Mostly open grassy area; some paved parking lot and roadway. Constructed wetlands along western boundary.	Industrial - 2	Yes – no change from previous Five-Year Review
BS1	2	October 2019	Contains remnants of old abandoned garden plot areas that were once suspected to be waste burial trenches, and two possible pits where sludge from fuel storage tanks may have been buried.	Grassy open area with scattered trees; located at northeast corner of Area A, adjacent to State Route 235and near City of Fairborn Recreational Facilities. New vehicle inspection facility and Gate 26A constructed on part of BS1. Facility and gate opened 18 November 2019	Industrial/Recreational - 2	Yes – land use now includes industrial land use for new vehicle inspection facility and Gate 26A
CCSA	2	October 2019	Storage of 25-gallon containers of muriatic acid and sulfuric acid, along with 2.5 gallon containers of carbon tetrachloride from the late 1940's to the early 1970's.	Grassy open area located due south of POL tank farm and east of Building 29.	Industrial - 3	Yes – no change from previous Five-Year Review
LTCSA	2	October 2019	Open storage, and then coal storage activities from 1953 to 1988.	Grassy open area; located in the northeast corner of Area A, on the east side of Loop Road, across from flightline and near City of Fairborn Recreational Facilities. New vehicle inspection facility and Gate 26A constructed on part of LTSCA. Facility and gate opened 18 November 2019.	Industrial - 3	Yes – no change from previous Five-Year Review
TCSP	2	October 2019	Coal storage activities between 1946 and 1948, with remnants removed in September 1960.	Paved road and gravel areas, some grassy areas, located in northeast corner of POL tank farm.	Industrial - 3	Yes – no change from previous Five-Year Review
EFDZ11	3	October 2019	Disposal of construction debris from a runway improvement project completed in the 1940s.	Recreational, 40% trees, 30% grass area, and 30% roadways; includes Boy Scout camping area.	Recreational - 2	Yes – no change from previous Five-Year Review
EFDZ12	3	October 2019	Disposal of construction debris from a runway improvement project completed in the 1940s.	Recreational, hunting; wooded area; located due south of the munitions storage facility.	Recreational - 2	Yes – no change from previous Five-Year Review
FTA2	3	October 2019	Small, gravel-covered burn pits once used to conduct fire training exercises from the mid-1950s to the early 1980s.	Recreational, grassy area located adjacent to flightline and between EFDZ11 and LF14. Area includes Taxiway Alpha, Riverview Road and FTA5.	Industrial - 3	Yes – no change from previous Five-Year Review
FTA3	3	October 2019	Small, gravel-covered burn pits once used to conduct fire training exercises from the mid-1950s to the early 1980s.	Combined with FTA4 and SP1,open gravel covered area, entrance to access gate for LFs 11 and 12.	Industrial - 3	Yes – the concrete batch plant that was previously staged on FTA3 has been removed
FTA4	3	October 2019	Small, gravel-covered burn pits once used to conduct fire training exercises from the mid-1950s to the early 1980s.	Open gravel covered area, entrance to access gate for LFs 11 and 12.	Industrial - 3	Yes – the concrete batch plant that was previously staged on FTA4 has been removed.
FTA5	3	October 2019	Fire training exercises using petroleum-based fuels (jet fuels), and an accidental jet fuel spill of approximately 2,700 gallons in 1986.	The current WPAFB FTA that includes firefighting structures, is a predominantly graveled area with some mowed grass. Located between Riverview Road and the Mad River.	Training Area - 3	Yes – no change from previous Five-Year Review
LF14	3	October 2019	Construction rubble and earthfill site during the late 1950s and the early 1960s.	Recreational hunting; wooded and grassy areas.	Recreational - Hunting - 3	Yes – no change from previous Five-Year Review
SP1	3	October 2019	Quantity of jet fuel, estimated at 1,000 to 2,000 gallons was accidentally released in 1972.	Open gravel covered area, entrance to access gate for LFs 11 and 12.	Light Industrial - 3	Yes – the concrete batch plant that was previously staged on SS1 has been removed

Table 5-2
Site Inspection Summary and Land Use
21 No Action Sites
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IRP Site	OU	Inspect. Date	Former Land Use	Current Land Use Observed During 5th Five-Year Review	Allowable Land Use - Restrictions(1)	Is Current Land Use Consistent with Allowable Land Use?
BS4	5	October 2019	Approximately 10 to 15 scattered drums, visible on the ground surface throughout the site, were removed as part of a drum removal action in 1990. Period of use or types of wastes disposed of not known.	Wooded and grassy area located adjacent to Marl Road at Symmes Road, the northeastern end is now a parking lot for the Huffman Prairie Flying Field.	Outdoor Recreation - 2	Yes – a paved parking lot for park visitors has been added.

IRP Site	OU	Inspect. Date	Former Land Use	Current Land Use Observed During the 5th Five-Year Review	Allowable Land Use - Restrictions(1)	Is Current Land Use Consistent with Allowable Land Use?
FTA1	5	October 2019	Fire training exercises in which fuels (typical fuels and contaminants included, but may not be limited to, oily wastes, hydrocarbons, halogenated solvents, and leaded gasoline) were burned and extinguished in pits surrounded by earthen dikes from 1950 to 1955.	Commercial/Industrial grassy area and gravel roads, with some buildings and temporary structures.	Industrial/Training Area - 3	Yes – no change from previous Five-Year Review.
GLTS	5	October 2019	Contains a sludge burning vat and four tanks from the 1940s.	Wooded area adjacent to Gravel Lake and Marl Road.	Outdoor Recreation - 3	Yes – no change from previous Five-Year Review
EFDZ1	6	October 2019	Disposal of earthfill from the 1940s to 1949.	Grassy area within Laser Test Range adjacent to Harshman Road.	Industrial/Recreational - 2	Yes – no change from previous Five-Year Review
CHP-3	10	October 2019	In operation from 1939 to 1980, and includes a former coal storage area, a former compressor oil sump, and a battery burial site.	Paved parking lot used for storage and open grassy lot.	Industrial - 3	Yes – no change from previous Five-Year Review
LF13	10	October 2019	Filled with aircraft parts, construction and demolition debris in the 1940s.	Paved parking lot and open grassy lot near offices between Allbrook Drive and Harness Road.	Industrial - 2	Yes – no change from previous Five-Year Review
TR49A	10	October 2019	UST farm used for storing various liquids including aviation gasoline, JP-4, JP-5, Stoddard solvent, and plane deicing fluids.	Paved parking lot adjacent to Pearson Drive and Van Patton Drive.	Industrial - 3	Yes – no change from previous Five-Year Review
UST30119	10	October 2019	Base Exchange Service Station with five USTs used to store gasoline and waste oils.	Open grassy lot at Allbrook Drive and Pearson Road.	Industrial - 3	Yes – no change from previous Five-Year Review

Abbreviations:

B89CSP	= Building 89 Coal Storage Pile	JP	= Jet Petroleum
BEEF	= Base Engineering and Emergency Force	LF	= Landfill
BS	= Burial Site	LTCSA	= Long-Term Coal Storage Area
CCSA	= Coal and Chemical Storage Area	OU	= Operable unit(s)
CE	= Civil Engineering	POL	= Petroleum, Oil, and Lubricants
CHP	= Central Heating Plant	SP	= Spill Site
EFDZ	= Earthfill Disposal Zone	TCSP	= Temporary Coal Storage Pile
FTA	= Fire Training Area	TR49A	= Tank Removal 49A
GLTS	= Gravel Lake Tank Site	UST	= Underground Storage Tank

(1) Land Use Key:

1 – No digging, building, construction, etc. or otherwise disturbing landfill covers.

2 – Digging, construction and other soil disturbances allowable after approval by ACECE/CZOM personnel; area subject to use restriction. May require an OEPA application of authority to disturb area within a 300-foot boundary of an Earthfill Disposal Zone, Landfill, or Waste Burial Site per OAC 3745-27-13(F).

3 – Digging, construction and other soil disturbances allowable after approval by AFCEC/CZOM personnel; area subject to use restriction.

Table 5-3
Chemicals of Concern and Risk Assessment Results
21 No Action Sites
Wright-Patterson AFB, Ohio
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IRP Site	OU	Chemicals of Concern[(1)]	Reference Source[(2)]	Risk Assessment Scenario[(3)] (Human Receptors)	Reference Source[(2)]
B89CSP	2	Benzene, toluene, xylene, PCE, PAHs, metals, mercury.	b	Commercial/Industrial – Surface Soil <1E-4 carcinogenic risk for RME scenario, HI <1 for CTE scenario. Construction Worker – Subsurface Soil <1E-4 carcinogenic risk for RME scenario, HI <1 for CTE scenario.	b
BS1[(4)] (Determined to be a garden plot area.)	2	BTEX, PAHs, pesticides, metals.	b	Recreational – 8E-6 carcinogenic (<1E-06 for CTE scenario), HI <1. Commercial/Industrial – Surface Soil, 1.7E-04 carcinogenic, HI = 4.6 (2.4E-6 carcinogenic risk and HI <1 for CTE scenario). Construction Worker – Subsurface Soil, 1.1E-5 carcinogenic, HI =7.4 (<1E-06 carcinogenic and HI <1 for CTE scenario).	l
CCSA[(4)]	2	Metals, toluene, VOCs, and SVOC TICs.	l	Current – Commercial/Industrial Worker, Surface Soil – 7.3 E-04 carcinogenic risk, HI=3.6 (6.8E-06 carcinogenic risk and HI <1 for CTE scenario). Future – Commercial/Industrial Worker, Surface Soil – 7.3E-04 carcinogenic risk HI=3.6 (6.8E-06 carcinogenic risk and HI <1 for CTE scenario). Future – Construction Worker, Subsurface Soil – 1.2E-04 carcinogenic risk, HI=5.2 (1.5E-06 carcinogenic risk and HI<1 for CTE scenario).	l
LTCSA[(4)]	2	BTEX, PAHs, pesticides, metals.	b	Recreational – 8E-6 carcinogenic (<1E-06 for CTE scenario), HI <1. Commercial/Industrial – Surface Soil – 1.7E-04 carcinogenic, HI = 4.6 (2.4E-6 carcinogenic risk and HI <1 for CTE scenario).	l

Table 5-3
Chemicals of Concern and Risk Assessment Results
21 No Action Sites
Wright-Patterson AFB, Ohio

IRP Site	OU	Chemicals of Concern[1]	Reference Source[2]	Risk Assessment Scenario[3] (Human Receptors)	Reference Source[2]
				Construction Worker, Subsurface Soil – 1.1E-5 carcinogenic, HI =7.4 (<1E-06 carcinogenic and HI <1 for CTE scenario).	
TCSP[4]	2	Metals, PAHs, pesticides, mercury.	b	Current – Commercial/Industrial Worker, Surface Soil – 7.3 E-04 carcinogenic risk, HI=3.6 (6.8E-06 carcinogenic risk and HI <1 for CTE scenario). Future – Commercial/Industrial Worker, Surface Soil – 7.3E-04 carcinogenic risk HI=3.6 (6.8E-06 carcinogenic risk and HI <1 for CTE scenario). Future – Construction Worker, Subsurface Soil – 1.2E-04 carcinogenic risk, HI=5.2 (1.5E-06 carcinogenic risk and HI<1 for CTE scenario).	l
EFDZ11	3	VOC and SVOC TICs.	f	None. Only TICs detected in soil.	f
EFDZ12	3	VOC and SVOC TICs.	b	Results of Site Investigation indicate that no contamination was detected that adversely impacts the environment.	h
FTA2	3	Benzo(a)pyrene Dibenzo(a)anthracene	b	Current – Trespassers and Recreational Users – <1E-06 carcinogenic, HI <1; Worker, 1E-06 carcinogenic, HI <1. Future – Trespassers and Recreational Users – 1E-06 carcinogenic, HI <1; Worker, 1.2E-06 carcinogenic, HI <1.	a a
FTA3	3	Beryllium Benzo(a)pyrene Dibenzo(a,h)anthracene	d	Current – Trespassers and Recreational Users, 2E-05 carcinogenic (<1E-06 for CTE scenario), HI <1; Worker, 2E-05 carcinogenic (1.2 E-06 for CTE scenario), HI <1. Future – Trespassers and Recreational Users, 3.6E-05 carcinogenic (<1E-	a a

Table 5-3
Chemicals of Concern and Risk Assessment Results
21 No Action Sites
Wright-Patterson AFB, Ohio

IRP Site	OU	Chemicals of Concern[1]	Reference Source[2]	Risk Assessment Scenario[3] (Human Receptors)	Reference Source[2]
				06 for CTE scenario), HI = 1.2 (<1 for CTE scenario); Worker, 1.7E-05 carcinogenic (1.2E-06 for CTE scenario), HI <1).	
FTA4	3	Beryllium Benzo(a)pyrene Dibenzo(a,h)anthracene	d	Current – Trespassers and Recreational Users, 2E-05 carcinogenic (<1E-06 for CTE scenario), HI <1; Worker, 2E-05 carcinogenic (1.2 E-06 for CTE scenario), HI <1. Future – Trespassers and Recreational Users, 3.6E-05 carcinogenic (<1E-06 for CTE scenario), HI = 1.2 (<1 for CTE scenario); Worker, 1.7E-05 carcinogenic (1.2E-06 for CTE scenario), HI <1).	a a
FTA5	3	Benzo(a)pyrene Dibenzo(a,h)anthracene	d	Current – Trespassers and Recreational Users, <1E-06 carcinogenic, HI <1; Worker, 1E-06 carcinogenic, HI <1. Future – Trespassers and Recreational Users, 1E-06 carcinogenic, HI <1; Worker, 1.2E-06 carcinogenic, HI <1.	a a
LF14	3	Construction debris and earthfill. Benzo(a)pyrene Dibenzo(a,h)anthracene	d	PRGs calculated for Workers and Recreational/Trespasser Child and Adult receptors, at a 1E-06 carcinogenic risk and a HI of 1. Benzo(a)pyrene detected above PRG based on 1E-06 risk level, but below 1E-04 risk level for Worker receptors. Current – Trespassers and Recreational Users, <1E-06 carcinogenic, HI <1; Worker, 3E-06 carcinogenic, HI <1. Future – Trespassers and Recreational Users, 3E-06 carcinogenic, HI =2 (<1 under CTE scenario); Worker, 3.3E-06 carcinogenic, HI <1.	g, b a a

Table 5-3
Chemicals of Concern and Risk Assessment Results
21 No Action Sites
Wright-Patterson AFB, Ohio
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IRP SITE	OU	Chemicals of Concern[1]	Reference Source[2]	Risk Assessment Scenario[3] (Human Receptors)	Reference Source[2]
SP1	3	Beryllium Benzo(a)pyrene Dibenzo(a,h)anthracene	b	Current – trespassers and recreational users, 2E-05 carcinogenic (<1E-06 for CTE scenario), HI <1; Worker, 2E-05 carcinogenic (1.2 E-06 for CTE scenario), HI <1. Future – Trespassers and Recreational Users, 3.6E-05 carcinogenic (<1E-06 for CTE scenario), HI = 1.2 (<1 for CTE scenario); Worker, 1.7E-05 carcinogenic (1.2E-06 for CTE scenario), HI <1.	a a
BS4	5	None	k	EPA Region III PRGs calculated for Industrial/Commercial scenario at 1E-07 carcinogenic risk and HI =0.1. All contaminants below PRGs. Lead concentrations did not exceed residential screening level of 400 mg/kg.	k
FTA1	5	Benz(a)anthracene Benzo(b)fluoranthene Benzo(k)fluoranthene Benzo(a)pyrene Dibenzo(a,h)anthracene Indeno(1,2,3-cd)pyrene Beryllium	k	Current – Worker and recreational users, PRGs calculated at a 1E-06 cancer level and a HI=1. All contaminants less than PRGs for RME scenario. Future – same as current scenario.	k k
GLTS	5	None	k	EPA Region III PRGs calculated for Industrial/Commercial scenario at 1E-07 carcinogenic risk and HI =0.1. All contaminants below PRGs.	k
EFDZ1	6	Benzo(b)fluoranthene Benzo(a)pyrene Endrin ketone Aluminum Thallium	c	Lawn maintenance Worker, excavation Worker, adolescent recreational receptor: <1E-4 carcinogenic risk, HI <1 for all COCs and receptors.	c

Table 5-3
Chemicals of Concern and Risk Assessment Results
21 No Action Sites
Wright-Patterson AFB, Ohio

IRP SITE	OU	Chemicals of Concern(1)	Reference Source(2)	Risk Assessment Scenario(3) (Human Receptors)	Reference Source(2)
CHP-3	10	SVOCs, metals.	b	Commercial/Industrial Adult Worker: Surface soil <1E-06 carcinogenic, HI <1; Subsurface soil 4E-05, HI <1.	d
LF13	10	Refuse, aircraft parts, construction and demolition debris. No soil samples taken, area currently paved.	m, b	Site is paved. No current exposure pathways. Future exposure scenario assumed to be Industrial/Commercial. No soil samples taken from LF13 area. Groundwater samples indicate that LF13 is not a significant source of contaminants to groundwater.	j
TR49A	10	TPH, benzene, toluene, ethylbenzene, and xylene	i	Closed in accordance with BUSTR requirements; meets Category 2 action levels.	i
UST30119	10	TPH, benzene, toluene, ethylbenzene, and xylene	e	Closed in accordance with BUSTR requirements; Ohio State Fire Marshall concurred with no further action decision (letter dated September 14, 1994).	e

Notes:

1 – Residual contamination refers to soil only, with the exception of the GWOU. Residual contaminants may or may not exceed risk-based criteria. See adjacent column for risk assessment information.

2 – See references immediately following this table.

3 – All risk assessment scenarios based on the RME unless otherwise noted.

4 – OU2 was divided into three discrete source areas, the POL Storage Area, the TCSP and BS1, and the B89CSP. The POL Storage area vicinity included Spill Sites 2, 3, and 10; the TCSP, and the CCSA. Risk assessment was conducted for the three discrete source areas, and risk was not calculated for each individual site with the source areas.

Table 5-3
Chemicals of Concern and Risk Assessment Results
21 No Action Sites
Wright-Patterson AFB, Ohio

Abbreviations:

B89CSP	= Building 89 Coal Storage Pile
BS	= Burial Site
BTEX	= Benzene, toluene, ethylbenzene, xylene
BUSTR	= Bureau of Underground Storage Tank Regulations
CCSA	= Coal and Chemical Storage Area.
CHP	= Central Heating Plant
COC	= Chemical of Concern
CTE	= Central Tendency Estimate
EFDZ	= Earthfill Disposal Zone
EPA	= U.S. Environmental Protection Agency
FTA	= Fire Training Area
GLTS	= Gravel Lake Tank Site
GWOU	= Groundwater Operable Unit
HI	= Hazard Index
IRP	=Installation Restoration Program
LF	= Landfill
LTCSA	= Long Term Coal Storage Area
LUC	= Land Use Contract
mg/kg	= Milligram(s) per kilogram
OU	= Operable Unit(s)
PAH	= Polycyclic Aromatic Hydrocarbon
PCE	= Perchloroethylene
POL	= Petroleum, Oil, and Lubricants
PRG	= Preliminary Remediation Goal
RME	= Reasonable Maximum Exposure
SP	= Spill Site
SVOC	= Semi-Volatile Organic Compound
TCSP	= Temporary Coal Storage Pile
TIC	= Tentatively Identified Compound
TPH	= Total Petroleum Hydrocarbon
TR49A	= Tank Removal 49A
UST	= Underground Storage Tank
VOC	= Volatile Organic Compound

List of References for Chemicals of Concern and Risk Assessment Information

a. Operable Unit 3 Final Remedial Investigation (RI) Report, July 1995, Chapter 6.
b. Record of Decision for 21 No Action Sites, August 1996.
c. No Action Proposed Plan for EFDZ1, April 1996.
d. Operable Unit 10 Decision Document, Central Heating Plant 3, September 1995.
e. Operable Unit 10 Decision Document, Building 30119, August 1995.
f. Decision Document, EFDZ11, September 1992.
g. Decision Document, Landfill 14, September 1994.
h. Final Report, Technical Document to Support Long-Term Monitoring, EFDZ12, September 1992.
i. Technical Document to Support No Further Action, Tank Farm 49A, August 1995.
j. Operable Unit 10 Final RI Report, December 1995.
k. Operable Unit 5 Final RI Report, August 1995.
l. Final Remedial Investigation Report for Operable Unit 2, August 1995.
m. No Action Proposed Plan for Sites Within or Near Operable Unit 10, May 1996.

Table 5-4
Current Site Controls
21 No Action Sites
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IRP Site	OU	Base Perimeter Fence	Site Fence	Gate	Current Site Controls
B89CSP	2	X			No controls other than base perimeter fence.
BS1	2	X	X	X	Base perimeter fence with guarded gate. Limited access hours.
CCSA	2	X			No controls other than base perimeter fence.
LTCSA	2	X			No controls other than base perimeter fence.
TCSP	2	X	X	X	Located in POL Farm, fenced with gate; access controlled by Base Fuels Office (Building 154).
EFDZ11	3	X			No controls other than base perimeter fence and “Earthfill disposal zone” signage(1).
EFDZ12	3	X			No controls other than base perimeter fence and “Earthfill disposal zone” signage(1).
FTA2	3	X		X	Base perimeter fence, partially located in flightline, strict controls on access, includes FTA5.
FTA3	3	X			No controls other than base perimeter fence.
FTA4	3	X			No controls other than base perimeter fence.
FTA5	3	X	X	X	Partially fenced with two gates; access controlled by WPAFB Fire Department.
LF14	3	X			No controls other than base perimeter fence, heavily wooded area.
SS1	3				Accessible from the Mad River – WPAFB signage only, base perimeter fence along eastern boundary.
BS4	5	X			No controls other than base perimeter fence, accessible to public when Prairie Gate is open.
FTA1	5	X	X	X	Fenced and gated at Riverview Road.; access controlled area – Warfighter Training Center.
GLTS	5	X			No controls other than base perimeter fence. Gate to Gravel Lake is occasionally locked; area is heavily wooded.

Table 5-4
Current Site Controls
21 No Action Sites
Wright-Patterson AFB, Ohio
Page 2 of 2

IRP Site	OU	Base Perimeter Fence	Site Fence	Gate	Current Site Controls
EFDZ1	6	X		X	Located in Laser Test Area; within perimeter fence for runway; access controlled by locked gate at Loop Road. Laser Test Office has key and controls access X
CHP3	10	X			No controls other than base perimeter fence.
LF13	10	X			No controls other than base perimeter fence. Parking lot covers both areas of landfill.
TF49A	10	X			No controls other than base perimeter fence.
UST30119	10	X			No controls other than base perimeter fence.

Abbreviations:

B89CSP = Building 89 Coal Storage Pile
BS = Burial Site
CCSA = Coal and Chemical Storage Area
CHP = Central Heating Plant
EFDZ = Earthfill Disposal Zone
FTA = Fire Training Area
GLTS = Gravel Lake Tank Site
IRP = Installation Restoration Program
LF = Landfill
LTCSA = Long-term Coal Storage Area
OU = Operable Unit(s)
POL = Petroleum, Oils, and Lubricants
SP = Spill Site
TCSP = Temporary Coal Storage Pile
TF49A = Tank Farm 49A
UST = Underground Storage Tank
WPAFB = Wright-Patterson Air Force Base

Notes:

1 – Signage indicates presence of an earthfill disposal zone with “do not dig” warnings and lists the Environmental Management telephone number and contact

Table 5-5
Maintenance of Site Controls
21 No Action Sites
Wright-Patterson AFB, Ohio

Site Control	Applicable Sites	Responsible Party and/or Site Control Mechanism	Point of Contact(1) (Organization, Phone Number)	Frequency of Site Control Verification(2)
Base Perimeter Fencing – Guarded Gates	All	WPAFB Security Forces	88 ABW/SFS 937-257-6516	Monitored Frequently
Discrete Site Fencing - Controlled Access (Locked or Guarded Gates)	TCSP	POL Farm – Guarded gate	POL Farm Desk Attendant 937-257-2224	Daily
	FTA5	WPAFB Fire Department – Controls access key to locked gate	788 CES/CEXF 937-904-3158	Every 2 weeks during spring, summer, and fall.
	FTA1	CE Warfighter Training Area – Controls access	AFMC 88 SFS/S3T 937-257-0088	Daily, except November–February (4–5 times per month)
	EFDZ1	Laser Test Office – Controls access key	AFRL/RYMT 937-904-9913	As needed
	FTA2	WPAFB Fire Department – Controls access key to locked gate	788 CES/CEXF 937-904-3158	Every 2 weeks during spring, summer, and fall.
Surface Cover (asphalt or concrete)	LF13	Real Estate Office	88 CEG/CEAOR 937-257-3701	Quarterly

Notes:

1 – POC Organization responsible for maintaining site control and reporting to Environmental Management/CZOM any irregularities requiring attention.

2 – Frequency of verifying that site control is in place and functional by the POC.

Abbreviations:

CE = Civil Engineering
EFDZ = Earthfill Disposal Zone
FTA = Fire Training Area
LF = Landfill
POC = Point of Contact
POL = Petroleum, Oil, and Lubricants
TCSP = Temporary Coal Storage Pile
WPAFB = Wright-Patterson Air Force Base

Table 5-6
Summary of Technical Assessment (Question B)
21 NA Sites[1]
Wright-Patterson AFB, Ohio

IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
B89CSP OU2 21 sites	Surface and subsurface soil was evaluated. The NA is based on ICs already in place at the site, and the quantitative risk assessment indicated risks and hazards for the CTE. All receptors were below the upper bound limit of the target risk range at $1x10^{-4}$ and 1, respectively. [It should be noted that the RME risks for the commercial industrial and construction workers were equal to $1x10^{-4}$. The HIs for the RME for the commercial industrial worker and the construction worker were above 1.]	ARARs/TBCs: No specific ARARs were listed in the ROD. Chemical-specific toxicity values were applied in the quantitative risk assessment as TBCs. Land Use/Exposure Assumptions: The site is mostly grass-covered with a paved parking lot; land use is currently designated as industrial. Exposure scenarios included a commercial industrial worker and a construction worker. Toxicity Values: Based on updated toxicity values (2015), the RME risks for the current/future commercial/industrial worker would be reduced below $1x10^{-4}$. The conclusions of the risk assessment are not affected. RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that No Action (NA) was necessary because ICs are already in place at the site to limit access to or use of the site. The risk assessment concluded that there was only minimal risk to human and animals. Since this ROD only addressed soils at each of the sites, groundwater is addressed in another OU, the GWOU ROD.	Final Remedial Investigation Report for Operable Unit 2, ES, 1995. Record of Decision for 21 NA Sites at Wright-Patterson Air Force Base, WPAFB, 1996.

Table 5-6
Summary of Technical Assessment (Question B)
21 NA Sites[(1)]
Wright-Patterson AFB, Ohio

IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
BS1 OU2 21 sites	Surface and subsurface soil was evaluated. The NA is based on ICs already in place at the site, and the quantitative risk assessment indicated risks and hazards for the CTE. All receptors were below the upper bound limit of the target risk range at $1x10^{-4}$ and 1, respectively. [It should be noted that the risk for the RME for the commercial industrial worker was above $1x10^{-4}$; the HIs for the RME exposure for the commercial industrial worker and the construction worker were above 1.]	ARARs/TBCs: No specific ARARs were listed in the ROD. Chemical-specific toxicity values were applied in the quantitative risk assessment as TBCs. Land Use/Exposure Assumptions: Since the previous Five-Year Review, a new vehicle inspection facility and Gate 26A was constructed on part of BS1. The facility and gate opened in November 2019. Land use remains designated as industrial/recreational. The site is a grass-covered field with a concrete pad on one part. Exposure assumptions are still valid. Exposure scenarios in the original risk assessment included an adolescent recreational visitor, a commercial industrial worker, and a construction worker. The LTCSA and BS1 were evaluated as one exposure unit. Toxicity Values: Although there have been changes to a number of the toxicity values used in the risk assessment, these changes do not affect the conclusion of the risk assessment. RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that NA was necessary because ICs are already in place at the site to limit access to or use of the site. The risk assessment concluded that there was only minimal risk to human and animals. Since this ROD only addressed soils at each of the sites, groundwater is addressed in another OU, the GWOU ROD.	Final Remedial Investigation Report for Operable Unit 2, ES, 1995. Record of Decision for 21 NA Sites at Wright Patterson Air Force Base, WPAFB, 1996.

Table 5-6
Summary of Technical Assessment (Question B)
21 NA Sites(1)
Wright-Patterson AFB, Ohio

IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
CCSA OU2 21 sites	Surface and subsurface soil was evaluated. The NA is based on ICs already in place at the site, and the quantitative risk assessment indicated risks and hazards for the CTE. All receptors were below the upper bound limit of the target risk range at $1x10^{-4}$ and 1, respectively. [It should be noted that the risks for the RME for the commercial industrial worker and the construction worker were above $1x10^{-4}$; the HIs for the RME exposure for the commercial industrial worker and the construction worker were above 1.]	ARARs/TBCs: No specific ARARs were listed in the ROD. Chemical-specific toxicity values were applied in the quantitative risk assessment as TBCs. Land Use/Exposure Assumptions: The site is grass-covered; land use is currently designated as industrial. Exposure scenarios included a commercial industrial worker and a construction worker. The CCSA, TCSP, and Spill Sites 2, 3, and 10 were evaluated as one exposure unit. Toxicity Values: Although there have been changes to a number of the toxicity values used in the risk assessment, these changes do not affect the conclusion of the risk assessment. RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that NA was necessary because ICs are already in place at the site to limit access to or use of the site. The risk assessment concluded that there was only minimal risk to human and animals. Since this ROD only addressed soils at each of the sites, groundwater is addressed in another OU, the GWOU ROD.	Final Remedial Investigation Report for Operable Unit 2, ES, 1995. Record of Decision for 21 NA Sites at Wright-Patterson Air Force Base, WPAFB, 1996.

Table 5-6
Summary of Technical Assessment (Question B)
21 NA Sites(1)
Wright-Patterson AFB, Ohio

IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
LTCSA OU2 21 sites	Surface and subsurface soil was evaluated. The NA is based on ICs already in place at the site, and the quantitative risk assessment indicated risks and hazards for the CTE. All receptors were below the upper bound limit of the target risk range at $1x10^{-4}$ and 1, respectively. [It should be noted that the risk for the RME for the commercial/industrial worker was above $1x10^{-4}$; the HIs for the RME exposure for the commercial industrial worker and the construction worker were above 1.]	ARARs/TBCs: No specific ARARs were listed in the ROD. Chemical-specific toxicity values were applied in the quantitative risk assessment as TBCs. Land Use/Exposure Assumptions: Since the previous Five-Year Review, a new vehicle inspection facility and Gate 26A was constructed on part of LTCSA. The facility and gate opened in November 2019. Land use is currently designated as industrial. The site is a grassy area within the Laser Test Area. Exposure assumptions are still valid. Exposure scenarios included an adolescent recreational visitor, a commercial industrial worker, and a construction worker. The LTCSA and BS1 were evaluated as one exposure unit. Toxicity Values: Although there have been changes to a number of the toxicity values used in the risk assessment, these changes do not affect the conclusion of the risk assessment. RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that NA was necessary because ICs are already in place at the site to limit access to or use of the site. The risk assessment concluded that there was only minimal risk to human and animals. Since this ROD only addressed soils at each of the sites, groundwater is addressed in another OU, the GWOU ROD.	Final Remedial Investigation Report for Operable Unit 2, ES, 1995. Record of Decision for 21 NA Sites at Wright-Patterson Air Force Base, WPAFB, 1996.

Table 5-6
Summary of Technical Assessment (Question B)
21 NA Sites(1)
Wright-Patterson AFB, Ohio

IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
TCSP OU2 21 sites	Surface and subsurface soil was evaluated. The NA is based on ICs already in place at the site and the quantitative risk assessment indicated risks and hazards for the CTE. All receptors were below the upper bound limit of the target risk range at $1x10^{-4}$ and 1, respectively. [It should be noted that the risks for the RME exposure for the commercial industrial worker and the construction worker were above $1x10^{-4}$; the HIs for the RME for the commercial industrial worker and the construction worker were above 1.]	ARARs/TBCs: No specific ARARs were listed in the ROD. Chemical-specific toxicity values were applied in the quantitative risk assessment as TBCs. Land Use/Exposure Assumptions: The site is a grassy area with the southwest portion being paved with asphalt; land use is currently designated as industrial. Previous land use designation was an airfield. Exposure assumptions are still valid. Exposure scenarios included a commercial industrial worker and a construction worker. The TCSP, CCSA, and Spill Sites 2, 3, and 10 were evaluated as one exposure unit. Toxicity Values: Although there have been changes to a number of the toxicity values used in the risk assessment, these changes do not affect the conclusion of the risk assessment. RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that NA was necessary because ICs are already in place at the site to limit access to or use of the site. The risk assessment concluded that there was only minimal risk to human and animals. Since this ROD only addressed soils at each of the sites, groundwater is addressed in another OU, the GWOU ROD.	Final Remedial Investigation Report for Operable Unit 2, ES, 1995. Record of Decision for 21 NA Sites at Wright-Patterson Air Force Base, WPAFB, 1996.
EFDZ11 OU3 21 sites	Surface and subsurface soil was evaluated. The NA is based on ICs already in place, and contaminants detected (i.e., metals) were determined to be present in amounts that occur naturally.	ARARs/TBCs: No specific ARARs were listed in the ROD. Background data were used as TBCs in the evaluation of metals in soil. Land Use/Exposure Assumptions: The site is grass-covered with trees and gravel roads; land use was classified as part open space, including recreational and industrial. Land use is currently designated as recreational. Toxicity Values: No risk assessment was conducted; only VOC and SVOC TICs, and metals were detected at the site. The metals detected were considered to be naturally-occurring. RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that NA was necessary because ICs are already in place, and	Site Investigation Report for 16 IRP Sites, SAIC, 1993. Record of Decision for 21 NA Sites at Wright-Patterson Air Force Base, WPAFB, 1996.

Table 5-6
Summary of Technical Assessment (Question B)
21 NA Sites(1)
Wright-Patterson AFB, Ohio

IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
		land use of the site reduces the risk to humans and the environment. Since this ROD only addressed soils at each of the sites, groundwater is addressed in another OU, the GWOU ROD.	
EFDZ12 OU3 21 sites	Surface and subsurface soil was evaluated. The NA is based on ICs already in place, and contaminants detected (i.e., metals) were determined to be present in amounts that occur naturally.	ARARs/TBCs: No specific ARARs were listed in the ROD. Background data were used as TBCs in the evaluation of metals in soil. Land Use/Exposure Assumptions: The area is mostly wooded; land use was classified as part open space, including recreational and industrial. Land use is currently designated as recreational. Recreational hunting continues in the area. Current allowable land use is for “industrial” and an “airfield”. Exposure assumptions are still valid. Toxicity Values: No risk assessment was conducted. No VOCs or SVOCs were detected. One pesticide (endosulfan) was detected at very low concentrations. This concentration was below the most current industrial and residential RSLs (2009). Metals (i.e., manganese) which were detected are considered to be occurring naturally (concentration was less than background) or, were below the 2015 industrial and residential RSLs. RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that NA was necessary because ICs are already in place, and land use of the site reduces the risk to humans and the environment. Since this ROD only addressed soils at each of the sites, groundwater is addressed in another OU, the GWOU ROD.	Site Investigation Report for 16 IRP Sites, SAIC, 1993. Record of Decision for 21 NA Sites at Wright-Patterson Air Force Base, WPAFB, 1996.

Table 5-6
Summary of Technical Assessment (Question B)
21 NA Sites(1)
Wright-Patterson AFB, Ohio
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IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
FTA2 OU3 21 sites	Site surface soil was evaluated. The NA is based on ICs already in place. The quantitative risk assessment indicated that the risks and hazards for the RME for all receptors were below the upper bound of the target risk range at $1x10^{-4}$ and 1, respectively.	ARARs/TBCs: No specific ARARs were listed in the ROD. Chemical-specific toxicity values were applied in the quantitative risk assessment as TBCs. Land Use/Exposure Assumptions: FTA2 is mostly grass-covered with paved taxiway located on the southeastern side. Land use was assumed to be recreational. Current land use is designated as industrial. Exposure assumptions are still valid. Exposure scenarios included maintenance workers, industrial users, trespassers, and recreational users. FTA2 and FTA5 were evaluated as one exposure unit. Toxicity Values: Although there have been changes to a number of the toxicity values used in the risk assessment, these changes do not affect the conclusion of the risk assessment (i.e., HI<1 and risk $<10^{-4}$). RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that NA was necessary because ICs are already in place at the site to limit access to or use of the site. The risk assessment concluded that there was only minimal risk to human and animals. Since this ROD only addressed soils at each of the sites, groundwater is addressed in another OU, the GWOU ROD.	Final Remedial Investigation Report for Operable Unit 3, SAIC, 1995. Record of Decision for 21 NA Sites at Wright-Patterson Air Force Base, WPAFB, 1996.

Table 5-6
Summary of Technical Assessment (Question B)
21 NA Sites(1)
Wright-Patterson AFB, Ohio

IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
FTA3 OU3 21 sites	Site surface soil was evaluated. The NA is based on ICs already in place. The quantitative risk assessment indicated that the risks and hazards for the RME for all receptors were below the upper bound of the target risk range at $1x10^{-4}$ and 1, respectively.	ARARs/TBCs: No specific ARARs were listed in the ROD. Chemical-specific toxicity values were applied in the quantitative risk assessment as TBCs. Land Use/Exposure Assumptions: FTA3 is gravel-covered; land use is currently designated as industrial. The previous designation was “open space”. Exposure assumptions are still valid. Exposure scenarios included maintenance workers, industrial users, trespassers, and recreational users. FTA 3, FTA 4, and SP1 were evaluated as one exposure unit Toxicity Values: Although there have been changes to a number of the toxicity values used in the risk assessment, these changes do not affect the conclusion of the risk assessment (i.e., HI<1 and risk $<10^{-4}$). RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that NA was necessary because ICs are already in place at the site to limit access to or use of the site. The risk assessment concluded that there was only minimal risk to human and animals. Since this ROD only addressed soils at each of the sites, groundwater is addressed in another OU, the GWOU ROD.	Final Remedial Investigation Report for Operable Unit 3, SAIC, 1995. Record of Decision for 21 NA Sites at Wright-Patterson Air Force Base, WPAFB, 1996.

Table 5-6
Summary of Technical Assessment (Question B)
21 NA Sites(1)
Wright-Patterson AFB, Ohio

IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
FTA4 OU3 21 sites	Site surface soil was evaluated. The NA is based on ICs already in place. The quantitative risk assessment indicated that the risks and hazards for the RME for all receptors were below the upper bound of the target risk range at $1x10^{-4}$ and 1, respectively.	ARARs/TBCs: No specific ARARs were listed in the ROD. Chemical-specific toxicity values were applied in the quantitative risk assessment as TBCs. Land Use/Exposure Assumptions: FTA4 is gravel-covered; land use is currently designated as industrial. The previous designation was "open space". Exposure assumptions are still valid. Exposure scenarios included maintenance workers, industrial users, trespassers, and recreational users. FTA3, FTA4, and SP1 were evaluated as one exposure unit. Toxicity Values: Although there have been changes to a number of the toxicity values used in the risk assessment, these changes do not affect the conclusion of the risk assessment (i.e., HI<1 and risk $<10^{-4}$). RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that NA was necessary because ICs are already in place at the site to limit access to or use of the site. The risk assessment concluded that there was only minimal risk to human and animals. Since this ROD only addressed soils at each of the sites, groundwater is addressed in another OU, the GWOU ROD.	Final Remedial Investigation Report for Operable Unit 3, SAIC, 1995. Record of Decision for 21 NA Sites at Wright-Patterson Air Force Base, WPAFB, 1996.

Table 5-6
Summary of Technical Assessment (Question B)
21 NA Sites(1)
Wright-Patterson AFB, Ohio

IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
FTA5 OU3 21 sites	Site surface soil was evaluated. The NA is based on ICs already in place. The quantitative risk assessment indicated that the risks and hazards for the RME for all receptors were below the upper bound of the target risk range at $1x10^{-4}$ and 1, respectively.	ARARs/TBCs: No specific ARARs were listed in the ROD. Chemical-specific toxicity values were applied in the quantitative risk assessment as TBCs. Land Use/Exposure Assumptions: FTA5 was previously grass-covered, but now is mostly gravel-covered with a small grass-covered area; land use is currently designated as a training area. Exposure assumptions are still valid. Exposure scenarios included maintenance workers, industrial users, trespassers and recreational users. FTA2 and FTA5 were evaluated as one exposure unit. Toxicity Values: Although there have been changes to a number of the toxicity values used in the risk assessment, these changes do not affect the conclusion of the risk assessment (i.e., HI<1 and risk $<10^{-4}$). RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that NA was necessary because ICs are already in place at the site to limit access to or use of the site. The risk assessment concluded that there was only minimal risk to human and animals. (In 1996, USTs were removed from the site and accepted for closure by the State Fire Marshall. A new FTA constructed adjacent to FTA5 uses propane as a fuel source.) Since this ROD only addressed soils at each of the sites, groundwater is addressed in another OU, the GWOU ROD.	Final Remedial Investigation Report for Operable Unit 3, SAIC, 1995. Record of Decision for 21 NA Sites at Wright-Patterson Air Force Base, WPAFB, 1996.

Table 5-6
Summary of Technical Assessment (Question B)
21 NA Sites(1)
Wright-Patterson AFB, Ohio

IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
LF14 OU3 21 sites	Site surface soil was evaluated. The NA is based on ICs already in place. The quantitative risk assessment indicated that the risks and hazards for the RME for all receptors were below the upper bound of the target risk range at $1x10^{-4}$ and 1, respectively.	ARARs/TBCs: No specific ARARs were listed in the ROD. Chemical-specific toxicity values were applied in the quantitative risk assessment as TBCs. Land Use/Exposure Assumptions: LF14 is wooded and grass-covered; land use is currently designated as recreational. The previous land use designation was "open space". Recreational hunting continues in the area. Exposure scenarios included maintenance workers, industrial users, trespassers, and recreational users. Toxicity Values: Although there have been changes to a number of the toxicity values used in the risk assessment, these changes do not affect the conclusion of the risk assessment (i.e., HI<1 and risk $<10^{-4}$). RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that NA was necessary because ICs are already in place at the site to limit access to or use of the site. The risk assessment concluded that there was no unacceptable risk to human and animals. Since this ROD only addressed soils at each of the sites, groundwater is addressed in another OU, the GWOU ROD.	Final Remedial Investigation Report for Operable Unit 3, SAIC, 1995. Record of Decision for 21 NA Sites at Wright-Patterson Air Force Base, WPAFB, 1996.
SS1 OU3 21 sites	Site surface soil was evaluated. The NA is based on ICs already in place. The quantitative risk assessment indicated that the risks and hazards for the RME for all receptors were below the upper bound of the target risk range at $1x10^{-4}$ and 1, respectively.	ARARs/TBCs: No specific ARARs were listed in the ROD. Chemical-specific toxicity values were applied in the quantitative risk assessment as TBCs. Land Use/Exposure Assumptions: SS1 is gravel-covered; land use was assumed to be light industrial. The concrete batch plant has been removed. Land use is currently designated as light industrial. The previous designation was "open space". Exposure assumptions are still valid. Exposure scenarios included maintenance workers, industrial users, trespassers, and recreational users. FTA3, FTA4, and SP1 were evaluated as one exposure unit. Toxicity Values: Although there have been changes to a number of the toxicity values used in the risk assessment, these changes do not affect the conclusion of the risk assessment (i.e., HI<1 and risk $<10^{-4}$).	Final Remedial Investigation Report for Operable Unit 3, SAIC, 1995. Record of Decision for 21 NA Sites at Wright-Patterson Air Force Base, WPAFB, 1996.

Table 5-6
Summary of Technical Assessment (Question B)
21 NA Sites(1)
Wright-Patterson AFB, Ohio
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IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
		RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that NA was necessary because ICs are already in place at the site to limit access to or use of the site. The risk assessment concluded that there was only minimal risk to human and animals. Since this ROD only addressed soils at each of the sites, groundwater is addressed in another OU, the GWOU ROD.	
BS4 OU5 21 sites	Site soil was evaluated. The soil data was not segregated by depth due to the limited number of samples. The NA is based on ICs already in place. Site contaminant concentrations were below Region 9 or site-specific PRGs.	ARARs/TBCs: No specific ARARs were listed in the ROD. The Region 9 PRGs were applied as TBCs in the semi-quantitative risk assessment. Land Use/Exposure Assumptions: The area of BS4 is mostly wooded. A paved parking lot has been added for visitors on the northeast end. Land use is currently designated as recreational. Exposure assumptions are still valid. Exposure scenarios evaluated were for maintenance workers (i.e., industrial exposures). A semi-quantitative risk assessment was conducted; site concentrations were compared to the Region 9 industrial soil PRGs. All chemicals were below the PRGs. Toxicity Values: Although the Region 9 PRG values are no longer used, the changes do not impact the conclusions. Detected chemical concentrations remain below the current residential and industrial RSL values (2015). RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that NA was required to protect human health and the environment. Because all concentrations of detected compounds are below the residential PRGs, WPAFB may consider lifting restrictions on this site. Since this ROD only addressed soils at each of the sites, groundwater is addressed in another OU, the GWOU ROD.	Decision Document Burial Site 4, SAIC, 1994. Final Remedial Investigation Report for Operable Unit 5, IT Corporation, 1995. Record of Decision for 21 NA Sites at Wright-Patterson Air Force Base, WPAFB, 1996.

Table 5-6
Summary of Technical Assessment (Question B)
21 NA Sites[1]
Wright-Patterson AFB, Ohio

IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
FTA1 OU5 21 sites	Site surface soil was evaluated. The NA is based on ICs already in place, and site contaminant concentrations were below Region 9 and/or site-specific PRGs.	ARARs/TBCs: No specific ARARs were listed in the ROD. The Region 9 PRGs were applied as TBCs in the semi-quantitative risk assessment. Land Use/Exposure Assumptions: The area of FTA1 is grass-covered with gravel roads and structures; land use is currently designated as industrial/training area. Exposure scenarios included maintenance workers. A semi-quantitative risk assessment was conducted, and site concentrations were compared to the Region 9 industrial soil PRGs. Contaminants above Region 9 PRGs were compared against site-specific PRGs. All chemicals were below either Region 9 or site-specific PRGs. Toxicity Values: The Region 9 PRGs have been replaced by the RSL since the original risk assessment. Maximum COC concentrations were screened against the most recent RSLs (2015), and as a result, five PAHs were found to be above the industrial RSLs. RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that NA was required to protect human health and the environment. Since this ROD only addressed soils at each of the sites, groundwater is addressed in another OU, the GWOU ROD.	Final Remedial Investigation Report for Operable Unit 5, IT Corporation, 1995. Record of Decision for 21 NA Sites at Wright-Patterson Air Force Base, WPAFB, 1996.

Table 5-6
Summary of Technical Assessment (Question B)
21 NA Sites[1]
Wright-Patterson AFB, Ohio

IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
GLTS OU5 21 sites	Site soil was evaluated. The soil data was not segregated by depth due to the limited number of samples. The NA is based on ICs already in place, and site contaminant concentrations were below Region 9 or site-specific PRGs.	ARARs/TBCs: No specific ARARs were listed in the ROD. The Region 9 PRGs were applied as TBCs in the semi-quantitative risk assessment. Land Use/Exposure Assumptions: The area of GLTS is mostly brush-covered; land use is currently designated as recreational. Exposure scenarios included maintenance workers. A semi-quantitative risk assessment was conducted, and site concentrations were compared to the Region 9 industrial soil PRGs. All chemicals were below these values. Toxicity Values: The Region 9 PRGs have been replaced by the RSL since the original risk assessment. This change does not impact the conclusions of the risk assessment. Detected chemicals remain below the current residential and industrial RSL values (2015). RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that NA was required to protect human health and the environment. Since this ROD only addressed soils at each of the sites, groundwater is addressed in another OU, the GWOU ROD.	Decision Document Gravel Lake Tank Site, SAIC, 1992. Final Remedial Investigation Report for Operable Unit 5, IT Corporation, 1995. Record of Decision for 21 NA Sites at Wright-Patterson Air Force Base, WPAFB, 1996.

Table 5-6
Summary of Technical Assessment (Question B)
21 NA Sites[(1)]
Wright-Patterson AFB, Ohio

IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
EFDZ1 OU6 21 Sites	None of the COC concentrations in surface and subsurface soil samples exceeded the USEPA target risk range ($1x10^{-4}$ to $1x10^{-6}$) for cancer effects. HIs for non-cancer related health effects were below the USEPA hazard index of 1. None of the compounds detected in the soil at EFDZ1 exceeded the benchmarks for ecological toxicity.	ARARs/TBCs: No specific ARARs were listed in the ROD. Chemical-specific toxicity values were applied in the quantitative human health risk assessment as TBCs. In addition, benchmarks for ecological toxicity were used as TBCs in the ecological assessment. Land Use/Exposure Assumptions: EFDZ1 is a grassy area. Land use is currently designated as industrial/recreational. The previous land use designation was part commercial/industrial and open space. Recreational activities continue in the area. EFDZ1 consists of three areas: EFDZ1A and EFDZ1B, which are both on the base and EFDZ1C, which is off-base. EFDZ1C is a 4-acre, grassy community park, maintained by the City of Riverside. No fill materials were found during the drilling operations at the park. Potential receptors evaluated for EFDZ1 soils include an adult maintenance worker, an excavation worker and an adolescent recreational receptor. Toxicity Values: Although there were changes to some toxicity values used in the original risk assessment, the changes do not impact the conclusions of the risk assessment. RAOs/Cleanup Goals: PAHs present in EFDZ1C surface soils are likely influenced by the asphalt walking path in the park and the exhaust from the heavily traveled road nearby. Petroleum hydrocarbons found in the surface soil are expected to biodegrade quickly. Recreational and limited industrial use of the land at these sites reduces the risk to people, plants and animals who visit/reside in the area; therefore, the preferred alternative to protect human health at this area is NA. Since this ROD only addressed soils at each of the sites, groundwater is addressed in another OU, the GWOU ROD.	Record of Decision for 21 NA Sites at Wright-Patterson Air Force Base, WPAFB, 1996. Installation Restoration Program, Site Investigation Report for Eight Earthfill Disposal Zones, WPAFB, 1992.

Table 5-6
Summary of Technical Assessment (Question B)
21 NA Sites[1]
Wright-Patterson AFB, Ohio
Page 16 of 19

IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
CHP-3 OU10 21 Sites	Surface and subsurface samples were taken in this area. A quantitative risk assessment concluded that cancer risks due to exposure to surface soil would be <$1x10^{-6}$ and risk from subsurface soil would be $3x10^{-5}$. All non-cancer HIs due to soil exposure ranged from 1 – 1.5 with the greatest risk being exposure to arsenic in the soil. CHP-3 also includes the BBS. Near-surface soil samples from this area were found to contain lead concentrations, however, it does not warrant remedial action. The quantitative evaluation of future cancer risks at this site was 2 x 10^{-5}. Arsenic contributed the majority of the cancer risk. The HI for subsurface soil exposure was less than 1. The HI for surface soil was greater than 1.	ARARs/TBCs: No specific ARARs were listed in the ROD. No specific ARARs were listed in the ROD. Chemical-specific toxicity values were applied in the quantitative human health risk assessment as TBCs. Land Use/Exposure Assumptions: Land use at CHP-3 was a light industrial/office complex. At the time that the risk assessment was performed, CHP-3 consisted of three areas; former coal storage area, a former compressor oil sump, and a BBS. Buildings have since been demolished. There is currently a paved parking lot and an open grassy lot. Land use is currently designated as industrial. Exposure assumptions are still valid. Current exposure to contaminated soil at CHP-3 is considered unlikely because of the partial concrete and asphalt cover; therefore, there is minimal risk. Potential receptors include an adult commercial/industrial worker exposure to subsurface soil. Toxicity Values: There have been changes to some default exposure parameters (e.g., AFs, SA) used in the risk assessment. Also, based on the most current RSLs (2015), there have been changes made to the reference dose and oral slope factors since this risk assessment was done. Most of the cancer risks and hazard indexes remained below the USEPA-defined risk levels, with a few exceptions. RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. Current exposure to soils in this area is considered unlikely because of the partial concrete and asphalt cover, so the resulting risk is minimal. Even under future exposure scenarios, the resulting risks from exposure to the soils in this area are minimal; therefore, an NA alternative was chosen for this area. Finally, the base land use is not expected to change to a less restrictive land use, so the potential for exposure will not increase. Since this ROD only addressed soils at each of the sites, groundwater is addressed in another OU, the GWOU ROD.	Record of Decision for 21 NA Sites at Wright-Patterson Air Force Base, WPAFB, 1996. Remedial Investigation Report. Operable Unit 10, Landfill 13, Central Heating Plant 3 & Associated Battery Burial Site, TCE/PCE Plume & Related Potential Source Areas, Volume 1. WPAFB, 1995.

Table 5-6
Summary of Technical Assessment (Question B)
21 NA Sites(1)
Wright-Patterson AFB, Ohio

IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
LF13 OU10 21 Sites	Based on the existing conditions of the LF and the RI conducted for OU10, it has been determined that there is no significant risk to public health or the environment, and no further action is required. No soil samples were taken at this site.	ARARs/TBCs: No ARARs or TBCs were listed in the ROD. Exposure pathways at the site were determined to be incomplete and no soil samples were collected. Land Use/Exposure Assumptions: Land use is currently designated as industrial. Allowable use includes light industrial/office complex. The LF13 area is currently used as a paved parking area. Toxicity Values: No risk assessment was performed. RAOs/Cleanup Goals: The NA alternative was chosen for LF13 since it is covered and exposure pathways to LF materials are incomplete, and the resulting risk is minimal. Also, the base land use is not expected to change to a less restrictive land use, so the potential for exposure will not increase. Since this ROD only addressed soils at each of the sites, groundwater is addressed in another OU, the GWOU ROD.	Record of Decision for 21 NA Sites at Wright-Patterson Air Force Base, WPAFB, 1996. Remedial Investigation Report. Operable Unit 10, Landfill 13, Central Heating Plant 3 & Associated Battery Burial Site, TCE/PCE Plume & Related Potential Source Areas, Volume 1. WPAFB, 1995.
TF49A OU10 21 Sites	Soil samples were collected during and after the UST removal. With the contaminated soil removed, the risk of exposure has been eliminated.	ARARs/TBCs: The BUSTR regulations applied as ARARs for the UST removal at the site. In 1993, all USTs at the site were removed. Contaminated soil was also removed from the site, and the excavation was backfilled with clean soil in accordance with BUSTR regulations. Land Use/Exposure Assumptions: The area is a paved parking lot; land use is currently designated as industrial. Previous land use designation was “airfield operations and maintenance”. The risk of exposure to contaminated soil was eliminated when the area was paved. Toxicity Values: No risk assessment conducted. RAOs/Cleanup Goals: TR49A has been remediated in accordance with the BUSTR Program. It included the 1993 removal of tanks and contaminated soil from the site, resulting in the potential for exposure to contaminated soil at the site being eliminated. The State Fire Marshall recommended that no further action be taken.	Record of Decision for 21 NA Sites at Wright-Patterson Air Force Base, WPAFB, 1996. IRP NA Proposed Plan for Sites Within or Near OU10, CH2M HILL, 1996.

Table 5-6
Summary of Technical Assessment (Question B)
21 NA Sites[(1)]
Wright-Patterson AFB, Ohio

IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
UST 30119 OU10 21 Sites	Soil samples were taken at the site after removal of the tanks and contaminated soil. A qualitative assessment was made, based on the results of the sampling. As a result of the source of contamination (leaking tanks) and the contaminated soil being removed from the site, no significant risk to human health and environment is expected.	ARARs/TBCs: The BUSTR regulations applied as ARARs for the UST removal at the site. In 1989, two USTs at the site were discovered to be leaking and were taken out of service. In 1994, all five USTs at the site were removed. Contaminated soil was removed, and the excavation was backfilled with clean soil in accordance with BUSTR regulations. Land Use/Exposure Assumptions: At the time of the risk assessment, the area was mostly paved and was used as the base gas station. The site is now an open grassy lot. Land use is currently designated as industrial. Exposure assumptions are still valid. The potential for exposure to contaminated soil was eliminated after removal of the leaking USTs. Toxicity Values: No risk assessment conducted. RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. Based on evaluations of the site data, the concurrence with BUSTR, and the current site conditions, UST site 30119 is not expected to pose significant human health risks. The preferred alternative for this site is NA. As a result of the contaminated soil being removed and disposed, no additional action is necessary to protect human health and environment under current and future land use plans.	Record of Decision for 21 NA Sites at Wright-Patterson Air Force Base, WPAFB, 1996. Technical Document to Support No Further Action Declaration, IRP Site 30119 (USTs 303-306 and UST 57), WPAFB, 1995. IRP NA Proposed Plan for Sites Within or Near OU10, CH2M HILL, 1996.

Table 5-6
Summary of Technical Assessment (Question B)
21 NA Sites[(1)]
Wright-Patterson AFB, Ohio
Page 19 of 19

Notes:

1 – These sites were categorized as NA sites with the condition that land use remain restricted.

Abbreviations:

AF = Adherence Factor
ARAR = Applicable or Relevant and Appropriate Requirement
B89CSP = Building 89 Coal Storage Pile
BBS = Battery Burial Site
BS = Burial Site
BUSTR = Bureau of Underground Storage Tank Regulations
CCSA = Coal and Chemical Storage Area
CHP = Central Heating Plant
COC = Chemicals of Concern
CTE = Central Tendency Exposure
EFDZ = Earthfill Disposal Zone
ES = Environmental Science
FTA = Fire Training Area
GLTS = Gravel Lake Tank Site
HI = Hazard Index
IRP = Installation Restoration Program
LF = Landfill
LTCSA = Long-term Coal Storage Area
LTM = Long-term Groundwater Monitoring
NA = NA
OU = Operable Unit(s)
PAH = Polycyclic Aromatic Hydrocarbons
PCE = Perchloroethylene
PRG = Preliminary Remediation Goals
RAO = Remedial Action Objective
RI = Remedial Investigation
RME = Reasonable Maximum Exposure
ROD = Record of Decision
RSL = Regional Screening Level
SA = Surface Area
SAIC = Science Applications International Corporation
SP = Spill Site
SVOC = Semi-Volatile Organic Compounds
TBC = To Be Considered
TCE = Trichloroethylene
TCSP = Temporary Coal Storage Pile
TIC = Tentatively Identified Compounds
TR = Tank Removal
USEPA = U.S. Environmental Protection Agency
UST = Underground Storage Tank
VOC = Volatile Organic Compounds
WPAFB = Wright-Patterson Air Force Base

Legend

- Gate 26A Vehicle Inspection Facility
- WPAFB Building with Building Numbers
- Restoration Site (Access and Restriction Area)
- Operable Unit (OU) Boundary
- WPAFB Base Boundary
- Fence

Source: WPAFB Land Use Control Plan (Labat, 2012)

N

0 250 500 1,000

Feet

WRIGHT-PATTERSON AIR FORCE BASE, OHIO

FIFTH FIVE-YEAR ROD REVIEW

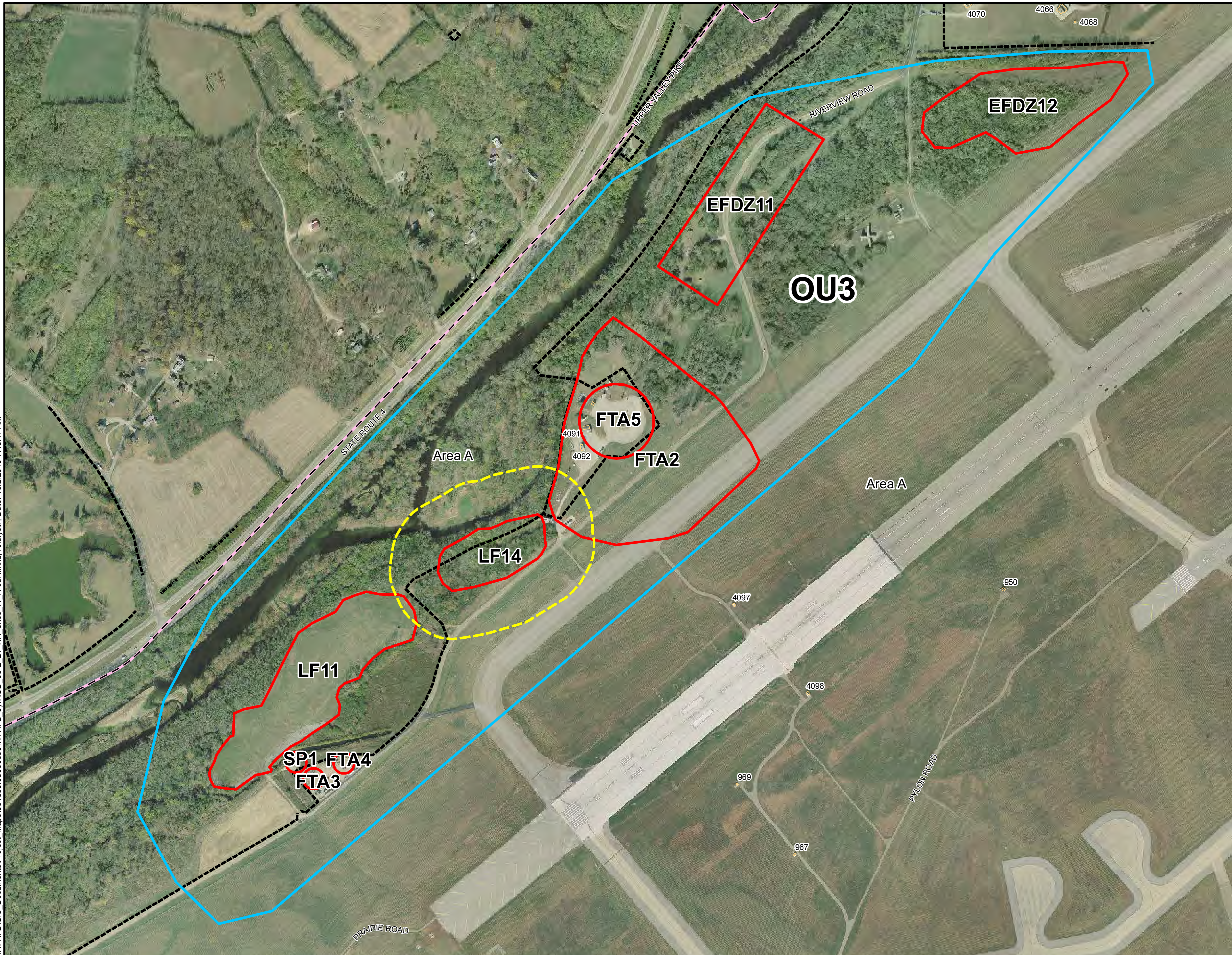
FIGURE NUMBER 5-1

Location of 21 NA Sites, Northeast Area A

APTIM

APTIM
5050 Section Avenue
Cincinnati, Ohio 45212

F:\Projects\WPAFB\GIS_Documents\Project_Maps\501363.03000000\WPAFB_5yrROD_05-1_21_NA_Sites_NE_AreaA_R1.mxd; Analyst: ; Date: 9/30/2020 7:28:13 AM



Legend

300 ft (Disturbance) Restriction Area
WPAFB Building with Building Numbers
Restoration Site (Access and Restriction Area)
Operable Unit (OU) Boundary
WPAFB Base Boundary
Fence

N

600 300 0 600
Feet

Source: WPAFB Land Use Control Plan (Labat, 2012)

WRIGHT-PATTERSON AIR FORCE BASE, OHIO

FIFTH FIVE-YEAR ROD REVIEW

FIGURE NUMBER 5-2

Location of 21 NA Sites, West Area A

APTIM
5050 Section Avenue
Cincinnati, Ohio 45212

G:\WPAFB\GIS_Documents\Project_Maps\501363.03000000\WPAFB_5yrROD_05-2_21_NA_Sites_W_AreaA.mxd; Analyst: ; Date: 10/2/2019 7:48:47 AM

G:\WPAFB\GIS_Documents\Project_Maps\501363.03000000\WPAFB_5yrROD_05-3_21_NA_Sites_SW_AreaA.mxd; Analyst: ; Date: 10/2/2019 7:50:03 AM

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FIFTH FIVE-YEAR ROD REVIEW

FIGURE NUMBER
5-3

Location of 21 NA Sites, Southwest Area A

APTIM
5050 Section Avenue
Cincinnati, Ohio 45212

G:\WPAFB\GIS_Documents\Project_Maps\501363.03000000\WPAFB_5yrROD_05-4_21_NA_Sites_SW_AreaB.mxd; Analyst: ; Date: 10/2/2019 7:54:36 AM

Legend

- WPAFB Building with Building Numbers
- Restoration Site (Access and Restriction Area)
- Operable Unit (OU) Boundary
- WPAFB Base Boundary
- Fence

N

400 200 0 400

Feet

Source: WPAFB Land Use Control Plan (Labat, 2012)

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OHIO

FIFTH FIVE-YEAR ROD REVIEW

FIGURE NUMBER
5-4

Location of 21 NA Sites, Southwest Area B

APTIM
APTIM
5050 Section Avenue
Cincinnati, Ohio 45212

Legend

300 ft (Disturbance) Restriction Area
WPAFB Building with Building Numbers
Restoration Site (Access and Restriction Area)
Operable Unit (OU) Boundary
WPAFB Base Boundary
Fence

N

300 150 0 300

Feet

Source: WPAFB Land Use Control Plan (Labat, 2012)

WRIGHT-PATTERSON
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OHIO

FIFTH FIVE-YEAR ROD REVIEW

FIGURE NUMBER
5-5

Location of 21 NA Sites, East Area A

APTIM
5050 Section Avenue
Cincinnati, Ohio 45212

G:\WPAFB\GIS_Documents\Project_Maps\501363.03000000\WPAFB_5yrROD_05-5_21_NA_Sites_E_AreaA.mxd; Analyst: ; Date: 10/2/2019 8:23:37 AM

6.0 Remedial Action Completion Report (RACR) for SPs 2, 3, and 10, Within Operable Unit 2

The ROD for SPs 2, 3, and 10 within Operable Unit 2 (WPAFB, 1997b) addressed the remediation of subsurface soil and groundwater at the Petroleum, Oil, and Lubricants (POL) Storage Area at WPAFB. A brief summary is provided in this chapter describing the history and chronological events leading to the RACR that was approved by the OEPA and USEPA in September 2018.

6.1 Background and History of Contamination

SPs 2 and 3 were located within the gated POL Storage area (**Figure 6-1**). Historically, the OU2 POL Storage Area was used to store heating, automotive, and jet fuel products. Petroleum products were transferred to fueling stations or other areas of the base through a network of underground pipes and valves, which were abandoned in place and replaced with aboveground piping. The POL Storage Area is currently active. SP10 is physically located outside the gated POL Storage Area, in a flightline area; access is strictly controlled by WPAFB Operations.

SP2 was located within the POL Storage Area, approximately 200 ft inside the WPAFB east boundary. In April 1976, approximately 8,300 gallons of JP-4 jet fuel was inadvertently released within the diked area surrounding Tank 256. Approximately 4,800 gallons of spilled jet fuel was recovered from three recovery wells installed adjacent to Tank 256.

SP3 was located within the POL Storage Area, approximately 400 ft inside the WPAFB east boundary. In March 1981, approximately 1,200 to 2,500 gallons of No. 2 fuel oil was released from Tank 272. The spill occurred between Tank 272 and the fueling station. Although a recovery trench was installed adjacent to the spill, no fuel oil was recovered.

SP10 was located west-southwest of the POL Storage Area and 1,400 ft inside the WPAFB east boundary. In October 1989, a flange gasket ruptured on a JP-4 hydrant and released an estimated 150 gallons of fuel. This site is currently surfaced with limestone gravel and asphalt; at the time of the fuel spill, the site was grass-covered. Cleanup at the time of the spill involved the use of absorbent materials to recover approximately 10 percent of the spilled jet fuel.

In May 2004, a spill of JP-8 jet fuel occurred in the tanker truck off-loading area along the western boundary of the POL tank farm. A transfer pipe gasket ruptured during fuel off-loading releasing approximately 200 gallons of JP-8 to a 15 ft by 35 ft area of soil beneath the fuel distribution pipes and onto approximately 2,000 square feet of asphalt access road. Remediation actions consisted of immediately closing the shutoff valve and removing the free standing liquid by vacuum truck.

The contaminated soil was removed down to 18 inches by hand due to the piping of the distribution system. Degraded asphalt was removed with a backhoe and sent for disposal with the contaminated soil. Groundwater was monitored by three new wells at the site and was not impacted. This release is not considered a part of SPs 2, 3, or 10.

6.2 Site Chronology

A chronology of relevant dates for SPs 2, 3, and 10 is presented in **Table 6-1**.

6.3 Remedial Actions

6.3.1 Remedy Selection

The ROD for SPs 2, 3, and 10 documents the selected remedy for subsurface soil and groundwater contamination at SPs 2, 3, and 10; the selected alternative remediation consisted of:

- In situ biodegradation of subsurface soil
- Natural attenuation of groundwater
- O&M of existing removal actions
- Institutional controls
- Subsurface soil and groundwater monitoring.

6.3.2 SPs 2, 3, and 10 RAOs

Contaminants found at SPs 2, 3, and 10 in the POL Storage Area vicinity are those generally associated with petroleum storage areas; namely BTEX, PAHs, and some metals. The results of the screening process indicated that benzene in groundwater and BTEX in subsurface soil were the only contaminants that required remediation.

The goal of the remedial action for subsurface soil was to reduce the BTEX contamination to levels below the criteria set by the State of Ohio’s Bureau of Underground Storage Tank Regulations (BUSTR). These levels were:

- Benzene – 0.17 mg/kg
- Toluene – 7 mg/kg
- Ethylbenzene – 10 mg/kg
- Xylene – 47 mg/kg.

The goal of the remedial action for groundwater was to reduce the benzene contamination to below the MCL of 5 μg/L (WPAFB, 1997b).

6.3.3 Remedy Implementation and System O&M

In accordance with the SP 2, 3, and 10 ROD, a long-term soil gas and groundwater monitoring program was initiated for this area. The ICs and ECs required by the ROD were in-place and functioning prior to the effective date of the ROD. ECs, such as fencing, gates and locks, at the POL Storage Area are maintained by the Base Fuels Office (Building 30154) at WPAFB. In addition to the site controls, WPAFB implements various ICs to ensure that digging or excavation at these sites remains restricted. These ICs include:

- Review of plans/specifications for on-base construction by WPAFB IRP personnel.
- Submittal and approval of AF Form 103 to the IRP personnel prior to anyone excavating or digging anywhere within base boundaries.
- Submittal and approval of AF Form 813 to assess the potential environmental impact of any action proposed at WPAFB.
- Entering all ROD use limitations and exposure restrictions into the IDP and the GIS implemented by WPAFB CE and IRP personnel.
- Reevaluation of each IC during the 5-Year ROD review period for continued protectiveness of human health and the environment.
- Inspection of sites to identify land use and condition of site controls in place, ensure that the land uses identified in the RODs are maintained, and verify that land use activities remain compatible with underlying risk assessment assumptions.

These ICs and ECs are currently summarized and documented in the ESD (WPAFB, 2012).

The monitoring program consisted of biannual groundwater, soil gas sampling, and analysis (spring and fall). The objectives of this monitoring program were to evaluate the effectiveness of the in situ biodegradation and natural attenuation processes on petroleum hydrocarbon contamination in the soil and groundwater.

In addition, the following actions were implemented after the ROD was signed:

- In 1997, MWs 04-518-M and WP-NEA-MW21-3S had belt-skimmer free-product removal systems installed to remove the layer of hydrocarbon product ranging from 0.01 ft to 1.0 ft on the water surface. These systems operated until June 1999 (IT, 1999c).
- In June 1999, the belt-skimmers in wells 04-518-M and WP-NEA-MW21-3S were replaced with disposable-hydrophobic-hydrocarbon absorbent tubes (i.e., SoakEase™) to remove the hydrocarbon layers. Due to an increase in the hydrocarbon layer in well NEA-MW21-3S, the SoakEase™ system was replaced with a Petro-trap™ hydrocarbon removal system on June 9, 2000. In fall 2001, it was determined that the product layer had

diminished to the extent that the Petro-trap™ was ineffective. The SoakEase™ was then reinstalled for continued recovery of the thin product layer.

- In October 2001, the SoakEase™ in well 04-518-M was removed when free-product recovery stopped. In April 2003 well 04-518-M was abandoned due to casing separation.

- Due to an increase in the product layer, an active free-product recovery system was installed during the Fall 2002 sampling event and activated in November 2002. The system, called a Bioslurper, was a flexible vacuum tube that was installed inside a MW and used to "slurp" up the light non-aqueous phase liquid (LNAPL) and shallow contaminated groundwater. The contaminated groundwater, along with minor LNAPL, was processed through the Bioslurper system's phase separation tank, oil/water separator, and liquid and air carbon units. The finished water was discharged via the storm sewer under a NPDES permit.

  The Bioslurper was hooked-up to piezometer SB1 for several months in 2003. Free product was discovered during an underground piping upgrade. An unknown amount of free product was recovered. The Bioslurper operated until October 2003 then was deactivated due to diminished free-product levels and the piezometer was removed.

- Currently, free-product is periodically removed from well NEA-MW21-3S, using a SoakEase™ absorbent element.

6.4 Progress Since the Last Five-Year Review / Approved RACR

A Final Remedial Action Completion Report: Record of Decision for Spill Sites 2, 3, and 10 (Within Operable Unit 2) was completed in July 2018 that documented WPAFB completed all response actions at SPs 2, 3, and 10 in accordance with Close Out Procedures for NPL Sites. During performance of the RACR, WPAFB reviewed the remedy and determined the remediation criteria established in the ROD had been met and that the cleanup levels had been achieved as specified in the National Oil and Hazardous Substances Pollution Contingency Plan (WPAFB 2018).

The RACR demonstrated the selected remedy achieved the goals for groundwater and soil and that benzene, toluene, ethylbenzene, and xylenes (BTEX) compounds were below drinking water MCLs at all groundwater monitoring locations for at least five years and had not leached from soils to groundwater. This five-year timeframe also indicated that rebound of BTEX concentrations had not occurred and had satisfied the ROD requirement (WPAFB 2018).

The RACR was signed by OEPA on September 11, 2018, by the USEPA Remedial Program Manager on September 17, 2018, and the USEPA Region V Branch Chief on August 19, 2020, which makes the RACR a final USEPA approved document. The site is now going through the NPL deletion process.

6.5 Five-Year Review Process

See Section 6.4.

6.6 Technical Assessment Summary

See Section 6.4.

6.7 Issues

See Section 6.4.

6.8 Recommendations and Follow-up Actions

No recommendations or follow-up actions are noted for SPs 2, 3, and 10. The remedy for SPs 2, 3, and 10 continues to be protective of human health and the environment.

Table 6-1
Site Chronologies
Spill Sites 2, 3, and 10
Wright-Patterson AFB, Ohio

Event / Milestone	Date
Preliminary Assessment	May 1988
Initial Response Actions	March 1991 March 1993 May 1993 September 1993
Remedial Investigation	August 1995
Feasibility Study	August 1996
Record of Decision	September 1997
Treatability Study: Petroleum, Oil, and Lubricant (POL), Storage Area Free Product Recovery System	March 1998
OU2 Baseline Sampling Results	1999
First Five Year Review	March 2000
Second Five Year Review	January 2006
Third Five Year Review	August 2011
Explanation of Significant Differences: Multiple Sites	August 2012
Data Gap Investigation Work Plan for Soils at the Spill Sites at OU2	January 2015
Fourth Five Year Review	March 2017
Final Data Gap Investigation Report for Soils at Spill Sites 2, 3, and 10	May 2017
Final Remedial Action Completion Report: Record of Decision for Spill Sites 2, 3, and 10 (Within Operable Unit 2)	July 2018
OEPA RACR Approval / Signature	September 11, 2018
USEPA RACR Approval / Signature	September 17, 2018

Source: WPAFB Land Use Control Plan (Labat, 2012)

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FIFTH FIVE-YEAR ROD REVIEW

FIGURE NUMBER 6-1

Location of Spill Sites 2, 3, and 10 (Operable Unit 2), Northeast Area A

APTIM
5050 Section Avenue
Cincinnati, Ohio 45212

G:\WPAFB\GIS_Documents\Project_Maps\501363.03000000\WPAFB_5yrROD_06-1_SS_2_3_10_OU2_NW_AreaA.mxd; Analyst: ; Date: 10/2/2019 8:35:02 AM

7.0 Five-Year Review for 41 No Action Sites

The 41 NA Sites ROD (WPAFB, 1998) addresses remedial actions for soils only at 41 IRP sites listed in **Table 7-1**. The remedy for groundwater at WPAFB is included in the GWOU remedy (discussed in **Chapter 8**). The remedy selected in the 41 NA Sites ROD for each of these 41 sites was the NA alternative; the USAF determined that no remedial action or no additional remedial action was necessary to ensure protection of human health and the environment at these sites. This decision was based on analytical data, restricted land uses at each of the 41 NA sites, and the assumption that these restrictions would remain in place. (Because ICs and ECs were already in place at the 41 NA sites when the ROD was written in 1998, the selected remedy is considered a "limited action" according to USEPA IC guidance document [USEPA, 2010a] rather than a "no action" remedy.)

A five-year review of the selected remedial alternative of NA for soil is necessary to determine whether land-use restrictions, as presented in the ROD, remain effective at each of the 41 NA sites. In accordance with the LUCIP (TetraTech, 2019) and the ESD (WPAFB, 2012a), land use for all of the 41 NA Sites remains either industrial or recreational and unrestricted land use remains prohibited. These land uses will remain in effect until otherwise allowed under a revised LUCIP. In the future, if portions of WPAFB are transferred or sold to either a federal or non-federal entity, the provisions specified in **Section 2.4** (Land Use Control Procedures) will be followed.

7.1 Background

A site by site description of the 41 NA sites is presented in the ROD for the 41 NA sites (WPAFB, 1998). **Figures 7-1** through **7-7** show the location of the sites addressed in the 41 NA Sites ROD. A chronology of important and relevant dates for the 41 NA sites is provided in **Table 7-1**.

7.1.1 History of Contamination

The 41 NA sites had a variety of former uses. **Table 7-2** provides a listing of the former, current, and allowable land uses for each site.

7.1.2 Initial Response

Initial response actions were conducted at many of the 41 NA sites. These initial response actions consisted primarily of UST removals under the BUSTR and LF capping under CERCLA's removal action authority and presumptive remedies. For example, LFs with similar types of contamination (LFs 1 through 9) were identified in the Basewide Removal Action Plan for Landfill Capping (IT, 1994b). This program sped up the process of cleaning up the LFs on WPAFB by using remedies already approved by USEPA (also known as presumptive remedies). **Table 7-3** provides a listing of the 41 NA Sites, including where initial response activities occurred and a description of those activities.

7.1.3 Basis for Taking Action

The basis for taking action (implementing restrictions on land use) was due to the presence of hazardous substances above levels that would allow for unrestricted use of the site, or the need to protect aspects of the initial response actions (such as the LF caps). **Table 7-4** provides a summary of the COCs detected at each site and a summary of the risk assessment results.

7.2 Remedial Actions

7.2.1 Remedy Selection

The 41 NA Sites ROD documents the selected remedy for soils at the subject 41 IRP sites to be "no action." However, ICs and ECs were already in place at the 41 IRP sites when the ROD was written in 1998. Therefore, the selected remedy is considered a "limited action" according to USEPA IC guidance document (USEPA, 2010a) rather than a "no action" remedy. This ROD is one of six original RODs for WPAFB. The remedial actions for the IRP sites included in the 41 Sites ROD was limited to ICs and ECs to prevent exposure to hazardous substances. The 41 NA Sites ROD requires the following:

- Land uses listed in the 41 Sites ROD would remain the same in the future.
- Limited access to general public due to the location within an active military installation.
- Further access restrictions at selected sites due to the nature of the military activities at these sites.
- Restrictions on digging or excavation at any of these sites.
- Continued maintenance of LFs 1 through 7, 9, and 11.
- Deed restrictions to be placed on the Explosive Ordnance Disposal (EOD) Range to restrict land use to industrial uses, if and when that portion of WPAFB was to be conveyed to a non-federal entity.

The 41 NA Sites ROD states that the NA decision for these sites deals only with soils; remedies for groundwater, surface water, and sediments at the sites are addressed under the BMP. As noted in **Section 2.2**, these monitoring activities were combined to form the GWOU (**Chapter 8**).

7.2.2 41 No Action Sites RAO

The RAO in the 41 NA Sites ROD was to prevent exposure to contaminated soils above acceptable risk levels. In the 41 NA Sites ROD, the NA alternative was selected as the remedy for the sites. The USEPA, OEPA, and WPAFB determined that conditions at the 41 NA sites posed no current or potential threat to human health and the environment at levels that would warrant remedial action. Thus, the RAO for these sites is to prevent exposure to hazardous substances until and unless unlimited use and unrestricted exposure levels are attained at each individual site.

7.2.3 Remedy Implementation

The ICs and ECs required by the 41 NA Sites ROD were in place and functioning prior to the effective date of the ROD. **Table 7-5** provides a listing of the current ECs for each of the 41 NA sites. Points of contact for these sites (as applicable) can be found in the LUCIP (TetraTech, 2019). In addition to the ECs, WPAFB implements various ICs to ensure that digging or excavation at these sites remains restricted. These ICs include:

- Review of plans/specifications for on-Base construction by WPAFB IRP personnel.
- Submittal and approval of AF Form 103 to the IRP personnel prior to anyone excavating or digging anywhere within Base boundaries.
- Submittal and approval of AF Form 813 to assess the potential environmental impact of any action proposed at WPAFB.
- Updating the IDP and the GIS with ROD use limitations and exposure restrictions and IRP site locations.
- Reevaluation of each IC during the five-year review period for continued protectiveness of human health and the environment.
- Inspection of sites to identify land use and condition of site controls in place, ensure that the land uses identified in the RODs are maintained, and verify that land use activities remain compatible with underlying risk assessment assumptions.

These ICs and ECs are currently summarized and documented in the ESD (WPAFB, 2012) and the LUCIP (TetraTech, 2019).

7.2.4 System O&M

O&M activities taken at the 41 NA sites since the signing of the ROD include, but are not limited to, maintenance of ECs (such as fencing, signs and gates), O&M of LF caps, and monitoring of LFG at LF4. ECs are maintained by various entities at WPAFB. **Table 7-6** provides a listing of the entities responsible for maintaining the ECs at the 41 NA sites. LFs included in the 41 NA Sites ROD are inspected by the LF O&M contractor and maintained as required. O&M activities, site observations, and EC repairs are presented in the Quarterly Recovery System Performance Reports (CAM, 2015-2019c). A discussion of the O&M requirements for the LFs included in the 41 NA Sites ROD is provided in the following subsections.

7.2.4.1 LF1 and LF2

LF1 and LF2 consist of vegetative covered fields that are approximately 4 and 15 acres in size, respectively. Quarterly O&M for LF1 and LF2 consists of visual observations to determine if:

- The LF covers are subsiding
- Improvements are required to address erosion from stormwater runoff
- Turf growth is inhibiting drainage
- The integrity of the covers or slopes is being threatened by burrowing animals.

Maintenance is then completed on an as-needed basis.

7.2.4.2 LF3 and LF4

LF3 is partially covered by the Prairie Trace Golf Course and LF4 covered by the Base Civil Engineering maintenance yard. In accordance with the 41 NA Sites ROD it was determined that the existing soil cover at LF3 and LF4 provided adequate protection for human health and the environment and “no additional action” was necessary beyond the existing land-use restrictions and limited access.

In accordance with the OU4 Landfill Gas (LFG) Monitoring Technical Memorandum (CH2M HILL, 1998) and the Operation and Maintenance Plan Operable Unit 4 Landfills 3, 4, 6, and 7, and Drum Staging/Disposal Area (CH2M HILL, 1997a), LFG is monitored quarterly to evaluate the potential for migration away from the landfills toward nearby structures. However, per the approval of the recommendations presented in the Annual LTM Report for 2011 (Shaw, 2013b), LFG monitoring probes LG-1, LG-2, LG-3, LG-6, LG-7, LG-8, and LG-9 have been deleted from the OU4 LFG monitoring network. These probes were recommended for deletion based on the removal of the buildings that once existed near the probes and the absence of methane detected at these locations. LFG monitoring at OU4 now consists of measuring field parameters at LFG probe LG-10 only (LF4). Groundwater at OU4 is monitored under GWOU and the LTM Program.

7.2.4.3 LF5

LF5 is a 23-acre site located at the southwest corner of Area A and adjacent to the Miami Conservancy District’s Huffman Preserve. Quarterly O&M for LF5 consists of visual observations to determine if:

- The LF covers are subsiding
- Improvements are required to address erosion from stormwater runoff
- Turf growth is inhibiting drainage
- The integrity of the covers or slopes is being threatened by burrowing animals
- Rock check dams are in place and still functioning properly
- The gas venting system is still operational
- Fences, gates, signs and locks are in place and operational
- MWs are not disturbed.

Maintenance is then completed on an as-needed basis. The landfill is mowed twice annually to control woody growth.

7.2.4.4 LF6, LF7, and Drum Disposal Area

LF6 is a grass-covered field currently maintained as open space. The southern section of LF7 is maintained by the golf course and is an addition to the end of the driving range and the remainder is a grass covered field. Quarterly O&M for LF6 and LF7 consists of visual observations to determine if:

- The LF covers are subsiding
- Improvements are required to address erosion from stormwater runoff
- Turf growth is inhibiting drainage
- The integrity of the covers or slopes is being threatened by burrowing animals.

Maintenance is then completed on an as-needed basis.

Under a presumptive remedy, LF6 and LF7 were capped in 1997 with 18 inches of common soil, 6 inches of top soil, and vegetative cover (WPAFB, 2014). Soil gas monitoring has been eliminated based on removal of many of the structures and recommendations described earlier (**Section 7.2.4.2**).

7.2.4.5 LF9

Quarterly O&M for LF9 consists of visual observations to determine if:

- The LF cover is subsiding
- Improvements are required to address erosion from stormwater runoff
- Turf growth is inhibiting drainage
- The integrity of the cover or slopes is being threatened by burrowing animals.

Maintenance is then completed on an as-needed basis. The landfill is mowed twice annually to control woody growth due to airfield proximity.

7.2.4.6 LF11 and LF12

LF12 has been excavated of hazardous materials, which were transported off-base to a certified solid waste landfill. LF12 is not inspected and is not included in the Quarterly Recovery System Performance Reports (CAM, 2015-2019c); however, groundwater is monitored semiannually under the LTM Program and is discussed in **Chapter 8**. LF12 is mowed as-needed by CE to control woody growth due to airfield proximity.

Quarterly O&M for LF11 consists of visual observations to determine if:

- The LF covers are subsiding
- Improvements are required to address erosion from stormwater runoff
- Turf growth is inhibiting drainage
- The integrity of the covers or slopes is being threatened by burrowing animals
- Rock check dams are in place and still functioning properly
- Fences, gates, signs and locks are in place and/or operational.

Maintenance is then completed on an as-needed basis. LF11 is mowed twice annually to control woody growth.

7.2.4.7 SP11

Quarterly O&M for SP11 consists of visual inspections of the French drain components, which consist of the following:

- Catch basins
- Manhole and grating drain concrete
- Inlet sump and pump
- Drain line and separator pit water level
- Float switches and other electrical components.

In addition, the controller and pump are operated manually to identify any system malfunctions. Maintenance is then completed on an as-needed basis.

7.3 Progress Since the Last Five-Year Review

The recommendation for the 41 NA sites presented in the previous Five-Year Review (WPAFB, 2016a) was to continue monitoring LFG at LG-10 (at LF4). This has continued and is summarized in **Section 7.4.4.2**, below.

The WPAFB IRP and CE offices have established a maintenance checklist to address an issue raised by the OEPA concerning the maintenance of the cover (specifically, cover disruption and ponding of water on the cover) at LF4. As reported in the Quarterly Recovery System Performance Reports (CAM, 2015-2019c), the drainage system is working properly and as designed. No further concerns were raised. There have been no other recorded changes in the status of the remaining NA sites. Groundwater quality at the monitoring locations sampled under the LTM Program remain consistent with historic levels and are evaluated annually in the LTM Program Annual Reports.

7.4 Five-Year Review Process

The five-year review was completed following USEPA guidance in Comprehensive Five-Year Review Guidance (USEPA, 2001, 2012a). This section provides a summary of the process used for the five-year review for the IRP sites contained in the 41 NA Sites ROD.

7.4.1 Administrative Components

The five-year review process was initiated by the WPAFB IRP AFCEC/CZO. The five-year review process is managed by AFCEC/CZO with regulatory oversight by USEPA and OEPA. The review schedule was established by the review team and included the following components:

- Community Involvement
- Document Review
- Data Review
- Site Inspection
- Deed Review
- Five-Year Review Report Development and Review.

7.4.2 Community Involvement

The USEPA's OSWER guidance requirements for five year reviews specifies a draft public notice of initiation of the review should be published initially identifying to the community that a five-year review will be conducted. An initiation notice was published in the Dayton Daily News legal section on June 4, 2020, notifying the community that the Fifth Five-Year Review for WPAFB is currently being conducted. The initiation notice was posted at the following online link: https://classifieds.daytondailynews.com/ads/public-notices/legal-notice/notice-of-initiation-of-the-five-year-record-626812.

After USEPA and OEPA concur on the final report, a notice for formal public review will be placed in the Dayton Daily News. A copy of the CERCLA Five-Year Review Report will be provided to the WPAFB RAB stakeholders and added to the Administrative Record at the WPAFB IRP office, as well as the Information Repository located at Wright State University, 3640 Colonel Glenn Highway, Dayton, Ohio.

7.4.3 Document Review

The five-year review consisted of a review of the following documents:

- Final Fourth Five-Year Record of Decision Review Report (WPAFB, 2016a)
- Long Term Groundwater Monitoring Reports (CB&I, 2015-2016, APTIM, 2017-2020)
- Record of Decision for 41 No Action Sites (WPAFB, 1998)
- Operable Unit 3 Final Remedial Investigation Report (SAIC, 1995)
- Operable Unit 4 Final Remedial Investigation Report (CH2M HILL, 1995e)
- Operable Unit 5 Final Remedial Investigation Report (IT, 1995b)
- Operable Unit 6 Draft-Final Site-Specific Removal Action Plan (Metcalfe and Eddy, 1996a)
- Operable Unit 7 Final Field Investigation Report (ICI, 1996)
- Operable Unit 8 Final Remedial Investigation Report (CH2M HILL, 1997b)
- Operable Unit 9 Final Remedial Investigation Report (IT, 1997c)
- Decision Document – No Further Action Planned Spill Site 4 (WPAFB, 1991a)
- Decision Document – No Further Action Planned Spill Site 6 (WPAFB, 1992b)
- Decision Document – No Further Action Planned Spill Site 7 (WPAFB, 1993b)
- Decision Document – No Further Action Planned Spill Site 8 (WPAFB, 1991b)
- Decision Document – No Further Action Planned Spill Site 9 (WPAFB, 1993c)
- Decision Document – No Further Action Planned Earthfill Disposal Zones 1,2,3,4,5,6,7,8 (ES, 1992b)
- Decision Document – No Further Action Planned for Earthfill Disposal Zones 10,11, 12 (SAIC, 1992a)
- Operable Unit 4 RI/FS Addendum (CH2M HILL, 1998)
- Decision Document – No Further Action Planned East Ramp UST (WPAFB, 1991c)

- Decision Document – No Further Action Planned Radioactive Waste Burial Site (WPAFB, 1992a)
- Final Field Investigation Report – Operable Unit 11 (Metcalfe and Eddy, 1997)
- Final Site Investigation Report – Eight Earthfill Disposal Zones (SAIC, 1992b)
- Decision Document – Central Heating Plan 1 (WPAFB, 1991d)
- Operation and Maintenance Plan Operable Unit 4 Landfills 3, 4, 6, and 7, and Drum Staging/Disposal Area (CH2M HILL, 1997a)
- Quarterly Recovery System Performance Reports (CAM, 2015-2019c)
- Monthly Operating Reports, O&M, Landfill 5 (CAM, 2015-2019b)
- Explanation of Significant Differences: Source Control Operable Unit – Landfills 8 and 10; Off-Source Operable Unit and Final Remedial Actions Landfills 8 and 10; 21 No Actions Sites; Spill Sites 2, 3, and 10 (Operable Unit 2); 41 No Action Sites; and Groundwater Operable Unit (WPAFB, 2012a).

7.4.4 Data Review

Actions taken at the sites since the signing of the ROD include (but are not limited to) groundwater monitoring under the LTM Program, maintenance of ECs (such as fencing, signs, and gates), O&M of LF caps, and monitoring of LFG at various landfill sites. Groundwater monitoring results under the LTM Program and recommended changes to monitoring at the 41 NA sites are provided in **Chapter 8**. A summary of the O&M performed at some of the 41 NA sites was provided in **Section 7.2.4**.

7.4.4.1 LF1 and LF2

There were no recurring maintenance items that would indicate an ongoing O&M problem.

7.4.4.2 LF3 and LF4

LF3 is partially within the Prairie Trace Golf Course and is maintained by routine grounds maintenance. LF4 is maintained by the Base CE maintenance yard and is used for storage of roadway and landscaping materials, and heavy equipment. LFs 3 and 4 are inspected quarterly by the LF O&M contractor. No problems associated with LFs 3 and 4 were brought to the attention of the LF O&M contractor during this five-year period.

Methane continues to be detected at probe LG-10 at concentrations greater than 100 percent of the LEL. During the 2019 quarterly monitoring events, methane was not detected at Building 10879. The ongoing elevated methane concentrations at OU4 LFG probe LG-10 are believed to be related to biological decomposition of materials disposed of in LF4.

7.4.4.3 LF5

Maintenance items for the landfill cap are performed when problems are identified and are summarized in the Quarterly Recovery System Performance Reports (CAM, 2015-2019c). Burrowing animals are a recurring maintenance issue. Humane traps are set and the animals are removed. Performance data and maintenance issues for the associated groundwater treatment system (GWTS) are reported monthly by the LF O&M contractor (CAM, 2015-2019a).

7.4.4.4 LF6, LF7 and Drum Storage Area

Maintenance items for the landfill caps are performed when problems are identified and are summarized in the Quarterly Recovery System Performance Reports (CAM, 2015-2019c). Occasional surface water ponding issues are remedied by the LF O&M contractor. Surface drainage from the landfill is adequate, and a protective topsoil layer and seeding application prevents soil erosion and improves surface runoff.

7.4.4.5 LF9

Maintenance items for the landfill cap are performed when problems are identified. There were no recurring maintenance items that would indicate an ongoing O&M problem.

7.4.4.6 LF11 and LF12

Maintenance items for the LF11 cap are performed when problems are identified. There were no recurring maintenance items that would indicate an ongoing O&M problem. LF12 waste was removed in 1997 and is now a grassy open space. There are no special maintenance requirements.

7.4.4.7 SP11

Maintenance items for the French drain at SP11 are performed when problems are identified. There were no recurring maintenance items that would indicate an ongoing O&M problem.

7.4.4.8 Recommended Changes to Monitoring

Via letter dated July 30, 2020 and approved by USEPA on August 12, 2020, WPAFB requested the following reduction of inspections and reporting for LFs 1 through 7, 9, and 11:

Landfill No. / Cap Installation Date	Current Schedule		Proposed Optimized Schedule	
	Inspections	Reporting	Inspections[1]	Reporting
LF1 / 1998	Quarterly	Quarterly	Semi-annual	Annual
LF2 / 1998	Quarterly	Quarterly	Semi-annual	Annual
LF3 / 1994	Quarterly	Quarterly	Annual	Annual
LF4 / 1998	Quarterly	Quarterly	Annual	Annual
LF5 / 1994	Quarterly	Quarterly	Semi-annual	Annual

Landfill No. / Cap Installation Date	Current Schedule		Proposed Optimized Schedule	
	Inspections	Reporting	Inspections[1]	Reporting
LF6 / 1998	Quarterly	Quarterly	Semi-annual	Annual
LF7 / 1998	Quarterly	Quarterly	Semi-annual	Annual
LF9 / 1998	Quarterly	Quarterly	Semi-annual	Annual
LF11 / 1997	Quarterly	Quarterly	Semi-annual	Annual

(1) = Semi-annual inspections will be performed in spring and fall, and annual inspections will be performed in spring.

7.4.5 Site Inspection

Summaries of the site inspections are presented in **Table 7-2**. Site photographs are presented in **Appendix B**.

7.4.6 Interviews

The following personnel were interviewed regarding the status of the 41 sites to determine if any additional actions or concerns had occurred:

- Justin Hall, CAM

The results of the interviews are included in **Appendix B**. As indicated on the forms the following concerns were raised:

- Keys for locked gates to LFs located along the Base boundary (LFs 1, 2, 9, 11, and 12) are controlled by Base Security Forces. Keys for LFs 11 and 12 are also available through the IRP office. The LFs are not left unlocked at any time.
- LF5 is occasionally driven on. Any ruts or disturbed areas are fixed and reseeded as soon as possible after discovery of the problem.
- The LF O&M contractor has requested that the frequency of the inspections for LFs 1 through 7, 9, and 11, be reduced from quarterly to semiannually (for LFs 1, 2, 5, 6, 7, 9, and 11) and annually (for LFs 3 and 4). The rationale is that is no appreciable change in site conditions over a 6-month period when compared to a 3-month period. This request was approved by the USEPA on August 12, 2020.

7.5 Technical Assessment

The primary goal of the five-year review is to determine whether the remedy at a site is protective of human health and the environment. To provide a framework for organizing and evaluating data and information and to ensure that all relevant issues are considered when determining the protectiveness of the remedy, USEPA guidance lists three questions to consider. The questions are as follows:

Question A: Is the remedy functioning as intended by the DD?

Question B: Are the exposure assumptions, toxicity data, cleanup levels and RAOs used at the time of the remedy still valid?

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

The following sections provide responses to the questions for each of the sites being reviewed.

7.5.1 Question A: Is the remedy functioning as intended by the DDs?

The review of documents and the results of interviews with the LF O&M contractor indicate that the remedy is functioning as intended by the 41 NA Sites ROD. Implemented ICs have achieved the objective of preventing exposure to contaminants. Land-use restrictions and ECs required under the 41 NA Sites ROD are currently summarized and documented in the LUCIP (TetraTech, 2019). Copies of the LUCIP were provided to WPAFB personnel responsible for maintaining the ECs, implementing ICs on excavating, digging and construction, and WPAFB entities responsible for ensuring that land usage remains consist with the 41 NA Sites ROD requirements. These land-use controls are being implemented in accordance with the LUCIP and the ROD.

Since this ROD only addressed soils at each of the sites, groundwater is addressed in another OU, the GWOU ROD (**Chapter 8.0**).

7.5.2 Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?

Yes, the exposure assumptions, toxicity data, cleanup levels, and RAOs are still valid. The 41 NA sites were evaluated using semi-quantitative risk assessment (i.e., screening-level risk assessment) and quantitative risk assessment methods. As a result of these evaluations, no action was specified for these sites. Supporting documentation is provided in **Appendix A**, **Section A.5**. The rationale for each component of Question B is provided below and in **Table 7-7**.

7.5.2.1 Changes in ARARs and TBCs

While there were no ARARs or TBCs listed in the ROD for most of the 41 NA sites, ARARs or TBCs were applied as appropriate to each risk evaluation. The remedy selected for each of the 41 sites addressed in the ROD is the NA alternative, which is based on restricted land use and ICs.

Prior to 1992, several of the 41 NA sites (SP4, SP7, SP9, UST 71A, UST 4020, and East Ramp Tank Removal [ERTR]) were closed in accordance with BUSTR. The BUSTR regulations (OAC 1301:7-9-13) were revised in 1999, 2001, 2005, 2014, and 2017 (ODC 1999, 2001, 2005, 2014, 2017). As part of the revisions to these regulations, the action levels for protection of human health were expanded to address specific exposure pathways. Corrective actions completed prior to March 31, 1999 are not affected by the new updated rules; thus, because these sites were closed prior to 1992, they were not impacted by the new rules.

Two of the 41 NA sites (SPs 6 and 8) were evaluated in accordance with cleanup levels under the Toxic Substances Control Act (TSCA). There have been no changes to cleanup levels for PCBs under TSCA.

7.5.2.2 Changes in Land-Use and Exposure Assumptions

Land use at the 41 NA sites includes industrial (including labs), commercial, and recreational. Although land use remains unchanged at all of the sites covered in the 41 NA Sites ROD, several of the land use designations have changed since the last Five-Year Review. The designations used in the previous LUC (Labat, 2012) were changed in the updated LUCIP (TetraTech, 2019). In particular, land use previously designated as “open space” is now referred to as “industrial”.

Although guidance regarding some exposure assumptions has changed (i.e., current guidance for dermal risk assessment [USEPA, 2004]), these revisions would not affect the protectiveness of the remedy. There have been no significant changes to the exposure pathways that were evaluated for direct contact since the Fourth Five-Year Review (WPAFB, 2016a). Although USEPA updated the default exposure factors used in the derivation of the RSLs and in quantitative HHRAs in 2014 (USEPA, 2011a, 2014b), these factors have not changed since the previous review (USEPA, 2019a). Changes in the RSLs and the default factors are discussed in the introduction to **Appendix A** and **Section A.7**. Therefore, the RSLs continue to address the land use and exposure assumptions of interest for the 41 NA Sites. In summary, land use designations for the 41 NA Sites have not changed since the previous Five-Year Review and the allowable land uses that were originally evaluated at these sites remain the same. The industrial exposure scenario used in the original HHRA was sufficiently conservative to cover the current mix of industrial use at the 41 No Action Sites. Similarly, land uses at those sites that included a recreational exposure scenario have not changed since the previous review. Therefore, the conclusions of the original HHRA and previous Five-Year Reviews remain valid and the remedy for soil remains protective.

As stated previously, USEPA, DoD, and others have published guidance regarding the evaluation of the vapor intrusion pathway (USEPA, 2002; DoD, 2009; ITRC, 2007) since the preparation of the ROD (WPAFB, 1998). The OEPA finalized their guidance for vapor intrusion in 2010 (OEPA, 2010) and the USEPA revised their guidance in 2015 (USEPA, 2015). These documents present methods for estimating potential exposures to VOCs from groundwater and soil that may migrate through building foundations via vapor intrusion.

As described in the introduction to **Appendix A**, USEPA has also issued recommendations for assessing protectiveness at sites for vapor intrusion as a supplement to the Comprehensive Five-Year Review Guidance (USEPA, 2001, 2012b). The vapor intrusion pathway for several landfills within OU4 was evaluated by reviewing VOC results for soil gas and groundwater and is discussed in the following paragraphs.

Soil gas monitoring at OU4 is conducted to evaluate the potential for methane migration from the LFs into the surrounding buildings. However, the majority of the original buildings were removed prior to the Fourth Five-Year Review (WPAFB, 2016a) and there has been no other land use change. Currently, soil gas monitoring at LF4 consists only of quarterly methane/landfill gas measurements at soil vapor probe LG-10 and Building 10879. It is noted that there are no toxicity values for methane. Therefore, changes to toxicity values do not apply to this soil gas evaluation.

Land use for the 41 NA Sites has not changed since the remedy was implemented; therefore, the land use assumptions remain valid. An ESD was approved in 2012 to address six RODs at WPAFB including the 41 NA Sites (WPAFB, 2012a). As described in the introduction to **Appendix A**, this ESD clarified the implementation of ICs for each of the RODs. The LUCIP, which replaced the LUC Plan (Labat, 2012), is the primary administrative mechanism employed by WPAFB to determine which ICs are protective for the site and to ensure that current ICs remain environmentally compatible with future land use and are properly implemented. The ICs in place for the site include access restrictions that limit access to the site and uses of the site. There are no current plans to transfer any of the properties associated with these sites; however, if a different land use were to be proposed, an amended risk assessment would be performed to evaluate the new land use. These land uses will remain in effect until otherwise allowed under the LUCIP (TetraTech, 2019) and the ESD (WPAFB, 2012a). In the future, if portions of WPAFB are transferred or sold to either a federal or non-federal entity, the provisions specified in **Section 2.4** (Land Use Control Procedures) will be followed.

7.5.2.3 Changes in Toxicity Values

The IRIS database (USEPA, 2019b) was reviewed to determine whether the toxicity data had changed since the risk assessments had been conducted. The IRIS database is considered to be the first tier in the USEPA’s hierarchy of sources of toxicity values (USEPA, 2003b). A review of the toxicity values indicated the following:

- The PRGs used in the original risk assessments at the 41 NA Sites have since been replaced by the RSLs. Therefore, several individual toxicity values have changed. Some criteria are now more stringent, while some are less stringent.

- Toxicity values are now available for some chemicals that did not have toxicity criteria at the time of the risk assessment. In particular, several toxicity values are now available for the inhalation pathway. In support of the IRIS database, USEPA finalized the toxicological reviews for PCE and TCE and verified inhalation toxicity values (USEPA, 2012c, 2011b, respectively). As is the case for the current toxicity values, some of the proposed values are more stringent than those used in the baseline HHRA and some are less stringent.

- PAHs were identified as COCs in soil at BS1, LTCSA, TCSP, FTA2, FTA3, FTA4, FTA5, LF14, SP1, FTA1, and EFDZ1. As discussed in the introduction to **Appendix A**, USEPA issued an updated *Toxicological Review of Benzo(a)pyrene* under the IRIS Program in January 2017 (USEPA, 2017). This review updated the previous IRIS assessment of benzo(a)pyrene, which had been used since 1987. It was based on studies conducted after 1987 and the 2011 recommendations for the improvement of IRIS toxicity assessments.

  Benzo(a)pyrene is now identified as “carcinogenic to humans” rather than the 1987 “probable human carcinogen” weight-of-evidence classification. USEPA (2019b, 2017) provided a verified oral cancer SF for benzo(a)pyrene of 1.0E+0 per mg/kg-day and a verified IUR of 6.0E-4 per $\mu g/m^3$ in 2017.

  Although the IRIS database currently indicates that the toxicity criteria for benzo(a)pyrene have been “suspended” (USEPA, 2019b), the updated oral cancer SF (1.0E+0 per mg/kg-day) and the IUR (6.0E-4 per $\mu g/m^3$) continue to be included in the current RSL table USEPA, 2019a) and applied in the RSL calculator (USEPA, 2019d). When compared with the previous oral SF (7.30E+0 per mg/kg-day), the current toxicity value represents less potency and, therefore, is less stringent. It is noted, however, that there was previously no IRIS-verified IUR for benzo(a)pyrene.

  There are no IRIS-verified toxicity values for the remaining carcinogenic PAHs; however, these values have been derived from the SF and IUR for benzo(a)pyrene using their corresponding RPFs. The resulting values are used to develop RSLs for these compounds.

  In addition, the RSL table now includes an RfD (3.0E-4 mg/kg-day) and an RfC (2.0E-6 mg/m^3). Previously, there were no noncancer-based toxicity values available for benzo(a)pyrene. Both of these toxicity values are based on developmental effects.

- Some of the values are considered provisional or PPRTVs. These values are obtained from Tier 2 sources according to USEPA’s hierarchy because they have not undergone the required review process for the values to be placed in IRIS. In addition, some criteria are from Tier 3 sources, which are developed by other USEPA or non-USEPA sources, such as ATSDR and Cal EPA.

As described in **Appendix A**, **Section A.3**, Changes in Toxicity Values, the “no action” sites were evaluated to determine whether additional measures would be needed if changes in toxicity values resulted in exceedances of acceptable limits for cancer risk or noncancer hazard for the industrial/commercial scenario. Although the soil at the “No Action” sites is subject to the provisions of the ROD, the screening levels and/or toxicity values were evaluated at sites where exposures to surface soil could occur. Sites at which removal actions had been taken or soil had been capped were not included. In addition, sites where semi-quantitative risk assessment had indicated very low levels of contamination were not further assessed. The rationale for further evaluating screening levels or toxicity values for specific sites in provided in **Appendix A**, **Table A-15**. For the subset of sites evaluated, the screening levels used in the semi-quantitative risk assessments were compared with current screening levels in **Appendix A**, **Table A-16**. Although some of the current screening levels are more stringent, no new COPCs were identified. Therefore, with respect to the toxicity information used in the risk assessment, the conclusions of the risk assessment are still considered to be valid.

As discussed in the previous Five-Year Reviews, there were changes to some of the factors and assumptions used to calculate dermal toxicity values in the original risk assessment. However, the remedy continues to be effective and there is no direct contact with soil at these sites. The original human health risk assessments were performed using a semi-quantitative or qualitative methodology and comparing the site concentrations with Region 9 PRGs or Region 3 RBCs. In 2008, USEPA consolidated the screening levels for all regions into a single set of values that have been designated as RSLs (USEPA, 2019a) and the agency continues to update these values every 6 months as necessary. For this evaluation, maximum contaminant concentrations were compared to the most current industrial and/or residential soil RSLs. For most sites, the changes to the RSL values would not have changed the outcome of the qualitative risk assessment. Although the maximum concentrations of some of the COCs in soil (as shown in **Table 7-7** and discussed in **Section A.5**) exceeded the updated industrial RSLs at a 1×10^{-6} risk level, they were generally below RSLs based on 1×10^{-5}. COCs by location are as follows:

- Arsenic in soil at EFDZs 2, 3, 5, 6, 7, 8, 9, and 10
- Arsenic and benzo(a)pyrene in soil at EFDZ4
- Elemental mercury in soil at CHP2 (removed)
- Benzo(a)pyrene in soil at LF9
- Arsenic in soil at BS2
- Arsenic, benzo(a)pyrene, and dibenz(a,h)anthracene in soil at Chemical Disposal Area (CDA)

Since the ROD (WPAFB, 1998), USEPA published guidance regarding the assessment of bioavailability of arsenic in soil (USEPA, 2012d). An oral RBA of 60 percent is assumed in the derivation of the RSL for the ingestion of soil. As a result, the RSL for arsenic is less stringent than the screening values used for arsenic in the original risk assessment. Therefore, risks and hazards calculated for arsenic in soil are likely to be slightly less than originally estimated. There have been no further changes to the RBA since the Fourth Five-Year Review (WPAFB, 2016a). In addition, there is no change in the protectiveness of the remedy for soil because direct contact with soil is prevented.

For several sites, exposures to lead in soil were evaluated using the IEUBK Model, Version 0.99 (USEPA, 1994), which does not address adult exposures to lead. Since the original 41 NA sites risk assessments were performed, the IEUBK model has been updated (USEPA, 2007, 2010c). In addition, the USEPA has since developed the ALM to evaluate occupational exposures to lead (USEPA, 2003a). The use of ALM would not impact the remedy because the IEUBK model conservatively addresses potential exposures to the most sensitive population.

USEPA also developed the Soil Screening Guidance (USEPA, 1996b) as a framework for screening contaminated soils that encompasses both simple (i.e., screening-level) and more detailed approaches for calculating site-specific SSLs. In particular, this guidance presents methodologies to address the leaching of contaminants through soil to an underlying potable aquifer. These methodologies have not changed since the SSL Guidance was issued. Given the period of time the sites have existed, migration of chemicals from the LF has most likely occurred. The use of the SSLs would have no effect on the remedy. Groundwater is being monitored under the LTM Program.

7.5.2.4 Changes in RAOs and Cleanup Goals

There were no specific RAOs for any of the 41 NA sites; however, the overall RAO is to prevent exposures to COCs in soil at these sites as identified in the ROD. The NA alternative was selected as remedy for all 41 NA sites (i.e., the USAF determined that no remedial action was necessary to ensure protection of human health and the environment at these sites). This decision was based on the evaluation of analytical data and current site conditions at the time of the site inspections. (Because ICs and ECs were already in place at the 41 IRP sites when the ROD was written in 1998, the selected remedy is considered a “limited action” according to USEPA IC guidance document [USEPA, 2010a] rather than a “no action” remedy.) The 41 NA Sites ROD states that groundwater, surface water, and sediment would be monitored under the LTM Program. Thus, the RAO for these sites is to prevent exposure to hazardous substances until and unless unlimited use and unrestricted exposure levels are attained at each individual site.

To prevent exposure to soil, ICs and access/land-use restrictions are in place at all of the sites (e.g., requiring proponents to obtain dig permits prior to performing excavations). Additionally, some sites have fencing around them, further limiting access. Digging or excavation at any of the 41 NA sites, especially those with waste or contaminants left in place, is currently restricted by the nature of the installation, and is expected to remain restricted. If portions of WPAFB are sold, the appropriate land use would need to be evaluated for the specific intended application. For the EOD Range, land-use restrictions would be placed to limit industrial uses.

7.5.3 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No additional information has been identified that could call into question the protectiveness of the remedy.

7.5.4 Technical Assessment Summary

The review of documents, ARARs, risk assessment assumptions, and the results of interviews with the LF O&M contractor indicate that the remedy for soils is functioning as intended by the 41 NA Sites ROD. The LUCIP (TetraTech, 2019) is the primary administrative mechanism employed at WPAFB that ensures that land usage remains consistent with the ROD, and that ECs and ICs are maintained. Groundwater monitoring under the LTM Program is discussed in **Chapter 8**.

There have been some changes to the RSLs (formerly PRGs), toxicity values, and changes to risk assessment guidance documents since the last five-year review as noted in **Section 7.5.2.3**. Most of these changes do not affect the protectiveness of the remedy because the new values are less stringent, or the remedy eliminates the pathway of exposure. For most sites, the changes to PRG values would not have changed the outcome of the qualitative risk assessment.

In addition, soil vapor media have been added to the media to be addressed. LFG monitoring at LF4 will continue to evaluate any changes methane concentrations. Therefore, the remedy will remain protective of human health and the environment under current and future land use.

There is no additional information that calls into question the effectiveness of the remedy.

7.6 Issues

The following issue was identified during the review for the 41 NA Sites ROD:

- OU4 LFG probe LG-10 (at LF4) continues to have elevated methane concentrations.

7.7 Recommendations and Follow-up Actions

The following actions are recommended for the 41 NA Sites:

- Continue quarterly monitoring LFG at LG-10 (at LF4) until methane is not detected for four consecutive quarters

- Reduce the site inspection frequency for LFs 1 through 7, 9, and 11 from quarterly to semiannually (reduction approved by USEPA on August 12, 2020).

Table 7-1
Site Chronologies
41 No Action Sites
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OU	IRP Site	Event	Date
NA	EOD Range	RCRA Closure	1998
NA	HP1	Preliminary Assessment	May 1988
NA	HP4	Preliminary Assessment	May 1988
NA	SP8	Preliminary Assessment Transformer Removal/Disposal Decision Document	December 1988 June 1990 May 1991
NA	NUC	Phase I Records Search	February 1982
NA	RADB	Phase I Records Search	February 1982
3	LF11	Preliminary Assessment Removal Action – Landfill Capping	May 1988 April 1997
3	LF12	Preliminary Assessment Removal Action – Container/soil removal	May 1988 January 1998
4	CHP2	Preliminary Assessment Removal Action –Mercury cleanup	May 1988 January 1996
4	LF3	Preliminary Assessment	May 1988
4	LF4	Preliminary Assessment	May 1988
4	LF6	Preliminary Assessment Removal Action – Landfill Capping	May 1988 1997
4	LF7	Preliminary Assessment Drum Removal Removal Action – Landfill Capping Settlement Maintenance Activities	May 1988 1990 1994 September 2013
5	LF5	Preliminary Assessment Removal Action – Landfill Capping	May 1988 August 1996
6	LF1	Preliminary Assessment Removal Action – Landfill Capping	May 1988 July 1998
6	LF2	Preliminary Assessment Removal Action – Landfill Capping	May 1988 July 1998
7	LF9	Preliminary Assessment Removal Action – Landfill Capping	May 1988 June 1998
8	SP5	Preliminary Assessment Removal Action – Soil venting/floating product removal	September 1988 March 1997-December 1997
8	SP6	Preliminary Assessment Transformer removal Soil Excavation/Disposal	October 1988 1986 1987

Table 7-1
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41 No Action Sites
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OU	IRP Site	Event	Date
8	SP7	Preliminary Assessment UST Removal	October 1988 1991
8	SP9	Preliminary Assessment UST Removal	May 1989 1992
8	SP11	Preliminary Assessment Removal Action – French drain/LNAPL removal Further Action Area B Treatability Test Report	May 1991 February 1998 December 2000
8	UST71A	Preliminary Assessment Removal Action – Soil venting/floating product removal	May 1988 March 1997-December 1997
9	BS3	Preliminary Assessment	September 1988
9	BS5	Site Investigation	1997
9	BS6	Site Investigation	1997
9	EFDZ2	Preliminary Assessment	May 1988
9	EFDZ3	Preliminary Assessment	May 1988
9	EFDZ4	Preliminary Assessment	May 1988
9	EFDZ5	Preliminary Assessment	May 1988
9	EFDZ6	Preliminary Assessment	May 1988
9	EFDZ7	Preliminary Assessment	May 1988
9	EFDZ8	Preliminary Assessment	May 1988
9	EFDZ9	Preliminary Assessment	December 1988
9	EFDZ10	Preliminary Assessment	January 1989
9	HP5	Preliminary Assessment Coal storage area upgrades Removal Action – excavation of surface soil at DRMO facility	May 1988 October 1998
9	Multiple	Remedial Investigation Report: Operable Unit 9	September 1997
10	ERTR	Preliminary Assessment UST Removal BUSTR Closure	January 1989 December 1988 July 1991
10	SP4	Preliminary Assessment UST Removal Soil Removal BUSTR Closure	June 1988 1983 1988 July 1991
11	BS2	Phase I Records Search	January 1982

Table 7-1
Site Chronologies
41 No Action Sites
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OU	IRP Site	Event	Date
11	CDA	Preliminary Assessment	August 1988
11	UST 34020	Preliminary Assessment UST Removal	May 1988 1986
Multiple	41 Sites	Proposed Plan for 41 No Action Sites	June 1998
Multiple	41 Sites	Record of Decision for 41 No Action Sites	August 1998
Multiple	41 Sites	First Five-Year Record of Decision Review	March 2000
Multiple	41 Sites	Second Five-Year Record of Decision Review	January 2006
Multiple	41 Sites	Third Five-Year Record of Decision Review	August 2011
Multiple	41 Sites	Fourth Five-Year Record of Decision Review	April 2017

Abbreviations:

BS = Burial Site
BUSTR = Bureau of Underground Storage Tank Regulations
CDA = Chemical Disposal Area
DRMO = Defense Reutilization Materials Office
EFDZ = Earthfill Disposal Zone
EOD = Explosive Ordinance Disposal
ERTR = East Ramp Tank Removal
HP = Heating Plant
IRP = Installation Restoration Program
LF = Landfill
LNAPL = Light Non-Aqueous Phase Liquid
NA = Not Applicable
NUC = Deactivated Nuclear Reactor
OU = Operable Unit(s)
RADB = Radioactive Waste Disposal Area
SP = Spill Site
UST = Underground Storage Tank

Table 7-2
Site Inspection Summary and Land Use
41 No Action Sites
Wright-Patterson AFB, Ohio
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OU Location	IRP Site	Inspect. Date	Former Land Use	Land Use Observed During This Review	Designated Land Use - Restrictions(1)	Is Current Land Use Consistent with Allowable Land Use?
NA	EOD Range	10/10/2019	Used for over 40 years to thermally treat unserviceable munitions via detonation and burning	Vacant grassy area between the Mad River and Riverview Road, located in flood zone. Locked and Fenced. Figure 7-1	Industrial - 3	Yes – no change from previous Five-Year Review
NA	HP1	10/11/2019	Plant contained seven coal-fired boilers and began operating in 1930, but was shut down in 1980 as part of a heating plant consolidation	Closed heating plant – mostly parking lot with some grassy area, located near Building 91. Figure 7-6	Industrial - 3	Yes – no change from previous Five-Year Review
NA	HP4	10/10/2019	Began operation in 1957 and expanded to present size in 1980	Operational heating plant. Figure 7-4	Industrial - 3	Yes – no change from previous Five-Year Review
NA	SP8	10/10/2019	Discovered in 1988 during removal of two transformers that were leaking oil with PCBs	Grassy area at northeast end of Building 2 and adjacent to parking lot for Building 1. Figure 7-4	Industrial - 3	Yes – no change from previous Five-Year Review
3	LF11	10/10/2019	A 16-acre site used for general refuse disposal from 1968 to 1977 - initially operated as a trench-and-cover landfill and later as a ramp-and-compaction landfill with daily cover, various chemical wastes reportedly disposed include undetermined quantities of oily wastes, solvents, organic and inorganic chemicals, and hospital wastes	Capped landfill with maintained grass surface, located between the Mad River and Riverview Drive. Figure 7-1	Recreational - Hunting - 2	Yes – no change from previous Five-Year Review
3	LF12	10/10/2019	Approximately 0.27 acres operated from 1968 to 1973 for chemical disposition and acid neutralization, all stored waste chemicals were removed and disposed of off-site in 1973	Grassy field, fenced. Figure 7-1	Recreational - Hunting- 2	Yes – no change from previous Five-Year Review
4	HP2	10/10/2019	Operated from the 1940s until 1980 when the plan was shut down as part of a heating plant consolidation	Site is now occupied by Building 271. Figure 7-2	Industrial - 3	Yes – no change from previous Five-Year Review
4	LF3	10/10/2019	Surface dump (general refuse and possible hazardous waste) and burn operation from about 1940 to 1944	Golf Course – tee off box for Hole #10. Figure 7-2	Recreational - Golf - 2	Yes – no change from previous Five-Year Review
4	LF4	10/10/2019	Eight acres (housing a one-acre water-filled gravel pit) operated from 1944 to 1949 that reportedly accepted large objects such as automobile bodies, in addition to general refuse and possible hazardous waste	Grounds equipment storage area, salt storage – partially paved. Figure 7-2	Industrial - 2	Yes – no change from previous Five-Year Review
4	LF6	10/10/2019	Seven acres (housing a two-acre water-filled gravel pit) operated from 1949 to 1952 as a trench-and-cover operation for general refuse and possible hazardous waste	Open grassy field adjacent to narrow wooded area along Skeel Avenue. Figure 7-2	Outdoor Recreation - 2	Yes – No longer a horse pasture, grassy area only
4	LF7	10/10/2019	Contains 18 acres and operated from 1952 to 1962 as a trench-and-cover operation for general refuse and possible hazardous waste	Large open grassy field and wooded area. Figure 7-2	Outdoor Recreation - 2	Yes – No longer an Equestrian Area, grassy area only (southern portion of LF7 is part of the golf course driving range, well maintained)
5	LF5	10/10/2019	A 23-acre site with history of varied uses: (1) lumber reclamation area in the 1940s, (2) surface dump for general refuse during an unknown time period, (3) waste petroleum handling operations from 1958 to 1978, (4) coal ash disposal by base heating plants from 1940 through 1991, (5) EOD and EOD ash in northwestern portion for an unspecified amount of time, and (6) reported placement of various chemical wastes, including undetermined quantities of oily wastes, solvents, and organic and inorganic chemicals	Maintained, capped landfill. Occasional recreational hunting. Figure 7-1	Recreational - Hunting - 1	Yes – no change from previous Five-Year Review

Table 7-2
Site Inspection Summary and Land Use
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OU Location	IRP Site	Inspect. Date	Former Land Use	Land Use Observed During This Review	Designated Land Use - Restrictions(1)	Is Current Land Use Consistent with Allowable Land Use?
6	LF1	10/11/2019	Storage of Area B refuse (containing unknown quantities of oily wastes and organic and inorganic chemicals), surface disposal and burning from the 1920s through 1940	Undeveloped – open grass field in front of museum; some recreational use when museum has large events. Figure 7-5	Recreational - 2	Yes – no change from previous Five-Year Review
6	LF2	10/11/2019	Storage of Area B refuse (containing unknown quantities of oily wastes and organic and inorganic chemicals) from the early 1940s through 1951, surficial disposal of hard fill and construction debris from 1955 through 1975	Undeveloped – wooded and open field; fenced. Figure 7-5	Recreational – Hunting - 2	Yes – no change from previous Five-Year Review
7	LF9	10/10/2019	Operated between 1962 and 1964 as a trench-and-cover operation that may contain hazardous waste	Undeveloped – open area (LF9) surrounded by woods – used occasionally for recreational hunting. Figure 7-3	Recreational - Hunting - 2	Yes – no change from previous Five-Year Review
8	SP5	10/11/2019	Waste oil contamination discovered in 1988 waste drainage system investigation.	Grassy area in front of research laboratory Building 70. Figure 7-3	Industrial - 3	Yes – no change from previous Five-Year Review
8	SP6	10/11/2019	A 100 square-foot area where an electrical transformer leaked 100 to 200 gallons of oil containing PCBs, discovered in 1985 with transformer and pad removed in 1986	Grass area near Building 14. Figure 7-6	Industrial - 3	Yes – no change from previous Five-Year Review
8	SP7	10/11/2019	Product release discovered in a 1989 tank farm inspection - tanks stored waste oil, aviation fuel, and fuel additives and in use from 1956 to 1992	Fuel Storage – located in downtown Area B, near many research facilities including Buildings 71/71A. Figure 7-6	Industrial - 3	Yes – no change from previous Five-Year Review
8	SP9	10/11/2019	Tank farm suspected of spills or leaks in 1989 - USTs were used from 1956 to 1992 to store aviation fuel and fuel additives for research purposes as part of the Aero Propulsion Laboratory Fuel Storage Facilities	Fuel Storage, pavement and graveled surface, near Building 5. Figure 7-6	Industrial - 3	Yes – no change from previous Five-Year Review
8	SP11	10/11/2019	Two small gun ranges constructed in the late 1960s to mid-1970s where partially full fuel tanks were fired upon, releasing fuel onto unpaved ground and in 1991, an aboveground fuel supply line ruptured, releasing jet fuel	Aircraft Survivability Research Facility. Figure 7-7	Industrial - 3	Yes – no change from previous Five-Year Review
8	UST71A	10/11/2019	Contamination discovered in 1985 during removal of USTs that stored gasoline, jet fuel (JP-4), and waste oil used for aircraft engine and propeller endurance tests	Street and parking lot located near research laboratories Buildings 71/71A and 5. Figure 7-6	Industrial - 3	Yes – no change from previous Five-Year Review
9	BS3	10/11/2019	May have been used to dispose of fuel sludge, but records indicating amount and nature of wastes are not available	Grassy and wooded area within Laser Test Range boundary, adjacent to BS6. Figure 7-7	Industrial - 2	Yes – no change from previous Five-Year Review
9	BS5	10/11/2019	Aerial photographs from 1944 to the present, indicate the presence of a BS appearing as a patch of stressed vegetation approximately one acre in size with a road or trail leading to the BS	Grassy area adjacent to AF Museum runway and within Laser Test Range boundary. Figure 7-5	Industrial - 2	Yes – no change from previous Five-Year Review
9	BS6	10/11/2019	Aerial photographs from 1944 to the present, suggest the presence of a BS appearing as a patch of stressed vegetation	Grassy and wooded area within Laser Test Range boundary, adjacent to BS3. Figure 7-7	Industrial - 2	Yes – no change from previous Five-Year Review
9	EFDZ2	10/11/2019	Disposal site, identified through aerial photographs of the 1940s, that may contain hazardous chemical materials	Grassy open area. Figure 7-7	Industrial - 2	Yes – no change from previous Five-Year Review
9	EFDZ3	10/11/2019	Disposal site, identified through aerial photographs of the 1940s, that may contain hazardous chemical materials	Grassy open area. Figure 7-7	Industrial - 2	Yes – no change from previous Five-Year Review
9	EFDZ4	10/11/2019	Disposal site, identified through aerial photographs of the 1940s, that may contain hazardous chemical materials	Mostly grassy area that also has a portion of 13th Street and the EM hazardous waste storage area. Figure 7-7	Industrial - 2	Yes – no change from previous Five-Year Review

**Table 7-2
Site Inspection Summary and Land Use
41 No Action Sites
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OU Location	IRP Site	Inspect. Date	Former Land Use	Land Use Observed During This Review	Designated Land Use - Restrictions[1]	Is Current Land Use Consistent with Allowable Land Use?
9	EFDZ5	10/11/2019	Disposal site, identified through aerial photographs of the 1940s, that may contain hazardous chemical materials	Grass/trees- recreational areas; running/walking path. Figure 7-7	Recreation - 2	Yes – no change from previous Five-Year Review
9	EFDZ6	10/11/2019	Disposal site, identified through aerial photographs of the 1940s, that may contain hazardous chemical materials	Parking lot for Building 837. Figure 7-6	Industrial - 2	Yes – no change from previous Five-Year Review
9	EFDZ7	10/11/2019	Disposal site, identified through aerial photographs of the 1940s, that may contain hazardous chemical materials	Grassy strip that was the former continuation of Skyline Drive, near decommissioned nuclear reactor, contains a surface water retention pond. Figure 7-7	Industrial - 2	Yes – no change from previous Five-Year Review
9	EFDZ8	10/11/2019	Disposal site, identified through aerial photographs of the 1940s, that may contain hazardous chemical materials	Grassy open area with some roads (Skyline Drive), a parking lot, and a small surface water retention pond. Figure 7-7	Industrial - 2	Yes – no change from previous Five-Year Review
9	EFDZ9	10/11/2019	Disposal site, thought to have developed in the early 1950s, that may contain hazardous chemical materials	Wooded area adjacent to Loop Road. Figure 7-7	Industrial - 2	Yes – no change from previous Five-Year Review
9	EFDZ10	10/11/2019	Disposal site, thought to have developed in the early 1950s, that may contain hazardous chemical materials	Grassy and wooded area with a paved parking lot for Building 620. Figure 7-7	Industrial - 2	Yes – no change from previous Five-Year Review
9	HP5	10/11/2019	Began operation in 1956 and expanded to present size in 1980	Operational heating plant. Figure 7-6	Industrial - 3	Yes – no change from previous Five-Year Review
9	NUC	10/11/2019	A 10-megawatt reactor completed in 1965 and operated for five years supporting various projects of Defense Agencies, civilian institutions, and Air Force engineering students until it was shut down and decommissioned in 1970	Decommissioned, laboratories, classroom. Figure 7-7	Industrial - Labs - 3	Yes – no change from previous Five-Year Review
9	RADB	10/11/2019	Consisted of a 49 square foot concrete slab surrounded by an eight-foot barbed wire fence labeled “Radioactive Waste Burial Site”. Area was excavated and concrete pad was determined to be used for staging only.	Wooded area near AFIT and office buildings, corner of Hobson Way and 10th Street. Figure 7-7	Industrial - 3	Yes – no change from previous Five-Year Review
10	ERTR	10/10/2019	UST that contained leaded gasoline and was abandoned in place prior to 1970, and then removed in 1988	Paved parking lot with a narrow grass strip, near Area A fire station and Building 145. Figure 7-4	Industrial - 3	Yes – no change from previous Five-Year Review
10	SP4	10/10/2019	Petroleum contamination identified in 1988, in which the source is presumed to be a UST that was reportedly removed in 1983 and contained leaded gasoline	Grassy area with water well, two air stripper towers for water treatment, and reservoir. Figure 7-4	Industrial - 3	Yes – no change from previous Five-Year Review
11	BS2	10/10/2019	Used between 1971 and 1975 for disposal of sludge generated from cleaning bulk fuel storage tanks	Open area surrounded by woods, adjacent to Riverview Road and Mad River. Figure 7-3	Commercial - 2	Yes – no change from previous Five-Year Review
11	CDA	10/10/2019	During 1963 through 1974, reported disposal of various shop wastes into the drainage system, including ammonia, cleaning solutions, paint remover, and aircraft washing chemicals	Grassy area – Buildings 4046 and 4059, and Lightning Avenue have been removed from the vicinity; drainage ditch and road in area. Figure 7-3	Industrial - 3	Yes – no change from previous Five-Year Review
11	UST 34020	10/10/2019	UST used from 1956 to 1986 for storage of waste JP-4 fuel and hydraulic fluid – pumped out and removed in 1986	Paved and grassy area adjacent to Building 4020. Figure 7-3	Industrial - 3	Yes – no change from previous Five-Year Review

Table 7-2
Site Inspection Summary and Land Use
41 No Action Sites
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Abbreviations:

Bldg	= Building
BS	= Burial Site
CDA	= Chemical Disposal Area
CE	= Civil Engineering
EOD	= Explosive Ordnance Disposal
ERTR	= East Ramp Tank Removal
HP	= Heating Plant
IRP	= Installation Restoration Program
LF	= Landfill
NA	= Not Applicable
NUC	= Deactivated Nuclear Reactor
OU	= Operable Unit(s)
PCB	= Polychlorinated Biphenyls
RADB	= Radioactive Waste Disposal Area
SP	= Spill Site
UST	= Underground Storage Tank

[(1)] **Land Use Key:**

1 – No digging, building, construction, etc. or otherwise disturbing landfill covers.

2 – Digging, construction and other soil disturbances allowable after approval by AFCEC/CZOM personnel; area subject to use restriction. May require an OEPA application of authority to disturb area within a 300-foot boundary of an Earthfill Disposal Zone, Landfill, or Waste Burial Site per OAC 3745-27-13(F).

3 – Digging, construction and other soil disturbances allowable after approval by AFCEC/CZOM personnel; area subject to use restriction.

Table 7-3
Initial Response Actions
41 No Action Sites
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OU	IRP Site	Initial Response
NA	EOD Range	RCRA Closure.
NA	HP1	None.
NA	HP4	None.
NA	NUC	None.
NA	RADB	None.
NA	SP8	Transformer removal/disposal. Soil excavation/disposal.
3	LF11	Removal Action – landfill cap.
3	LF12	Removal Action – removal/disposal of buried containers and visibly contaminated soil.
4	HP2	Removal/disposal of elemental mercury and contaminated water from sewer pipe, removal/disposal of mercury contaminated soil, capping of storm sewer pipe exiting the heating plant, floor drain lines were cleaned and abandoned.
4	LF3	None – cover maintenance program developed.
4	LF4	None – cover maintenance program developed.
4	LF6	Removal Action – landfill cap.
4	LF7	Removal Action – landfill cap.
5	LF5	Removal Action – landfill cap, groundwater extraction/treatment.
6	LF1	Removal Action – landfill cap.
6	LF2	Removal Action – landfill cap.
7	LF9	Removal Action – landfill cap.
8	SP5	Removal Action – floating product removal and soil venting (see also UST71A)
8	SP6	Transformer removal/disposal. Soil excavation/disposal.
8	SP7	UST/soil removal/BUSTR closure.
8	SP9	UST/soil removal/BUSTR closure.
8	SP11	Removal Action – French drain for groundwater/LNAPL removal.
8	UST71A	UST Removal/ Removal Action – floating product removal and soil venting (see also SP5).
9	BS3	None.
9	BS5	None.
9	BS6	None.
9	EFDZ2	None.
9	EFDZ3	None.

Table 7-3
Initial Response Actions
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OU	IRP Site	Initial Response
9	EFDZ4	None.
9	EFDZ5	None.
9	EFDZ6	None.
9	EFDZ7	None.
9	EFDZ8	None.
9	EFDZ9	None.
9	EFDZ10	None.
9	HP5	Coal storage area upgraded portions of railroad tracks removed and surface areas graded and paved or resurfaced. Stormwater runoff collection/treatment system installed. Coal silo and conveying system removed. Removal Action – excavation/disposal of surface soil at DRMO area.
10	ERTR	UST/soil removal/BUSTR closure.
10	SP4	UST/soil removal/BUSTR closure.
11	BS2	None.
11	CDA	None.
11	UST 4020	UST removal.

Abbreviations:

BUSTR = Bureau of Underground Storage Tank Regulations
BS = Burial Site
CDA = Chemical Disposal Area
DRMO = Defense Reutilization Materials Office
EFDZ = Earthfill Disposal Zone
EOD = Explosive Ordnance Disposal
ERTR = East Ramp Tank Removal
HP = Heating Plant
IRP = Installation Restoration Program
LF = Landfill
LNAPL = Light Non-Aqueous Phase Liquid
NA = Not Applicable
NUC = Deactivated Nuclear Reactor
OU = Operable Unit
RADB = Radioactive Waste Disposal Area
SP = Spill Site
UST = Underground Storage Tank

Table 7-4
Chemicals of Concern and Risk Assessment Results – 41 No Action Sites
Wright-Patterson AFB, Ohio
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OU	IRP SITE	Chemicals of Concern[1]	Reference Source[2]	Risk Assessment Scenario[3] (Human Receptors)	Reference Source[2]
NA	EOD Range	Cadmium, lead, selenium, silver, acetone, ethylbenzene, toluene, xylenes, bis(2-ethylhexyl) phthalate, di-n-butyl phthalate, fluoranthene, pyrene.	dd	Quantitative risk assessment conducted in accordance with RCRA guidance using an industrial scenario. Carcinogenic risk 5E-8; HI 1E-1.	t
NA	HP1	Soil sampling not conducted. Former coal storage area was paved after heating plant consolidation, and is currently used as a parking lot. Metals and other inorganics generally associated with former coal storage are not expected to migrate or leach due to paved surface.	t	Soil samples not taken, thus no risk assessment for soils was conducted. Former coal storage area at CHP1 was paved in 1980 and currently used as a parking lot.	z
NA	HP4	None noted. Heating plant currently operational. Runoff from coal pile is collected, treated and discharged to storm sewer.	t	None. "….considering site data and regulatory criteria, HP4 is not expected to pose significant risks to public health or the environment."	t
NA	NUC	None noted.	t	None. Decommissioned facility is inspected, maintained and monitored to ensure compliance with AFI 91-109, USAF Special Nuclear Reactor Study 97-1, and protection of personnel and environment from unnecessary exposure to radiation.	t
NA	RADB	None.	t	None. Environment was not impacted by site activities. Concrete pad was removed and determined to be used for staging only.	v
NA	SP8	PCBs.	t	All verification samples met the TSCA criteria for unrestricted land use of 10 ppm.	j

Table 7-4
Chemicals of Concern and Risk Assessment Results – 41 No Action Sites
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OU	IRP SITE	Chemicals of Concern(1)	Reference Source(2)	Risk Assessment Scenario(3) (Human Receptors)	Reference Source(2)
3	LF11	Beryllium, benzo(a)pyrene, dibenz(a,h)anthracene, 2,3,7,8-TCDD	d	Current – trespassers and recreational users, 3E-05 carcinogenic (<1E-06 for CTE scenario), HI <1; workers, 3E-05 carcinogenic (1.9E-06 for CTE scenario), HI <1. Future – trespassers and recreational users, 6E-05 carcinogenic (1.5E-06 for CTE scenario), HI = 3 (<1 for CTE scenario); workers, 2.8E-05 carcinogenic (1.9E-06 for CTE scenario), HI <1.	d d
3	LF12	Waste/containers and visibly contaminated soil was excavated and disposed; LF12 was subsequently backfilled and seeded. Confirmatory soil samples indicate PCBs, SVOCs, VOCs and metals detected.	c	Current – trespassers and recreational users, <1E-06 carcinogenic, HI <1; workers = 1E-06 carcinogenic, HI <1. Future – trespassers and recreational users, <1E-06 carcinogenic, HI =2 (<1 for CTE scenario); workers, <1E-06 carcinogenic, HI <1.	d d
4	HP2	Boron, manganese, butyl benzyl phthalate, elemental mercury.	t	EPA Region IX commercial/industrial PRGs and Ohio VAP industrial standards used: mercury did not exceed these standards. Coal Storage Area – soil sampling not conducted, but former storage area was paved and is currently used as a parking lot.	s, t
4	LF3	Refuse and residual contamination is beneath current landfill cap. Refuse/fill – VOCs, SVOCs, TPH, pesticides. Surface/subsurface soil (beneath current cap) – SVOCs, pesticides, TPH, metals.	b, t	Current & Future – adult recreational (golfers), <1E-06 carcinogenic, HI <1; and adult occupational (golf course maintenance workers), 4E-06 carcinogenic (<1E-06 for CTE scenario), HI <1.	b

Table 7-4
Chemicals of Concern and Risk Assessment Results – 41 No Action Sites
Wright-Patterson AFB, Ohio

OU	IRP SITE	Chemicals of Concern[1]	Reference Source[2]	Risk Assessment Scenario[3] (Human Receptors)	Reference Source[2]
4	LF4	Refuse and residual contamination is beneath current landfill cap. Refuse/fill – VOCs, metals, SVOCs, pesticides, TPH. Surface/Subsurface soil – not sampled.	b, t	Current – no complete pathways. Future – Adult occupational (pavement replacement, excavation worker), 3E-05 carcinogenic (2E-06 for CTE scenario), HI <1.	b b
4	LF6	Refuse and residual contamination is beneath current landfill cap. Refuse/fill – VOCs, metals, pesticides, SVOCs. Surface/Subsurface soil (beneath current cap) – not sampled.	b, t	Current – no complete pathways. Future – adult occupational (mowing, seeding), <1E-06 carcinogenic, HI <1; child recreational, 6E-05 carcinogenic (5E-06 for CTE scenario), HI 3.1 (HI <1 for CTE scenario).	b b
4	LF7	Refuse and residual contamination is beneath current landfill cap. Refuse/fill – VOCs, metals, SVOCs, pesticides, TPH. Surface/Subsurface soil (beneath current cap) - not sampled. Drum Staging and Disposal Area – Surface soil; VOCs, SVOCs, TPH.	b, t	LF7 - Current – no complete pathways. LF7 - Future – Adult occupational (stable hand), 3E-05 carcinogenic (2E-06 for CTE scenario), HI <1, child recreational 6E-05 carcinogenic (5E-06 for CTE scenario), HI 3.1 (HI <1 for CTE scenario). Drum Staging Area – Current & Future – Child recreational, 1.2E-05 carcinogenic (<1E-06 for CTE scenario), HI <1; adult recreational, 3E-06 carcinogenic (<1E-06 for CTE scenario), HI <1. Drum Disposal Area – Current & Future - Child recreational, 2E-05 carcinogenic (2E-06 for CTE scenario), HI <1; Adult recreational, 3E-06 carcinogenic (<1E-06 for CTE scenario), HI <1.	b b b b

Table 7-4
Chemicals of Concern and Risk Assessment Results – 41 No Action Sites
Wright-Patterson AFB, Ohio
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OU	IRP SITE	Chemicals of Concern[(1)]	Reference Source[(2)]	Risk Assessment Scenario[(3)] (Human Receptors)	Reference Source[(2)]
5	LF5	Refuse and residual contamination is beneath current landfill cap. Refuse/fill - metals, SVOCs, TPH, VOCs, pesticides, PCBs, dioxins.	aa	Landfill Extension - Current – worker and recreational users, PRGs calculated at a 1E-06 cancer level and a HI=1. Surface soil exceeded RME PRG for arsenic, but did not exceed AVE PRG. Subsurface soil did not exceed RME PRGs. Recreational Area - Current – worker and recreational users, PRGs calculated at a 1E-06 cancer level and a HI=1. Contaminants did not exceed RME PRGs. Landfill 5 Proper – Current (prior to capping) – commercial/industrial, PRGs calculated at a 1E-06 cancer level and a HI=1. Various VOCs in the soils exceeded PRGs.	aa aa bb
6	LF1	Refuse and residual contamination is beneath current landfill cap. Refuse/fill - VOCs, pesticides, PCBs, TPH, SVOCs, metals. Surface/subsurface soil (beneath current cap) – VOCs, SVOCs, pesticides, TPH, metals.	t	Current – no complete pathways. Future – excavation worker; <1E-06 carcinogenic, HI <1.	a a
6	LF2	Refuse and residual contamination is beneath current landfill cap. Refuse/fill - VOCs, pesticides, PCBs, TPH, SVOCs, metals. Surface/subsurface soil (beneath current cap) – VOCs, SVOCs, pesticides, TPH, metals.	t	Current – adult lawn maintenance worker and teenage trespasser; <1E-06 carcinogenic, HI <1. Future - excavation worker;<1E-06 carcinogenic, HI <1.	a a

Table 7-4
Chemicals of Concern and Risk Assessment Results – 41 No Action Sites
Wright-Patterson AFB, Ohio
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OU	IRP SITE	Chemicals of Concern[1]	Reference Source[2]	Risk Assessment Scenario[3] (Human Receptors)	Reference Source[2]
7	LF9	Refuse and residual contamination is beneath current landfill cap. Refuse/fill – no analytical results, general refuse uncovered during investigations. Pit C Soil (beneath current cap) – PAHs, SVOCs, metals, pesticides.	t	EPA Region IX residential/industrial PRGs used; all COCs below residential PRGs except Aroclor-1242, which was below the industrial PRG.	c
8	SP5	Removal action conducted for floating product. Residual contamination consists of TPH and possibly floating product.	t	Current – no complete pathways. Future - EPA Region IX commercial/industrial PRGs used; all contaminants of concern below commercial/industrial PRGs.	e e
8	SP6	PCBs.	h	All verification samples except one met the TSCA criteria for unrestricted land use of 10 ppm. One sample at 11 ppm exceeded the TSCA 10 ppm criteria, but was below the TSCA criteria for electrical substations of 50 ppm.	h
8	SP7	Acetone, benzene, 2-butanone, chlorobenzene, ethylbenzene, methylene chloride, 4-methyl-2-pentanone, toluene, xylene, lead	i	EPA Region III risk-based concentrations for commercial/industrial scenario used; all contaminants below these risk-based concentrations.	i
8	SP9	1,1,1-Trichloroethane, chloroform, TCE, xylene, ethylbenzene, 4-methyl-2-pentanone, lead.	t	EPA Region III risk-based concentrations for commercial/industrial scenario used; all contaminants below these risk-based concentrations.	k

Table 7-4
Chemicals of Concern and Risk Assessment Results – 41 No Action Sites
Wright-Patterson AFB, Ohio

OU	IRP SITE	Chemicals of Concern[(1)]	Reference Source[(2)]	Risk Assessment Scenario[(3)] (Human Receptors)	Reference Source[(2)]
8	SP11	French drain collects groundwater and surface water. LNAPL, SVOCs, TPH, BTEX compounds present.	t	Current - Commercial/Industrial; subsurface soil –all contaminants below EPA Region IX PRGs, surface soil - <1E-06 carcinogenic, HI <1. Future – Commercial/Industrial; subsurface soil –all contaminants below EPA Region IX PRGs, surface soil - <1E-06 carcinogenic, HI <1.	e e
8	UST71A	Soil 5 ft bgs to groundwater: TPH, BTEX, PCE, methylene chloride, lead.	t	Current – no complete pathways. Future - EPA Region IX commercial/industrial PRGs used; all contaminants of concern below commercial/industrial PRGs. Lead concentrations did not exceed residential screening level of 400 mg/kg.	e
9	BS3	TPH, lead toluene, SVOC TICs.	t	Residential PRGs calculated at a 1E-06 level; no contamination was detected in soils that adversely impact the environment.	t
9	BS5	VOCs, SVOCs, VOC and SVOC TICs.	t, x	Region IX PRGs calculated at a 1E-06 level; all contaminants below residential PRGs.	x
9	BS6	PAHs, VOC and SVOC TICs.	t, x	Region IX PRGs calculated at a 1E-06 level; all contaminants below residential PRGs.	x
9	EFDZ2	Earthfill material and small amounts of buried metal. Metals, SVOC TICs.	l, t	Residential PRGs calculated at a 1E-06 level: all contaminants below PRGs except for beryllium, which was deemed to be naturally occurring. Semi-volatile TICs also detected, but not included in risk assessment.	l, y
9	EFDZ3	Earthfill material and small amounts of buried metal. Metals, PAHs.	m, t	Residential PRGs calculated at a 1E-06 level: all contaminants below PRGs.	m, y

Table 7-4
Chemicals of Concern and Risk Assessment Results – 41 No Action Sites
Wright-Patterson AFB, Ohio
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OU	IRP SITE	Chemicals of Concern[1]	Reference Source[2]	Risk Assessment Scenario[3] (Human Receptors)	Reference Source[2]
9	EFDZ4	Earthfill material and small amounts of buried metal. VOC, BTEX, SVOCs, metals.	f, t	EPA Region IX commercial/industrial PRGs used; all contaminants of concern below PRGs except for arsenic in surface and subsurface soil (surface soil – 8.2 mg/kg, subsurface soil 11 mg/kg, AVE PRG 6.0 mg/kg).	f
9	EFDZ5	Earthfill material and small amounts of buried metal. Metals, SVOC TICs.	n, t	Residential PRGs calculated at a 1E-06 level: all contaminants below PRGs except for beryllium, which was deemed to be naturally occurring. Semi-volatile TICs also detected, but not included in risk assessment.	n, y
9	EFDZ6	Earthfill material and small amounts of buried metal. SVOC TICs, metals.	o, t	Residential PRGs calculated at a 1E-06 level; all contaminants below PRGs except for beryllium, which was deemed to be naturally occurring.	y, o
9	EFDZ7	Earthfill material and small amounts of buried metal. SVOCs, metals.	p, t	Residential PRGs calculated at a 1E-06 level: all contaminants below PRGs.	p, y
9	EFDZ8	Earthfill material and small amounts of buried metal. VOCs, SVOCs, pesticides, metals.	q, t	Residential PRGs calculated at a 1E-06 level: all contaminants below PRGs except for beryllium, which was deemed to be naturally occurring.	q, y
9	EFDZ9	Earthfill material and small amounts of buried metal. VOCs, PAHs, metals.	f, t	EPA Region IX commercial/industrial PRGs used; all COCs below PRGs except for arsenic in surface (surface soil – 9.3 mg/kg, AVE PRG 6.0 mg/kg).	f
9	EFDZ10	Earthfill material and small amounts of buried metal. VOCs, SVOCs.	r, t	No Risk Assessment conducted. "The soil and groundwater sampling indicated the presence of low levels of VOCs and SVOCs, but not at levels of concern."	r

Table 7-4
Chemicals of Concern and Risk Assessment Results – 41 No Action Sites
Wright-Patterson AFB, Ohio

OU	IRP SITE	Chemicals of Concern[1]	Reference Source[2]	Risk Assessment Scenario[3] (Human Receptors)	Reference Source[2]
9	HP5	HP5: SVOCs, VOC and SVOC TICs, pesticides, PCBs, metals. DRMO: contaminated soil was excavated and disposed, area backfilled with clean soil.	t	EPA Region IX commercial/industrial PRGs used; all contaminants of concern below PRGs except for PAHs and arsenic in surface and subsurface soil.	f
10	ERTR	Closed in accordance with BUSTR. Petroleum VOCs, TPH, lead.	t	None. "Considering the site data, regulatory criteria, and current site conditions, no further action at the East Ramp. UST is not expected to pose significant health risks." Ohio State Fire Marshall concurred with no further action decision (ltr dated 12 July 1991).	u
10	SP4	Slightly elevated TPH in shallow soils; closed in accordance with BUSTR.	t	Closed in accordance with BUSTR requirements; Ohio State Fire Marshall concurred with no further action decision (ltr dated 12 July 1991).	g
11	BS2	TPH, zinc, toluene, PAHs, methylene chloride.	t	Region IX PRGs calculated at a 1E-06 level; all contaminant concentrations in surface soil below residential PRGs except for beryllium and arsenic, only arsenic exceeded Industrial PRG; all contaminants in subsurface soil below residential PRGs except for arsenic, which also exceeded Industrial PRG.	w
11	CDA	SVOC TICs.	t	Region IX PRGs calculated at a 1E-06 level; all contaminants in surface soil below residential PRGs except for beryllium and chromium (which did not exceed Industrial PRGs); all contaminants in subsurface soil below residential PRGs except for arsenic and beryllium (only arsenic exceeded Industrial PRG).	w
11	UST 4020	TPH, xylene, toluene.	t	Contaminant concentrations do not exceed BUSTR acceptable concentrations for VOCs and TPH except for one soil sample that slightly exceeded Category 1 standards for xylene and TPH.	t

Table 7-4
Chemicals of Concern and Risk Assessment Results – 41 No Action Sites
Wright-Patterson AFB, Ohio

(1) Chemicals of concern refer to soil only.
(2) See references immediately following this table.
(3) All risk assessment scenarios based on the RME unless otherwise noted.

AVE = Average exposure estimate
BS = Burial Site
BTEX = Benzene, toluene, ethylbenzene, xylene
BUSTR = Bureau of Underground Storage Tank Regulations
CDA = Chemical Disposal Area
COC = Chemical of Concern
CTE = Central Tendency Estimate
DRMO = Defense Reutilization Marketing Office
EFDZ = Earthfill Disposal Zone
EOD = Explosive Ordnance Disposal
EPA = U.S. Environmental Protection Agency
ERTR = East Ramp Tank Removal
HI = Hazard Index
HP = Heating Plant
IRP = Installation Restoration Program
LF = Landfill
LNAPL = Light Nonaqueous Phase Liquid
mg/kg = milligram(s) per kilogram
NA = Not applicable
NUC = Deactivated Nuclear Reactor
OU = Operable Unit
PAH = Polycyclic Aromatic Hydrocarbon
PCB = Polychlorinated Biphenyl
PCE = Perchloroethylene
ppm = part(s) per million
PRG = Preliminary Remediation Goal
RADB = Radioactive Waste Disposal Area
RCRA = Resource Conservation and Recovery Act
RME = Reasonable Maximum Exposure
SP = Spill Site
SVOC = Semi-volatile Organic Compound
TCE = Trichloroethylene
TIC = Tentatively Identified Compound
TPH = Total Petroleum Hydrocarbon
TSCA = Toxic Substances Control Act
USAF = U.S. Air Force
UST = Underground Storage Tank
VOC = Volatile Organic Compound

Table 7-4
Chemicals of Concern and Risk Assessment Results – 41 No Action Sites
Wright-Patterson AFB, Ohio

<u>List of References for Chemicals of Concern and Risk Assessment Information</u>

a. *Operable Unit 6 Draft-Final SSRAP, January 30, 1996, pp.2-15 through 2-17*
b. *Operable Unit 4 Final RI Report, April 1996, Table 6-2 and Table 6-15*
c. *Operable Unit 7 Final Field Investigation Report, November 1996, p 4-22*
d. *Operable Unit 3 Final Remedial Investigation Report, July 1995, Chapter 6*
e. *Operable Unit 8 Final RI Report, January 1997, Chapter 6*
f. *Operable Unit 9 Final RI Report, September 1997, Tables 6-8, 6-9, 6-12, 6-13*
g. *Decision Document – No Further Action Planned Spill Site 4 – September 1991*
h. *Decision Document – No Further Action Planned Spill Site 6 – September 1992*
i. *Decision Document – No Further Action Planned Spill Site 7 – September 1993*
j. *Decision Document – No Further Action Planned Spill Site 8 – May 1991*
k. *Decision Document – No Further Action Planned Spill Site 9 – September1993*
l. *Decision Document – No Further Action Planned EFDZ2 – August 1992*
m. *Decision Document – No Further Action Planned EFDZ3 – August 1992*
n. *Decision Document – No Further Action Planned EFDZ5 – August 1992*
o. *Decision Document – No Further Action Planned EFDZ6 – August 1992*
p. *Decision Document – No Further Action Planned EFDZ7 – August 1992*
q. *Decision Document – No Further Action Planned EFDZ8 – August 1992*
r. *Decision Document – No Further Action Planned EFDZ10 – September 1992*
s. *Operable Unit 4 RI/FS Report Addendum, August 1998*
t. *Record of Decision for 41 No Action Sites, August 1998*
u. *Decision Document – No Further Action Planned East Ramp UST – September 1991*
v. *Decision Document – No Further Action Planned Radioactive Waste Burial Site – February 1992*
w. *Final Field Investigation Report – Operable Unit 11, August 1997*
x. *Final Site Investigation Report – Burial Sites 5 & 6, June 1998*
y. *Final Site Investigation Report – Eight Earth Fill Disposal Zones - August 1992*
z. *Decision Document – Central Heating Plant 1 – September 1991*
aa. *Operable Unit 5 Final RI Report - August 1995*
bb. *LF5 Final Site-Specific Removal Action Plan, June 1994*
cc. *LF12 Removal Action Final Report, June 1998*
dd. *Closure Certification Report, Explosive Ordnance Disposal Range, September 1999*

Table 7-5
Current Site Controls
41 No Action Sites
Wright-Patterson AFB, Ohio

OU Location	IRP Site	Base Perimeter Fence	Site Fence	Gate	Signs	LF Cap	Current Site Controls
NA	EOD Range	X	X	X			Fenced site with chained and locked gate on Riverview Road
NA	HP1	X					No controls other than base perimeter fence
NA	HP4	X					Active heating plant; No controls other than base perimeter fence
NA	SP8	X					No controls other than base perimeter fence
3	LF11	X		X	X	X	Base perimeter fence with chained and locked gates; signage on two gates along perimeter fence(1); accessible to public via Mad River.
3	LF12	X		X			Base perimeter fence with chained and locked gate; accessible to public via Mad River (landfill was removed).
4	HP2	X					No controls other than base perimeter fence, majority of site has Building 271 over top of it
4	LF3	X			X	X	Base perimeter fence and signage on west side of site near tee-off box for 7th hole(1).
4	LF4	X	X	X	X	X	Base perimeter fence and part of area fenced off for equipment storage; signage on gates(1).
4	LF6	X			X	X	Base perimeter fence and signage on posts(1); accessible to public when Prairie Gates open.
4	LF7	X			X	X	Base perimeter fence and signage on posts(1); accessible to public when Prairie Gates open.
5	LF5	X	X	X	X	X	Split rail fence along Riverview Road; chain-link fence along Prairie Road with locked gates on northeast and northwest ends (signage on gates(1)); cable fence along northeast side of landfill to prevent vehicular traffic

Table 7-5
Current Site Controls
41 No Action Sites
Wright-Patterson AFB, Ohio

OU Location	IRP Site	Base Perimeter Fence	Site Fence	Gate	Signs	LF Cap	Current Site Controls
6	LF1	X			X	X	Base perimeter fence; signage near landfill on Perimeter Road [1] and also on Perimeter Road at intersection of Bony Street[2]
6	LF2	X		X	X	X	Base perimeter fence with two gates (chained and locked) for access with signage on gates[1]
7	LF9	X		X	X	X	Fenced with chained and locked gate at Haddix Road with signage on gate; signage at landfill[1]; accessible to public off of Sandhill Road via fields
8	SP5	X					No controls other than base perimeter fence
8	SP6	X					No controls other than base perimeter fence
8	SP7	X					No controls other than base perimeter fence
8	SP9	X					No controls other than base perimeter fence
8	SP11	X	X	X			Located in the Aircraft Survivability Testing Area; surrounded by a chain link/barbed wire fence; access maintained by site workers; site check-in required
8	UST71A	X					No controls other than base perimeter fence
9	BS3	X		X			Located in Laser Test Area; within perimeter fence for runway; access controlled by locked gate at Loop Road – Laser Test Office has key and controls access
9	BS5	X		X			Located in Laser Test Area; within perimeter fence for runway; access controlled by locked gate at Loop Road – Laser Test Office has key and controls access
9	BS6	X		X			Located in Laser Test Area; within perimeter fence for runway; access controlled by locked gate at Loop Road – Laser Test Office has key and controls access
9	EFDZ2	X			X		No controls other than base perimeter fence and earthfill disposal zone signage[3]

Table 7-5
Current Site Controls
41 No Action Sites
Wright-Patterson AFB, Ohio

OU Location	IRP Site	Base Perimeter Fence	Site Fence	Gate	Signs	LF Cap	Current Site Controls
9	EFDZ3	X			X		No controls other than base perimeter fence and earthfill disposal zone signage(3)
9	EFDZ4	X			X		No controls other than base perimeter fence and earthfill disposal zone signage(3)
9	EFDZ5	X			X		No controls other than base perimeter fence and earthfill disposal zone signage(3)
9	EFDZ6	X			X		No controls other than base perimeter fence and earthfill disposal zone signage(3)
9	EFDZ7	X			X		No controls other than base perimeter fence and earthfill disposal zone signage(3)
9	EFDZ8	X			X		No controls other than base perimeter fence and earthfill disposal zone signage(3)
9	EFDZ9	X			X		No controls other than base perimeter fence and earthfill disposal zone signage(3)
9	EFDZ10	X			X		No controls other than base perimeter fence and earthfill disposal zone signage(3)
9	HP5	X					Active heating plant; No controls other than base perimeter fence
9	NUC	X			X		Base perimeter fence; access to building restricted other than offices
9	RADB	X					No controls other than base perimeter fence
10	ERTR	X					No controls other than base perimeter fence
10	SP4	X	X	X			Fenced with gate; controlled by CE Water Dept.; located near Area C water well, treatment and reservoir
11	BS2	X					Open area – no controls other than base perimeter fence; perimeter fence runs between BS2 area and Mad River
11	CDA	X					No controls other than base perimeter fence
11	UST 4020	X					No controls other than base perimeter fence

Table 7-5
Current Site Controls
41 No Action Sites
Wright-Patterson AFB, Ohio

Notes:

1 – Signage indicates presence of landfill with “do not dig” warnings and lists the Environmental Management telephone number and contact.

2 – Signage indicates off limits to museum visitors.

3 – Signage indicates presence of earthfill disposal zone with “do not dig” warnings and lists the Environmental Management telephone number and contact.

Abbreviations:

BS = Burial Site
CDA = Chemical Disposal Area
CE = Civil Engineering
EFDZ = Earthfill Disposal Zone
EOD = Explosive Ordnance Disposal
ERTR = East Ramp Tank Removal
HP = Heating Plant
IRP = Installation Restoration Program
LF = Landfill
NUC = Deactivated Nuclear Reactor
OU = Operable Unit(s)
RADB = Radioactive Waste Disposal Area
SP = Spill Site
UST = Underground Storage Tank

Table 7-6
Maintenance of Site Controls
41 No Action Sites
Wright-Patterson AFB, Ohio
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Site Control	Applicable Sites	Responsible Party and/or Site Control Mechanism	Point of Contact[(1)] (Organization, phone number)	Frequency of Site Control Verification[(2)]	Frequency and Form of Verification with POC[(3)]
Base Perimeter Fencing – Guarded Gates	All but LF1, LF2, LF8, LF9, and LF10	WPAFB Security Forces	88 CEG/SFS On-call Person 937-257-6516	Privileged Information[(4)]	Not Applicable
Discrete Site Fencing – Locked Gates	LF1, LF2, LF8, LF9, and LF10	CZOM Maintenance Contract Multiple Landfills	AFCEC/CZOM 937-257-6391	Quarterly	At contract renewal
	LF4	CE Grounds Maintenance	88 CEG/CEME 937-904-2390	Maintained as necessary	Yearly/Phone Notification
	SP11	Site Workers – Aircraft Survivability Testing Area	706 TG/OL-AC 937-255-9216	Maintained as necessary	Yearly/Phone Notification
	EOD Range	Real Estate Office	88 CEG/CEAOR 937-257-3701	Quarterly	Yearly/Phone Notification
	BS3, BS5, BS6, EFDZ1	Laser Test Office	AFRL/RYMT 937-712-8447	Maintained as necessary	Yearly/Phone Notification
Signage	LF1, LF2, LF3 (golf course), LF5, LF6, LF7, LF9, LF11, LF12	CZOM Maintenance Contract Multiple Landfills	AFCEC/CZOM 937-257-6391	Quarterly	At contract renewal
Surface Cover (earthen/grass)	LF1, LF2, LF6, LF7 LF9, LF11	CZOM Maintenance Contract Multiple Landfills	AFCEC/CZOM 937-257-6392	Quarterly	At contract renewal
Surface Cover (engineered landfill cap)	LF5	CZOM Maintenance Contract Multiple Landfills	AFCEC/CZOM 937-257-6391	Quarterly	At contract renewal

Table 7-6
Maintenance of Site Controls
41 No Action Sites
Wright-Patterson AFB, Ohio
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Site Control	Applicable Sites	Responsible Party and/or Site Control Mechanism	Point of Contact(1) (Organization, phone number)	Frequency of Site Control Verification(2)	Frequency and Form of Verification with POC(3)
Surface Cover (asphalt or concrete)	LF4	CE Grounds Maintenance	88 CEG/CEME 937-904-2390	Maintained as necessary	Yearly/Phone Notification
Locking well caps	LF5, LF6, LF7, LF11	CZOM Maintenance Contract Multiple Landfills	AFCEC/CZOM 937-257-6391	Quarterly	At contract renewal

Notes:

1 – POC Organization responsible for maintaining the physical site control as listed in the first column of this table (not the IRP site itself).

2 – Frequency of verifying that site control is in place and functional by the POC.

3 – Frequency of verifying that the POC is maintaining site control (conducted by Environmental Management). Environmental Management) will also notify POCs of changes to the LUC Plan.

4 – The Base perimeter fencing is frequently patrolled and maintained.

Abbreviations:

BS = Burial Site
CE = Civil Engineering
EFDZ = Earthfill Disposal Zone
EOD = Explosive Ordnance Disposal
LF = Landfill
LUC = Land Use Control
POC = Point of contact
POL = Petroleum, Oil, and Lubricants
SP = Spill Site
WPAFB = Wright-Patterson Air Force Base

Table 7-7
Summary of Technical Assessment (Question B)
41 No Action Sites[1]
Wright-Patterson AFB, Ohio

IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
LF11 OU3 41 sites	Surface and subsurface soil samples were collected at LF11; however, only surface soil was evaluated in the HHRA because soil intrusion below 2 feet was not expected. The HHRA showed risk below the $1x10^{-4}$ and hazard below 1. The NFA is based on the fact that institutional controls are already in place and a presumptive remedy (removal and capping) limits or prevents exposure.	ARARs/TBCs: Under a base-wide landfill capping program, LF11 was capped. Maintenance of the landfill cap will continue to be conducted. No specific ARARs were listed in the ROD. Chemical -specific toxicity values were applied in the quantitative human health risk assessment as TBCs. Land Use/Exposure Assumptions: The site was previously designated as open space and is currently designated as recreational. Recreational hunting continues at the site. Exposure scenarios included maintenance workers, industrial users, trespassers, and recreational users. Although the HHRA indicated minimal risk to human receptors, the ERA indicated risk to mammals and bird predators. In June 1997, construction of a soil and vegetative cover was completed as part of a presumptive remedy action. The presumptive remedy also included removing debris from the landfill surface. Because the area has been capped, there is no current exposure to soil. Toxicity Values: In the HHRA, all detected values except inorganics below background concentrations were evaluated. Although there have been changes to toxicity values used in the risk assessment, these changes do not affect the conclusions of the risk assessment. The area has been capped; therefore there is no current exposure to soil. RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that No Action (NA) was necessary beyond the landfill cap (a presumptive remedy) to ensure protection of human health and the environment under current and future land use plans. Groundwater is addressed under the BMP.	Final Remedial Investigation Report for Operable Unit 3, SAIC, 1995. Record of Decision for 41 No Action Sites at Wright-Patterson Air Force Base, WPAFB, 1998.

Table 7-7
Summary of Technical Assessment (Question B)
41 No Action Sites[1]
Wright-Patterson AFB, Ohio

IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
LF12 OU3 41 sites	Surface and subsurface soil samples were collected at LF12; however, only surface soil was evaluated in the HHRA because soil intrusion below 2 feet was not expected. The HHRA showed risk below the $1x10^{-6}$ and hazard below 1. The NFA is based on the fact that institutional controls are already in place and a removal action limits or prevents exposure.	ARARs/TBCs: Under a non-time critical removal action, LF12 was excavated and waste was removed and disposed. No specific ARARs were listed in the ROD. Chemical-specific toxicity values were applied in the quantitative human health risk assessment as TBCs. Land Use/Exposure Assumptions: The site is mostly an open, grassy field; land use was previously designated as open space and is currently designated as recreational. Recreational hunting and camping/light industrial activities continue at the site. Exposure scenarios included maintenance workers, industrial users, trespassers, and recreational users. Although the HHRA indicated minimal risk to human receptors, the ERA indicated risk to mammals and bird predators. In November 1997, excavation and disposal of waste was completed as part of a non-time critical removal action. The LF was backfilled and reseeded. Since the contents of the landfill were excavated, exposure is limited. Toxicity Values: The contents of the landfill have been excavated and the landfill backfilled and reseeded. Therefore, there is no exposure to soil. RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that no action was necessary beyond the removal action to ensure protection of human health and the environment under current and future land use plans. Groundwater is addressed under the BMP.	Final Remedial Investigation Report for Operable Unit 3, SAIC, 1995. Record of Decision for 41 No Action Sites at Wright-Patterson Air Force Base, WPAFB, 1998. Independent Engineer's Report for Landfill 12 Removal Action, IT, 1998.

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IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
CHP2 OU4 41 sites	Site soil (surface and subsurface) was evaluated. The NFA is based on the fact that institutional controls are already in place and actions had been taken at the site to mitigate contamination.	ARARs/TBCs: In 1996, elemental mercury was seen in a sewer pipe during an excavation. Water, soil, and elemental mercury were pumped from the excavation, the storm sewer pipe that exits the heating plant was capped, and the floor drain lines were cleaned and abandoned. No specific ARARs were listed in the ROD. Background data were used as TBCs in the initial evaluation. Region 9 PRGs were applied as TBCs in the semi-quantitative human health risk assessment; ecological criteria were used as TBCs to evaluate ecological risk. Land Use/Exposure Assumptions: At the time of the risk assessment, the site was occupied by a heating plant and an asphalt parking lot; land use at this site was designated as industrial. Building 271 currently occupies the site. Current allowable land use is industrial; however, the exposure assumptions are still valid. Separate evaluations of risk were conducted for the coal storage area (CSA) and the elemental mercury release. For the CSA, detected soil contaminant concentrations were compared against background concentrations; boron and manganese exceeded background. Only one organic, butyl benzyl phthalate, was detected. A semi-quantitative risk assessment was conducted for the HP2 mercury release. Maximum detected mercury concentrations were compared to the Region 9 industrial soil PRGs and ARARs. The concentrations did not exceed the PRGs or ARARs or any ecological risk criteria. Toxicity Values: When compared against the most current industrial RSLs (2019), inorganics are above background and butyl benzyl phthalate are below these values. If the RSL for elemental mercury (46 mg/kg) is used, the maximum concentrations exceed the RSL. The maximum mercury concentrations detected in soil are still below the 2019 industrial RSL for mercury, inorganic salts (350 mg/kg). Current use of this land as a building site reduces the likelihood of exposure, resulting in minimal risks to human health and the environment. Although it is unlikely that mercury remains in its elemental form at the site, the ROD requires that an environmental assessment (EA) be performed if the heating plant were to be demolished. RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels.. It was concluded that no action beyond the mitigation actions described above was necessary to ensure protection of human health and the environment under current and future land use plans.	Installation Restoration Program Stage 2 Report, Roy F. Weston, Inc., 1989. Decision Document Central Heating Plant 2, WPAFB, 1991. RI/FS Addendum for Operable Unit 4, CH2M HILL, 1998. Record of Decision for 41 No Action Sites at Wright-Patterson Air Force Base, WPAFB, 1998.
LF3	Surface soil was evaluated	ARARs/TBCs: Limited access and land use restrictions that prevent intrusive activities will	Record of Decision for 41 No

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IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
OU4 41 sites	for the site. NFA is based on a quantitative baseline risk assessment (grouping together Landfills 3, 4, 6 and 7). BRA indicated lifetime cancer risk from surface soil exposures are within the acceptable range of $1x10^{-4}$ to $1x10^{-6}$.	continue to be implemented at LF3 per the 41 No Action Sites ROD. Landfill gas monitoring will continue at points between the landfills and nearby structures in accordance with the OU4 O&M Plan (CH2M HILL, 1997). No specific ARARs were listed in the ROD. Chemical-specific toxicity values were applied in the quantitative human health risk assessment as TBCs. Land Use/Exposure Assumptions: Land use for this area was classified as commercial. Current allowable use is outdoor recreation. Recreational golf continues at the site. The former landfill underlies the tenth hole of the Military Golf Course and Hebble Creek flows along a portion of the northern boundary of the landfill. It is currently covered with grasses and shrubs, with no observed erosion or exposed debris. Access to the site has been restricted to prevent intrusive activities at the landfill and to protect facility users and maintenance personnel. Exposure assumptions are still valid. Current and future exposure receptors include adult recreational (golfers) and site maintenance workers. There have been changes to some default exposure parameters (e.g., AFs, SA) used in the risk assessment; however, these changes do not affect the conclusions of the risk assessment. Toxicity Values: Although there have been changes to the toxicity values used in the risk assessment, these changes do not affect the conclusions of the risk assessment. The area has been capped; therefore there is no current exposure to soil. RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that no action was necessary beyond the landfill cap (a presumptive remedy) to ensure protection of human health and the environment under current and future land use plans. Groundwater, surface water, and sediment are addressed under the BMP.	Action Sites at Wright-Patterson Air Force Base, WPAFB, 1998. Installation Restoration Program, Proposed Plan for 41 Sites, Wright-Patterson Air Force Base, June 1998.

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41 No Action Sites(1)
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IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
LF4 OU4 41 sites	Subsurface soil was evaluated (during excavation for the construction of Skeel Avenue). NFA is based on a quantitative baseline risk assessment (grouping together Landfills 3, 4, 6 and 7). BRA indicated lifetime cancer risk for subsurface soil exposures is within the acceptable range of $1x10^{-4}$ to $1x10^{-6}$. Site hazards were below 1.	ARARs/TBCs: Limited access and land use restrictions that prevent intrusive activities will continue to be implemented at LF4 per the 41 No Action Sites ROD. Landfill gas monitoring will continue at points between the landfills and nearby structures in accordance with the OU4 O&M Plan (CH2M HILL, 1997). No specific ARARs were listed in the ROD. Chemical-specific toxicity values were applied in the quantitative human health risk assessment as TBCs. Land Use/Exposure Assumptions: Land use classification for this area was industrial. The current designated land use is industrial. The area is partially paved and used by Civil Engineering for storing equipment. Skeel Avenue runs along the southwest edge of the landfill. Other areas are covered with densely compacted sand and gravel fill. Site access has been restricted to prevent potentially intrusive activities at the landfill and to protect facility users and maintenance personnel. Exposure assumptions are still valid. Because the area has been capped, there is no current exposure to soil. No current exposure receptors, but future exposure receptor includes adult excavation workers. There have been changes to some default exposure parameters (e.g., AFs, SA) used in the risk assessment; however, these changes do not affect the conclusions of the risk assessment. Toxicity Values: Although there have been changes to the toxicity values used in the risk assessment, these changes do not affect the conclusions of the risk assessment. The area has been capped; therefore there is no current exposure to soil. RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that no action was necessary beyond the landfill cap (a presumptive remedy) to ensure protection of human health and the environment under current and future land use plans. Groundwater, surface water, and sediment are addressed under the BMP.	Record of Decision for 41 No Action Sites at Wright-Patterson Air Force Base, WPAFB, 1998. Installation Restoration Program, Proposed Plan for 41 Sites, Wright-Patterson Air Force Base, June 1998.

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41 No Action Sites[(1)]
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IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
LF6 OU4 41 sites	Subsurface soil was evaluated. NFA is based on a quantitative baseline risk assessment (grouping together Landfills 3, 4, 6 and 7). BRA indicated lifetime cancer risk from subsurface soil is within the acceptable range of $1x10^{-4}$ to $1x10^{-6}$. Non-cancer risk for exposure to subsurface soil is greater than the target HI of 1 for the child recreational visitor.	ARARs/TBCs: Limited access and land use restrictions that prevent intrusive activities will continue to be implemented at LF6 per the 41 No Action Sites ROD. The protective soil cover over the clay landfill cap will continue to be maintained as required to prevent erosion and ponding. Landfill gas monitoring will continue at points between the landfills and nearby structures in accordance with the OU4 O&M Plan (CH2M HILL, 1997). No specific ARARs were listed in the ROD. Chemical-specific toxicity values were applied in the quantitative human health risk assessment as TBCs. Land Use/Exposure Assumptions: At the time of the risk assessment, the area was covered with a mixture of grasses and was used by the WPAFB equestrian facility as pasture land. The site is no longer used as a horse pasture and is now an open grassy field. Current allowable land use is outdoor recreation. The site has received several layers of clay and topsoil since its closure in 1952. Access control activities are being conducted to restrict intrusive activities at the landfill and to protect facility users and maintenance personnel. Since the area has been capped, there is no current exposure to soil. No current exposure receptors, but future exposure includes adult site workers and child recreational visitor. There have been changes to some default exposure parameters (e.g., AFs, SA) used in the risk assessment; however, these changes do not affect the conclusions of the risk assessment. Toxicity Values: Changes to the toxicity values used in the risk assessment would not affect the protectiveness of the remedy. The area has been capped; therefore there is no current exposure to soil. RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that no action was necessary beyond the landfill cap (a presumptive remedy) to ensure protection of human health and the environment under current and future land use plans. Groundwater, surface water, and sediment are addressed under the BMP.	Record of Decision for 41 No Action Sites at Wright-Patterson Air Force Base, WPAFB, 1998. Installation Restoration Program, Proposed Plan for 41 Sites, Wright-Patterson Air Force Base, June 1998.

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IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
LF7 OU4 41 sites	Subsurface soil was evaluated. NFA is based on a quantitative baseline risk assessment (grouping together Landfills 3, 4, 6 and 7). BRA indicated lifetime cancer risk from subsurface soil is within the acceptable range of $1x10^{-4}$ to $1x10^{-6}$. Non-cancer risk for exposure to subsurface soil is greater than the target HI of 1 for the child recreational visitor. Site surface soil was evaluated at the Drum Staging Area (DSA). NFA is based on a quantitative baseline risk assessment. The BRA indicated lifetime incremental cancer risk for exposure to surface soil at the DSA is less than the target risk range of $1x10^{-4}$ to $1x10^{-6}$ while the incremental cancer risk for exposure to surface soil in the Drum Disposal Area (DDA) is within the target risk range of $1x10^{-4}$ to $1x10^{-6}$.	ARARs/TBCs: Limited access and land use restrictions that prevent intrusive activities will continue to be implemented at LF7 per the 41 No Action Sites ROD. The protective soil cover over the clay landfill cap will continue to be maintained as required to prevent erosion and ponding. Landfill gas monitoring will continue at points between the landfills and nearby structures in accordance with the OU4 O&M Plan (CH2M HILL, 1997). No specific ARARs were listed in the ROD. Chemical-specific toxicity values were applied as TBCs in the semi-quantitative (and quantitative) human health risk assessments. Land Use/Exposure Assumptions: The land previously supported the WPAFB equestrian facility and was classified as open space. Differential settlement was visible throughout the horse stable complex; the parking lot had subsided in some places, and the horse barns were sagging and shifting. Refuse had reportedly been uncovered during seeding and planting operations, indicating that only a thin soil cover existed in some portions. The site is no longer used as an equestrian area. It is an open grassy area and current allowable land use is outdoor recreation. The barn was razed and engineered cover was placed over the landfill. Cover maintenance and access control activities are being conducted to restrict intrusive activities and protect facility users and maintenance personnel. Also included in this area are the Drum Staging and Disposal Area. This area is wooded with mature trees and shrubs. No landfilling was known to have occurred in this area and no cover soil is believed to have been placed over the native soils. No evidence of drums in the drum staging area was encountered during RI activities. There are no current exposure receptors considered at this site. Future receptors include the adult site maintenance worker and child recreational receptor. Current and future exposure points considered in the DSA/DDA are children (recreational). As recreation is still allowable, exposure assumptions are still valid. There have been changes to some default exposure parameters (e.g., AFs, SA) used in the risk assessment; however, these changes do not affect the conclusions of the risk assessment. Toxicity Values: Changes to the toxicity values used in the risk assessment would not affect the protectiveness of the remedy. LF7 has been capped; therefore there is no current soil exposure. RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that no action was necessary beyond the landfill cap (a presumptive remedy) to ensure protection of human health and the environment under current and future land use plans. Groundwater, surface water, and sediment are addressed under the BMP.	Record of Decision for 41 No Action Sites at Wright-Patterson Air Force Base, WPAFB, 1998. Installation Restoration Program, Proposed Plan for 41 Sites, Wright-Patterson Air Force Base, June 1998.

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Summary of Technical Assessment (Question B)
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IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
LF5 OU5 41 sites	Surface and subsurface samples were evaluated to determine whether the site met the selection criteria for capping. The NFA is based on the fact that institutional controls are already in place and a presumptive remedy (capping) limits or prevents exposure.	ARARs/TBCs: Under a base-wide landfill capping program, LF5 was capped. The cap primarily consists of a passive gas venting system, low permeability barrier layers, a subsurface drainage collection/routing system, a vegetative cover, and a perimeter surface drainage system. Maintenance of the landfill cap will continue to be conducted as described in the Operation and Maintenance Plan. No specific ARARs were listed in the ROD. Region 9 PRGs were applied in the semi-quantitative human health risk assessments as TBCs. Land Use/Exposure Assumptions: This area is a grassy maintained capped landfill and is occasionally used for recreational hunting. Land use is currently designated as recreational . A semi-quantitative risk assessment was conducted for LF5 assuming current land use as commercial/industrial. Concentrations of detected contaminants were compared to Region 9 industrial soil PRGs. A number of organic compounds exceeded PRGs. In August 1996, capping activities were completed as part of a presumptive remedy action. Because the area has been capped, there is no current exposure to soil. Toxicity Values: Changes to the toxicity values used in the risk assessment would not affect the protectiveness of the remedy. The area has been capped; therefore there is no current exposure to soil. RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that no action was necessary beyond the landfill cap (a presumptive remedy) to ensure protection of human health and the environment under current and future land use plans. Groundwater, surface water, and sediment are addressed under the BMP.	Site-Specific Removal Action Plan for Landfill Capping, Site Specific Document for Landfill 5, IT Corporation, 1994. Final Remedial Investigation Report for Operable Unit 5, IT Corporation, 1995. Independent Engineer's Certification Report for Landfill 5 Capping System, IT Corporation and EEC, 1996. Record of Decision for 41 No Action Sites at Wright-Patterson Air Force Base, WPAFB, 1998.

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Wright-Patterson AFB, Ohio

IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
LF1 OU6 41 Sites	In a 1995 RI, surface and subsurface soils were evaluated. Quantitative risk assessment was performed and it was determined that the incremental lifetime cancer risk associated with exposure to soil and landfill gas was less than 1 x 10^{-6}. Cobalt presents a potential ecological risk for LF1.	ARARs/TBCs: Maintenance of the landfill cap will continue to be conducted as described in the Operation and Maintenance Plan specific to the landfill. No specific ARARs were listed in the ROD. Chemical-specific toxicity values were applied in the quantitative human health risk assessment as TBCs. In addition, benchmarks for ecological toxicity were used as TBCs in the ecological assessment. Land Use/Exposure Assumptions: The site encompasses approximately 4 acres and is located in an old gravel quarry. Most of LF1 now appears to be covered by Perimeter Road on base and extends as far west as the northbound exit ramp from Harshman Road to Springfield Pike. Current designated land use is recreational. The previous designation was open space. There are currently no receptors assumed to be exposed to contaminants in soils and groundwater at LF1, given the intact cover. Excavation workers and adult and child residents were evaluated as potential future receptors. There have been changes to some default exposure parameters (e.g., AFs, SA) used in the risk assessment; however, these changes do not affect the conclusions of the risk assessment. Toxicity Values: Changes to the toxicity values used in the risk assessment would not affect the protectiveness of the remedy. The area has been capped; therefore, there is no current exposure to soil. RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. Landfill capping was selected as the presumptive remedy. This control limits the exposure of human and ecological receptors to landfill refuse. Land use and excavation activities have been restricted. Groundwater is addressed under the BMP.	RI/FS Site Specific Work Plan, OU6 LF1, LF2 and EFDZ1, WPAFB, 1993. Record of Decision for 41 No Action Sites at Wright-Patterson Air Force Base, WPAFB, 1998. SSRAP, Operable Unit 6, Landfill Nos. 1 and 2, WPAFB, 1996.

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IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
LF2 OU6 41 Sites	Surface and subsurface soil were evaluated. A quantitative risk assessment was performed. Cancer risk for exposure to soil was determined to be less than $1x10^{-6}$. Several metals were found to pose an ecological risk.	ARARs/TBCs: Maintenance of the landfill cap will continue to be conducted as described in the Operation and Maintenance Plan specific to the landfill. No specific ARARs were listed in the ROD. Chemical-specific toxicity values were applied in the quantitative human health risk assessment as TBCs. In addition, benchmarks for ecological toxicity were used as TBCs in the ecological assessment. Land Use/Exposure Assumptions: Landfill 2 is a densely wooded area on the west side of Harshman Road. Surficially deposited debris (most likely from trespassers) can be found outside the limits of buried waste. Current designated land use is recreational. The previous designation was open space. Recreational hunting continues at the site. Risk assessment assumed an adult maintenance worker and an adolescent trespasser would be the most likely receptors exposed to contaminants. Excavation workers and adult and child residents were evaluated as potential future land use scenarios. There have been changes to some default exposure parameters (e.g., AFs, SA) used in the risk assessment; however, these changes do not affect the conclusions of the risk assessment. Toxicity Values: Changes to the toxicity values used in the risk assessment would not affect the protectiveness of the remedy. The area has been capped; therefore there is no current exposure to soil. RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. Landfill capping was selected as the presumptive remedy. This control limits the exposure of human and ecological receptors to landfill refuse. Land use and excavation activities have been restricted. Groundwater, surface water, and sediment are addressed under the BMP.	Record of Decision for 41 No Action Sites at Wright-Patterson Air Force Base, WPAFB, 1998. SSRAP, Operable Unit 6, Landfill Nos. 1 and 2, WPAFB, 1996.

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IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
LF9 OU7 41 sites	Surface and subsurface soil were evaluated at the site. NFA is based on a semi-quantitative risk assessment (screening against Region 9 residential and industrial PRGs). All chemicals were below residential PRGs except Aroclor 1242, which was below the industrial PRG.	ARARs/TBCs: There was a requirement for explosive gas monitoring for licensed sanitary landfills, however, LF9 is not licensed and no buildings are within 1,000 feet of the site. Under a base-wide landfill capping program, LF9 was capped. Monitoring requirements for landfill cover are followed. No specific ARARs were listed in the ROD. Region 9 PRGs were applied in the screening level risk assessment as TBCs. Land Use/Exposure Assumptions: The site is an undeveloped, open area surrounded by woods and is occasionally used for recreational hunting. The land use is currently designated as recreational; the previous designation was open space and an airfield. Exposure assumptions are still valid. It is located in a runway flyover zone and neither industrial use nor residential development is viable. The trespasser (hunter) scenario was the only complete exposure pathway identified at the site. In June 1998, construction of a native soil and vegetative cover was completed as part of a presumptive remedy action. Since the area has been capped, there is no current exposure to soil. Toxicity Values: Only a screening level risk assessment was conducted. All PRG values have been replaced with RSLs. Using the most current RSL values (2019), the only COC to exceed the RSLs is benzo(a)pyrene and it exceeds only the residential RSL values. The area has been capped; therefore, there is no current exposure to soil. RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that no action was necessary beyond the landfill cap (a presumptive remedy) to ensure protection of human health and the environment under current and future land use plans. Surface water and sediment are addressed under the BMP.	Final Field Investigation Report, Wright-Patterson Air Force Base, Operable Unit 7, WPAFB, 1996. Final Removal Action Report, Operable Unit 7 (LF9), Kelchner, 1998. Record of Decision for 41 No Action Sites at Wright-Patterson Air Force Base, WPAFB, 1998.

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IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
SP11 OU8 41 sites	Surface and subsurface soil were evaluated. The NFA is based on the fact that Institutional Controls are already in place, the quantitative risk assessment indicated that the risks and hazards for the RME for all receptors were below the target level of $1x10^{-4}$ and 1, respectively, and a removal action mitigates threats to human health and the environment.	ARARs/TBCs: TPH in subsurface soil exceeded BUSTR action levels. A non-time critical removal action was implemented consisting of the installation of a downgradient french drain to collect groundwater and surface water. The collected water is pumped to an existing oil/water separator for treatment. The BUSTR action levels were applied as ARARs for the removal action. Region 9 PRGs and chemical-specific toxicity values were applied in the quantitative human health risk assessment as TBCs. Land Use/Exposure Assumptions: At the time of the risk assessment, land use at SP11 was designated as industrial. The site is currently designated as industrial and is used as the Aircraft Survivability Research Facility; allowable land use is for research and development. Exposure assumptions are still valid. The exposure scenario evaluated was for a commercial/industrial worker. In a semi-quantitative risk assessment, Region 9 industrial soil PRGs were used to screen soil samples. Based on this screening, risks and hazards were not calculated for subsurface soil because concentrations were below the PRGs. There have been changes to some default exposure parameters (e.g., AFs, SA) used in the risk assessment; however, these changes do not affect the conclusions of the risk assessment. Toxicity Values: Although there have been changes to toxicity values and the PRGs used in the risk assessment have been replaced with RSLs, these changes do not affect the conclusions of the risk assessment. RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that no action was necessary beyond the removal action to ensure protection of human health and the environment under current and future land use plans. Sediment, surface water, and groundwater are addressed under the BMP.	Final Remedial Investigation Report for Operable Unit 8, CH2M HILL, 1997. Record of Decision for 41 No Action Sites at Wright-Patterson Air Force Base, WPAFB, 1998.

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41 No Action Sites[(1)]
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IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
SP5 OU8 41 sites	Site subsurface soil was evaluated. The NFA is based on the fact that institutional controls are already in place. The semi-quantitative risk assessment indicated that site concentrations were below the Region 9 PRG values based on $1x10^{-6}$, and a removal action mitigates threats to human health and the environment.	ARARs/TBCs: TPH in subsurface soil west of SP5 exceeded BUSTR action levels. As part of a non-time critical removal action, a bioslurper was installed to remove floating product from groundwater, in addition to organic soil vapors from the vadose soils. The bioslurper was operated form March 1997 to December 1997. Groundwater continues to be monitored under the BMP. The BUSTR action levels were applied as ARARs for the removal action. Region 9 PRGs were applied in the semi-quantitative human health risk assessment as TBCs. Land Use/Exposure Assumptions: The site cover includes grass, asphalt, and gravel; the area is currently designated as industrial. Current allowable land use is for research and development. Exposure assumptions are still valid. The exposure scenario evaluated was for commercial/industrial workers. In a semi-quantitative risk assessment, Region 9 industrial soil PRGs were used to screen soil samples. Based on this screen, risks and hazards were not calculated for subsurface soil because concentrations were below the PRGs. Toxicity Values: The Region 9 PRGs were replaced with the RSLs since the time of the original risk assessment. When compared against the most current Industrial RSLs (2019), the COC maximum detected concentrations are below these values. Therefore, this does not affect the conclusions of the risk assessment. RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that no action was necessary beyond the removal action to ensure protection of human health and the environment under current and future land use plans. Groundwater is addressed under the BMP.	Final Remedial Investigation Report for Operable Unit 8, CH2M HILL, 1997. Record of Decision for 41 No Action Sites at Wright-Patterson Air Force Base, WPAFB, 1998.

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IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
SP6 OU8 41 sites	Surface and subsurface soil was evaluated. The NFA is based on the fact that institutional controls are already in place and excavations removed all soils with PCB concentrations of 50 ppm or greater.	ARARs/TBCs: Site concentrations of PCBs were found to exceed the cleanup levels under TSCA. In 1986, the transformer and pad located at this site were removed and soil excavations were conducted in 1986, 1987, and 1992. The TCSCA cleanup criteria for PCBs were applied as ARARs. Land Use/Exposure Assumptions: Site is a grassy area near Building 14. Land use is currently designated as commercial. Current allowable land use is for research and development. Exposure assumptions are still valid. Toxicity Values: Verification samples collected after the last excavation effort showed that PCB contamination was below 10 ppm for all but one sample at 11.7 ppm. These concentration levels were below the TSCA cleanup criteria for electrical substations (50 ppm). RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that no action other than the previous excavation activities is necessary to protection of human health and the environment under current and future land use plans.	Final Report Wright-Patterson AFB, Spill Sites 6 & 8, USACOE, 1991. Record of Decision for 41 No Action Sites at Wright-Patterson Air Force Base, WPAFB, 1998.

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IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
SP7 OU8 41 sites	Surface and subsurface soil was evaluated. The NFA is warranted because the site was remediated under the oversight of BUSTR, with the approval of both Ohio EPA and USEPA.	ARARs/TBCs: When SP7 was incorporated into the IRP, it was placed under the oversight authority of BUSTR. Closure of 14 USTs at the site was conducted in late 1991. The site was "over-excavated" to the top of bedrock exposure or building foundation was encountered. The tanks were then replaced. The BUSTR action levels were applied as ARARs for the UST closures. Region 3 RBCs were applied in the semi-quantitative human health risk assessment as TBCs. Land Use/Exposure Assumptions: Land use is currently designated as industrial. Site is currently used for fuel storage and allowable land use is for research and development. Exposure assumptions are still valid. A semi-quantitative risk assessment was conducted based on utility worker exposures (i.e., industrial/commercial). Soil sample concentrations were compared to Region 3 RBCs and were found to be below the risk-based levels for an industrial/commercial scenario. Toxicity Values: Although there have been changes to the toxicity values used in the risk assessment, these changes do not affect the conclusions of the risk assessment. RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that no action other than the previous removal and excavation is necessary to protection of human health and the environment under current and future land use plans.	Decision Document for Spill Site 7, WPAFB, 1993. Record of Decision for 41 No Action Sites at Wright-Patterson Air Force Base, WPAFB, 1998.

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Wright-Patterson AFB, Ohio

IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
SP9 OU8 41 sites	Surface and subsurface soil was evaluated. The NFA is warranted because the site was remediated under the oversight of BUSTR in accordance with all applicable federal and state regulations.	ARARs/TBCs: When SP9 was incorporated into the IRP, it was placed under the oversight authority of BUSTR. Closure of the USTs at the site was conducted in 1992. The site was "over-excavated" to the top of bedrock exposure. The BUSTR action levels were applied as ARARs for the UST closure. Region 3 RBCs were applied in the semi-quantitative human health risk assessment as TBCs. Land Use/Exposure Assumptions: Land use is currently designated as industrial. The site is currently used for fuel storage and the allowable land use is research and development. Exposure assumptions are still valid. A semi-quantitative risk assessment was conducted based on utility worker exposures (i.e., industrial/commercial). Soil sample concentrations were compared to Region 3 RBCs and were found to be below the risk-based levels for an industrial/commercial scenario. Toxicity Values: The Region 3 RBCs have been replaced by the RSLs since the original risk assessment was performed. When screened against the most recent RSLs (2019), maximum COC concentrations are still below these values. Concentrations are also below the most current Action Levels set by BUSTR (2017). RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that no action other than the previous removal and excavation is necessary to protection of human health and the environment under current and future land use plans.	Decision Document for Spill Site 9, WPAFB, 1993. Record of Decision for 41 No Action Sites at Wright-Patterson Air Force Base, WPAFB, 1998.

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Summary of Technical Assessment (Question B)
41 No Action Sites[1]
Wright-Patterson AFB, Ohio

IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
UST 71A OU8 41 sites	Site subsurface soil was evaluated. The NFA is based on the fact that institutional controls are already in place. The semi-quantitative risk assessment indicated that site concentrations were below the Region 9 PRG values based on $1x10^{-6}$, and 80% of the area is covered.	ARARs/TBCs: No specific ARARs were listed in the ROD. Region 9 PRGs were applied in the semi-quantitative human health risk assessment as TBCs. Land Use/Exposure Assumptions: The site cover includes a gravel parking lot, a paved road, a lawn, and a landscaped median; the area is currently designated as industrial. Current allowable land use is research and development. Exposure assumptions are still valid. The exposure scenario evaluated was for future commercial/industrial workers. In a semi-quantitative risk assessment, Region 9 industrial soil PRGs were used to screen soil samples. Based on this screen, risks and hazards were not calculated for subsurface soil because concentrations were below the PRGs. Toxicity Values: The Region 9 PRGs have been replaced by the RSLs since the original risk assessment. When compared against the most current Industrial RSLs (2019), the maximum detected COC concentrations are still below these values. Therefore, this does not affect the conclusions of the risk assessment. RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that no action was necessary to ensure protection of human health and the environment under current and future land use plans. Groundwater is addressed under the BMP.	Final Remedial Investigation Report for Operable Unit 8, CH2M HILL, 1997. Record of Decision for 41 No Action Sites at Wright-Patterson Air Force Base, WPAFB, 1998.

Table 7-7
Summary of Technical Assessment (Question B)
41 No Action Sites(1)
Wright-Patterson AFB, Ohio

IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
BS3 OU9 41 sites	Surface and subsurface soil was evaluated. The NFA is based on the fact that institutional controls are already in place. Lead concentrations were slightly above background but were considered to be within the naturally occurring range of lead.	ARARs/TBCs: No specific ARARs were listed in the ROD. Background data were used as TBC in the evaluation of lead in soil. Land Use/Exposure Assumptions: This site is grassy and wooded area; land use at BS3 is currently designated as industrial. The previous designation was open space. A qualitative risk assessment was conducted (i.e., inorganics were compared to background). Lead concentrations exceeded background values slightly but are thought to be within the naturally occurring range. Toluene and SVOC TICs were the only other detected contaminants. Toluene was not considered to be site related. Toxicity Values: Lead was not compared to the residential lead exposure criteria of 400 mg/kg. Site concentrations of lead are below this level. RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that no action was necessary to ensure protection of human health and the environment under current and future land use plans. Groundwater is addressed under the BMP.	Final Site Investigation Report for 16 IRP Sites, SAIC, 1993. Record of Decision for 41 No Action Sites at Wright-Patterson Air Force Base, WPAFB, 1998.
BS5 OU9 41 sites	Surface and subsurface soil was evaluated. The NFA is based on the fact that institutional controls are already in place and the semi-quantitative risk assessment indicated that site concentrations were below the Region 9 PRGs, based on $1x10^{-6}$.	ARARs/TBCs: No specific ARARs were listed in the ROD. Region 9 PRGs were applied in the semi-quantitative human health risk assessment as TBCs. Land Use/Exposure Assumptions: BS5 is grass covered; land use is currently designated as industrial. The previous designation was open space. In a semi-quantitative risk assessment, Region 9 residential and industrial soil PRGs were used to screen soil samples. The maximum concentration of all COCs was lower than the residential PRG. Toxicity Values: The Region 9 PRGs have been replaced by the RSLs since the original risk assessment. When compared against the most current residential and industrial RSLs (2019), the maximum COC concentrations are still below these values. Therefore, this does not affect the conclusions of the risk assessment. RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that no action was necessary to ensure protection of human health and the	Final Site Investigation Report for Burial Sites 5 and 6, ICI, 1998. Record of Decision for 41 No Action Sites at Wright-Patterson Air Force Base, WPAFB, 1998.

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Summary of Technical Assessment (Question B)
41 No Action Sites(1)
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IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
		environment under current and future land use plans. Groundwater is addressed under the BMP.	
BS6 OU9 41 sites	Surface and subsurface soil was evaluated. The NFA is based on the fact that institutional controls are already in place and the semi-quantitative risk assessment indicated that site concentrations were below the Region 9 $1x10^{-6}$ PRGs.	ARARs/TBCs: No specific ARARs were listed in the ROD. Region 9 PRGs were applied in the semi-quantitative human health risk assessment as TBCs. Land Use/Exposure Assumptions: BS6 is grass covered; land use at is currently designated as industrial. The previous designation was open space. In a semi-quantitative risk assessment, Region 9 residential and industrial soil PRGs were used to screen soil samples. The maximum concentration of all COCs was lower than the residential PRG. Toxicity Values: The Region 9 PRGs have been replaced by the RSLs since the original risk assessment. When compared against the most current residential and industrial RSLs (2019), the maximum COC concentrations are still below these values. Therefore, this does not affect the conclusions of the risk assessment. RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that no action was necessary to ensure protection of human health and the environment under current and future land use plans. Groundwater is addressed under the BMP.	Final Site Investigation Report for Burial Sites 5 and 6, ICI, 1998. Record of Decision for 41 No Action Sites at Wright-Patterson Air Force Base, WPAFB, 1998.
EFDZ10 OU9 41 sites	Surface and subsurface soil was evaluated. The NFA is based on the fact that institutional controls are already in place.	ARARs/TBCs: No specific ARARs were listed in the ROD. Although a preliminary risk evaluation was not performed at the time of the RI, the site data were compared with USEPA RSLs as TBCs. Land Use/Exposure Assumptions: EFDZ10 is partially wooded; land use is currently designated as industrial. The previous designation was open space. Metals and low levels of VOCs and SVOC TICs were detected in soil. Toxicity Values: When compared against the most current industrial RSLs (2019), all detected concentrations of arsenic are above these values. RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that no action was necessary to ensure protection of human health and the environment under current and future land use plans. Groundwater is addressed under the BMP.	Final Site Investigation Report for 16 IRP Sites, SAIC, 1993. Record of Decision for 41 No Action Sites at Wright-Patterson Air Force Base, WPAFB, 1998.

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Summary of Technical Assessment (Question B)
41 No Action Sites[(1)]
Wright-Patterson AFB, Ohio

IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
EFDZ2 OU9 41 sites	Surface and subsurface soil was evaluated. The NFA is based on the fact that institutional controls are already in place and the semi-quantitative risk assessment indicated that site concentrations were below the Region 9 PRGs, based on 1×10^{-6}.	ARARs/TBCs: No specific ARARs were listed in the ROD. Region 9 PRGs were applied in the semi-quantitative human health risk assessment as TBCs. Land Use/Exposure Assumptions: EFDZ2 is grass covered; land use is currently designated as industrial. Current allowable land use is research and development. Exposure assumptions are still valid. Metals and low levels of VOCs and SVOC TICs were detected in soil. In a semi-quantitative risk assessment, Region 9 residential soil PRGs were used to screen soil samples. The maximum concentration of all COCs was lower than the residential PRG with the exception of beryllium; beryllium did not appear to be site related. Toxicity Values: The Region 9 PRGs were replaced by the RSLs since the original risk assessment. When screened against the most current industrial RSLs (2019), the maximum COC concentrations are all still below these values, with the exception of arsenic. Although the maximum concentration for arsenic is above the RSL based on 1×10^{-6}, it is less than the RSL based on 1×10^{-5}. RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that no action was necessary to ensure protection of human health and the environment under current and future land use plans.	Site Investigation Report for Eight Earthfill Disposal Zones, ES, 1992. Record of Decision for 41 No Action Sites at Wright-Patterson Air Force Base, WPAFB, 1998.

Table 7-7
Summary of Technical Assessment (Question B)
41 No Action Sites(1)
Wright-Patterson AFB, Ohio

IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
EFDZ3 OU9 41 sites	Surface and subsurface soil was evaluated. The NFA is based on the fact that institutional controls are already in place and the semi-quantitative risk assessment indicated that site concentrations were below the Region 9 PRGs, based on $1x10^{-6}$.	ARARs/TBCs: No specific ARARs were listed in the ROD. Region 9 PRGs were applied in the semi-quantitative human health risk assessment as TBCs. Land Use/Exposure Assumptions: EFDZ3 is grass covered; land use is currently designated as industrial. Previous designation was open space. Exposure assumptions are still valid. Metals and low levels of VOCs and SVOC TICs were detected in soil. In a semi-quantitative risk assessment, Region 9 residential soil PRGs were used to screen soil samples. The maximum concentration of all COCs was lower than the residential PRG. Toxicity Values: The Region 9 PRGs have been replaced by the RSLs since the original risk assessment. When compared against the most current industrial RSLs (2019), the maximum COC concentrations are still below these values, with the exception of arsenic. Although the maximum concentration for arsenic is above the RSL based on $1x10^{-6}$, it is less than the RSL based on $1x10^{-5}$ RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that no action was necessary to ensure protection of human health and the environment under current and future land use plans.	Site Investigation Report for Eight Earthfill Disposal Zones, ES, 1992. Record of Decision for 41 No Action Sites at Wright-Patterson Air Force Base, WPAFB, 1998.

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Summary of Technical Assessment (Question B)
41 No Action Sites[1]
Wright-Patterson AFB, Ohio

IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
EFDZ4 OU9 41 sites	Surface and subsurface soil was evaluated. The NFA is based on the fact that institutional controls are already in place and the semi-quantitative risk assessment indicated that site concentrations were below the Region 9 Region 9 PRGs, based on $1x10^{-6}$.; arsenic was below the PRG, based on $1x10^{-5}$.	ARARs/TBCs: No specific ARARs were listed in the ROD. Region 9 PRGs were applied in the semi-quantitative human health risk assessment as TBCs. Land Use/Exposure Assumptions: EFDZ4 is grass covered; land use is currently designated as industrial. Previous designation was open space. Exposure assumptions are still valid. Metals and low levels of VOCs and SVOC TICs were detected in soil. In a semi-quantitative risk assessment, Region 9 industrial soil PRGs were used to screen soil samples. The maximum concentration of all COCs was lower than the industrial soil PRG at the $1x10^{-6}$ level except arsenic. Arsenic was below the $1x10^{-5}$ PRG level. Toxicity Values: The Region 9 PRGs have been replaced by the RSLs since the original risk assessment. When screened against the most current industrial RSLs (2019), COC concentrations are still below these values, with the exception of arsenic and benzo(a)pyrene. These COCs are above their RSL values based on $1x10^{-6}$, but below the RSL values based on $1x10^{-5}$. RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that no action was necessary to ensure protection of human health and the environment under current and future land use plans.	Site Investigation Report for Eight Earthfill Disposal Zones, ES, 1992. Final Remedial Investigation Report Operable Unit 9, IT, 1997. Record of Decision for 41 No Action Sites at Wright-Patterson Air Force Base, WPAFB, 1998.

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Summary of Technical Assessment (Question B)
41 No Action Sites[(1)]
Wright-Patterson AFB, Ohio

IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
EFDZ5 OU9 41 sites	Surface and subsurface soil was evaluated. The NFA is based on the fact that institutional controls are already in place and the semi-quantitative risk assessment indicated that site concentrations were below the Region 9 PRGs, based on $1x10^{-6}$.	ARARs/TBCs: No specific ARARs were listed in the ROD. Region 9 PRGs were applied in the semi-quantitative human health risk assessment as TBCs. Land Use/Exposure Assumptions: EFDZ5 is grass covered; land use is currently designated as recreational. Previous land use was open space. Exposure assumptions are still valid. Metals were detected in soil. In a semi-quantitative risk assessment, Region 9 residential soil PRGs were used to screen soil samples. The maximum concentration of all COCs was lower than the residential PRG with the exception of beryllium; beryllium did not appear to be site related. Toxicity Values: The Region 9 PRGs have been replaced by the RSLs since the original risk assessment. When screened against the most current industrial RSLs (2019), COC concentrations are still below these values, with the exception of arsenic. Although the maximum concentration for arsenic is above the RSL based on $1x10^{-6}$, it is less than the RSL value based on $1x10^{-5}$. RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that no action was necessary to ensure protection of human health and the environment under current and future land use plans.	Site Investigation Report for Eight Earthfill Disposal Zones, ES, 1992. Record of Decision for 41 No Action Sites at Wright-Patterson Air Force Base, WPAFB, 1998.

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Summary of Technical Assessment (Question B)
41 No Action Sites(1)
Wright-Patterson AFB, Ohio

IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
EFDZ6 OU9 41 sites	Surface and subsurface soil was evaluated. The NFA is based on the fact that institutional controls are already in place and the semi-quantitative risk assessment indicated that site concentrations were below the Region 9 PRGs, based on $1x10^{-6}$.	ARARs/TBCs: No specific ARARs were listed in the ROD. Region 9 PRGs were applied in the semi-quantitative human health risk assessment as TBCs. Land Use/Exposure Assumptions: At the time of the risk assessment, EFDZ6 was mostly grass covered. A parking lot for Building 837 now occupies the site. Land use is currently designated as industrial. Current allowable land use is research and development. Exposure assumptions are still valid. Metals were detected in soil. In a semi-quantitative risk assessment, Region 9 residential soil PRGs were used to screen soil samples. The maximum concentration of all COCs was lower than the residential PRG with the exception of beryllium; beryllium did not appear to be site related. Toxicity Values: The Region 9 PRGs have been replaced by the RSLs since the original risk assessment. When screened against the most current industrial RSLs (2019), COC concentrations are still below these values, with the exception of arsenic. Although the maximum concentration for arsenic is above the RSL value based on $1x10^{-6}$, it is less than the RSL value based on $1x10^{-5}$. RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that no action was necessary to ensure protection of human health and the environment under current and future land use plans. Groundwater is addressed under the BMP.	Site Investigation Report for Eight Earthfill Disposal Zones, ES, 1992. Record of Decision for 41 No Action Sites at Wright-Patterson Air Force Base, WPAFB, 1998.

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Summary of Technical Assessment (Question B)
41 No Action Sites(1)
Wright-Patterson AFB, Ohio

IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
EFDZ7 OU9 41 sites	Surface and subsurface soil was evaluated. The NFA is based on the fact that institutional controls are already in place and the semi-quantitative risk assessment indicated that site concentrations were below the Region 9 PRGs, based on $1x10^{-6}$.	ARARs/TBCs: No specific ARARs were listed in the ROD. Region 9 PRGs were applied in the semi-quantitative human health risk assessment as TBCs. Land Use/Exposure Assumptions: EFDZ3 is grass covered; land use is currently designated as industrial. Previous land use designation was open space. Metals and low levels of organics were detected in soil. In a semi-quantitative risk assessment, Region 9 residential soil PRGs were used to screen soil samples. The maximum concentration of all COCs was lower than the residential PRG. Toxicity Values: The Region 9 PRGs have been replaced by the RSLs since the original risk assessment. When screened against the most current industrial RSLs (2019), COC concentrations are still below these values, with the exception of arsenic. Although the maximum concentration for arsenic is above the RSL value based on $1x10^{-6}$, it is less than the RSL value based on $1x10^{-5}$. RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that no action was necessary to ensure protection of human health and the environment under current and future land use plans.	Site Investigation Report for Eight Earthfill Disposal Zones, ES, 1992. Record of Decision for 41 No Action Sites at Wright-Patterson Air Force Base, WPAFB, 1998.

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Summary of Technical Assessment (Question B)
41 No Action Sites(1)
Wright-Patterson AFB, Ohio

IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
EFDZ8 OU9 41 sites	Surface and subsurface soil was evaluated. The NFA is based on the fact that institutional controls are already in place and the semi-quantitative risk assessment indicated that site concentrations were below the Region 9 PRGs, based on $1x10^{-6}$.	ARARs/TBCs: No specific ARARs were listed in the ROD. Region 9 PRGs were applied in the semi-quantitative human health risk assessment as TBCs. Land Use/Exposure Assumptions: EFDZ8 is mostly grass covered except for a portion covered by an asphalt parking lot; land use is currently designated as industrial. Previous land use designation was open space. Metals and low levels of VOCs were detected in soil. In a semi-quantitative risk assessment, Region 9 residential soil PRGs were used to screen soil samples. The maximum concentration of all COCs was lower than the residential PRG with the exception of beryllium; beryllium did not appear to be site related. Toxicity Values: The Region 9 PRGs have been replaced by the RSLs since the original risk assessment. When screened against the most current industrial RSLs (2019), COC concentrations are still below these values, with the exception of arsenic. Although the maximum concentration for arsenic is above the RSL value based on $1x10^{-6}$, it is less than the RSL value based on $1x10^{-5}$. RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that no action was necessary to ensure protection of human health and the environment under current and future land use plans.	Site Investigation Report for Eight Earthfill Disposal Zones, ES, 1992. Record of Decision for 41 No Action Sites at Wright-Patterson Air Force Base, WPAFB, 1998.

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Summary of Technical Assessment (Question B)
41 No Action Sites(1)
Wright-Patterson AFB, Ohio

IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
EFDZ9 OU9 41 sites	Surface and subsurface soil was evaluated. The NFA is based on the fact that institutional controls are already in place and the semi-quantitative risk assessment indicated that site concentrations were below the Region 9 PRGs, based on $1x10^{-6}$.; arsenic was below the PRG, based on $1x10^{-5}$.	ARARs/TBCs: No specific ARARs were listed in the ROD. Region 9 PRGs were applied in the semi-quantitative human health risk assessment as TBCs. Land Use/Exposure Assumptions: EFDZ9 was previously grass covered, but is now a wooded lot. Land use is currently designated as industrial. Previous land use designation was open space. Exposure assumptions are still valid. Metals and low levels of VOCs and SVOC TICs were detected in soil. In a semi-quantitative risk assessment, Region 9 industrial soil PRGs were used to screen soil samples. The maximum concentration of all COCs was lower than the industrial soil PRG at the $1x10^{-6}$ level except arsenic. Arsenic was below the $1x10^{-5}$ PRG level. Toxicity Values: The Region 9 PRGs have been replaced by the RSLs since the original risk assessment. When screened against the most current industrial RSLs (2019), COC concentrations are still below these values, with the exception of arsenic. Arsenic, however, is still above its RSL value based on $1x10^{-6}$, but below the RSL value based on $1x10^{-5}$. RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that no action was necessary to ensure protection of human health and the environment under current and future land use plans.	Site Investigation Report for Eight Earthfill Disposal Zones, ES, 1992. Final Remedial Investigation Report Operable Unit 9, IT, 1997. Record of Decision for 41 No Action Sites at Wright-Patterson Air Force Base, WPAFB, 1998.

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Summary of Technical Assessment (Question B)
41 No Action Sites(1)
Wright-Patterson AFB, Ohio

IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
HP5 OU9 41 sites	Surface and subsurface soil was evaluated. The NFA is based on the fact that institutional controls are already in place and actions had been taken at the site to mitigate contamination.	ARARs/TBCs: Because PAHs were found to exceed PRGs in the coal storage area, portions of the railroad tracks were removed and surface areas were graded and paved or resurfaced with clean gravel. Measures were also taken to control storm water runoff and its contamination. No specific ARARs were listed in the ROD. Region 9 PRGs were applied in the semi-quantitative human health risk assessment as TBCs. Land Use/Exposure Assumptions: The heating plant at this site has been converted to natural gas and continues to operate. Land use at this site is currently designated as industrial. Exposure assumptions are still valid. In a semi-quantitative risk assessment, Region 9 industrial PRGs were used to screen soil samples. PAHs, Aroclor 1242, and arsenic exceeded the PRGs. WPAFB upgraded the coal storage area to mitigate potential threats to human health and the environment. Toxicity Values: The Region 9 PRGs have been replaced by the RSLs since the original risk assessment. When screened against the most current industrial RSLs (2019), the maximum concentrations of PAHs (except chrysene and anthracene), Aroclor -1254 and arsenic still exceed their respective RSL values. RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that no action beyond the mitigation actions described above was necessary to ensure protection of human health and the environment under current and future land use plans.	Final Remedial Investigation Report Operable Unit 9, IT, 1997. Record of Decision for 41 No Action Sites at Wright-Patterson Air Force Base, WPAFB, 1998.

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41 No Action Sites(1)
Wright-Patterson AFB, Ohio

IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
DRMO	Surface and subsurface soil was evaluated. The NFA is based on the fact that institutional controls are already in place and a removal action that mitigates threats to human health and the environment.	ARARs/TBCs: Because PAHs were found to exceed PRGs, an EE/CA was conducted to evaluate a non-time critical removal action for the site. The removal action, completed in October 1998, consisted of excavation and off-site disposal of surface soil and backfilling and placing clean gravel over the affected areas. No specific ARARs were listed in the ROD. Region 9 PRGs were applied in the semi-quantitative human health risk assessment as TBCs. Land Use/Exposure Assumptions: The DRMO is mostly gravel and asphalt covered; land use at this site is designated as industrial. In a semi-quantitative risk assessment for the RI, Region 9 industrial PRGs were used to screen soil samples. PAHs and arsenic exceeded the PRGs. In a quantitative risk assessment conducted for the EE/CA, 12 of 16 surface soil samples were associated with cancer risk greater than 1×10^{-4}. The remaining four samples were associated with cancer risk greater than 1×10^{-5}. Based on these results, the non-time critical action was taken. Toxicity Values: The Region 9 PRGs have been replaced by the RSLs since the original risk assessment. When maximum concentrations from the supplemental investigation (post-removal action) were screened against the most current industrial RSLs (2019), PAHs (except anthracene, benzo(k)fluoranthene and chrysene) still exceeded the new RSL values. Though not analyzed in the supplemental investigation, the arsenic concentration from the initial sampling exceeded its RSL value. This area is currently covered with gravel and asphalt. RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that no action beyond the removal action described above was necessary to ensure protection of human health and the environment under current and future land use plans.	Final Remedial Investigation Report Operable Unit 9, IT, 1997. Engineering Evaluation/Cost Analysis at Defense Reutilization Marketing Office Storage Yard Removal Action, IT, 1998. DRMO Final Action Removal Report, IT, 1998. Record of Decision for 41 No Action Sites at Wright-Patterson Air Force Base, WPAFB, 1998. Soil Removal Project, Operable Unit 9 – DRMO, Kelchner Environmental, Inc., 1999.

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41 No Action Sites[(1)]
Wright-Patterson AFB, Ohio

IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
East Ramp UST OU10 41 Sites	Minimal soil contamination was encountered in the vicinity of the fill pipe to the tank and all visibly contaminated soil was removed. Soil samples were taken. A qualitative analysis was conducted and results indicate only low concentrations of VOC and TPH remain in soils.	ARARs/TBCs: The BUSTR regulations were applied as ARARs for the tank closure. Region 9 PRGs were applied in the risk analysis as TBCs. Land Use/Exposure Assumptions: Land use designation is industrial. The area is partially paved. The excellent condition of the tank when removed and the distribution of TPH exclusively in shallow soil suggests high background levels for the site or a contamination source other than the UST. Drainage from the nearby flight line or Skeel Avenue may account for the contamination. Potential receptors considered for the risk assessment include adult site workers. Toxicity Values: The Region 9 PRGs have been replaced by the RSLs since the original risk assessment. When screened against the most current residential and industrial RSLs (2019), the maximum COC concentrations are still below these values. Concentrations are also below the most current Action Levels set by BUSTR (2017). Therefore, this does not affect the conclusions of the risk assessment. RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. The 12,000 gal UST was removed in 1988 and closed in accordance with BUSTR and USEPA regulations. Based on evaluations of the site data, the concurrence with BUSTR, and the current site conditions, this area is not expected to pose significant human health risks. The preferred alternative for this site is no action. Because the contaminated soil has been removed and disposed, no additional action is necessary to protect human health and environment under current and future land use plans. Groundwater is addressed under the BMP.	Record of Decision for 41 No Action Sites at Wright-Patterson Air Force Base, WPAFB, 1998. Technical Document to Support No Further Response Action Planned, IRP East Ramp UST, WPAFB 1991.

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Summary of Technical Assessment (Question B)
41 No Action Sites[1]
Wright-Patterson AFB, Ohio

IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
SP4 OU10 41 Sites	A qualitative analysis of health risk associated with the site indicated that VOCs and TPH remain on the site at low concentrations in shallow soil. Slightly elevated TPH concentrations may be due to the drainage from the nearby flight line.	ARARs/TBCs: The BUSTR regulations were applied as ARARs for the tank closure. Region 9 PRGs were applied in the risk analysis as TBCs. Land Use/Exposure Assumptions: SP4 is a leaded gasoline UST spill area discovered in 1988. Visibly contaminated soil was removed and the excavation was backfilled with uncontaminated material and closed in accordance with BUSTR and USEPA regulations. Land use in the area is currently designated as industrial, and is expected to remain the same; use for recreational purposes is unlikely. Current allowable use is industrial. Toxicity Values: When screened against the most current residential and industrial RSLs (2019), all VOC and lead concentrations are still below these values. Concentrations are also below the most current Action Levels set by BUSTR (2017). Therefore, this does not affect the conclusions of the risk assessment. RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels.. Based on evaluations of the site data, the concurrence with BUSTR, and the current site conditions, SP4 is not expected to pose significant health risks. The preferred alternative for this site is no action. Because the contaminated soil has been removed and disposed, no additional action is necessary to protect human health and environment under current and future land use plans. Groundwater is addressed under the BMP.	Record of Decision for 41 No Action Sites at Wright-Patterson Air Force Base, WPAFB, 1998. Technical Document to Support No Further Response Action Planned IRP Spill Site 4, WPAFB 1991.

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41 No Action Sites(1)
Wright-Patterson AFB, Ohio

IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
BS2 OU11 41 sites	Surface and subsurface soil was evaluated. The NFA is based on the fact that institutional controls are already in place. In addition, the semi-quantitative risk assessment (i.e., PRG screening) was not considered to represent the most likely receptors – lawn maintenance workers and excavation workers – and evaluates exposures to residents and industrial workers.	ARARs/TBCs: No specific ARARs were listed in the ROD. Region 9 PRGs were applied in the semi-quantitative human health risk assessment as TBCs. In addition, benchmarks for ecological toxicity were used as TBCs in the ecological assessment. Land Use/Exposure Assumptions: BS2 is grass covered; land use is currently designated as commercial. Previous designation was open space. In a semi-quantitative risk assessment, Region 9 industrial and residential soil PRGs were used to screen soil samples. The maximum concentration of all COCs was lower than the residential soil PRGs at the $1x10^{-6}$ level except arsenic and beryllium. Arsenic also exceeded the industrial soil PRG. Receptor-specific (maintenance and excavation worker) PRGs were calculated for arsenic; arsenic was below these values. Arsenic, manganese, selenium, and thallium exceeded ecological benchmarks for soil. Toxicity Values: When screened against the most current residential and industrial RSLs (2019), the maximum COC concentrations are still below these values, with the exception of arsenic. Arsenic concentrations are still above the most current RSL (2019) values for the surface and subsurface samples. Ecological Risk Assessment used NOAA screening guidelines for soil. In risk calculations, benchmarks developed by Opreska (1994), USEPA (1993), Verschueren (1983), and ATSDR were used. USEPA Region 5 has since developed Ecological Screening Levels (ESLs; USEPA, 2003); however, concentrations of contaminants in surface water and sediment would have changed over time. The ROD concluded that the uniformity of chemical patterns throughout the base surface water systems and the lack of correlation of these patterns with the activities historically conducted within the OUs, seem to imply sources present in the environment due to human activity, such as automobile or airplane exhaust, or pesticides used for agricultural purposes rather than an OU-related source. RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that no action was necessary to ensure protection of human health and the environment under current and future land use plans. Groundwater, surface water, and sediment are addressed under the BMP.	Final Field Investigation Report Operable Unit 11, Metcalf & Eddy, Inc., 1997. Record of Decision for 41 No Action Sites at Wright-Patterson Air Force Base, WPAFB, 1998.

Table 7-7
Summary of Technical Assessment (Question B)
41 No Action Sites(1)
Wright-Patterson AFB, Ohio

IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
CDA OU11 41 sites	Surface and subsurface soil was evaluated. The NFA is based on the fact that institutional controls are already in place and the semi-quantitative risk assessment indicated that site concentrations were below the Region 9 PRGs, based on $1x10^{-6}$; arsenic was below background.	ARARs/TBCs: No specific ARARs were listed in the ROD. Region 9 PRGs were applied in the semi-quantitative human health risk assessment as TBCs. In addition, benchmarks for ecological toxicity were used as TBCs in the ecological assessment. Land Use/Exposure Assumptions: The CDA is mostly grass covered or paved; land use was previously designated as partly aircraft operations and maintenance, partly open space. Current designated land use is industrial. Exposure assumptions are still valid. In a semi-quantitative risk assessment, Region 9 industrial and residential soil PRGs were used to screen soil samples. The maximum concentration of all COCs was lower than the residential and industrial soil PRGs at the $1x10^{-6}$ level except arsenic. Arsenic, however, was below background. Arsenic, cadmium, manganese, and selenium exceeded ecological benchmarks for soil. It was concluded that ecological exposures were limited; however, because the site has limited use other than for lawn and vegetation control/maintenance. Toxicity Values: When screened against the most current residential and industrial RSLs (2019), the maximum COC concentrations are still below these values, with the exception of arsenic, which exceeded the industrial and residential RSLs. Arsenic concentrations in the subsurface soil also exceeded the 2019 industrial RSL. However, arsenic concentrations were found to be below background. Ecological Risk Assessment used NOAA screening guidelines for soil. In risk calculations, benchmarks developed by Opreska (1994), USEPA (1993), Verschueren (1983), and ATSDR were used. USEPA Region 5 has since developed Ecological Screening Levels (ESLs; USEPA, 2003); however, concentrations of contaminants in surface water and sediment would have changed over time. The ROD concluded that the uniformity of chemical patterns throughout the base surface water systems and the lack of correlation of these patterns with the activities historically conducted within the OUs, seem to imply sources present in the environment due to human activity, such as automobile or airplane exhaust, or pesticides used for agricultural purposes rather than an OU-related source. RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that no action was necessary to ensure protection of human health and the environment under current and future land use plans. Groundwater, surface water, and sediment are addressed under the BMP.	Final Field Investigation Report Operable Unit 11, Metcalf & Eddy, Inc., 1997. Record of Decision for 41 No Action Sites at Wright-Patterson Air Force Base, WPAFB, 1998.

Table 7-7
Summary of Technical Assessment (Question B)
41 No Action Sites(1)
Wright-Patterson AFB, Ohio

IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
UST 4020 OU11 41 sites	Surface and subsurface soil was evaluated. The NFA is based on the fact that institutional controls are already in place and the UST was removed.	ARARs/TBCs: The UST was removed in 1986. The BUSTR action levels were applied as the ARARs for the tank removal. Land Use/Exposure Assumptions: The site is mostly grass covered or paved; land use is currently designated as industrial. Current allowable land use is aircraft operations and maintenance. Toxicity Values: No risk assessment was conducted. The concentration of contaminants detected did not exceed BUSTR cleanup criteria with the exception of one sample taken at a depth of 13 to 15 ft. TPH (164 ppm) and xylenes (37 ppm) exceeded the BUSTR Category 1 criteria for TPH of 105 ppm and xylenes of 28 ppm. BUSTR levels for closure and corrective action were revised in 2005. The closure action level for total xylenes was revised to a less stringent level in 2017 (42.7 ppm). TPH action levels range from 1,000 – 5,000 ppm based on soil class. Neither the TPH nor the xylene levels exceed the current closure action levels. Revised BUSTR guidance includes action levels for PAHs. Although PAHs were not specifically analyzed at this site, there were no detections in analyses for aromatic VOCs. RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that no action was necessary to ensure protection of human health and the environment under current and future land use plans.	Installation Restoration Program Stage 2 Report, Roy F. Weston, Inc., 1989. Record of Decision for 41 No Action Sites at Wright-Patterson Air Force Base, WPAFB, 1998.

Table 7-7
Summary of Technical Assessment (Question B)
41 No Action Sites(1)
Wright-Patterson AFB, Ohio

IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
EOD NA 41 sites	Surface and subsurface soil were evaluated. The NFA is based on the fact that institutional controls are already in place and site closure activities have been completed in accordance with the approved Closure Plan.	ARARs/TBCs: The site is regulated under State of Ohio RCRA regulations. Closure activities, completed in early 1998, consisted of removing ash and debris from the Open Burning (OB) unit, removing and recycling the OB unit, removing and disposing of approximately 10 cubic yards of non-hazardous contaminated soil from beneath the OB unit, and regarding the site. No specific ARARs were listed in the ROD. Chemical-specific toxicity values were applied in the quantitative human health risk assessment as TBCs. Land Use/Exposure Assumptions: The site is mostly grass-covered or paved; land use was designated as industrial. Current allowable land use is industrial. Exposure assumptions are still valid. Quantitative risk assessments based on an industrial exposure scenario were conducted before and after the removal actions. Both risk assessments indicated that risk and hazard estimates were below targets of $1x10^{-5}$ and 1, respectively. There have been changes to some default exposure parameters (e.g., AFs, SA) used in the risk assessment; however, these changes do not affect the conclusions of the risk assessment. Toxicity Values: Although there have been changes to the toxicity values used in the risk assessment, these changes do not affect the conclusions of the risk assessment. RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. No other remedy other than ICs were selected and site closure activities were completed in accordance with the approved Closure Plan and are protective of human health, welfare, and the environment at the site. ICs are based on the condition that land use remains industrial.	Closure Certification Explosive Ordnance Disposal Range, IT Corporation, 1999. Record of Decision for 41 No Action Sites at Wright-Patterson Air Force Base, WPAFB, 1998.

Table 7-7
Summary of Technical Assessment (Question B)
41 No Action Sites[(1)]
Wright-Patterson AFB, Ohio

IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
HP1 NA 41 sites	No soil sampling was conducted. The NFA is based on the fact that institutional controls are already in place. The coal storage area was removed and the majority of the site was covered by an asphalt parking lot.	ARARs/TBCs: No specific ARARs or TBCs were listed in the ROD. The coal storage area was removed and covered by asphalt. No soil samples were collected from this site. Land Use/Exposure Assumptions: The site is mostly covered by an asphalt parking lot; land use is designated as industrial. Current allowable land use is administrative/industrial. Exposure assumptions are still valid. Toxicity Values: No risk assessment was conducted. No soil samples were collected (bedrock was encountered at 3.5 ft bgs). RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that no action was necessary to ensure protection of human health and the environment under current and future land use plans. ICs in place are based on the condition that land use remains industrial.	Installation Restoration Program Stage 2 Report, Roy F. Weston, Inc., 1989. Record of Decision for 41 No Action Sites at Wright-Patterson Air Force Base, WPAFB, 1998.
HP4 NA 41 sites	The NFA is based on the fact that institutional controls are already in place and that stormwater runoff is collected and neutralized before being discharged to the storm sewer system.	ARARs/TBCs: NPDES requirements are applied as ARARs to address stormwater runoff. Land Use/Exposure Assumptions: The site is mostly covered by an asphalt parking lot; land use is currently designated as industrial. As a result of the Stage 2 investigation, a stormwater runoff collection system was implemented. Stormwater is combined with other aqueous waste effluent streams from HP4 and are neutralized before being discharged to the storm sewer system. Toxicity Values: No risk assessment was conducted. No soil samples were collected. RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that no action other than those described above are necessary to ensure protection of human health and the environment under current and future land use plans. ICs in place are based on the condition that land use remains industrial. Surface water runoff is addressed under the BMP.	Installation Restoration Program Stage 2 Report, Roy F. Weston, Inc., 1989. Record of Decision for 41 No Action Sites at Wright-Patterson Air Force Base, WPAFB, 1998.

Table 7-7
Summary of Technical Assessment (Question B)
41 No Action Sites(1)
Wright-Patterson AFB, Ohio

IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
NUC NA 41 sites	The NFA is based on the continued maintenance of the NUC, which is internally regulated by the USAF.	ARARs/TBCs: The NUC is classified as a Site 91B under the AEA of 1954, thus exempted from NRC oversight. Applicable inspection, maintenance and monitoring activities are performed to ensure compliance with the Air Force Nuclear Reactor Program (AFI 91-109), the USAF Special Nuclear Reactor Study 97-1, and the protection of personnel and environment from unnecessary exposure to radiation. Land Use/Exposure Assumptions: Land use is currently designated as industrial labs. The reactor was decommissioned in 1970. Radiological monitoring is conducted inside and outside the facility. Toxicity Values: None RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that no action is necessary under CERCLA and the IRP program to ensure protection of human health and the environment.	Installation Restoration Program Stage 2 Report, Roy F. Weston, Inc., 1989. Record of Decision for 41 No Action Sites at Wright-Patterson Air Force Base, WPAFB, 1998.
RADB NA 41 sites	Subsurface soil was evaluated. The NFA was based on the conclusion that the site poses no health risk.	ARARs/TBCs: In 1990, the concrete slab at the site was removed and the soils were excavated to bedrock (approximately 9 ft). The excavation was then filled and graded. No evidence of the site was observed. No specific ARARs were listed in the ROD. Levels of radioactivity at the site were compared with naturally occurring background levels as TBCs. Land Use/Exposure Assumptions: The site is a wooded area. Land use is currently designated as industrial. Previous land use designation was open space. Toxicity Values: Soil samples from the site showed only naturally occurring radioactivity at background levels. RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that no action is necessary to protection of human health and the environment under current and future land use plans.	Installation Restoration Program Stage 2 Report, Roy F. Weston, Inc., 1989. Decision Document Radioactive Waste Burial Site, WPAFB, 1992. Record of Decision for 41 No Action Sites at Wright-Patterson Air Force Base, WPAFB, 1998.

Table 7-7
Summary of Technical Assessment (Question B)
41 No Action Sites[1]
Wright-Patterson AFB, Ohio

IRP Site	Description/Basis	Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?	References
SP8 NA 41 sites	Site soil was evaluated. The NFA is based on the fact that institutional controls are already in place and a removal action that mitigates threats to human health and the environment.	ARARs/TBCs: Soil samples collected in 1988 after two transformers were found to be leaking showed PCB contamination at the site with concentrations ranging up to 42 ppm. After the transformers were removed, contaminated soil was excavated. The TCSCA cleanup criteria for PCBs were applied as ARARs. Land Use/Exposure Assumptions: Site is primarily a grassy lot. Land use was designated as administrative. Current designated land use is industrial. Exposure assumptions are still valid. Toxicity Values: A risk assessment was not conducted for this site. After excavation of contaminated soil, confirmatory samples were collected. It was concluded that SP8 is not expected to pose significant risks to public health or the environments because PCB concentrations on site were less than the regulatory criterion of 10 ppm for a residential scenario. RAOs/Cleanup Goals: Prevent exposure to contaminated soil above acceptable risk levels. It was concluded that no action is necessary to protection of human health and the environment under current and future land use plans.	Final Report Wright-Patterson AFB, Spill Sites 6 & 8, USACOE, 1991. Record of Decision for 41 No Action Sites at Wright-Patterson Air Force Base, WPAFB, 1998.

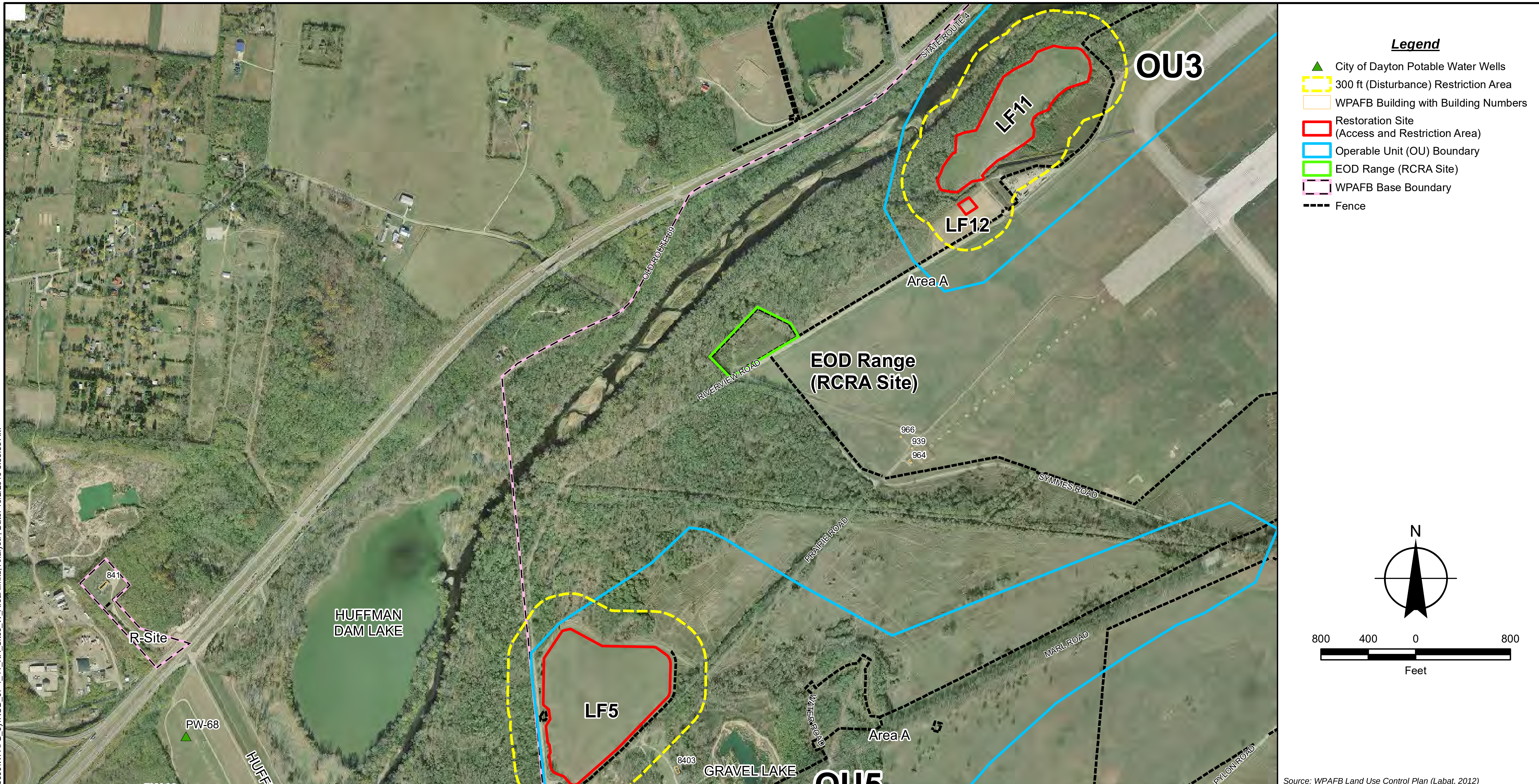
<u>Notes:</u>

1 – These sites were categorized as NA sites with the condition that land use remain restricted.

Table 7-7
Summary of Technical Assessment (Question B)
41 No Action Sites(1)
Wright-Patterson AFB, Ohio

Abbreviations:

AEA = Atomic Energy Act
AF = Adherence Factor
ARAR = Applicable or Relevant and Appropriate Requirement
ATSDR = Agency for Toxic Substances and Disease Registry
BGS = Below ground surface
BMP = Basewide Monitoring Program
BRA = Baseline Risk Assessment
BS = Burial Site
BUSTR = Bureau of Underground Storage Tank Regulations
CDA = Chemical Disposal Area
CERCLA= Comprehensive Environmental Response, Compensation, and Liability Act
CHP = Central Heating Plant
COCs = Chemicals of Concern
CTE = Central Tendency Exposure
DAF = Dilution Attenuation Factor
DRMO = Defense Reutilization Management Office
EE/CA = Engineering Evaluation/Cost Analysis
EFDZ = Earthfill Disposal Zone
EOD = Explosive Ordnance Disposal
EPA = Environmental Protection Agency
ERA = Ecological Risk Assessment
FTA = Fire Training Area
HHRA = Human Health Risk Assessment
HI = Hazard Index
HP = Heating Plant
ICs = Institutional Controls
IRP = Installation Restoration Program
LF = Landfill
mg/kg = milligram(s) per kilogram
NFA = No Further Action
NPDES = National Pollution Discharge Elimination System
NRC = Nuclear Regulatory Commission
NUC = Deactivated Nuclear Reactor
OU = Operable Unit(s)
PAH = Polycyclic Aromatic Hydrocarbons
PCB = Polychlorinated Biphenyl
ppm = parts per million
PRGs = Preliminary Remediation Goals
RAO = Remedial Action Objective
RBC = Risk-Based Concentrations
RCRA = Resource Conservation and Recovery Act
RI = Remedial Investigation
RME = Reasonable Maximum Exposure
ROD = Record of Decision
RSL = Regional Screening Level
SA = Surface area
SP = Spill Site
SSL = Soil Screening Level
SSRAP = Site Specific Remedial Action Plan
SVOC = Semi-volatile Organic Compound
TBC = To Be Considered
TCE = Trichloroethylene
TIC = Tentatively Identified Compounds
TPH = Total Petroleum Hydrocarbons
TSCA = Toxic Substances Control Act
USAF = U.S. Air Force
USEPA = U.S. Environmental Protection Agency
UST = Underground Storage Tank
VOC = Volatile Organic Compound
WPAFB = Wright-Patterson Air Force Base



Source: WPAFB Land Use Control Plan (Labat, 2012)

WRIGHT-PATTERSON
AIR FORCE BASE,
OHIO

FIFTH FIVE-YEAR ROD REVIEW

FIGURE NUMBER 7-1

Location of 41 NA Sites, West Area A

APTIM
5050 Section Avenue
Cincinnati, Ohio 45212

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Source: WPAFB Land Use Control Plan (Labat, 2012)

WRIGHT-PATTERSON
AIR FORCE BASE,
OHIO

FIFTH FIVE-YEAR ROD REVIEW

FIGURE NUMBER 7-2

Location of 41 NA Sites, South Area A

APTIM
5050 Section Avenue
Cincinnati, Ohio 45212

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Legend

- 300 ft (Disturbance) Restriction Area
- WPAFB Building with Building Numbers
- Restoration Site (Access and Restriction Area)
- Operable Unit (OU) Boundary
- WPAFB Base Boundary
- County Boundary
- Fence

Source: WPAFB Land Use Control Plan (Labat, 2012)

N

800 400 0 800

Feet

WRIGHT-PATTERSON AIR FORCE BASE, OHIO

FIFTH FIVE-YEAR ROD REVIEW

FIGURE NUMBER 7-3

Location of 41 NA Sites, North Area A

APTIM

APTIM
5050 Section Avenue
Cincinnati, Ohio 45212

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Legend

- WPAFB Building with Building Numbers
- Restoration Site (Access and Restriction Area)
- Operable Unit (OU) Boundary
- WPAFB Base Boundary
- Fence

N

0 200 400 800
Feet

Source: WPAFB Land Use Control Plan (Labat, 2012)

G:\WPAFB\GIS_Documents\Project_Maps\501363.03000000\WPAFB_5yrROD_07-4_41_NA_Sites_E_AreaA.mxd; Analyst: ; Date: 10/2/2019 9:18:57 AM

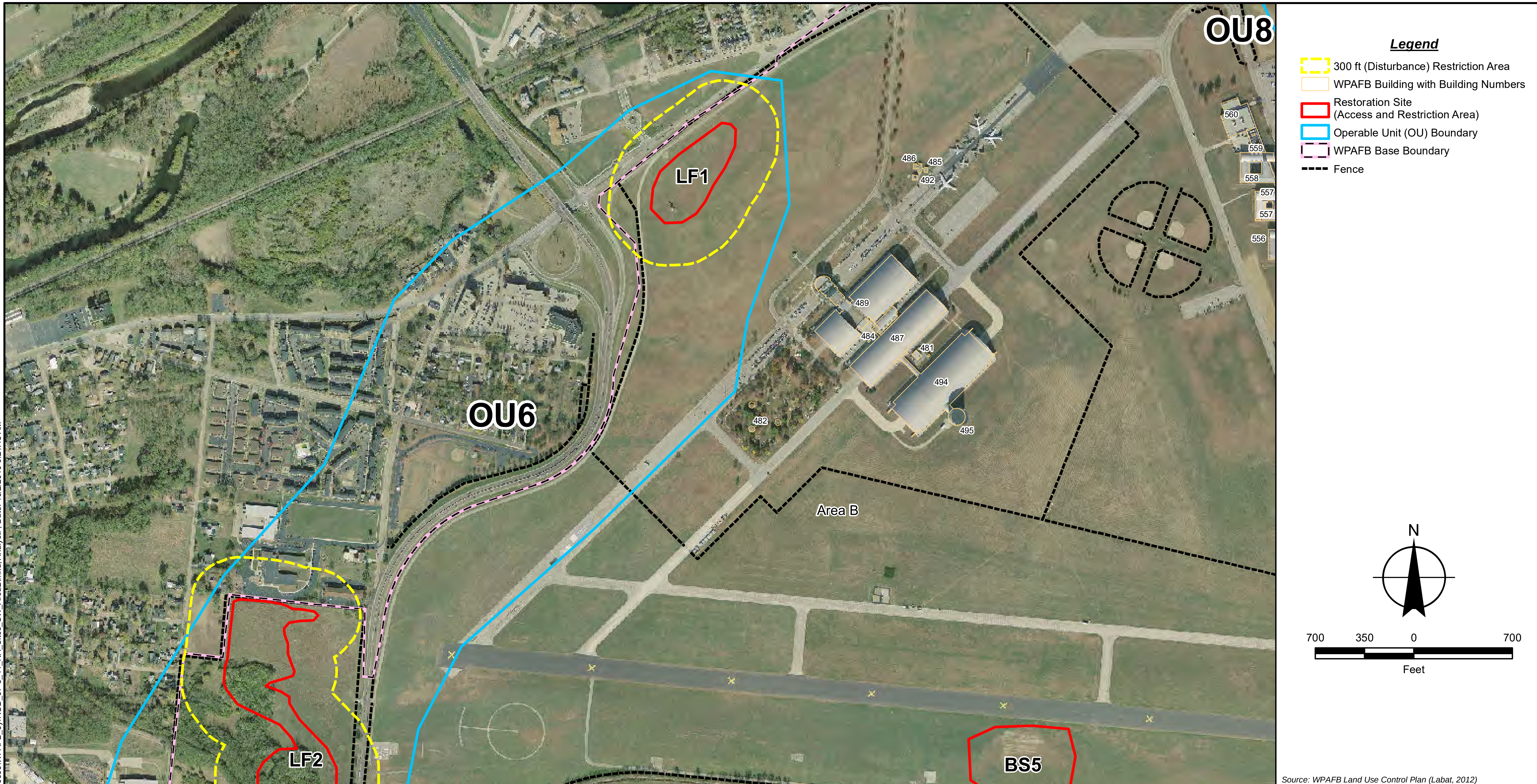
WRIGHT-PATTERSON AIR FORCE BASE, OHIO

FIFTH FIVE-YEAR ROD REVIEW

FIGURE NUMBER 7-4

Location of 41 NA Sites, East Area A

APTIM
5050 Section Avenue
Cincinnati, Ohio 45212



Source: WPAFB Land Use Control Plan (Labat, 2012)

WRIGHT-PATTERSON
AIR FORCE BASE,
OHIO

FIFTH FIVE-YEAR ROD REVIEW

FIGURE NUMBER
7-5

Location of 41 NA Sites, Southwest Area B

APTIM

APTIM
5050 Section Avenue
Cincinnati, Ohio 45212

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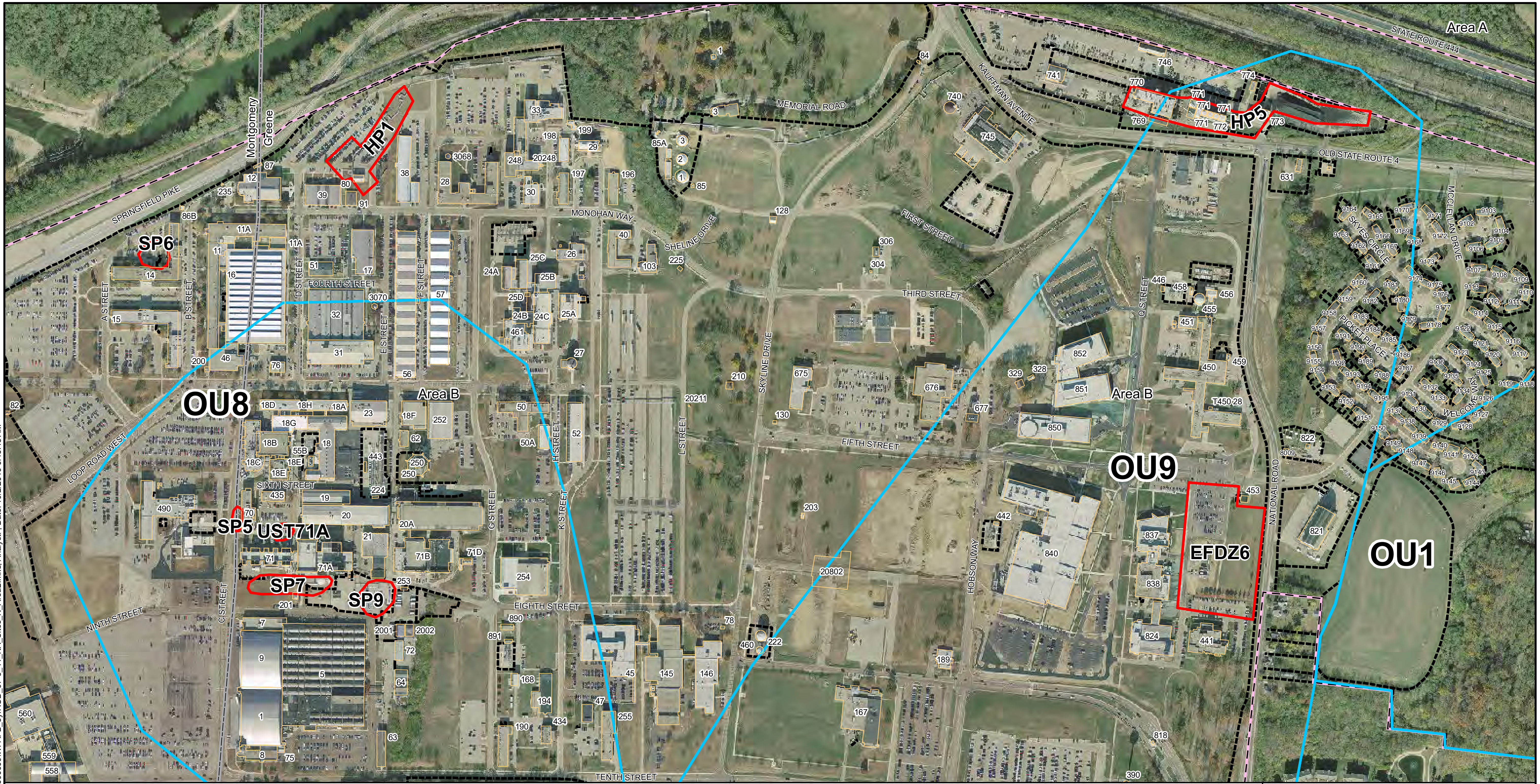

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Legend

- WPAFB Building with Building Numbers
- Restoration Site (Access and Restriction Area)
- Operable Unit (OU) Boundary
- WPAFB Base Boundary
- County Boundary
- Fence

Source: WPAFB Land Use Control Plan (Labat, 2012)

N

500 250 0 500

Feet

WRIGHT-PATTERSON
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OHIO

FIFTH FIVE-YEAR ROD REVIEW

FIGURE NUMBER
7-6

Location of 41 NA Sites, North Area B

APTIM

APTIM
5050 Section Avenue
Cincinnati, Ohio 45212

FIGURE NUMBER 7-7

Location of 41 NA Sites, South Area B

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8.0 Five-Year Review for the Groundwater Operable Unit

The GWOU ROD (WPAFB, 1999) addresses the remedial action for groundwater, surface water, and sediment at WPAFB. The GWOU ROD also addresses areas affected by off-site migration of contaminants from WPAFB. The GWOU ROD does not include unsaturated soils at the identified OUs and the individual IRP sites within the OUs. This media was addressed in previous RODs as discussed in **Chapters 3** through **7**. The GWOU is monitored under the LTM Program.

The objective of this five-year review is to determine if the remedial actions implemented for the GWOU currently remain protective of human health and the environment and for the foreseeable future. LTM groundwater data for those IRP sites previously presented and evaluated in their associated RODs will be summarized in this section to provide a complete review of the GWOU.

WPAFB is not scheduled for closure under the Base Realignment and Closure Program; therefore, land uses are expected to remain as noted in the individual RODs, the LUCIP (TetraTech, 2019) and the Installation Development Plan (WPAFB, 2014). In the future, if portions of WPAFB are sold for residential development, for example, the appropriate land use would need to be evaluated for those specific applications.

8.1 Background

As part of the IRP, WPAFB grouped 68 individual sites into 11 geographically based source OUs. Groundwater, surface water, and sediment contaminants from each of the 11 OUs, and groundwater contaminants that are not attributable to a known source on the Base, were combined to form the GWOU for restoration activities under the BMP. The GWOU was created by combining sites OT069 (Area A groundwater) and OT070 (Area B groundwater) and includes surface water and sediment. The Final Site Specific Work Plan for Remedial Design Tasks (IT, 1995a) presented a conceptual model of the GWOU and defined the boundaries of the GWOU as follows:

- Upper boundary – the water table surface (including the vertical zone of seasonal water table fluctuations)
- Lower boundary – first occurrence of bedrock at the base of the alluvial aquifer
- Horizontal boundaries – within the confines of WPAFB and areas affected by off-site migration of contaminants from WPAFB.

The GWOU definition includes the following four important points:

i. The GWOU is limited to the coarse-grained glaciofluvial deposits known collectively as the Great Miami Buried-Valley Aquifer System. This aquifer system has been designated a sole-source aquifer as defined under Section 1424(e) of the SDWA. The lower vertical boundary of the GWOU is represented by the area limestone and shale bedrock. The bedrock is not considered a viable aquifer. Therefore, the bedrock does not represent a viable mechanism for contaminant transport or exposure to receptors.

ii. The upper vertical boundary of the GWOU is represented by the water table surface. Surface water, however, is also included in the GWOU primarily because it presents similar issues to groundwater in the geographic OU strategy.

iii. The GWOU does not include unsaturated soils within current IRP site boundaries.

iv. The horizontal boundaries of the GWOU are limited to the confines of WPAFB and areas affected by off-site migration of contaminants from WPAFB.

A chronology of important and relevant dates for the GWOU is provided in **Table 8-1**. Current photographs of the applicable sites are presented in **Appendix B**.

8.1.1 History of Contamination

Investigations conducted at the source OUs (presented in previous sections of this report) indicate the presence of groundwater contaminants in various locations throughout the Base. These contaminants, primarily VOCs, occur both as definable plumes and as isolated occurrences.

Perchlorate

In January 2009, subsequent to the issuance of the six RODs for WPAFB, the USEPA issued an interim HAL for perchlorate (an oxidizer) which is still in effect (USEPA, 2018). Similarly, USEPA's Office of Land and Emergency Management recommended a PRG (15 μg/L) for perchlorate at Superfund sites where there is an actual or potential drinking water exposure pathway and where no ARARs exist under federal or state laws (USEPA, 2009). In February 2011, USEPA determined that perchlorate met the SDWA criteria for regulation as a contaminant. Under the rulemaking process, an MCL and MCLG were derived. National Primary Drinking Water Regulations for perchlorate were announced in the Federal Register on June 26, 2019. The USEPA issued its Final Action on perchlorate on July 21, 2020 (85 Federal Register 43990) and is making a final determination not to regulate perchlorate. The following investigations related to perchlorate have been conducted at WPAFB:

- Former Building 79/95 Complex – The former Building 79/95 Complex in Area B (**Figure 2-3**) was a rocket test facility that was identified as an area of concern in May 1999 after TCE was detected in a drainage pipe water sample at a concentration of 19 µg/L. A PA and phased SI were conducted from 2000 - 2002. During the SI, surface and subsurface soil, sediments from the site storm sewer system, groundwater, and surface water were analyzed for perchlorate but it was not detected in any media.

- Drinking Water – In 2006, seven of seven samples detected perchlorate from 0.21 to 0.5 µg/L. Prior to 2007, 6 of 24 samples detected perchlorate from 0.24 to 0.52 µg/L. Because all samples were below the USEPA and DoD PRG of 15 µg/L, no further action was necessary (DENIX, 2016).

Perchlorate use or disposal is not known to have occurred at the other sites at WPAFB, including those listed in the SCOU and OSOU RODs, the 21 NA Sites ROD, the 41 NA Sites ROD, or Spill Sites 2, 3, and 10.

PFOS/PFOA

As noted in **Section 2.6.2**, PFOS and PFOA are man-made chemicals that are included in the per- and polyfluoroalkyl substances group. These chemicals have been manufactured and used in a variety of industries around the globe, including in the United States since the 1940s. PFOS and PFOA have been the most extensively produced and studied of these chemicals. In 1970, the USAF began using AFFF, firefighting agents containing PFOS and PFOA, to extinguish petroleum fires. Releases of AFFF to the environment routinely occur during fire training and equipment maintenance, storage, and use. Both chemicals are very persistent in the environment and in the human body, meaning they don't break down and they can accumulate over time. WPAFB has reportedly removed all long-chain AFFF from its inventory and has replaced it with formulations based on shorter carbon chains, which may be less persistent and bioaccumulative in the environment (Aerostar, 2018).

In May 2016 the USEPA established a drinking water HAL for PFOS and PFOA (and in combination) of 70 ppt, or 0.070 µg/L, or 70 nanograms per liter (ng/L) (USEPA, 2016). According to the USEPA, the HAL for PFOA and PFOS offers a margin of protection throughout a person's life from adverse health effects resulting from exposure to PFOS and PFOA in drinking water. No other perfluorinated compounds have HALs. The following documents were issued for PFOS/PFOA investigations conducted under the LTM Program and the GWOU:

- Revised Technical Memorandum, Perfluorinated Compounds Sampling, June 2016 (Versar, 2016)
- Quarterly Perfluorinated Compounds Long-Term Groundwater Monitoring Summary Report (APTIM, 2019a).

A complete chronology of events related to the management, investigation, and remediation of PFOS/PFOA impacted media at WPAFB is presented in **Section 2.6.2**.

8.1.2 Initial Response

Initial response actions were conducted at many source OUs to prevent migration of contaminants to groundwater. A discussion of initial response actions at the sites within the source OUs are provided in **Chapters 3** through **7**. Other than LFs 8 and 10 (**Chapters 3** and **4**), the only site with an active groundwater extraction and treatment system is FAA-A, the area downgradient (southwest) of LF5/OU5 (**Figure 8-1**).

The following sections discuss the initial response actions at FAA-A and FAA-B.

Further Action Area A

FAA-A is defined as the region extending from approximately the eastern boundary of LF5/OU5, across the Miami Conservancy District (MCD)/Huffman Reserve property, to the Huffman Dam Wellfield, west of Huffman Dam (**Figure 8-1**). This area covers approximately 155 acres. Groundwater through portions of this area is contaminated with the VOCs TCE, PCE, and VC. The plumes of these contaminants were delineated during the OU5 RI (IT, 1995b) and the continuing LTM Program.

In 1991 extraction well EW-1 was installed at the western boundary of LF5/OU5 to control groundwater flow and intercept contaminated groundwater, prior to it leaving WPAFB. Groundwater extracted by EW-1 was treated for removal of VOCs using a temporary packed-tower air stripper (TAS). The treated groundwater is discharged to the Mad River or West (Lower) Twin Lake.

In July 1992 a more permanent aeration tank and GWTS was installed and designated as the primary system replacing the TAS. The TAS was consigned as the backup system. Groundwater is extracted via a single pump in EW-1 with a design pumping rate of 600 to 800 gallons per minute (gpm). The resultant capture zone across the western boundary of LF5/OU5 prevents contaminants from migrating off site per the GWOU ROD.

In December 2015, a new replacement GWTS was placed in operation. The new GWTS is a sliding tray air stripper type that has fewer components, is more efficient, and is less expensive to operate than the previous GWTS. The new GWTS in combination with extraction well EW-1 continues to provide hydraulic containment along the southwest boundary of LF5/OU5. A Memo to Site File was approved by the OEPA in July 2020 for the “Replacement of Groundwater Treatment System (GWTS) Air Stripper at OT059 for the Groundwater Operable Unit Record of Decision”.

Prior to the startup of EW-1 in 1991, investigations determined that VOC contamination had migrated across the WPAFB property boundary and on to MCD property. Due to the contaminant migration toward City of Dayton wells, to address any off-site migration, WPAFB agreed to pay the City of Dayton $1.86 million to install and operate air strippers at Huffman Dam per the Memorandum of Agreement Between the City of Dayton, Ohio and the United States Air Force (June, 1994). City of Dayton production wells P-65 and P-71 are located downgradient of the FAA-A TCE plume and would likely intercept groundwater not within the capture zone of EW-1. Groundwater extracted from these two wells is treated via air stripping by the City of Dayton. This system, operated by the City of Dayton, is independent of WPAFB efforts at controlling further migration of the plume. Historical analytical data from the City of Dayton indicates that groundwater has not exceeded an MCL at the Huffman Dam production wells since September 1995 (TCE at 5.3 µg/L in well PW-65).

Further Action Area B

FAA-B is located in Area B, at the intersection of G and 10th Streets, and due east of SP11 (**Figure 8-2**). Included within FAA-B is Facility 92, a concrete-paved, covered, and fenced active drum storage area. The area was originally identified during the OU8 RI (CH2M HILL, 1997b) when VC was detected in the groundwater upgradient (east) of SP11 and the Aircraft Survivability Test Range. The area was named FAA-B in the Engineering Evaluation/Cost Analysis (EE/CA) (IT, 1999a).

FAA-B was further investigated in 1996 during the BMP field activities to fill data gaps. The BMP investigation showed VC to be present in groundwater above the MCL, with a maximum detected concentration of 200 µg/L. The plume was estimated to be approximately 400 ft long by 200 ft wide, and extended from the water table to near the bedrock surface at a depth of approximately 33 ft. Bedrock in this area occurs at depths ranging from 20 to 36 ft bgs and is overlain by clay and silt-rich till with some discontinuous sand and gravel stringers. The soils in the upland areas of Area B have been classified as aquifer “Layer 1” in the “Hill” area. Characteristics of these soils include hydraulic conductivities that range from 0.0003 to 0.2 ft per day and are considered zones of low groundwater flow (IT, 1997d). The unconsolidated material pinches-out as the bedrock rises to the east from SP11.

A pilot-scale treatability test was conducted at this site as described in **Section 8.2.3.2**. No other initial response actions were conducted.

Former Building 79/95 Complex

Groundwater monitoring at the former Building 79/95 Complex falls under the LTM Program as required by the GWOU ROD. The selected remedy for the GWOU ROD is monitored natural attenuation; however, to treat the downgradient edge of the TCE plume, an emulsified vegetable oil injection pilot test was conducted in November 2014 immediately upgradient of well B79C/D-MW01. A Pilot Study Report was prepared and submitted to the regulatory agencies (QEPI, 2016). Following the pilot study, concentrations of TCE in well B79C/D-MW01 decreased to below detection levels and the TCE breakdown product, VC, increased to over the MCL (2 µg/L). Currently (spring 2019), the concentration of VC is 4.0 µg/L. The area downgradient of well B79C/D-MW01 is monitored by well B79C/D-MW06, and VC is below the detection level (see **Section 8.4.4.1**).

Former Building 59 Complex

Groundwater monitoring at the former Building 59 Complex falls under the LTM Program as required by the GWOU ROD. The former Building 59 Complex was identified as an area of concern and an SI was conducted in 1998. In June 2005, a permanganate injection pilot study was conducted at the TCE hot spot in bedrock well B59-MW02, located at the northeastern corner of the complex footprint. Following the pilot study, concentrations of TCE in well B59-MW02 decreased from 4,000 µg/L to a current (spring 2019) concentration of 466 µg/L. Concentrations of VC, however, increased from 50 µg/L to 297 µg/L (see **Section 8.4.4.1**).

8.1.3 Basis for Taking Action

The basis for taking action at the GWOU was due to the presence of hazardous substances that may present an imminent and substantial endangerment to public health, welfare, or the environment, if the response action selected in the ROD was not implemented. During the risk assessment for the GWOU, some VOCs were identified as COCs, and are listed in **Table 8-2**. The risk assessment, based on a current exposure scenario, indicated that in several areas the carcinogenic risk for COCs exceeds 1×10^{-4} and non-carcinogenic risk exceeded an HI of 1. A detailed discussion of the risk associated with exposure to contaminants in the GWOU can be found in the GWOU ROD, Current Conditions Human Health Risk Assessment (CCRA) (IT, 1997d), and the Future Conditions Human Health Risk Assessment (FCRA) (IT, 1998b).

8.2 Remedial Actions

8.2.1 Remedy Selection

The remedial actions implemented for the GWOU address the principal threats to groundwater at WPAFB by treating the most highly contaminated areas of groundwater and those areas of contaminated groundwater most likely to migrate off-site. The GWOU ROD does not include unsaturated soils at the identified OUs and the individual sites within the OUs. This media was addressed in previous RODs as discussed in **Chapters 3** through **7**. The ROD for the GWOU is the sixth for sites at WPAFB.

The selected remedy for the GWOU is:

- Continue current groundwater extraction, treatment and discharge at the WPAFB property boundary in OU5 and continue LTM in this area. This area has been termed FAA-A.
- Perform in-situ chemical oxidation and monitoring in the area near SP11. This area has been termed FAA-B.
- Perform LTM for the remainder of the GWOU; the areas to be monitored are:
  - Areas that exceed MCLs for organic COCs, but do not exceed the target risk range of $1x10^{-4}$ to $1x10^{-6}$.
  - Areas that exceed a cumulative cancer risk of $1x10^{-4}$ or an HI of 1 for organic COCs but do not exceed MCLs.
  - Areas exceeding remediation goals (RGs) (MCLs or background) for inorganic COCs.
  - Areas with existing remedies in place (OU1 and the spill sites at OU2).
- Implement access restrictions to limit access to groundwater. The bulk of the GWOU is located within an active military installation with limited access. This access restriction is applicable to the installation of private wells and new public water supply well fields. Public water supply wells will require approval from the State of Ohio prior to installation. WPAFB, as an active military installation, will control the installation of private wells.
- No Action for surface water and sediment. Surface water will continue to be monitored in accordance with WPAFB’s NPDES permit for stormwater.

8.2.2 GWOU Remedial Action Objectives

The following RAOs were developed to mitigate the risks posed to human health and the environment:

- Return useable groundwater to its beneficial use within a reasonable timeframe.
- Prevent off-site migration and ingestion of inorganic COCs in groundwater that exceed the RG.
- Prevent off-site migration and ingestion of organic COCs in groundwater that exceed the RG.
- Monitor groundwater areas that exhibit sporadic (spatial or temporal) exceedances of the RG.

(Note that the GWOU ROD RAOs do not include a requirement to capture or remediate past contamination that has already migrated off-site [i.e., FAA-A]. Rather, Section 9.1 of the Decision Summary of the GWOU ROD states that, “Alternative A1 [groundwater extraction, treatment and discharge] will provide long-term effectiveness and permanence. Monitoring data from the current groundwater extraction and treatment system indicates that extraction of groundwater at EW-1 has been effective in controlling further off-site migration and that the treatment system is capable of treating the groundwater successfully. Alternative A1 will require long-term operation, maintenance, and monitoring, as the timeframe for achieving remedial objectives is approximately 60 to 90 years.”)

The RG for inorganic COCs is the MCL or background, whichever is greater. The RG for inorganic COCs that do not have an MCL is the background concentration. The RG for organic COCs is the MCL. If the COC does not have an MCL, the RG will be a cancer risk of $1x10^{-4}$ or a HQ of 1. In addition, if the cumulative risk posed by multiple organic COCs exceeds a cancer risk of $1x10^{-4}$, or an HI of 1, the RG will be cumulative cancer risk of $1x10^{-4}$, or an HI of 1, whichever is lower.

8.2.3 Remedy Implementation

The selected remedy for the GWOU includes the continued operation of well EW-1 and the GWTS at OU5 (FAA-A), in situ chemical oxidation at FAA-B, and LTM of natural attenuation at other sites with VOC COCs. A description of the GWTS is provided in Section 10.1 Remedy Description for FAA-A for the ROD. In addition, the GWOU ROD recommended oxidation pilot tests at FAA-A and FAA-B to determine the effectiveness of in situ treatment for reducing the time necessary to achieve RAOs. Descriptions of the remedial actions and the LTM Program are provided in the following sections.

WPAFB and the City of Dayton entered a Memorandum of Agreement (MOA) in 1994 under 10 U.S. Code Section 2701(d), which authorizes reimbursement agreements with local agencies for the purpose of identifying, investigating, and cleanup of any off-site contamination resulting from the release of a hazardous substance or waste at a facility under the jurisdiction of the Secretary of Defense. The MOA was entered for the purpose of “alleviating off-site contamination possibly resulting from the release of hazardous substances at Wright-Patterson Air Force Base” and stated that the City of Dayton shall be solely responsible for seeking and obtaining all necessary approvals required from OEPA to allow for the installation and operation of the treatment facility (three air strippers) and reimbursement of expenses from the Air Force. The MOA (USAF, 1994) was implemented prior to the signing of the GWOU ROD (WPAFB, 1999), and treatment of groundwater by the end user is not a component of the ongoing selected remedy for FAA-A specified in the GWOU ROD. A Memorandum to Site File has been prepared for the MOA between the City of Dayton and USAF and is currently being reviewed by the regulatory agencies.

In addition, WPAFB has entered into a Land Use Agreement with the MCD to allow limited access for well monitoring, maintenance, and other issues related to maintaining the remedy for FAA-A.

8.2.3.1 FAA-A Remedy Implementation

EW-1 has been capturing and the GWTS and TAS have been treating contaminated water since 1991. The remedy for FAA-A was to continue the groundwater extraction/treatment/discharge and to evaluate an in situ remediation technique (chemical oxidation) to potentially reduce the time necessary to achieve the RAOs.

In 2000 a pilot test was conducted to determine the effectiveness of using potassium permanganate to reduce time required to achieve RAOs. While the technology was determined to be potentially effective, the cost/benefit of implementation was not favorable. For a complete presentation of the test, please see the Final Report, Further Action Area-A Treatability Tests, WPAFB, Groundwater Basewide Monitoring Program (IT, 2001a).

8.2.3.2 FAA-B Remedy Implementation

In fall 1999, a baseline characterization was performed to better define the nature and extent of contamination. A pilot-scale treatability test was then conducted in October 1999 to test the effectiveness of three in situ remedial techniques (Fenton’s reagent, potassium permanganate, and hydrogen injection) to remediate the contaminants found in the subsurface of FAA-B. The baseline characterization showed that the contamination in groundwater in the area is limited to areas of soil contamination, that the hydraulic conductivity of the soil is low, and that migration of contaminants is limited to a few sand lenses in the area. Full-scale treatment, as presented in the ROD, was not implemented because the technologies tested were limited by the ability to deliver the reagents and the uptake of reagents by the natural organic material in the soil.

On October 24, 2000, WPAFB excavated approximately 200 cubic yards of contaminated soil as a source removal measure. The remedy also includes groundwater monitoring, which is conducted under the LTM.

This removal action was not memorialized in a decision document reviewed and approved by the regulatory agencies. Accordingly, a Memo to Site File or ESD will be prepared to address the change in remedy.

8.2.3.3 Implementation of the Long-Term Monitoring Program

The LTM Program for the GWOU began in spring 1998 under the BMP in accordance with the MW network and analysis recommendations presented in the BMP EE/CA, Appendix A: BMP Groundwater Monitoring Plan (IT, 1999a). Field activities were conducted in accordance with the Site-Specific Work Plan for Remedial Design Tasks for the BMP (IT, 1995a), and the IRP Project Work Plan (ES, 1991).

The baseline LTM data set is used to evaluate trends in the organic COCs in groundwater at sampling locations throughout WPAFB. Per the approved recommendations presented in the RPO of the GWOU ROD (Shaw, 2009a), groundwater monitoring for inorganic parameters under the LTM Program has been discontinued with the last sampling event occurring in the spring 2011. The current groundwater monitoring network for the LTM Program is presented in **Table 8-3**.

The objectives of the LTM Program are:

- Provide data to monitor past detections of inorganic COCs above the MCLs at WPAFB that do not appear to form congruent contaminant plumes. This action is completed per the RPO of the GWOU (Shaw, 2009a); as noted above, inorganic COCs monitoring is no longer conducted under the LTM Program.
- Provide data to monitor areas of groundwater at WPAFB that exceed MCLs for VOCs. This now includes the former Building 59 and former Building 79/95 Complexes in Area B.
- Provide monitoring to verify progress of ongoing remedial efforts in accordance with the RODs at OU1 and OU2.
- Provide monitoring data in accordance with the recommended action for FAA-A (OU5 off-site plume) to evaluate the progress of the selected remedy. Monitoring data to be evaluated includes groundwater level elevations for determining the capture zone of extraction well EW-1, and analytical data for evaluating potential plume migration and contaminant trends.
- Provide monitoring data in accordance with the recommended action for FAA-B to evaluate the effects of the pilot test on 1998 conditions.
- Provide monitoring data to determine whether attenuation processes have reduced VOC concentrations since initial RI data was collected at OUs 3, 4, 8, 9 and 10. This monitoring was conducted at locations that are not associated with existing remedial actions or remedial actions proposed in the EE/CA.

The baseline LTM data will be compared to historic data collected during the RIs and other site investigation activities.

8.2.4 System O&M

8.2.4.1 OU5 and OU5 Off-Site Plume (FAA-A)

As noted in **Section 8.1.2**, The new GWTS replaced the old GWTS in December 2015 and is the only operating remedial action monitored under the GWOU. In addition, quarterly LTM of the OU5 monitoring network is conducted under the LTM Program to verify hydraulic containment.

Routine O&M activities include monitoring the following:

- GWTS influent and effluent
- EW-1 daily flow rate.

A programmable logic (PLC) controller monitors process sensors for control of the air stripper system, to record (i.e., datalog) operating data, and report alarm conditions vial email and text messages to O&M personnel. The PLC continuously monitors the operating status of the GWTS and informs O&M personnel if an operating parameter is out of range and maintenance is required. The PLC provides remote viewing of GWTS operations and the ability to remotely start up and shut down the system.

Typical O&M activities associated with the GWTS consists of conducting daily, weekly, monthly, and quarterly inspections. Specific O&M tasks and repairs completed over the past five years include:

- Installed backflow preventers at the TAS and the GWTS
- Installed clean air stripper trays
- Performed routine O&M on the pumps and blowers in accordance with manufacturer's recommendations, remove sand from sump.
- Cleaned the EW-1 well screen using a bore blast cleaning method
- Repaired discharge pipeline
- Repaired PLC system
- Rehabilitated, redeveloped, and video logged well EW-1.

Results from the O&M sampling and maintenance tasks are presented in the Monthly Operating Reports for the GWTS.

8.2.4.2 FAA-B

O&M activities at FAA-B consist of LTM under the LTM Program.

8.2.4.3 Remainder of the GWOU

MWs in the LTM Program do not have an ongoing maintenance program but are repaired on an as-needed basis. Typical repairs or refurbishing to the GWOU MWs and dedicated pumps consist of the following tasks:

- Repair well pads
- Replace damaged flush-mounted well vaults
- Replace damaged above-ground well casings
- Replace or restamp worn brass surveys/identification markers
- Remove tree and brush
- Replace or repair damaged pumps
- Replace tubing
- Redevelop wells
- Paint the MW casings.

8.3 Progress Since the Last Five-Year Review

Recommendations for the GWOU presented in the previous Five-Year Review (WPAFB, 2016a) included:

- FAA-A
    - Prepare a Memo to Site File to the GWOU ROD to include the MOA between the City of Dayton and the USAF concerning the purchase, and operation and maintenance of three air stripper systems located downgradient of FAA-A.
    - Conduct additional investigations in the FAA-A area to address the presence of TCE concentrations downgradient of monitoring well CW10-055
    - Replace the GWTS with a more sustainable and cost-effective system.
    - Continue to monitor well OU5/MCD-MW2.

- Former Building 79/95 – conduct monitoring the continuing elevated concentrations of TCE in groundwater

The following section discusses the progress made on these recommendations.

FAA-A

The following is a summary of the completed tasks and progress at FAA-A, including the GWTS, since the last Five-Year Review:

- GWTS replacement. The new system consists of a multi-tray air stripper housed in a pre-engineered treatment building located within the existing concrete containment area. The new GWTS was brought on-line in December 2015.

- Memo to Site for the Replacement of GWTS Air Stripper at OT059 for the GWOU ROD; approved by the OEPA in July 2020.

- FAA-A Site Evaluation Technical Memorandum (CB&I, 2016). This report evaluated the results of the FAA-A field investigation activities that included completing three soil borings and the installing monitoring well OU5/MCD-MW02. The report recommended the installation of two additional downgradient monitoring wells to further define the TCE plume at the Mad River.

- Groundwater Investigation Report, Miami Conservancy District - OU5 (CB&I, 2017a). This report presented the results of the additional well installations recommended in the FAA-A Site Evaluation Technical Memorandum to fill data gaps in the TCE plume on MCD property downgradient of OU5. Analytical results indicate that the FAA-A TCE plume extends west and beneath the Mad River at concentrations that are now below the MCL.

- Memo to Site File for the GWOU ROD: City of Dayton Memorandum of Agreement (CB&I, 2017b). This document memorializes the MOA between the City of Dayton and the AF that was signed in June 1994. With the MOA, the AF agreed to compensate the City of Dayton for the construction and O&M of a treatment facility for the treatment of groundwater contamination that may have resulted from the release of hazardous substances at WPAFB. The City of Dayton groundwater treatment facility (air strippers) is solely for the purpose of treating groundwater that had migrated across the WPAFB facility boundary and onto MCD property prior to the activation of extraction well EW-1 in December 1991 and is not a component of the GWOU ROD selected remedy. However, due to concerns over the potential migration of emerging contaminants PFOS/PFOA from the vicinity of the WPAFB boundary, the City of Dayton shut down the Huffman Dam Wellfield in the fall of 2016. Since that time the City of Dayton, has operated the wellfield intermittently at an average volume of 3 MG per week (300 gpm). The primary pumping wells that alternate operation continue to be wells PW65, PW66, and PW71, which discharge to the on-site air strippers for treatment. The Memo to Site File is currently in review by the regulatory agencies.

Former Building 79/95

Groundwater monitoring continued in this area under the LTM Program; **Section 8.4.4.1** presents a summary of the results.

GWOU

As recommended in the Fourth Five-Year Review, a comprehensive evaluation of the Long-term Groundwater Monitoring Report: 2015 was conducted to evaluate the fall 2015 data that were omitted from the GWOU ROD review due to the December 2015 review completion date. The fall monitoring well set for the GWOU are only those 28 wells that are sampled semiannually (spring and fall) and does not include OU1 wells. The fall 2015 LTM data are included in **Table**

8-4. In reviewing the 2015 groundwater data set in the Annual LTM Report: 2015 (CB&I, 2015 - 2016) the following trends were determined:

- TCE concentrations in FAA-A well OU5/MCD-MW02 decreased from 36 µg/L in spring 2015 to 27 µg/L in fall 2015
- PCE concentrations in OU10 well OU10-MW-25S increased from 5.0 µg/L in spring 2015 to 6.4 µg/L in fall 2015
- Due to the oxidant injection into the TCE plume at the former Building 79/95 Complex (November 2014), the VC concentration in well B79C/D-MW01 increased from 0.65 µg/L in spring 2015 to 3.4 µg/L in fall 2015
- The VC concentration in the former Building 79/95 Complex well B79C/D-MW01 increased from 12 µg/L in spring 2015 to 16 µg/L in fall 2015
- The fall 2015 VOC concentrations in the remainder of the GWOU monitoring well network were consistent with the spring 2015 and historic data.

8.4 Five-Year Review Process

The five-year review was completed following USEPA's Comprehensive Five-Year Review Guidance (USEPA, 2001, 2012a). This section provides a summary of the process used for the five-year review for the GWOU ROD.

8.4.1 Administrative Components

The five-year review process was initiated by the WPAFB IRP AFCEC/CZO. The five-year review process is managed by AFCEC with regulatory oversight by USEPA and OEPA. The review schedule was established by the review team and included the following components:

- Community Involvement
- Document Review
- Data Review
- Site Inspection
- Deed Review
- Five-year Review Report Development and Review.

8.4.2 Community Involvement

The USEPA's OSWER guidance requirements for five year reviews specifies a draft public notice of initiation of the review should be published initially identifying to the community that a five-year review will be conducted. An initiation notice was published in the Dayton Daily News legal section on June 4, 2020, notifying the community that the Fifth Five-Year Review for WPAFB is currently being conducted. The initiation notice was posted at the following online link: https://classifieds.daytondailynews.com/ads/public-notices/legal-notice/notice-of-initiation-of-the-five-year-record-626812.

After USEPA and OEPA concur on the final CERCLA Five-Year Review Report, a notice for formal public review will be placed in the Dayton Daily News. A copy of the Report will be provided to the WPAFB RAB stakeholders and added to the Administrative Record at the WPAFB IRP office, as well as the Information Repository located at Wright State University, 3640 Colonel Glenn Highway, Dayton, Ohio.

8.4.3 Document Review

The five-year review consisted of a review of the following documents:

- Final Fourth Five-Year Record of Decision Review Report (WPAFB, 2016a)
- Record of Decision Groundwater Operable Unit Groundwater Basewide Monitoring Program (WPAFB, 1999)
- Final Report on Treatability Studies Conducted at FAA-A (IT, 2001a)
- Final Report on Treatability Studies Conducted at FAA-B (IT, 2001b)
- Annual Long-Term Groundwater Monitoring Reports (CB&I, 2015-2016; APTIM, 2017-2020)
- Internal Draft Annual Long-Term Groundwater Monitoring Report: 2019 (APTIM, 2019b).
- Monthly Operating Reports for LFs 8 & 10 (CAM, 2015-2019b)
- Monthly Operating Reports for LF5 and the GWTS (CAM, 2015-2019b)
- Quarterly System Performance Reports for O&M of LFs 1 through 7, 9, and 11, and Spill Site 11 (CAM, 2015-2019c)
- Final Remedial Process Optimization of the Groundwater Operable Unit (Shaw, 2009a)
- Memo to Site File for Monitoring, Sampling, and Reporting Revisions to the Groundwater Operable Unit, Record of Decision (Shaw, 2012)
- Revised Draft, Remedial Design Plans and Specifications (70% Design), OT059 Groundwater Treatment System, EW-1, TAS (Versar, 2015)
- FAA-A Site Evaluation Technical Memorandum (CB&I, 2016)
- Groundwater Investigation Miami Conservancy District – OU5 (CB&I, 2017a)

- Memo to Site File for the Groundwater Operable Unit Record of Decision: City of Dayton Memorandum of Agreement (CB&I, 2017b)
- Site Inspection Report of Aqueous Film Forming Foam Areas at WPAFB (Aerostar, 2018)
- Quarterly Perfluorinated Compounds LTM Summary Report (APTIM, 2019a)

8.4.4 Data Review

This section summarizes the Basewide LTM data, PFOS/PFOA data, and recommended changes to monitoring for this five-year period.

8.4.4.1 Basewide Long-Term Monitoring

The following sections discuss the analytical results from the basewide LTM sampling events dating back over the past five years. The basewide LTM Program monitoring well network consists of wells in OU2, OU3, OU4, OU10, BS5, the former Building 59 area, and the Building 79/95 Complexes, that have a history of COCs exceeding MCLs. Data are presented in the same format used in the annual LTM reports, i.e., by each OU or investigation area. The LTM data discussed here pertain to all groundwater monitored under the LTM Program, with the exception of OU1. Results of groundwater monitoring at the SCOU and affiliated with the OSOU are discussed in **Chapters 3** and **4**, respectively.

Overall, the vast majority of wells monitored under the LTM Program exhibit concentrations of VOCs that are either below their respective MCLs or are declining. VOC concentrations for the LTM Program are presented in **Table 8-4**. For the sake of brevity, the discussion presented below focuses on concentration trends for wells that have a history of VOCs above MCLs. These wells represent a minority of the wells monitored at WPAFB. In the legend of each graph, the MCL concentration is noted for the VOCs of concern.

OU5 and OU5 Off-Site Plume (FAA-A)

The LTM monitoring locations and monitoring requirements are provided in **Table 8-3**. Overall, concentrations of VOCs are declining at FAA-A. With the exception of periods of flooding, power outages, or maintenance, EW-1 has provided continuous contaminant capture and groundwater control along the WPAFB boundary since it began pumping at a flow rate ranging from approximately 0.75 million to 1 million gallons of groundwater per day since 1991. Semiannual groundwater analytical results from the LTM Program over the last 5 years indicate the following VOC concentration trends at FAA-A:

- TCE concentrations at the LF5-FAA-A boundary (**Figure 8-1**) have steadily decreased in the vicinity of extraction well EW-1 (wells HD-11 and CW05-085) **Figure 8-4**)

- TCE concentrations in well OU5/MCD-MW02 in the central portion of FAA-A TCE plume have shown a decreasing TCE trend but the concentrations remain above the MCL (5 µg/L); TCE concentrations in well MW132S in the northeastern portion of the TCE plume have shown variable results, with concentrations bouncing above and below the MCL since the beginning of this five-year period (**Figure 8-5**)

- TCE concentrations in the downgradient portion of the FAA-A TCE plume at the Mad River have been stable above the MCL at well CW10-055 (**Figure 8-6**), but have shown a decreasing trend since the fall 2017 in wells OU5/MCD-MW04 and OU5/MCD-MW05 (**Figure 8-7**)

- TCE concentrations in well MW125S located downgradient of the FAA-A TCE plume continue to be non-detect and below the MCL for this five-year period (**Figure 8-3**).

FAA-A wells exceeding the TCE MCL during this five-year period include CW05-085, CW10-055, MW132S, OU5/MCD-MW02, OU5/MCD-MW04, and OU5/MCD-MW05 (**Table 8-4**). **Figure 8-3** illustrates the distribution of TCE concentrations throughout FAA-A over the last four LTM sampling events from fall 2018 through spring 2020 (APTIM, 2017-2020). Monitoring wells OU5/MCD-MW04 and OU5/MCD-MW05 were installed during this five-year period (October 2016). Based on the decreasing TCE concentrations at the downgradient portion of the TCE plume (**Figure 8-3**), it appears that the reduction in pumping at the City of Dayton Huffman Dam Wellfield has slowed the migration of the plume. Another cause for the decrease in TCE concentrations downgradient may be a potential decrease in matrix diffusion (i.e., silt or clay lenses in the sand and gravel aquifer serve as indirect, low-level sources of contamination), which was presented as a potential VOC source in the Fourth Five-Year Review (WPAFB, 2016a). Matrix diffusion in FAA-A was characterized in a data gap investigation conducted in May 2013 and presented in Groundwater Investigation, Miami Conservancy District – OU5 Report (CB&I, 2017a). **Figures 8-4** through **8-7** show the concentrations over time for those FAA-A wells that exceeded the MCL over the past two review periods. **Figure 8-8** shows the VC concentration graphs for wells HD-13S and MW131-M, including those concentrations that exceeded the MCL (2 µg/L) during the last review period.

The chlorinated VOCs cis-1,2-DCE, trans-1,2-DCE, VC, and PCE did not exceed their respective MCLs of 70 µg/L, 100 µg/L, 2 µg/L, and 5 µg/L, respectively, in any FAA-A monitoring wells during this five-year period (**Table 8-4**). Additionally, chlorinated VOC constituents of PCE, TCE, 1,2-DCE, and VC did not exceed their respective MCLs during this five-year period in any of the seven City of Dayton production wells or monitoring wells immediately downgradient of WPAFB. Analytical results from the City of Dayton groundwater monitoring program database are included in **Appendix C** as 'detects only' tables for 2015 to 2019. The City of Dayton Water Department has been asked to inform WPAFB when it samples even when no VOCs have been detected. Data from previous investigations in FAA-A conducted by WPAFB and the City of Dayton show that fine-grain discontinuous matrix lenses of silt, clay and sand are present in the portion of the aquifer beneath FAA-A as shown in geologic cross-section A-A' (**Figure 8-9**). The cross-section of the aquifer is based on soil descriptions from numerous soil borings, and from geotechnical sample results from the 2013 data gap investigation. The low hydraulic conductivity zones of silt, clay and sand may result in variable contaminant dispersion over time. Variable dissolution of residual contamination in the form of a dissolved-phase plume in the aquifer is resulting in fluctuating TCE concentrations in groundwater samples collected from monitoring wells cross-gradient and downgradient of EW-1 over time.

FAA-B

VC is the primary COC at FAA-B and, as shown in **Table 8-4**, monitoring wells SP11-MW03 and -MW05 (added to LTM Program spring 2019) are the only FAA-B wells to exceed the VC MCL (2 µg/L). The graphs presented in **Figures 8-10** through **8-12** present the VC concentrations over time for this five-year period and the previous review period. In the current five-year period, VC concentrations in wells SP11-MW07 and SP11-MW09 have decreasing trends while wells SP11-MW03 and SP11-MW08 have slightly increasing trends. **Figure 8-13** presents the FAA-B VOC concentrations from the spring 2015 LTM Program sampling event. As shown on **Figure 8-13**, the VC plume occurs downgradient of the drum storage facility (Building 92) in Area B, an area of relatively low groundwater flow (IT, 1997d). Monitoring wells SP11-MW01 and SP11-MW02 had not exceeded the VC MCL in over five years and were removed from the LTM Program monitoring well network for the Spring 2019 sampling round and all subsequent sampling per the recommendations in the 2017 Annual LTM Report (APTIM, 2017-2020).

No other VOC COCs exceeded their respective MCLs in all wells. Studies have shown that this shallow upland till aquifer with discontinuous sand stringers does not pose a contaminant transport risk.

OU2

As shown in **Figure 8-14**, PCE concentrations in well NEA-MW27-3I remained below the MCL (5 µg/L) for this five-year period. In addition, PCE concentrations have consistently been below 4 µg/L for the past two review periods (**Table 8-4**). The PCE plume that includes well NEA-MW27-3I appears to be originating from an off-site source and is plotted with the OU10 VOC concentrations on **Figure 8-24**. TCE was non-detect (ND) for this period in this well.

OU3

TCE and total 1,2-DCE have been ND or detected at low concentrations at estimated values in OU3 wells 05-DM-123S-M (also known as GR-214) and 05-DM-123I-M (also known as GR-215) over this five-year period (**Table 8-4**).

OU4

As shown on the graphs on **Figure 8-15**, PCE was consistently detected above the MCL in wells OU4-MW-12B and 11-538-M over this five-year period. TCE has been detected at concentrations below the MCL in wells OU4-MW-02B and OU4-MW-03C (**Figure 8-16**). The PCE plume at OU4 is shown on **Figure 8-17** and has remained consistent since well 11-538-M was added to the monitoring well network in the spring 2017.

OU8

Monitoring well CW03-77 is the only well currently being monitored at OU8. VOCs (PCE and TCE) concentrations have been below the MCL at estimated values below the reporting limits (**Table 8-4**).

OU9

As shown in **Table 8-4**, the VOC COC concentrations in OU9 monitoring wells EFDZ4-MW06 and EFDZ9-M575 were ND for this reporting period.

OU10 (CHP4)

VOC COCs were not detected above an MCL in monitoring well 23-578-M (CHP4) (**Table 8-4**). LTM Program sampling in monitoring well CHP4-MW01 was discontinued beginning with the spring 2019 sampling event in accordance with the recommendations presented in the Draft Annual LTM Program Report: 2017 (APTIM, 2017-2020). The location of the CHP4 area and its proximity to the other IRP sites can be seen on **Figure 2-2**.

OU10

PCE concentrations exceeded the MCL at seven of nine OU10 sampling locations (**Table 8-4**). Concentrations of the VOC COCs over time are presented on **Figures 8-18** through **8-23**. Over this five-year period, PCE concentrations have shown increasing trends in monitoring wells LF512-MW-14 and OU10-MW-02S, OU10-MW-03S and OU10-MW-06S, OU10-MW-11D, and OU10-MW-25S (**Figures 8-18**, **8-19**, **8-20**, and **8-22**, respectively). PCE concentrations are considered stable (not significantly changing) in wells OU10-MW11S, and 23-578-M and GR-330, **Figures 8-20** and **8-23**, respectively. **Figure 8-24** shows the OU10 and OU2 (well NEA-MW-27-3I) monitoring well network locations, the spring 2019 LTM Program concentrations of PCE and TCE, and the spring 2019 isopleth contours for PCE and TCE.

Monitoring wells OU10-MW-06S and OU10-MW-15S are the only wells with TCE concentrations above the MCL during this five-year period (**Table 8-4**); TCE concentrations in OU10-MW-06S have remained stable (**Figure 8-19**) while concentrations in OU10-MW-15S had an increasing trend (**Figure 8-21**).

Former Building 79/95

Four of the six monitoring wells sampled (B79C/D-MW02 [**Figure 8-25**], B79C/D-MW03 and B79C/D-MW04 [**Figure 8-26**], and B79C/D-MW06 [**Figure 8-27**]) had TCE concentrations above the MCL during this five-year period (**Table 8-4**). The referenced figures (graphs) indicate relatively stable trends in wells B79C/D-MW02, and B79C/D-MW04, and increasing trends in wells B79C/D-MW03 and B79C/D-MW06. Monitoring well B79C/D-MW01 (**Figure 8-25**) is located near the west (downgradient) end of the site and had a TCE concentration of 50 µg/L during the October 2014 LTM sampling event. After the pilot remediation study of emulsified oil substrate injection in November 2014, TCE concentrations decreased to below 1 µg/L while vinyl chloride increased to above MCL (2 µg/L). The furthest downgradient well (B79C/D-MW07) has been ND since its installation in the fall 2013.

The spring 2019 TCE distribution at the former Building 79/95 complex and the pilot test injection points are presented on **Figure 8-28**. As seen in the figure, the TCE plume at the former Building 79/95 complex has been divided into two areas with the vicinity of monitoring well B79C/D-MW01 remediated to below the MCLs. Sampling is conducted annually at the three upgradient monitoring wells and semiannually at the three downgradient wells. Beginning with the spring 2019 LTM sampling event, sampling was discontinued at well B79C/D-MW05 (side gradient) per the recommendations in the 2017 Annual LTM Report.

BS5

Monitoring well BS5 P-1 typically has PCE concentrations below the MCL but exceeded the MCL (5 µg/L) only during the spring 2015 sampling event (**Table 8-4**). At monitoring wells BS5 P-3 and BS5 P-4 PCE concentrations continued to exceed the MCL during this five-year period. However, as shown in the graphs on **Figure 8-29**, an overall decreasing trend is shown for both wells since the fall 2010. Monitoring well BS5-P2 was abandoned in December 2012 per the RPO of the GWOU (Shaw, 2009a) and Memo to Site File: GWOU ROD (Shaw, 2012). **Figure 8-30** shows the BS5 monitoring well network locations and the distribution of PCE concentrations for the spring 2019 LTM Program sampling event.

In October 2017, OEPA conducted a SI of the Page Manor Shopping Center (OEPA, 2018). The Page Manor Shopping Center is identified on **Figure 8-30** by the two former dry cleaner locations. Results from the SI indicate that no VOC contamination above groundwater MCLs or soil gas

RSLs was detected outside of the Base boundary in the vicinity of the shopping center. However, as shown on **Figure 8-30**, a storm sewer line runs from catch basins behind the two former dry cleaners to the outfall on Lilly Creek. This outfall is upgradient of the BS5 PCE plume and is downgradient from the SI sampling locations. In addition, the elevated soil gas concentrations of PCE in a soil gas boring located upgradient (south) of the former dry cleaner at 5604 Airway Road indicates that some outside spillage and infiltration of a PCE-containing fluid has occurred in this area. In addition, OEPA has confirmed workers and patrons inside the shopping facility are protected. WPAFB will continue sampling BS5 wells in accordance with the GWOU ROD and monitoring the PCE concentration trends.

Former Building 59

Monitoring wells B59-MW02 and B59-MW03 are the only Building 59 wells sampled under the LTM Program. Until the spring 2017 LTM Program sampling event, well B59-MW02 and B59-MW03 had residual oxidant present in the groundwater and were on a 5-year sampling frequency. After multiple purgings during the spring 2017 sampling event, the residual oxidant was removed and the wells were sampled. Based on the spring 2017 sampling results, OEPA requested the Building 59 wells be sampled semiannually, beginning with the fall 2018 sampling event. The VOC COC concentrations for the three sampling events for wells B59-MW02 and B59-MW03 have not been graphed but the concentrations of cis-1,2-DCE, TCE, and VC in both wells exceed the MCLs of 70 µg/L, 5 µg/L, and 2 µg/L, respectively (**Table 8-4**). The former Building 59 Complex monitoring well locations and the VOC data for the spring 2019 LTM Program sampling event are presented on **Figure 8-31**.

LTM Analytical Results Summary

Overall, the vast majority of wells monitored under the LTM Program exhibit VOC concentrations either below their respective MCLs or have VOC concentrations that show a decreasing trend. In a few locations, VOC concentrations have been increasing or have consistently remained above their respective MCLs. These wells represent a minority of the wells monitored at WPAFB; a summary of these areas follows:

- **FAA-A.** To further delineate the downgradient boundary of the TCE plume at FAA-A, wells OU5/MCD-MW04 and OU5/MCD-MW05 were installed along opposite sides of the Mad River in October 2016 (**Figure 8-3**). The initial TCE concentrations in these wells extended the plume with concentrations above the MCL across the Mad River. However, due to a reduction in pumping from the City of Dayton Huffman Dam Wellfield due to the potential for PFOS/PFOA impacts, the downgradient TCE plume boundary above the MCL is now on the upgradient (east) side of the Mad River. According to the Mann-Kendall statistical trend analysis performed as part of the LTM Program data evaluation, the TCE trends in wells OU5/MCD-MW02, OU5/MCD-MW04, and OU5/MCD-MW05 are decreasing while the TCE trends MW132S and CW10-055 are stable (APTIM, 2019b). TCE concentration fluctuations in this area appear to be a result of matrix diffusion as discussed in the previous Five-Year Review Report (WPAFB, 2016a).

As noted in Section 8.4.4.2, quarterly groundwater PFAS sampling was conducted under the LTM Program in FAA-A (APTIM, 2019a) from June 2016 to November 2017. Over this period, a total of 16 FAA-A monitoring wells were sampled. Results from the LTM Program quarterly sampling indicate that only well CW08-085 had a combined PFOS/PFOA concentration of 75.2 ng/L that exceeded the HAL (70 ng/L) during the initial quarter (February 2017) of sampling. Combined PFOS/PFOA concentrations from the following three quarters were below the HAL.

Based on the potential for PFAS contamination to migrate over the southwestern WPAFB boundary toward the City of Dayton wellfield, additional quarterly groundwater PFAS sampling was conducted under the USACE PFAS investigation contract. The USACE quarterly PFAS sampling was conducted for six quarters from March 2018 through June 2019 at eight FAA-A monitoring wells. Results from the USACE sampling indicated that no individual or combined concentrations of PFOS/PFOA exceeded the HAL, including well CW08-085 (maximum PFOS/PFOA concentration: 30 ng/L). FAA-A was not investigated under the SI of AFFF Areas (Aerostar, 2018) or the Expanded SI of AFFF Areas (Aerostar, 2020).

- **FAA-B.** VC concentrations at FAA-B have decreased or remained stable during this five-year period as shown in the concentration graphs on **Figures 8-10** through **8-12**. From October to December 1999, WPAFB conducted treatability tests of three in-situ remedial techniques. Conclusions of the tests indicated that contaminants in the vadose zone were providing a continued source of contamination to the groundwater. Source removal was recommended and was conducted by WPAFB in 2000 and VOC concentrations in general have been decreasing since the removal. The area is located in the upland till marginal aquifer. Since completing the treatability studies in 1999, the VC plume has remained stationary at its current location (**Figure 8-13**).

- **OU4.** During this five-year period, wells 11-536-M and 11-538-M were added to the OU4 monitoring well network. The concentration of PCE in well 11-538-M was above the MCL (**Table 8-4**) and it is now sampled semiannually. Well 11-536-M had PCE concentrations below the MCL and is sampled annually. As shown on **Figure 8-15**, OU4-MW-12B has an increasing trend while well 11-538-M has a stable trend. No other VOCs or any other wells exceed an MCL.

- **OU10.** TCE concentrations within OU10 exceed the MCL at two locations (OU10-MW-06S and OU10-MW-15S). These locations, however, do not appear to be connected by a common source of TCE (**Figure 8-24**). To further delineate the PCE plume within OU10 (**Figure 8-24**), monitoring wells LF512-MW-14 and OU10-MW-02S were added to the OU10 monitoring well network during this five-year period. Both wells have PCE concentrations that exceed the MCL and are now sampled semiannually.

- **Former Building 79/95 Complex**. In October 2013 monitoring wells B79C/D-MW06 and B79C/D-MW07 were installed downgradient (west) of the TCE plume at the former

Building 79/95 Complex (**Figure 8-28**). Well B79C/D-MW06 has exceeded the MCL since it was installed and well B79C/D-MW07 has not had any VOC detections (**Table 8-4**); the downgradient extent of the TCE plume is defined. An RI is planned for fall 2020 to further delineate the site.

- **BS5.** Three monitoring wells at BS5 exceed the MCL for PCE. In October 2017 the OEPA conducted an off-site SI of two former dry cleaners at the Page Manor Shopping Center to identify the potential source of the PCE (**Figure 8-30**). As noted above, a potential source of the BS5 PCE plume may be from historic leakage or spills from off-site drycleaners.

- **Former Building 59.** The VOC contamination in groundwater at former Building 59 occurs almost exclusively in the fractured bedrock on the east side of the site (**Figure 8-31**). WPAFB is planning to conduct an RI in spring 2020 to further delineate the site.

8.4.4.2 PFOS/PFOA

An initial round of monitoring well sampling for PFOS/PFOA at WPAFB was conducted in June 2016 and included monitoring wells in Areas A and B. Results of this sampling event are presented on **Figure 8-32**. Based on the initial sampling results, an LTM well network for PFOS/PFOA was established and sampled quarterly under the LTM Program. Sampling for PFOS/PFOA continued under the LTM Program until October/November 2017, then quarterly through a USACE PFAS Investigation contract beginning with the first quarter of 2018. **Figures 8-33** through **8-35** present the last quarterly sampling results for PFBS and PFOS/PFOA for wells sampled [Note: the monitoring well networks for the two quarterly sampling programs did not monitor all the same wells]. Elevated concentrations of PFOS and PFOA were detected during the LTM sampling events in the vicinity of the OU3 FTAs 2, 3, 4, and 5 (**Figure 8-33**); OU5 downgradient of LF5 (**Figure 8-34**); and OU10 at the fire training exercise areas (i.e., hazardous material [HazMat] shipping/receiving pad #3) and downgradient of Building 60 (**Figure 8-35**). Over the 10 total quarters of sampling, (from winter 2017 through summer 2019), no seasonal trends in concentration changes were observed. For the majority of the wells where PFOS/PFOA concentrations exceeded the HAL, PFOS was of higher concentration than PFOA. The exceptions were wells CW08-085 and GR-421, where PFOA concentrations were higher than PFOS concentrations, and OU10-MW-21S, where PFOA and PFOS concentrations were approximately equal.

In addition, a basewide PFOS/PFOA SI was conducted in 2016 - 2017 and is presented in the Site Inspection Report of Aqueous Film Forming Foams Areas at WPAFB (Aerostar, 2018). Table 70 of the SI Report shows that 20 investigation areas had combined concentrations of PFOS and PFOA that exceeded the HAL. The highest combined concentration was 7.6 μg/L at AFFF Area 21, which includes FTAs 2 and 5. AFFF Area 22, which includes former FTAs 3 and 4, had a combined concentration of 0.938 µg/L. As noted in **Chapter 5**, an RI is planned to further investigate the presence of PFOS and PFOA.

8.4.4.3 Recommended Changes to Monitoring

Changes to the GWOU monitoring program are a dynamic process that occurs through submittal and review of the LTM Program annual reports. Recommendations for sampling revisions provided in the 2018 Annual LTM Report include the following:

- FAA-A: add southern TCE plume boundary well (**Figure 8-3**)
- OU10: sample existing wells side gradient of wells OU10-MW-11S & D, add new well downgradient of this well pair (**Figure 8-24**). PFOS/PFOA SI well PFC06-MW02-026 (see **Figure 8-35**) was sampled in fall 2019 (PCE = 6.8 µg/L) and spring 2020 (PCE = 5.3 µg/L)
- OU10: add well upgradient of well OU10-MW-15S (**Figure 8-24**).

8.4.5 Site Inspection

Summaries of the site inspections are included in **Table 8-5**. Field forms for the site inspections are located in **Appendix B**.

8.4.6 Interviews

The following people were interviewed regarding the status of the GWOU to determine if any additional actions or concerns had occurred:

- Mr. Justin Hall, Site Supervisor – CAM (LF5)
- Mr. Harold Honeycutt, Supervisor – CE Grounds (LF4)
- Mr. David Blair, Operations Manager – Area A Metals Recycling Center (LF4).

The results of the interviews are included in **Appendix B**. As indicated on the forms, no concerns were raised.

8.5 Technical Assessment

The primary goal of the five-year review is to determine whether the remedy at a site is protective of human health and the environment. To provide a framework for organizing and evaluating data and information, and to ensure that all relevant issues are considered when determining the protectiveness of the remedy, USEPA guidance lists three questions to consider. The questions are as follows:

Question A: Is the remedy functioning as intended by the DD?

> **Question B:** Are the exposure assumptions, toxicity data, cleanup levels and RAOs used at the time of the remedy still valid?
>
> **Question C:** Has any other information come to light that could call into question the protectiveness of the remedy?

The following sections provide responses to the questions for the GWOU.

8.5.1 Question A: Is the remedy functioning as intended by the decision documents?

The review of documents and the results of interviews with WPAFB IRP personnel indicate that the remedies for the GWOU are functioning as intended. Concentrations of VOCs in most areas monitored at WPAFB are decreasing and in many areas have decreased to below MCLs. As of the Spring 2019 LTM Program sampling event, wells at FAA-A/OU5, FAA-B, OU4, OU10, BS5, Former Building 79/95 Complex, and Former Building 59 Complex, had VOC concentrations above the MCL (**Table 8-4**). The remedies remain protective because potential exposure to contaminated groundwater is prevented through use of a public water supply, treatment, and groundwater use restrictions. In addition, potential vapor intrusion exposures at Building 73, which is located in the vicinity of the Former Building 79/95 Complex (**Figure 8-28**), are prevented by a vapor barrier in its foundation. At FAA-A/OU5, the pump and treat system located at the WPAFB boundary controls groundwater flow, prevents off-site migration and ingestion of organic COCs in groundwater that exceed the RG, and returns useable groundwater to its beneficial use. For the remainder of the GWOU, groundwater receptors are either not immediately downgradient (e.g., the FAA-B area) or groundwater is treated prior to distribution (e.g., for the FAA-A area downgradient of the WPAFB boundary).

8.5.2 Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid:

Yes, the exposure assumptions, toxicity data, cleanup levels and RAOs are still valid. Supporting documentation is provided in **Appendix A**, Section A.6. The rationale for each component of Question B is provided below.

8.5.2.1 Changes in ARARs and TBCs

Action-specific ARARs were applicable to the operation of the current GWTS. The requirements for hazardous waste management addressed the handling and disposal of spent treatment media. An RPO for the GWTS (TetraTech, et. al., 2010) was prepared in 2010 and recommended replacement of the GWTS with a more sustainable and cost-effective system. As described in **Section 8.1.2**, the updated treatment system has been installed and is operating as designed. The treated groundwater is discharged to West Twin Lake in compliance with NPDES Permit

1IN00156*FD effective October 1, 2014 (CAM, 2015-2019a). The permit expires on September 30, 2019, and is in the process of being renewed. On September 11, 2019, OEPA wrote to WPAFB indicating to continue under the existing NPDES permit until the new permit has been issued. Compliance with the NPDES requirements is documented by the third week of each month using the Electronic Discharge Monitoring Report (eDMR) process for electronic submittal of analytical data results. The eDMR submittals are a requirement in the permit.

There are no changes planned for the TAS, which will remain the backup treatment system. The TAS originally discharged treated groundwater to an outfall at the Mad River, but the underground pipeline is damaged and cannot be used. A temporary aboveground pipeline was installed for the discharge of treated groundwater from the TAS to West Twin Lake. There are no changes to action-specific ARARs that impact the short-term protectiveness of the remedy for the GWOU.

Although there have been changes to the chemical-specific ARARs and TBCs since the GWOU ROD was issued, there has been no impact on the overall short-term protectiveness of the remedies because the use of groundwater at WPAFB is restricted by ICs. These changes are reflected in the overall LTM Program, as described in the following paragraphs.

An RPO was subsequently completed for the GWOU monitoring in 2009. Recommendations from the RPO included the reduction of monitored parameters and reduction of the monitoring well network (Shaw, 2009a). These changes were approved by OEPA (September 10, 2008), and USEPA (August 31, 2009) and presented in the Memo to Site File: GWOU ROD (Shaw, 2012). As a result, metals sampling was eliminated from the LTM Program.

The compliance levels for the GWOU are shown in **Table 8-2**. It is noted that these compliance levels were originally presented in Table 1 of the GWOU ROD, but included COCs from OU1 and Spill Sites 2, 3, and 10 of OU2. The ROD for the Spill Sites has since been closed. Although the sampling and analysis for the COCs covered by all three RODs is carried out concurrently within the LTM Program, the results associated with each ROD are reported separately.

As discussed in **Section 8.4.4.1**, the majority of wells monitored under the LTM Program exhibit concentrations of VOCs that are either below their respective MCLs or are declining. The VOC concentrations for the LTM Program are presented in **Table 8-4**. For organic COCs in groundwater, the RGs for 1,2-DCE, PCE, TCE, and VC are based on MCLs, which have not changed.

As requested by USAF, 1,4-dioxane was sampled as part of the LTM Program during the previous review period. 1,4-Dioxane was detected and tracked through the LTM Program as part of the

DoD's Emerging Contaminants Program (USEPA, 2014d). 1,4-Dioxane was not detected in the April 2019 sampling round and is proposed to be deleted from subsequent sampling rounds.

In addition, limited sampling of PFOS/PFOA was conducted as part of the LTM Program from June 2016 to November 2017. As discussed in **Sections 2.6** and **8.1.1**, PFOS/PFOA are also considered emerging contaminants. While there are currently no promulgated standards for PFOS/PFOA in environmental media, the drinking water HAL for PFOS and PFOA (and in combination) of 70 ppt (0.070 µg/L or 70 ng/L) (USEPA, 2016) is a TBC value in the interim. There has been no change in the HAL since the Fourth Five-Year Review (WPAFB, 2016a) or the completion of the SI (Aerostar, 2018). In addition, USEPA applied candidate toxicity values in the derivation of the HAL. These candidate values, an RfD of 2.0E-05 mg/kg/day and a SF of 7.0E-02 $(mg/kg/day)^{-1}$ would also be considered TBCs.

Ecological risks were assessed for major surface water bodies within WPAFB (IT, 1999b). Although no further action was taken for the surface water and sediment in the GWOU, the ARARs are protective because the selected remedy includes discharge of treated water to surface water. Furthermore, there is potential for discharge of contaminated groundwater to surface water via hydraulic connections.

Many of the criteria for surface water and sediment are more stringent than the values presented in the EE/CA for the GWOU (IT, 1999a). Similarly, many of the benchmark values for surface water and sediment are more stringent than the benchmark values applied in the ecological risk assessment for the GWOU (IT, 1999b). Exceedances of ecological benchmarks were acknowledged in the GWOU ROD (WPAFB, 1999). The GWOU ROD concluded that the uniformity of chemical patterns throughout the base surface water systems and the lack of correlation of these patterns with the activities historically conducted within the OUs seems to imply sources present in the environment due to human activity, such as automobile or airplane exhaust, or pesticides used for agricultural purposes rather than an OU-related source. With the exception of acetone, neither surface water nor sediment was associated with solvent contamination that exceeds water quality standards. Other constituents that were found to exceed water quality standards were a variety of inorganics, phthalates, PAHs, and chlorinated pesticides. These constituents were found relatively uniformly throughout the base and are reflective of urban environments and anthropogenic activities and not generally associated with OU-related contamination. Although anthropogenic sources persist at the base (e.g., automobile and aircraft exhaust), the GWOU remedy continues to address OU-related contamination.

8.5.2.2 Changes in Land-Use and Exposure Assumptions

A CCRA was conducted to provide estimates of potential current human health risk associated with exposures to the groundwater (IT, 1997d). Potential future risk to human health (resulting from movement to groundwater) and the ecological risk assessment of surface water and sediment were evaluated in the FCRA (IT, 1998b) and in the Basewide Ecological Risk Assessment (IT, 1999b). Hypothetical exposures to groundwater by on-base residents, on-base workers, and off-base residents were evaluated in the CCRA and FCRA (IT, 1997d and 1998b) with respect to various scenarios.

As cited in the Fourth Five-Year Review (WPAFB, 2016a), there has been no change in assumptions associated with the use of groundwater at WPAFB. The hypothetical receptors that were evaluated in the risk assessment are still valid and there are no new receptors to consider.

There have been no changes to the exposure pathways that were evaluated for direct contact since the Fourth Five-Year Review (WPAFB, 2016a). USEPA also updated the default exposure factors used in the original risk assessment (USEPA, 2011a, 2014b). The USEPA's National Center for Environmental Assessment/Office of Research and Development (NCEA/ORD) issued a substantive update to its exposure assessment recommendations in September 2011 and updated the guidance for standard default exposure factors used in human health risk assessments as described in OSWER Directive 9200.1-120 in February 2014 (USEPA, 2014b). This guidance superseded and replaced portions of Interim Final Standard Exposure Factors Guidance (USEPA, 1991b) and updates Risk Assessment Guidance for Superfund, Part E, Supplemental Guidance for Dermal Risk Assessment (USEPA, 2004). The default exposure factors that have changed since the baseline HHRA and previous Five-Year Reviews are discussed in the introduction to **Appendix A** and presented in **Table A-2**. The updated factors were evaluated as part of the Fourth Five-Year Review (WPAFB, 2016a). To demonstrate the impact of these changes, risks and hazard indices were calculated using the old and the new exposure factors. Based on the evaluation (WPAFB, 2016a), most risks and hazard indices based on the 2014 exposure factors were similar or lower than those based on the previous exposure factors. The exceptions were the hazard indices for groundwater exposures by the lifetime resident, which resulted in an increase of the cumulative hazard index by 7 percent. This evaluation continues to be valid as neither the Exposure Factors Handbook (USEPA, 2011a) nor the default exposure factors (USEPA, 2014b) have changed since the last Five-Year Review (WPAFB, 2016a).

The remedies for soil and groundwater were intended to address exceedances and, therefore, remain protective. Potential exposures to groundwater associated with drinking water or other domestic purposes continue to be prevented due to restrictions on the use of groundwater. The conclusions of the original HHRA and previous Five-Year Reviews remain valid. In addition, groundwater use is restricted. Therefore, the remedy for groundwater remains short-term protective.

With regard to exposure assumptions in the baseline HHRA, guidance for inhalation risk assessment (USEPA, 2009) was issued in 2009. This guidance recommended that estimates of risk via inhalation should be based on the concentration of the chemical in air as the exposure metric (e.g., milligrams per cubic meter [mg/m^3]) rather than inhalation intake of a contaminant in air based on an inhalation rate and a body weight (e.g., mg/kg-day). The guidance regarding the exposure metrics has not changed since the Fourth Five-Year Review and the current equations used to estimate exposure concentrations for use in risk and hazard calculations reflect this approach. There have been no changes to USEPA’s 2014 standard default exposure parameters used in the inhalation risk assessment since the last review. Although collective changes to inhalation risk assessment could affect earlier conclusions, this pathway is included in the derivation of current tap water RSLs and groundwater VISLs that have been used for screening in this review. Regardless, the remedy remains short-term protective because potential exposures to groundwater associated with drinking water or other domestic purposes continue to be prevented due to restrictions on the use of groundwater.

Since the preparation of the GWOU ROD, USEPA, OEPA, DoD, and others have published guidance regarding the evaluation of vapor intrusion (USEPA, 2015; OEPA, 2020; DoD, 2009; ITRC, 2007). These guidance documents present methods for estimating potential exposures to VOCs in groundwater and soil that may migrate through building foundations via vapor intrusion. These documents remain in effect. Furthermore, since the Fourth Five-Year Review for the GWOU, the USEPA has issued recommendations for assessing deferred protectiveness at sites for vapor intrusion as a supplement to the Comprehensive Five-Year Review Guidance (USEPA, 2012b; USEPA, 2001).

As part of this current Five-Year Review, the groundwater data from the April 2019 LTM data were compared with recent VISLs based on the migration of VOCs from groundwater-to-indoor air. As further described in the introduction to **Appendix A**, these values were derived from the VISL Calculator (USEPA, 2019c), which is based on USEPA’s most recent vapor intrusion guidance. VISL exceedances that occur in areas with occupied buildings are listed in **Table 8-6**. Based on the comparisons in **Table 8-6** and **Table A-18** in **Appendix A**, PCE, TCE, and VC were detected in various monitoring wells throughout the GWOU that exceed residential and/or industrial VISLs. (It should be noted that VISLs cannot be calculated for cis-1,2-DCE and trans-1,2-DCE due to the lack of a toxicity value.) In applying USEPA’s recommended distance for initial evaluation (USEPA, 2015), the locations of monitoring wells with exceedances of industrial/commercial VISLs were mapped with respect to buildings within a 100-ft radius of these locations. This radius is based on a buffer zone of 100 ft (laterally or vertically from the “boundary” of subsurface vapor concentrations of potential concern) that has been used in determining which buildings to use in vapor intrusion investigations when significant covers are not present. As shown in the figures referenced below, these exceedances were located in the following areas:

- OU5: seven monitoring wells had VISL exceedances. Five of the monitoring wells (CW05-085, CW05-055, OU5/MCD-MW02, OU5/MCD-MW04, and OU5/MCD-MW05) are located within the MCD property, and two of the wells (MW131M and MW132S) are located in wooded areas. There are no buildings within the 100 ft radius of any of these monitoring wells (**Figure 8-3**).

- FAA-B: over this five-year period, monitoring wells (SP-11-MW03, SP11-MW05, SP11-MW07, and SP-11-MW09) exceeded the commercial VISL for VC in groundwater (2.5 μg/L). Wells SP11-MW03 and SP11-MW07 are within the 100 ft radius of Facility 92; however this is an unoccupied, open-air, drum storage facility (**Figure 8-13**).

- OU4: two monitoring wells (OU4-MW-02B and OU4-MW-12B) had VISL exceedances; these wells are located on the edge of a golf course. There are no buildings within the 100 ft radius of either monitoring well (**Figure 8-17**).

- OU10: three monitoring wells (OU10-MW-06S, OU10-MW15S, and OU10-MW19D) had VISL exceedances. There are no occupied buildings within the 100 ft radius of any of the wells (**Table 8-6** and **Figure 8-24**).

- Former Building 79/95 Complex: Several wells in the vicinity of former Buildings 79A through 79D show VISL exceedances (**Table 8-6** and **Figure 8-28**). These buildings have been demolished; however, a new Entomology Laboratory (Building 73) has been constructed in the area. A vapor intrusion investigation was performed and a vapor barrier was installed during the construction of this building; this vapor barrier acts as an engineering control for vapor intrusion. Also, an indoor air sample was taken after construction. The results were below the residential RSLs.

- Former Building 59: one monitoring well (B59-MW02) had a VISL exceedance **(Table 8-6** and **Figure 8-31**). Building 143, located adjacent to the Former Building 59 Complex, is an unmanned electrical substation.

According to these guidelines, the remedy for the GWOU is considered to be protective because data reviewed during the five-year review process indicate that the current RAOs address vapor intrusion and are being met by the remedy. Data collected and assessed show that a vapor intrusion exposure pathway does not currently exist.

Although VOCs are present in groundwater in FAA-A and FAA-B, the areas associated with these plumes are restricted from excavation and construction work. Should it become evident that VOCs are migrating toward on-site buildings or off-site residences, potential vapor intrusion would be evaluated on a site-specific basis.

An ESD was approved in 2012 to address six RODs at WPAFB including the GWOU (WPAFB, 2012). As described in the introduction to **Appendix A**, this ESD clarified the implementation of ICs for each of the RODs. The LUCIP (TetraTech, 2019), which replaced the LUC Plan (Labat, 2012), is the primary administrative mechanism employed by WPAFB to determine which IC are protective for the site and ensure that current ICs remain environmentally compatible with future land use and are properly implemented. The exposure assumptions from the original risk assessment are still valid. In addition, the vapor intrusion pathway has also been added as a potential exposure pathway. If a change in use were to be proposed, an amended risk assessment would be performed to evaluate potential exposures to groundwater associated with the GWOU.

As stated previously, ecological risks were assessed for major surface water bodies within WPAFB (IT, 1999b). The evaluation focused on comparing detected chemical concentrations to surface water and sediment quality criteria. Uses of the surface water bodies and the potential for exposure to surface water and sediment at WPAFB have not changed since the GWOU was issued.

8.5.2.3 Changes in Toxicity Values

The toxicity values were reviewed to determine whether slope factors and reference doses/concentrations that applied at the time of the remedy had changed. Several of the toxicity values that were used in the risk assessments for current and future conditions (IT, 1997d and 1998b) have changed since the GWOU ROD was issued. These changes, however, did not impact the majority of the RGs because they were based on either MCLs or background concentrations. There were no IRIS-verified toxicity values for TCE at the time the GWOU ROD was prepared (WPAFB, 1999). The final version of the Toxicological Review of Trichloroethylene was issued in September 2011 (USEPA, 2011b). The verified oral and inhalation toxicity criteria were also posted in September 2011; however, this new information does not change the conclusions of the original risk assessment for groundwater because TCE concentrations at the GWOU are ultimately compared with the MCL. In addition, groundwater is currently restricted as a drinking water source.

Risk assessment guidance documents for assessing the toxicity of specific chemicals had been updated since the ROD. Groundwater at the GWOU is not currently being used. Furthermore, these changes would not affect the decisions regarding the future use of groundwater because the compliance levels for the GWOU are based on MCLs. However, these toxicity values could potentially apply to the vapor intrusion pathway if buildings were to be constructed and occupied in the areas overlying VOC-contaminated plumes. In such cases, a site-specific risk assessment would be conducted. For inhalation exposure pathways, several toxicity criteria have been revised since the ROD. In support of the IRIS data base, USEPA has finalized toxicological reviews for 1,2-DCE, PCE and TCE and verified inhalation toxicity values accordingly (USEPA, 2010b; 2012c; 2011b, respectively). Some of the proposed values are more stringent than those used in the baseline HHRA and some are less stringent. In particular, the toxicological review for 1,2-DCE concluded that inhalation data for cis-1,2-DCE and trans-1,2-DCE were insufficient to support the derivation of inhalation toxicity values. Therefore, at this time, VISLs cannot be calculated for cis-1,2-DCE and trans-1,2-DCE.

It is noted that USEPA provided guidance on applying the 2011 TCE IRIS assessment in decision-making on early or interim actions (USEPA, 2014c). According to this guidance, USEPA "…expects to take early actions at Superfund sites where appropriate to eliminate, reduce, or control the hazards posed by the site. In assessing such cases, USEPA will act with a bias for initiating response actions to ensure protection of human health." These health effects include teratogenic and developmental effects. For noncancer effects, IRIS developed a chronic inhalation RfC for noncancer effects of TCE, which is 2 $\mu g/m^3$. This value is based in part on the developmental toxicity endpoint of increased incidence of fetal cardiac malformations. In response to potential fetal cardiac effects from short-term inhalation exposures during early pregnancy, OEPA Division of Environmental Response and Revitalization (DERR) has developed imminent hazard indoor air response action levels for TCE. If TCE is detected in indoor air in structures, prompt action is needed depending on the concentration level and the receptors present. The August 2016 OEPA Guidance Document Recommendations Regarding Response Action Levels and Timeframes for Common Contaminants of Concern at Vapor Intrusion Sites in Ohio, (OEPA, 2016) or any subsequent updated versions, discusses action levels and timeframes, and advises prompt responses including temporary relocations of building occupants, ventilation, indoor air treatment, and/or engineering controls depending on the situation. The response action levels are derived for accelerated, urgent, and imminent timeframes, as defined by OEPA. For example, the accelerated response action levels for TCE in indoor air in residential and commercial buildings are 2.1 $\mu g/m^3$ and 8.8 $\mu g/m^3$, respectively. The corresponding response action levels for vapor intrusion from TCE in groundwater underlying residential and commercial buildings (fine-course soil scenario) are 21 $\mu g/L$ and 89 $\mu g/L$, respectively.

Furthermore, OEPA's DERR August 2016 document establishes chronic response action levels for vapor intrusion chemicals of concern, which includes TCE, VC, PCE, chloroform, carbon tetrachloride, and naphthalene. Response actions may include additional sampling, mitigation, and/or other activities to reduce exposure to elevated indoor air concentrations of COCs resulting from vapor intrusion.

To determine whether changes in toxicity values result in any new COCs in the LTM program, the MDCs of chemicals detected in groundwater samples collected in April 2019 were compared with current MCLs and RSLs. As shown in **Appendix A**, **Table A-19**, chemicals that were identified as COCs in the GWOU ROD are listed as "existing COCs". In the Fourth Five-year Review (WPAFB, 2016a), 1,4-dioxane was identified as an emerging contaminant and a new COC to be tracked through the LTM. There were no detections of 1,4-dioxane in the April 2019 groundwater samples.

Since the Fourth Five-Year Review, two chemicals (bromomethane and cis-1,2-DCE) would be considered new COCs because their MDCs exceeded their MCL and/or RSL. Although cis-1,2-DCE was not specified as a COC in the GWOU ROD, it is now being analyzed as an individual compound along with its related isomer trans-1,2-DCE. It is a common degradation product of chlorinated solvents such as PCE and TCE, which are existing COCs within the GWOU. Bromomethane, also known as methyl bromide, was also detected at an MDC above its RSL. Bromomethane is a solvent, fumigant, and common disinfectant breakdown product associated with chlorination systems. There is no MCL for comparison; however, the MDC only slightly exceeds the current RSL. Although neither of these specific chemicals (cis-1,2-DCE and bromomethane) were existing COCs, both of them are related to compounds or byproducts that are already being monitored as part of the LTM. The remedy is protective as no additional analyses will be necessary to track these recently identified COCs through the LTM.

As described in **Sections 2.6** and **8.5.2.1**, the HAL for PFOS and PFOA was based on a candidate RfD of 2.0E-05 mg/kg/day and a SF of 7.0E-02 $(mg/kg/day)^{-1}$. The RfD and SF have not yet been verified for IRIS or further evaluated as PPTRVs. Except for the RSL for a related compound (perfluorobutane sulfonic acid or PFBS), there are no RSLs for tap water listed in the RSL table for PFOS, PFOA, or a combination of these compounds (USEPA, 2019a). Given that these values are available in USEPA's on-line RSL calculator, however, screening levels can be calculated (USEPA, 2019c).

The DoD issued guidance on October 15, 2019 to address investigations of sites with per- and polyfluoroalkyl substances within the DoD Cleanup Program (DoD, 2019). As discussed in **Section 2.6.2**, DoD derived conservative screening levels using USEPA's on-line RSL calculator as part of this guidance. For PFOS/PFOA in groundwater, the resulting tap water RSL was 0.040

μg/L. In addition, the guidance recommended the candidate toxicity values for use in site-specific risk assessments in the interim.

The dermal risk assessment guidance (USEPA, 2004) that was applied in the previous Five-Year Reviews (USEPA, 2004, 2011a, 2016) has essentially not changed. As discussed in the previous reviews, there were changes to some of the standard default factors used to calculate dermal toxicity values in the original risk assessment. This change primarily affected skin surface areas, which results in only slight changes to the risk results. In addition, the oral absorption factors for some of the metals are more stringent; however, the impacts of these changes are no longer relevant because metals have been eliminated from the LTM Program.

The remedy remains short-term protective because potential exposures to groundwater will continue to be managed though ICs.

8.5.2.4 Changes in RAOs and Cleanup Goals

The RAOs for the GWOU are stated in **Section 8.2.2**. The RAOs are intended to:

1) return useable groundwater to its beneficial use within a reasonable timeframe,
2) prevent off-site migration and ingestion of COCs in groundwater that exceed the RG, and
3) monitor groundwater areas that exhibit sporadic exceedances of the RGs.

The COC RGs are given in *Table 1* of the GWOU ROD (WPAFB, 1999) and discussed in **Section 8.2.2** of this review. As discussed in **Section 8.5.2.1**, the compliance levels for the GWOU are MCLs. These values are summarized in **Table 8-2**. It is noted that Table 1 from the GWOU also lists COCs that are associated with other RODs (OU1 and OU2). Although these chemicals are sampled and analyzed as part of the overall LTM Program, these constituents are reported separately.

As previously described, an RPO was completed for the GWOU monitoring in 2009 that resulted in the reduction of monitored parameters and of the monitoring well network (Shaw, 2009a). These changes were approved by OEPA and USEPA and presented in the Memo to Site File: GWOU ROD (Shaw, 2012). As a result, metals were eliminated from the LTM Program. Therefore, the compliance levels for inorganic constituents no longer apply.

As discussed in **Section 8.4.4.1**, the majority of wells monitored under the LTM Program exhibit concentrations of VOCs that are either below their respective MCLs or are declining. VOC concentrations for the LTM Program are presented in **Table 8-4**. For organic COCs in groundwater, the RGs for cis-1,2-DCE, trans-1,2-DCE, PCE, TCE, and VC are based on MCLs.

It is noted that total 1,2-DCE was originally listed as a COC in the GWOU ROD. As laboratory analysis now differentiates between the individual congeners of 1,2-DCE, results for cis-1,2-DCE and trans-1,2-DCE are being monitored in the LTM Program. The MCLs have not changed since the Fourth Five-Year Review (WPAFB, 2016a). Therefore, the compliance levels for the remaining chemicals in the LTM Program, as amended through the Memo to Site File: GWOU ROD (Shaw, 2012), are still valid.

In addition, as discussed in **Sections 2.6.2** and **5.3**, an SI for Area A was conducted in 2017 to identify any releases of PFAS may have occurred at sites where AFFF containing PFAS may have been used. The SI Report (Aerostar, 2018) concluded that groundwater and surface water had been impacted by AFFF activities at the FTAs. Due to the PFAS concentrations exceeding screening levels and the close proximity of potential drinking water sources, an expanded SI to be followed by an RI was recommended.

8.5.3 Question C: Has any other Information come to light that could call into question the protectiveness of the remedy?

No additional information has been identified that could call into question the short-term protectiveness of the remedy. The USAF is in the process of evaluating PFAS at all USAF installation properties. Firefighting agents (AFFF) containing PFAS were used at the current or former WPAFB FTAs or during actual firefighting emergencies. PAs were conducted in 2014 and 2015. An SI to investigate AFFF was conducted at various sites in OU2, OU3, and OU10 (Aerostar, 2018). **Table 8.1** outlines the chronology of events related to management, investigation, and remediation of PFOS/PFOA contaminated groundwater at WPAFB. These compounds have not yet been evaluated through a risk assessment and do not currently have a drinking water MCL. As these compounds are considered to be emerging contaminants, further research is on-going.

The City of Dayton shut down the Huffman Dam Wellfield in fall 2016 and since that time, the City has operated the wellfield intermittently at an average volume of 3 MG per week (300 gpm). The primary pumping wells that alternate operation are wells PW65, PW66, and PW71, which discharge to the air strippers for treatment. Due to the decrease in production from the Huffman Dam Wellfield beginning in the summer 2016, the overall TCE concentrations in the FAA-A monitoring wells have decreased over this five-year period (see **Figure 8-3**).

8.5.4 Technical Assessment Summary

The review of documents, ARARs, risk assessment assumptions and the results of interviews with WPAFB IRP AFCEC/CZO personnel indicate that the remedy for the GWOU is functioning as intended. Concentrations of VOCs in most areas monitored at WPAFB are decreasing and in many areas have declined to below MCLs. Although there are a few isolated incidences where VOC concentrations are above the MCL, the remedy for the GWOU is still protective because implemented ICs prevent exposure to contaminated groundwater. In addition, the downgradient pump and treat system located at the WPAFB installation boundary controls groundwater flow, prevents off-site migration and ingestion of organic COCs in groundwater that exceed the RG, and returns useable groundwater to its beneficial use.

Figure 8-36 illustrates the potential LF5 contaminant particle tracks from the May 2019 (spring quarter) groundwater levels at OU5 (FAA-A). The particle tracks illustrate that the capture area of EW-1 occurs over the entire western boundary of LF5. Comparing **Figures 8-3** and **8-36**, it can be seen that the EW-1 captures the contaminant plume in the central portion of LF5 at the Base boundary. The southern portion of LF5 does not have particle tracks going through it because of the hydraulic influence of the Twin Lakes in this area. Extending the particle line southeast, off LF5, would show groundwater in this area is also being captured by EW-1. Downgradient wells CW04-060 and the HD-13S and HD-13D well pair monitor groundwater flowing from this portion of LF5 and, as seen in **Figure 8-3**, TCE was not detected in these wells during the spring 2019 LTM event. The data gap investigation conducted in 2013 (Shaw, 2014b) to further evaluate the persistent TCE plume on MCD property concluded that the most likely cause of the TCE was matrix diffusion from residual contamination in the soil.

There have been some changes to MCLs, toxicity values, and changes to risk assessment guidance documents since the last five-year review as noted in **Section 8.5.2**. With the exception of the HAL and corresponding toxicity values for PFOS/PFOA, most of these changes do not affect the short term protectiveness of the remedy because the new values are less stringent, or the remedy eliminates the pathway of exposure.

There is no additional information that calls into question the effectiveness of the remedy.

8.6 Issues

The remedy for the GWOU is deemed to be short-term protective because ICs and ECs are in place to manage exposure pathways that could result in unacceptable risks. The specific potential exposure issues are presented below.

FAA-A

During this five-year period, TCE concentrations in the downgradient portion of the FAA-A TCE plume at the Mad River have been stable above the MCL at well CW10-055, but have shown a decreasing trend since the fall 2017 in wells OU5/MCD-MW04 and OU5/MCD-MW05. TCE concentrations in well MW125S located downgradient of the FAA-A TCE plume continues to be non-detect and below the MCL for this five-year period. However, due to a reduction in pumping at the City of Dayton Huffman Dam Wellfield beginning in the summer of 2016, the downgradient boundary of the TCE plume that exceeds the MCL is now on the upgradient (east) side of the Mad River. However, the southern extent of the TCE plume on MCD property has not been bounded. Currently, there are no monitoring wells screened in the impacted depth interval (approximately 45 to 65 bgs).

A Memo to Site File to the GWOU ROD (CB&I, 2017b) was prepared to document the Memorandum of Agreement (MOA) between the City of Dayton and the USAF (Dayton/USAF, 1994). The MOA includes information concerning the purchase and operation and maintenance of three air stripper systems located downgradient of FAA-A. Installation of the air stripper systems preceded the GWOU ROD; therefore, a Memo to Site File was necessary to demonstrate the agreement between Dayton and the USAF to be protective of the Dayton groundwater wellfield. The Memo to Site File is currently in regulatory review.

Former Building 79/95

In October 2013 monitoring wells B79C/D-MW06 and B79C/D-MW07 were installed downgradient (west) of the TCE plume at the former Building 79/95 Complex. Well B79C/D-MW06 has exceeded the MCL since it was installed and well B79C/D-MW07 has not had any VOC detections. The downgradient extent of the TCE plume has been defined. An RI is planned for fall 2020 to further delineate the site.

BS5

At BS5, a PCE plume exists from an apparent off-base source located due south of the Area B boundary and in the vicinity of two former dry cleaners (**Figure 8-30**). An SI conducted by OEPA in 2017 did not identify a source area; however, sufficient data was obtained to warrant additional investigation activities in this off-base area to evaluate the potential for historic leakage or spills from the off-base drycleaners to be the source of the PCE plume.

PFOS/PFOA

PFOS/PFOA was detected in WPAFB Area A drinking water wells. A GAC unit was constructed on base to treat the impacted water prior to distribution. PFOS/PFOA has also been detected at concentrations that exceed the USEPA HAL of 70 ng/L at 20 areas studied in the SI (Aerostar, 2018).

OU10

At OU10, the TCE plume occurring in Area A, south-central portion of **Figure 8-24**, is not bounded in the upgradient direction (to the northeast) of groundwater flow. Also shown on **Figure 8-24** is the PCE plume occurring in the central portion of Area A. This PCE plume is not bounded in the downgradient direction (to the southwest) of groundwater flow.

FAA-B

The outcome of the pilot-scale treatability test as well as the source removal action has not been memorialized in a decision document with the regulatory agencies. In addition, FAA-B specific RAOs are not present in the GWOU ROD.

Former Building 59

VOC contamination above MCLs is present in the groundwater at the former Building 59.

8.7 Recommendations and Follow-up Actions

In order for the remedy to be protective in the long-term, additional actions may be necessary to address PFAS or other contaminants such as TCE and PCE and ensure protectiveness. The specific actions to address the issues in **Section 8.6** are presented below.

FAA-A

An investigation to further delineate the FAA-A TCE plume is anticipated pending funding. In addition, to evaluate the fate and transport mechanisms of the FAA-A VOC plume, a conceptual site model (CSM) has been developed to create a predictive timeline for plume attenuation. Results from any additional FAA-A characterization investigations and the CSM will then be incorporated into the next Five-Year Review. Under the LTM Program and the GWOU ROD, the FAA-A/OU5 monitoring well network will continue to be sampled to evaluate the continued effectiveness of EW-1 and the GWTS. Additionally, a Memo to Site File for the MOA between the City of Dayton and USAF for the protectiveness of the Dayton groundwater wellfield has been prepared and is currently in regulatory review. As noted in **Section 8.4.4.1**, recommended changes to monitoring at FAA-A include adding a monitoring well to bound the southern extent of the TCE plume occurring on MCD property (**Figure 8-3**). This well would be a new installation as there are no monitoring wells at the target depth interval (approximately 45 to 65 bgs) in this area. An investigation of the FAA-A area is planned for FY2021.

Former Building 79/95

To further evaluate the continuing elevated concentrations of TCE in groundwater at the former Building 79/95 Complex, an additional soil investigation is being planned for fall 2020. Semi-annual sampling of monitoring well B79C/D-MW01 and downgradient wells B79C/D-MW06, and

B79C/D-MW07 and annual monitoring of upgradient wells B79C/D-MW02, B79C/D-MW03, and B79C/D-MW04 (**Figure 8-28**) will continue under the LTM Program and will be reported in the Annual LTM Reports.

BS5

Under the LTM Program and GWOU ROD, the BS5 monitoring wells will continue to be sampled to evaluate the decreasing trend in PCE concentrations in on-site groundwater. To further characterize the potential off-site source of the PCE plume at BS5, WPAFB has requested that OEPA conduct additional investigation in the vicinity of the former dry cleaners along Airway Road (**Figure 8-30**).

PFOS/PFOA

To protect the drinking water supply at WPAFB, continue operation of the Area A GAC groundwater treatment unit. As discussed in **Section 5.3**, the SI conducted at AFFF areas at WPAFB (Aerostar, 2018) identified the areas throughout the Base that have elevated levels of the PFOS/PFOA components of AFFF. In addition, four quarters of PFOS/PFOA sampling was conducted under the LTM Program at selected areas throughout Area A, including near IRP sites within OU3 and OU10. The SI (Aerostar, 2018) recommended that an expanded SI followed by RI be conducted to further evaluate the areas most likely to be impacted by PFOS/PFOA associated with use of AFFF at the fire training areas. As PFOS/PFOA are emerging contaminants, a drinking water standard has not yet been proposed or promulgated. There are no IRIS-verified toxicity values or PPRTVs for derivation of screening levels or risk assessment. Therefore, a statement of protectiveness is deferred until sufficient information is obtained. In addition, the remedy for the GWOU is deemed to be short-term protective because ICs and ECs are in place to manage exposure pathways that could result in unacceptable risks.

OU10

As noted in **Section 8.4.4.1**, recommended changes to the LTM Program at OU10 to further delineate the PCE plume in the central portion of Area A (**Figure 8-24**) include sampling existing wells side-gradient of wells OU10-MW-11S and OU10-MW-11D, and adding a monitoring location downgradient of this well pair (PFOS/PFOA SI well PFC 06-MW02-026, which was sampled in fall 2019 [PCE = 6.8 µg/L] and spring 2020 [PCE = 5.3 µg/L]). In addition, to further delineate the Area A TCE plume (**Figure 8-24**) it is recommended that a new monitoring well, located upgradient of monitoring well OU10-MW15S, be installed and sampled.

FAA-B

To document the excavation of approximately 200 cubic yards of contaminated soil that occurred in October 2000 as a source removal measure, a Memo to Site File or ESD is necessary. Changes in the remedy also include groundwater monitoring, which is conducted annually under the LTM.

Former Building 59

Conduct an RI at the former Building 59 in spring 2020 to further delineate the site.

Table 8-1
Site Chronology
Groundwater Operable Unit
Wright-Patterson AFB, Ohio

Event	Date
Initial Response Action – Groundwater extraction and treatment at OU5	1991 and currently ongoing
Remedial Action (FAA-A)	1991 (ongoing)
BMP Field Investigations	1996
BMP Groundwater Flow and Transport Modeling	1997
BMP Risk Assessments	1997
Baseline Groundwater Sampling - Remedial Action (LTM)	April 1998 (ongoing)
Long-term Groundwater Monitoring Program Reports	1998 to Present
BMP EE/CA	March 1999
ROD GWOU	September 1999
Remedial Action (FAA-B)	October 1999
Remedial Process Optimization of the GWOU	2009
Remedial Process Optimization of the GWTS	2010 (ongoing)
Memo to Site File for Monitoring, Sampling, and Reporting Revisions to the GWOU ROD	January 2012
Explanation of Significant Differences (Multiple OUs)[1]	August 2012
Preliminary Assessment Report for Perfluorinated Compounds at WPAFB	September 2015
New sliding tray type air stripper replaces the old GWTS	December 2015
Further Action Area A (FAA-A) Site Evaluation Technical Memorandum	May 2016
Groundwater Investigation Report; Miami Conservancy District - OU5	August 2017
Memo to Site File for the Groundwater Operable Unit Record of Decision: City of Dayton Memorandum of Agreement	October 2017
Site Inspection Report of Aqueous Film Forming Foam Areas at Wright-Patterson Air Force Base, Ohio	June 2018
Expanded Site Inspection for PFOS/PFOA contract awarded	June 2018
Quarterly Perfluorinated Compounds LTM Summary Report	January 2019

Notes:

1 – Source Control Operable Unit; Off-Source Operable Unit; 21 No Action Sites; Spill Sites 2, 3, and 10; 41 No Action Sites; and Groundwater Operable Unit.

Abbreviations:

BMP = Base Wide Monitoring Program
EE/CA = Engineer Evaluation/Cost Analysis
FAA = Further Action Area
GWOU = Groundwater Operable Unit
GWTS = Groundwater Treatment System
MCD = Miami Conservancy District
OU = Operable Unit

Table 8-2
Groundwater Remediation Goals for VOCs of Concern
Groundwater Operable Unit
Wright-Patterson AFB, Ohio

Organic COCs	Remediation Goal All Layers (µg/L)	Remediation Goal Source
GWOU		
Benzene	5	MCL
Ethylbenzene	700	MCL
1,2-DCA	5	MCL
Cis 1,2-DCE	70	MCL
Trans 1,2-DCE	100	MCL
PCE	5	MCL
TCE	5	MCL
Vinyl Chloride	2	MCL
Toluene	1,000	MCL
Xylenes	10,000	MCL
OU1(1)		
4,4-DDT	20	risk-based(2,3)
OCDD	0.045	risk-based(3,4)

Notes:

1 – Contaminants from the OU1 ROD are sampled and analyzed within the LTM program but, are reported separately.
2 – Contaminant is sampled every 5 years and last sampled in April 2017.
3 – MCL not available; remediation goal based on 1 x 10^{-4} cancer risk.
4 – Parameter has been eliminated from the LTM Program.

Abbreviations:

1,2-DCA = 1,2-Dichloroethane
1,2-DCE = 1,2-Dichloroethylene
4,4-DDT = 4,4-Dichlorodiphenyltrichloroethane
COC = Chemicals of Concern
LTM = Long-Term Monitoring
µg/L = micrograms per liter
MCL = Maximum Contaminant Level, USEPA Drinking Water Standards (USEPA, April 2019)
OCDD = Octachlorodibenzo-p-dioxin
OU = Operable Unit
PCE = Tetrachloroethylene
TCE = Trichloroethylene
VOC = Volatile Organic Compound

Table 8-3
LTM Program Monitoring Locations and Sampling Criteria
Groundwater Operable Unit
Wright-Patterson AFB, Ohio
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Number of Wells	Sample Location	Area	Reason for Monitoring	Monitoring Frequency(s)	Sampling Season(s)	Analytical Parameters	Comments
GWOU Monitoring Network: Semi-Annual							
1	B59-MW02	Bldg. 59	GWOU ROD	Semi-Annual	Spring & Fall	VOCs	Begin Semiannual Spring 2017
2	B59-MW03	Bldg. 59	GWOU ROD	Semi-Annual	Spring & Fall	VOCs	Begin Semiannual Spring 2017
3	B79 C/D-MW01	Bldg. 79	GWOU ROD	Semi-Annual	Spring & Fall	VOCs	
4	B79 C/D-MW06	Bldg. 79	GWOU ROD	Semi-Annual	Spring & Fall	VOCs	New October 2013
5	B79 C/D-MW07	Bldg. 79	GWOU ROD	Semi-Annual	Spring & Fall	VOCs	New October 2013
6	NEA-MW27-3I	OU2	GWOU ROD	Semi-Annual	Spring & Fall	VOCs	Begin Annual Spring 2021 (2)
	GR-214 (05-DM-123S)	OU3	GWOU ROD	Semi-Annual	Spring & Fall	VOCs	Discontinued Spring 2019 (1)
7	GR-215 (05-DM-123I)	OU3	GWOU ROD	Semi-Annual	Spring & Fall	VOCs	Begin Annual Spring 2021 (2)
8	11-538-M	OU4	GWOU ROD	Semi-Annual	Spring & Fall	VOCs	Added Spring 2017
9	CW04-060	OU5	FAA-A/GWOU ROD	Semi-Annual	Spring & Fall	VOCs	Begin Annual Spring 2021 (2)
	CW05-055	OU5	FAA-A/GWOU ROD	Semi-Annual	Spring & Fall	VOCs	Pump stuck in well
10	CW05-085	OU5	FAA-A/GWOU ROD	Semi-Annual	Spring & Fall	VOCs	
11	CW07-055	OU5	FAA-A/GWOU ROD	Semi-Annual	Spring & Fall	VOCs	
12	CW10-055	OU5	FAA-A/GWOU ROD	Semi-Annual	Spring & Fall	VOCs	
13	HD-11	OU5	FAA-A/GWOU ROD	Semi-Annual	Spring & Fall	VOCs	Begin Annual Spring 2021 (2)
14	HD-12M	OU5	FAA-A/GWOU ROD	Semi-Annual	Spring & Fall	VOCs	
15	HD-12S	OU5	FAA-A/GWOU ROD	Semi-Annual	Spring & Fall	VOCs	Begin Annual Spring 2021 (2)
16	HD-13D	OU5	FAA-A/GWOU ROD	Semi-Annual	Spring & Fall	VOCs	Begin Annual Spring 2021 (2)

Table 8-3
LTM Program Monitoring Locations and Sampling Criteria
Groundwater Operable Unit
Wright-Patterson AFB, Ohio

Number of Wells	Sample Location	Area	Reason for Monitoring	Monitoring Frequency(s)	Sampling Season(s)	Analytical Parameters	Comments
17	HD-13S	OU5	FAA-A/GWOU ROD	Semi-Annual	Spring & Fall	VOCs	
18	MW-125S (HD-9S)	OU5	FAA-A/GWOU ROD	Semi-Annual	Spring & Fall	VOCs	Begin Annual Spring 2021 (2)
19	HSA-4A (MW131M)	OU5	FAA-A/GWOU ROD	Semi-Annual	Spring & Fall	VOCs	Begin Annual Spring 2021 (2)
20	HSA-4B (MW131S)	OU5	FAA-A/GWOU ROD	Semi-Annual	Spring & Fall	VOCs	
21	HSA-5 (MW132S)	OU5	FAA-A/GWOU ROD	Semi-Annual	Spring & Fall	VOCs	
22	OU5/MCD-MW02	OU5	FAA-A/GWOU ROD	Semi-Annual	Spring & Fall	VOCs	New May 2013
23	OU5/MCD-MW04	OU5	FAA-A/GWOU ROD	Semi-Annual	Spring & Fall	VOCs	New Oct. 2016
24	OU5/MCD-MW05	OU5	FAA-A/GWOU ROD	Semi-Annual	Spring & Fall	VOCs	New Oct. 2016
25	MT-230 (CW03-77)	OU8	GWOU ROD	Semi-Annual	Spring & Fall	VOCs	Begin Annual Spring 2021 (2)
26	GR-330	OU10	GWOU ROD	Semi-Annual	Spring & Fall	VOCs	Begin Annual Spring 2021 (2)
27	LF512-MW-14	OU10	GWOU ROD	Semi-Annual	Spring & Fall	VOCs	Added Fall 2016
28	OU10-MW-02S	OU10	GWOU ROD	Semi-Annual	Spring & Fall	VOCs	Added Fall 2016
29	OU10-MW-04S	OU10	GWOU ROD	Semi-Annual	Spring & Fall	VOCs	Begin Annual Spring 2021 (2)
30	OU10-MW-15S	OU10	GWOU ROD	Semi-Annual	Spring & Fall	VOCs	
31	OU10-MW-19D	OU10	GWOU ROD	Semi-Annual	Spring & Fall	VOCs	Begin Annual Spring 2021 (2)
32	OU10-MW-21S	OU10	GWOU ROD	Semi-Annual	Spring & Fall	VOCs	Begin Annual Spring 2021 (2)
33	OU10-MW-25S	OU10	GWOU ROD	Semi-Annual	Spring & Fall	VOCs	
34	23-578-M	OU10	GWOU ROD	Semi-Annual	Spring & Fall	VOCs	Begin Annual Spring 2021 (2)

Table 8-3
LTM Program Monitoring Locations and Sampling Criteria
Groundwater Operable Unit
Wright-Patterson AFB, Ohio

GWOU Monitoring Network: Annual							
1	BS5 P-1	BS5	GWOU ROD	Annual	Spring	VOCs	
2	BS5 P-3	BS5	GWOU ROD	Annual	Spring	VOCs	
3	BS5 P-4	BS5	GWOU ROD	Annual	Spring	VOCs	
4	B79 C/D-MW02	Bldg. 79	GWOU ROD	Annual	Spring	VOCs	
5	B79 C/D-MW03	Bldg. 79	GWOU ROD	Annual	Spring	VOCs	
6	B79 C/D-MW04	Bldg. 79	GWOU ROD	Annual	Spring	VOCs	
	B79 C/D-MW05	Bldg. 79	GWOU ROD	Annual	Spring	VOCs	Discontinued April 2019 (1)
7	11-536-M	OU4	OU4 North	Annual	Spring	VOCs	Added Spring 2017
8	BMP-OU4-01B-60	OU4	OU4 Downgradient	Annual	Spring	VOCs	
9	BMP-OU4-01C-84	OU4	OU4 Downgradient	Annual	Spring	VOCs	
10	OU4-MW-02A	OU4	GWOU ROD	Annual	Spring	VOCs	
11	OU4-MW-02B	OU4	GWOU ROD	Annual	Spring	VOCs	
12	OU4-MW-03B	OU4	GWOU ROD	Annual	Spring	VOCs	
13	OU4-MW-03C	OU4	GWOU ROD	Annual	Spring	VOCs	
14	OU4-MW-12B	OU4	GWOU ROD	Annual	Spring	VOCs	
15	EFD04-MW06	OU9	GWOU ROD	Annual	Spring	VOCs	Discontinued April 2019 (1)
16	EFD09-M575	OU9	GWOU ROD	Annual	Spring	VOCs	Discontinued April 2019 (1)
17	CHP4-MW01	OU10	GWOU ROD	Annual	Spring	VOCs	
18	GR-333	OU10	GWOU ROD	Annual	Spring	VOCs	
19	OU10-MW-03S	OU10	GWOU ROD	Annual	Spring	VOCs	

Table 8-3
LTM Program Monitoring Locations and Sampling Criteria
Groundwater Operable Unit
Wright-Patterson AFB, Ohio

20	OU10-MW-06D	OU10	GWOU ROD	Annual	Spring	VOCs	
21	OU10-MW-06S	OU10	GWOU ROD	Annual	Spring	VOCs	
22	OU10-MW-11D	OU10	GWOU ROD	Annual	Spring	VOCs	
23	OU10-MW-11S	OU10	GWOU ROD	Annual	Spring	VOCs	
	SP11-MW01	FAA-B	FAA-B/GWOU ROD	Annual	Spring	VOCs	Discontinued April 2019 (1)
24	SP11-MW02	FAA-B	FAA-B/GWOU ROD	Annual	Spring	VOCs	
25	SP11-MW03	FAA-B	FAA-B/GWOU ROD	Annual	Spring	VOCs	
26	SP11-MW05	FAA-B	FAA-B/GWOU ROD	Annual	Spring	VOCs	Added Spring 2018
27	SP11-MW07	FAA-B	FAA-B/GWOU ROD	Annual	Spring	VOCs	
28	SP11-MW08	FAA-B	FAA-B/GWOU ROD	Annual	Spring	VOCs	
29	SP11-MW09	FAA-B	FAA-B/GWOU ROD	Annual	Spring	VOCs	

Abbreviations:

Bldg. 59 = Former Building 59 Complex
Bldg. 79 = Former Building 79/95 Complex
BS = Burial Site
FAA = Further Action Area
GWOU = Groundwater Operable Unit
NA = Not applicable, well abandoned per the GWOU RPO (Shaw, 2009)
OU = Operable Unit
ROD = Record of Decision
RPO = Remedial Process Optimization
VOC = Volatile Organic Compound

1 = Sampling discontinued per approved recommendations in the Draft 2017 Annual LTM Report (APTIM, 2018)

2 = Sampling frequency reduced from semiannual to annual per approval of 2018 Annual LTM Report (APTIM, 2017-2020)

Table 8-4
LTM Program Groundwater Sampling Results: VOCs
Groundwater Operable Unit
Wright-Patterson AFB, Ohio
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Sample Location (Sample Frequency)	Management Area	Sample Date	cis-1,2-DCE µg/L		trans-1,2-DCE µg/L		PCE µg/L		TCE µg/L		Vinyl Chloride µg/L	
		MCL	70		100		5		5		2	
			Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
NEA-MW27-3I	**OU2**	20-Apr-10		ND		ND	3			ND		ND
(Semiannual)		11-Oct-10		ND		ND	2.5			ND		ND
		29-Apr-11		ND		ND	2.9			ND		ND
		19-Oct-11		ND		ND	1.9			ND		ND
		17-Apr-12		ND		ND	2.6			ND		ND
		10-Oct-12		ND		ND	2.6			ND		ND
		02-Apr-13		ND		ND	2.8			ND		ND
		08-Oct-13		ND		ND	3			ND		ND
		02-May-14		ND		ND	3.1			ND		ND
		21-Oct-14		ND		ND	1.9			ND		ND
		17-Apr-15		ND		ND	2.1			ND		ND
		20-Oct-15		ND		ND	1.4			ND		ND
		28-Apr-16		ND		ND	1.6			ND		ND
		25-Oct-16		ND		ND	1.3			ND		ND
		03-May-17		ND		ND	1.5			ND		ND
		19-Oct-17		ND		ND	1.5			ND		ND
		16-Apr-18		ND		ND	1.3			ND		ND
		17-Oct-18		ND		ND	1.1			ND		ND
		17-Apr-19		ND		ND	1.1			ND		ND
GR-214	**OU3**	15-Apr-10		ND		ND		ND		ND		ND
(05-DM-123S-M)	Duplicate	14-Oct-10	0.24	J		ND		ND		ND		ND
(Semiannual)		14-Oct-10	0.25	J		ND		ND		ND		ND
		26-Apr-11		ND		ND		ND		ND		ND
	Duplicate	17-Oct-11		ND		ND		ND		ND		ND
		17-Oct-11		ND		ND		ND	0.24	J		ND
		18-Apr-12		ND		ND		ND	0.23	J		ND
	Duplicate	09-Oct-12	0.31	J		ND		ND	0.24	J		ND
		09-Oct-12	0.34	J		ND		ND	0.24	J		ND
		05-Apr-13		ND		ND		ND	0.24	J		ND
	Duplicate	07-Oct-13		ND		ND		ND	0.23	J		ND
		07-Oct-13		ND		ND		ND	0.20	J		ND
		09-May-14		ND		ND		ND		ND		ND
	Duplicate	23-Oct-14	0.23	J		ND		ND		ND		ND
		23-Oct-14	0.23	J		ND		ND		ND		ND
		21-Apr-15		ND		ND		ND		ND		ND
	Duplicate	22-Oct-15		ND		ND		ND		ND		ND
		22-Oct-15		ND		ND		ND		ND		ND
		28-Apr-16	0.26	J		ND		ND		ND		ND
	Duplicate	26-Oct-16	0.29	J		ND		ND		ND		ND
		26-Oct-16	0.27	J		ND		ND		ND		ND
		15-May-17		ND		ND		ND		ND		ND
		01-Nov-17		ND		ND		ND		ND		ND
		19-Apr-18		ND		ND		ND		ND		ND
		17-Oct-18		ND		ND		ND		ND		ND
		Spring 2019	Not Sampled per 2017 Annual LTM Report									
GR-215	**OU3**	22-Apr-10	0.38	J		ND		ND	1.8	J		ND
(05-DM-123I-M)		14-Oct-10	0.31	J		ND		ND	1.3	J		ND
(Semiannual)		26-Apr-11	0.24	J		ND		ND	1.2	J		ND
		17-Oct-11		ND		ND		ND	1.4	J		ND
		18-Apr-12		ND		ND		ND	1.4	J		ND
		09-Oct-12	0.17	J		ND		ND	1.5	J		ND
		05-Apr-13		ND		ND		ND	1.2	J		ND
		07-Oct-13		ND		ND		ND	1.1	J		ND
		09-May-14		ND		ND		ND	0.92	J		ND
		23-Oct-14		ND		ND		ND	0.92	J		ND
		21-Apr-15		ND		ND		ND	0.5	J		ND
		22-Oct-15		ND		ND		ND	0.63	J		ND
		28-Apr-16		ND		ND		ND	0.36	J		ND
		26-Oct-16	0.23	J		ND		ND	0.32	J		ND
		15-May-17		ND		ND		ND		ND		ND
		01-Nov-17		ND		ND		ND	0.41	J		ND
		19-Apr-18		ND		ND		ND		ND		ND
		17-Oct-18	0.31	J		ND		ND		ND		ND
		24-Apr-19		ND		ND		ND		ND		ND

Table 8-4
LTM Program Groundwater Sampling Results: VOCs
Groundwater Operable Unit
Wright-Patterson AFB, Ohio

Sample Location (Sample Frequency)	Management Area	Sample Date	cis-1,2-DCE µg/L		trans-1,2-DCE µg/L		PCE µg/L		TCE µg/L		Vinyl Chloride µg/L	
		MCL	70		100		5		5		2	
			Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
BMP-OU4-01B-60	**OU4**	20-Apr-10	1.4			ND		ND	0.77	J	0.4	J
(Annual)		13-Oct-10	1.2			ND		ND	0.74	J	0.28	J
		28-Apr-11	1.3			ND		ND	0.65	J	0.24	J
		13-Apr-12	1.3			ND		ND	0.87	J	0.22	J
		03-Apr-13	1.3			ND		ND	0.66	J	0.30	J
		09-May-14	1.2			ND		ND	0.56	J		ND
		14-Apr-15	0.99			ND		ND	0.42	J		ND
		28-Apr-16	0.86	J		ND		ND	0.42	J		ND
		02-May-17	0.76	J		ND		ND	0.57	J		ND
		26-Apr-18	0.68	J		ND		ND	0.41	J		ND
		23-Apr-19	0.5	J		ND		ND	0.48	J		ND
OU4-MW-02B	**OU4**	23-Apr-10	0.28	J		ND		ND	**5.8**			ND
(Annual)		14-Oct-10	0.33	J		ND		ND	4.4			ND
		13-May-11	0.31	J		ND		ND	4.7			ND
		24-Apr-12		ND		ND	0.38	J	4.7			ND
		05-Apr-13	0.30	J		ND	0.32	J	4.4			ND
		09-May-14	0.28	J		ND	0.47	J	4.3			ND
		20-Apr-15		ND		ND	0.54	J	3.6			ND
		28-Apr-16		ND		ND	0.66	J	3			ND
		02-May-17		ND		ND	1.3		2.9			ND
		26-Apr-18		ND		ND		ND	2.3			ND
		23-Apr-19		ND		ND	0.25	J	2.6			ND
OU4-MW-03B	**OU4**	19-Apr-10	0.51			ND		ND	2.8			ND
(Annual)		13-Oct-10		ND		ND		ND	2			ND
		28-Apr-11	0.37	J		ND		ND	2.4			ND
		17-Apr-12	0.50			ND		ND	2.2			ND
		04-Apr-13	0.70			ND	0.66	J	1.9	J		ND
		09-May-14	0.51			ND		ND	2.1			ND
		14-Apr-15	0.36	J		ND		ND	1.5	J		ND
		29-Apr-16	0.37	J		ND		ND	1.2			ND
		02-May-17		ND		ND		ND	1.8			ND
		17-Apr-18		ND		ND	0.24	J	1.5			ND
		23-Apr-19		ND		ND	0.24	J	1.3			ND
OU4-MW-03C	**OU4**	13-Apr-10	0.8			ND	0.71	J	3			ND
(Annual)	Duplicate	13-Apr-10	0.75			ND	0.68	J	2.8			ND
		13-Oct-10	0.84			ND	0.63	J	2.3			ND
	Duplicate	28-Apr-11	0.58			ND	0.61	J	2.3			ND
		28-Apr-11	0.67			ND	0.61	J	2.5			ND
	Duplicate	17-Apr-12	0.88			ND	0.77	J	2.5			ND
		17-Apr-12	0.94			ND	0.76	J	2.6			ND
	Duplicate	04-Apr-13	0.76			ND	0.72	J	2.1			ND
		04-Apr-13	0.17	J		ND		ND	2.2			ND
	Duplicate	12-May-14	0.80			ND	0.80	J	2.9			ND
		12-May-14	0.67			ND	0.85	J	2.8			ND
	Duplicate	14-Apr-15	0.60			ND	0.75	J	1.8	J		ND
		14-Apr-15	0.55			ND	0.72	J	1.8	J		ND
		29-Apr-16	0.68	J		ND	0.72	J	1.5			ND
		02-May-17		ND		ND	0.85	J	2			ND
		17-Apr-18	0.64	J		ND	0.77	J	1.6			ND
		23-Apr-19	0.6	J		ND	0.72	J	1.3			ND
OU4-MW-12B	**OU4**	22-Apr-10	0.31	J		ND	**13**		3.4			ND
(Semiannual)		13-Oct-10	0.34	J		ND	**10**		2.5			ND
		13-May-11	0.22	J		ND	**11**		2.7			ND
		24-Apr-12		ND		ND	**13**		2.3			ND
		05-Apr-13	0.17	J		ND	**13**		2.3			ND
		09-May-14		ND		ND	**12**		2.1			ND
		20-Apr-15		ND		ND	**15**		1.8	J		ND
		28-Apr-16		ND		ND	**14**		1.4			ND
		02-May-17		ND		ND	**16.6**		1.5			ND
		19-Oct-17		ND		ND	**18.3**		1.4			ND
		26-Apr-18		ND		ND	**16.6**		1.3			ND
		16-Oct-18	0.35	J		ND	**17.1**		1.5			ND
		23-Apr-19		ND		ND	**17.8**		1.3			ND

Table 8-4
LTM Program Groundwater Sampling Results: VOCs
Groundwater Operable Unit
Wright-Patterson AFB, Ohio
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Sample Location (Sample Frequency)	Management Area	Sample Date	cis-1,2-DCE µg/L		trans-1,2-DCE µg/L		PCE µg/L		TCE µg/L		Vinyl Chloride µg/L	
		MCL	70		100		5		5		2	
			Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
11-536-M	**OU4**	03-May-17	0.71	J		ND	1.4			ND		ND
(Annual)		26-Apr-18	0.68	J		ND	1.3			ND		ND
		23-Apr-19	0.92	J		ND	1.0			ND		ND
11-538-M	**OU4**	03-May-17		ND		ND	**16**		0.74	J		ND
(Semiannual)	Duplicate	19-Oct-17		ND		ND	**17.3**		0.63	J		ND
		19-Oct-17		ND		ND	**16.7**		0.69	J		ND
		26-Apr-18		ND		ND	**16.3**		0.43	J		ND
		16-Oct-18		ND		ND	**16.2**		0.51	J		ND
	Duplicate	16-Oct-18		ND		ND	**15.7**		0.51	J		ND
		23-Apr-19		ND		ND	**15.4**		0.43	J		ND
CW04-060	**OU5**	19-Apr-10		ND		ND		ND		ND		ND
(Semiannual)		13-Oct-10	0.36	J		ND		ND		ND		ND
		28-Apr-11		ND		ND		ND		ND		ND
		17-Oct-11		ND		ND		ND		ND		ND
		18-Apr-12		ND		ND		ND		ND		ND
		09-Oct-12	0.29	J		ND		ND		ND		ND
		04-Apr-13	0.2	J		ND		ND		ND		ND
		07-Oct-13		ND		ND		ND		ND		ND
		12-May-14		ND		ND		ND		ND		ND
		23-Oct-14	0.27	J		ND		ND		ND		ND
		22-Apr-15	0.29	J		ND		ND		ND		ND
		20-Oct-15	0.33	J		ND		ND		ND		ND
		28-Apr-16	0.25	J		ND		ND		ND		ND
		26-Oct-16	0.20	J		ND		ND		ND		ND
		16-May-17		ND		ND		ND		ND		ND
		01-Nov-17		ND		ND		ND		ND		ND
		19-Apr-18		ND		ND		ND		ND		ND
		23-Oct-18	0.30	J		ND		ND		ND		ND
		29-Apr-19		ND		ND		ND		ND		ND
CW05-055	**OU5**	15-Apr-10	0.32	J		ND		ND		ND		ND
(Semiannual)	Duplicate	15-Apr-10	0.34	J		ND		ND		ND		ND
		13-Oct-10	0.48	J		ND		ND		ND		ND
		28-Apr-11	0.75			ND		ND		ND		ND
	Duplicate	28-Apr-11	0.67			ND		ND		ND		ND
		17-Oct-11		ND		ND		ND		ND		ND
		18-Apr-12	0.29	J		ND		ND		ND		ND
		09-Oct-12		ND		ND		ND		ND		ND
		04-Apr-13	0.18	J		ND		ND		ND		ND
		07-Oct-13		ND		ND		ND		ND		ND
		12-May-14		ND		ND		ND		ND		ND
		23-Oct-14	0.21	J		ND		ND		ND		ND
		22-Apr-15	0.43	J		ND		ND		ND		ND
		20-Oct-15		ND		ND		ND		ND		ND
		28-Apr-16	0.29	J		ND		ND		ND		ND
		28-Oct-16	Damaged Wellhead, Not Sampled									
CW05-085	**OU5**	19-Apr-10	12		0.35	J		ND	**17**		0.51	J
(Semiannual)		13-Oct-10	7.6		0.22	J		ND	**18**		0.44	J
	Duplicate	13-Oct-10	8		0.26	J		ND	**19**		0.44	J
		28-Apr-11	11		0.42	J		ND	**18**		0.51	J
	Duplicate	17-Oct-11	9.4		0.31	J		ND	**15**		0.52	J
		17-Oct-11	9.8		0.34	J		ND	**16**		0.6	J
	Duplicate	18-Apr-12	7.5		0.37	J		ND	**20**		0.61	J
		18-Apr-12	7.2		0.25	J		ND	**19**		0.56	J
	Duplicate	09-Oct-12	9.1		0.31	J		ND	**17**		0.57	J
		09-Oct-12	9.5		0.31	J		ND	**17**		0.5	J
	Duplicate	04-Apr-13	12		0.48	J		ND	**19**		0.57	J
		04-Apr-13	12		0.45	J		ND	**18**		0.54	J
	Duplicate	07-Oct-13	18		0.73			ND	**19**		0.66	J
		07-Oct-13	19		0.67			ND	**20**		0.74	J
	Duplicate	12-May-14	14		0.62			ND	**18**		0.68	J
		12-May-14	17		0.68			ND	**21**		0.87	J
	Duplicate	23-Oct-14	8.3		0.28	J		ND	**15**		0.41	J
		23-Oct-14	8.1		0.26	J		ND	**15**		0.47	J

Table 8-4
LTM Program Groundwater Sampling Results: VOCs
Groundwater Operable Unit
Wright-Patterson AFB, Ohio

Sample Location (Sample Frequency)	Management Area	Sample Date	cis-1,2-DCE µg/L		trans-1,2-DCE µg/L		PCE µg/L		TCE µg/L		Vinyl Chloride µg/L	
		MCL	70		100		5		5		2	
			Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
CW05-085	Duplicate	22-Apr-15	6.5			ND		ND	**13**			ND
(continued)		22-Apr-15	6.9			ND		ND	**13**		0.31	J
	Duplicate	20-Oct-15	5.9			ND		ND	**14**		0.47	J
		20-Oct-15	6			ND		ND	**14**		0.45	J
	Duplicate	28-Apr-16	13		0.47	J		ND	**11**		0.43	J
		28-Apr-16	13		0.54	J		ND	**11**		0.44	J
	Duplicate	26-Oct-16	6.4			ND		ND	**10**			ND
		26-Oct-16	6.5			ND		ND	**10**			ND
	Duplicate	16-May-17	13.3		0.59	J		ND	**13.5**			ND
		16-May-17	9.6			ND		ND	**13.3**		0.54	J
	Duplicate	25-Oct-17	5.9		0.23	J		ND	**12.3**			ND
		25-Oct-17	6		0.24	J		ND	**12.3**			ND
		19-Apr-18	22.0		0.72	J	1.2		**12.6**		0.58	J
	Duplicate	19-Apr-18	17.9		0.52	J	1.1		**12.5**		0.66	J
		23-Oct-18	25.3		0.74	J		ND	**9.8**		0.75	J
		29-Apr-19	11.5			ND		ND	**8.8**		ND	
	Duplicate	29-Apr-19	12.2			ND		ND	**8.6**		0.45	J
CW10-055	**OU5**	15-Apr-10	4.8			ND		ND	**12**			ND
(Semiannual)		12-Oct-10	4.5			ND		ND	**15**			ND
		05-May-11	4.1			ND		ND	**14**			ND
		17-Oct-11	5.2			ND		ND	**12**			ND
		11-Apr-12	4.7			ND		ND	**14**			ND
		10-Oct-12	5.2			ND		ND	**14**			ND
		04-Apr-13	5.1			ND		ND	**14**			ND
		09-Oct-13	4.4			ND	0.38	J	**15**			ND
		08-May-14	6.6			ND		ND	**8.7**			ND
		23-Oct-14	3.4			ND	0.29	J	**12**			ND
		22-Apr-15	4.5			ND	0.34	J	**13**			ND
		22-Oct-15	4.5			ND		ND	**11**			ND
		27-Apr-16	4.2			ND	0.37	J	**9.6**			ND
		24-Oct-16	3.8			ND	0.36	J	**11**			ND
		10-May-17	4.8			ND	0.32	J	**13.6**			ND
		02-Nov-17	3.7			ND	0.28	J	**16.5**			ND
		23-Apr-18	5.2		0.23	J		ND	**10**			ND
		23-Oct-18	6.5		0.30	J	0.33	J	**13.7**			ND
		01-May-19	6.2			ND	0.42	J	**11.8**			ND
OU5/MCD-MW02	**OU5**	09-Oct-13	4.5	D		ND D	1.1	J D	**43**	D		ND D
(Semiannual)		08-May-14	3.4			ND	1.7		**37**			ND
		23-Oct-14	5.3			ND	1.3		**34**			ND
		22-Apr-15	6.1			ND	1.3		**36**			ND
		29-Oct-15	3.3			ND	1.3		**27**			ND
	Duplicate	27-Apr-16	2.1			ND	1.4		**17**			ND
		27-Apr-16	2.3			ND	1.4		**18**			ND
		24-Oct-16	4.1			ND	1.0		**19**			ND
	Duplicate	10-May-17	5			ND	1.0		**26.9**			ND
		10-May-17	4.9			ND	0.8	J	**23.8**			ND
	Duplicate	24-Oct-17	3.9			ND	1.1		**23.6**			ND
		24-Oct-17	3.9			ND	1.2		**23.3**			ND
		23-Apr-18	3.1			ND	1.4		**16.5**			ND
	Duplicate	23-Apr-18	3.1			ND	1.5		**16.5**			ND
		18-Oct-18	4.2			ND	1.3		**17.4**			ND
	Duplicate	18-Oct-18	4.2			ND	1.3		**17**			ND
		01-May-19	2.8			ND	1.3		**12.8**			ND
	Duplicate	01-May-19	2.8			ND	1.4		**12.9**			ND
OU5/MCD-MW04	**OU5**	25-Oct-16	11		0.19	J	0.34	J	**21**			ND
(Semiannual)		10-May-17	10.1		0.57	J		ND	**26.9**			ND
		02-Nov-17	12.7			ND	0.24	J	**29.2**			ND
		23-Apr-18	13.1		0.39	J		ND	**22.4**			ND
		22-Oct-18	21.2		0.58	J		ND	**14.5**			ND
		01-May-19	22			ND		ND	**10**			ND

Table 8-4
LTM Program Groundwater Sampling Results: VOCs
Groundwater Operable Unit
Wright-Patterson AFB, Ohio

Sample Location (Sample Frequency)	Management Area	Sample Date	cis-1,2-DCE µg/L		trans-1,2-DCE µg/L		PCE µg/L		TCE µg/L		Vinyl Chloride µg/L	
		MCL	70		100		5		5		2	
			Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
OU5/MCD-MW05	**OU5**	25-Oct-16	7.3		0.18	J		ND	**18**			ND
(Semiannual)		10-May-17	6.4		0.34	J		ND	**18.7**			ND
		24-Oct-17	9.3		0.40	J		ND	**23.8**			ND
		19-Apr-18	9.5		0.29	J		ND	**19.4**			ND
		22-Oct-18	21.2		0.49	J		ND	**10.2**			ND
		02-May-19	22.3		0.23	J		ND	0.73	J		ND
HD-11[a]	**OU5**	20-Apr-10	17		0.75			ND	**5.4**		0.5	J
(Semiannual)		12-Oct-10	13		0.49	J		ND	**7**		0.31	J
		11-May-11	15		0.65			ND	2		0.53	J
		18-Oct-11	13		0.44	J		ND	2.8			ND
		11-Apr-12	12		0.48	J		ND	2.2		0.29	J
		10-Oct-12	11		0.42	J		ND	3.8		0.24	J
		10-Apr-13	9.3		0.39	J		ND	2			ND
		09-Oct-13	10		0.35	J		ND	4.3			ND
		08-May-14	6		0.26	J		ND	1.3	J		ND
		22-Oct-14	6.7			ND		ND	1.2	J		ND
		15-Apr-15	5.7			ND		ND	1.8	J	0.29	J
		22-Oct-15	5.2			ND		ND	0.87	J	0.37	J
		27-Apr-16	5.2		0.21	J		ND	0.47	J	0.25	J
		24-Oct-16	5.5			ND		ND	0.48	JQ		ND
		09-May-17	6		0.23	J		ND	0.52	J		ND
		23-Oct-17	6.7		0.28	J		ND	0.65	J		ND
		18-Apr-18	4.8			ND	1.2			ND		ND
		18-Oct-18	5.2		0.28	J		ND		ND		ND
		02-May-19	3.0			ND	0.41	J		ND		ND
HD-12M[a]	**OU5**	20-Apr-10		ND		ND		ND		ND		ND
(Semiannual)		12-Oct-10		ND		ND		ND		ND		ND
		11-May-11		ND		ND		ND		ND		ND
		18-Oct-11		ND		ND		ND		ND		ND
		11-Apr-12		ND		ND		ND		ND		ND
		10-Oct-12		ND		ND		ND		ND		ND
		10-Apr-13		ND		ND		ND		ND		ND
		09-Oct-13		ND		ND		ND		ND		ND
		08-May-14		ND		ND		ND		ND		ND
		22-Oct-14		ND		ND		ND		ND		ND
		15-Apr-15		ND		ND		ND		ND		ND
		22-Oct-15		ND		ND		ND		ND		ND
		27-Apr-16		ND		ND		ND		ND		ND
		24-Oct-16		ND		ND		ND		ND		ND
		09-May-17		ND		ND		ND		ND		ND
		23-Oct-17		ND		ND		ND		ND		ND
		18-Apr-18		ND		ND	1.5			ND		ND
		18-Oct-18		ND		ND		ND		ND		ND
		02-May-19		ND		ND		ND		ND		ND
HD-12S[a]	**OU5**	20-Apr-10		ND		ND	0.44	J		ND		ND
(Semiannual)		12-Oct-10		ND		ND	0.38	J		ND		ND
		11-May-11		ND		ND	0.34	J		ND		ND
		18-Oct-11		ND		ND	0.29	J		ND		ND
		11-Apr-12		ND		ND	0.3	J		ND		ND
		10-Oct-12		ND		ND	0.33	J		ND		ND
		10-Apr-13		ND		ND		ND		ND		ND
		09-Oct-13		ND		ND	0.31	J		ND		ND
		08-May-14		ND		ND		ND		ND		ND
		22-Oct-14		ND		ND	0.28	J		ND		ND
		15-Apr-15		ND		ND		ND		ND		ND
		22-Oct-15		ND		ND		ND		ND		ND
		27-Apr-16		ND		ND	0.35	J		ND		ND
		24-Oct-16		ND		ND		ND		ND		ND
		09-May-17		ND		ND		ND		ND		ND
		23-Oct-17		ND		ND		ND		ND		ND
		18-Apr-18		ND		ND	2.4			ND		ND
		18-Oct-18		ND		ND		ND		ND		ND
		02-May-19		ND		ND		ND		ND		ND

Table 8-4
LTM Program Groundwater Sampling Results: VOCs
Groundwater Operable Unit
Wright-Patterson AFB, Ohio

Sample Location (Sample Frequency)	Management Area	Sample Date	cis-1,2-DCE µg/L		trans-1,2-DCE µg/L		PCE µg/L		TCE µg/L		Vinyl Chloride µg/L	
		MCL	70		100		5		5		2	
			Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
HD-13D[a]	OU5	20-Apr-10	13		0.65			ND		ND	0.4	J
(Semiannual)		12-Oct-10	12		0.58			ND		ND	0.29	J
		11-May-11	12		0.62			ND		ND	0.36	J
		18-Oct-11	10		0.49	J		ND		ND		ND
		11-Apr-12	11		0.53			ND		ND	0.24	J
		10-Oct-12	13		0.64			ND		ND	0.41	J
		10-Apr-13	10		0.56			ND		ND	0.37	J
		09-Oct-13	12		0.59			ND		ND		ND
		08-May-14	11		0.58			ND		ND		ND
		22-Oct-14	11		0.52			ND		ND		ND
		15-Apr-15	11		0.44	J		ND		ND	0.34	J
		22-Oct-15	11		0.47	J		ND		ND		ND
		27-Apr-16	9.1		0.46	J		ND		ND		ND
		24-Oct-16	9.4		0.39	J		ND		ND		ND
		09-May-17	1.2			ND		ND		ND		ND
		23-Oct-17	10.3		0.54	J		ND		ND		ND
		18-Apr-18	10		0.53	J		ND		ND		ND
		18-Oct-18	7.2		0.25	J		ND		ND	0.63	J
		02-May-19	6.2		0.26	J		ND		ND	0.61	J
HD-13S[a]	OU5	20-Apr-10	5.5			ND		ND		ND	1.7	
(Semiannual)		12-Oct-10	5.1			ND		ND		ND	**2.3**	
		11-May-11	0.53			ND		ND		ND		ND
		18-Oct-11	1.5			ND		ND		ND		ND
		11-Apr-12	1.9			ND		ND		ND	0.39	J
		10-Oct-12	4.2			ND		ND		ND	0.94	J
		10-Apr-13	2.8			ND		ND		ND	1.3	
		09-Oct-13	3.1			ND		ND		ND	0.87	J
		08-May-14	1.7			ND		ND		ND		ND
		22-Oct-14	2			ND		ND		ND		ND
		15-Apr-15	1.4			ND		ND		ND		ND
		22-Oct-15	3.1			ND		ND		ND		ND
		27-Apr-16	2.5			ND		ND		ND		ND
		24-Oct-16	1.5			ND		ND		ND		ND
		09-May-17	9		0.55	J		ND		ND		ND
		23-Oct-17		ND		ND		ND		ND		ND
		18-Apr-18		ND		ND		ND		ND		ND
		18-Oct-18		ND		ND		ND		ND		ND
		02-May-19		ND		ND		ND		ND		ND
MW125S[a]	OU5	19-Apr-10	0.45	J		ND		ND		ND		ND
(Semiannual)		11-Oct-10	0.42	J		ND		ND		ND		ND
		11-May-11		ND		ND		ND		ND		ND
		17-Oct-11		ND		ND		ND		ND		ND
		11-JUL-12		ND		ND		ND	0.33	J		ND
		11-Oct-12	0.22	J		ND		ND	0.44	J		ND
		04-Apr-13	0.18	J		ND		ND	0.26	J		ND
		09-Oct-13	Well not sampled during this sampling round. City of Dayton unable to assist.									
		08-May-14	Well not sampled during this sampling round. City of Dayton unable to assist.									
		22-Oct-14	Well not sampled during this sampling round. City of Dayton unable to assist.									
		16-Apr-15	0.26	J		ND		ND	0.34	J		ND
		22-Oct-15	Well not sampled during this sampling round. City of Dayton unable to assist.									
		27-Apr-16	Well not sampled during this sampling round. City of Dayton unable to assist.									
		24-Oct-16	Well not sampled during this sampling round. City of Dayton unable to assist.									
		09-May-17		ND		ND		ND		ND		ND
		24-Oct-17		ND		ND		ND	0.43	J		ND
		19-Apr-18		ND		ND		ND		ND		ND
		22-Oct-18		ND		ND		ND		ND		ND
		02-May-19		ND		ND		ND		ND		ND
MW131M[a]	OU5	20-Apr-10	0.48	J		ND		ND		ND	1.4	
(Semiannual)		12-Oct-10	1.2			ND		ND		ND	**5.1**	
		11-May-11		ND		ND		ND		ND		ND
		18-Oct-11		ND		ND		ND		ND		ND
		11-Apr-12	0.63			ND		ND	0.71	J		ND

Table 8-4
LTM Program Groundwater Sampling Results: VOCs
Groundwater Operable Unit
Wright-Patterson AFB, Ohio

Sample Location (Sample Frequency)	Management Area	Sample Date	cis-1,2-DCE µg/L		trans-1,2-DCE µg/L		PCE µg/L		TCE µg/L		Vinyl Chloride µg/L	
		MCL	70		100		5		5		2	
			Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
MW131M[a] (continued)		10-Oct-12	2.7		0.23	J		ND	0.82	J	**2.2**	
		10-Apr-13	2.2			ND		ND	0.39	J	**4.2**	
		09-Oct-13	1.9			ND		ND		ND	**2.8**	
		08-May-14	0.35	J		ND		ND	0.35	J		ND
		22-Oct-14	0.5			ND		ND		ND	0.45	J
		15-Apr-15		ND		ND		ND		ND		ND
		22-Oct-15	1.1			ND		ND	1.9	J		ND
		27-Apr-16	1.1			ND		ND	1.1			ND
		24-Oct-16	2.2			ND		ND	2.2		0.46	J
		09-May-17	2			ND		ND	3.4		1.3	
		23-Oct-17	2.6			ND		ND	0.80	J		ND
		18-Apr-18		ND		ND		ND		ND		ND
		18-Oct-18	1.1			ND		ND		ND		ND
		02-May-19		ND		ND		ND		ND		ND
MW131S[a] (Semiannual)	**OU5**	20-Apr-10		ND		ND		ND		ND		ND
		12-Oct-10		ND		ND		ND		ND		ND
		11-May-11		ND		ND		ND		ND		ND
		18-Oct-11		ND		ND		ND		ND		ND
		11-Apr-12		ND		ND		ND		ND		ND
		10-Oct-12		ND		ND	0.36	J		ND		ND
		10-Apr-13		ND		ND		ND		ND		ND
		09-Oct-13		ND		ND	0.33	J		ND		ND
		08-May-14		ND		ND		ND		ND		ND
		22-Oct-14		ND		ND	0.27	J		ND		ND
		15-Apr-15		ND		ND		ND		ND		ND
		22-Oct-15		ND		ND		ND		ND		ND
		27-Apr-16		ND		ND		ND		ND		ND
		24-Oct-16		ND		ND		ND		ND		ND
		09-May-17		ND		ND		ND		ND		ND
		23-Oct-17		ND		ND		ND		ND		ND
		18-Apr-18		ND		ND		ND		ND		ND
		18-Oct-18		ND		ND		ND		ND		ND
		02-May-19		ND		ND		ND		ND		ND
MW132S[a] (Semiannual)	**OU5**	20-Apr-10	7.8			ND	1.2		**13**			ND
		12-Oct-10	3.8			ND	1.2		**15**			ND
		11-May-11	1			ND	0.78	J	**11**			ND
		18-Oct-11	7.7			ND	0.87	J	**8.6**			ND
		11-Apr-12	6.4			ND	0.83	J	**14**			ND
		10-Oct-12	6.7			ND	0.8	J	**12**			ND
		10-Apr-13	5.7			ND	0.73	J	**11**			ND
		09-Oct-13	5.1			ND	0.83	J	**11**			ND
		08-May-14	6.5			ND	0.31	J	4			ND
		22-Oct-14	7.5			ND	0.40	J	4.5		0.53	J
		15-Apr-15	8.8			ND	0.32	J	3.9		0.73	J
		22-Oct-15	7.5			ND	0.39	J	4.2		0.75	J
		27-Apr-16	7.0		0.18	J	0.32	J	3.1		0.92	J
		24-Oct-16	6.2			ND	0.30	J	3.8		0.74	J
		09-May-17	3.4			ND	0.67	J	**8.6**			ND
		23-Oct-17	3.3			ND	0.76	J	**11.1**			ND
		18-Apr-18	4.5			ND		ND	**7.7**			ND
		18-Oct-18	4.2			ND	0.61	J	**10.6**			ND
		02-May-19	7.8			ND	0.53	J	**2.6**			ND
CW03-077 (MT-230) (Semiannual)	**OU8**	19-Apr-10		ND		ND	0.68	J	0.49	J		ND
		12-Oct-10		ND		ND	0.52	J	0.34	J		ND
		27-Apr-11		ND		ND	0.59	J	0.5	J		ND
		19-Oct-11		ND		ND	0.54	J	0.35	J		ND
		11-Apr-12		ND		ND	0.65	J	0.48	J		ND
		11-Oct-12		ND		ND	0.49	J	0.35	J		ND
		04-Apr-13		ND		ND	0.55	J	0.55	J		ND
		07-Oct-13		ND		ND	0.65	J	0.41	J		ND
		30-Apr-14		ND		ND	0.63	J	0.50	J		ND
		20-Oct-14		ND		ND	0.67	J	0.56	J		ND
		14-Apr-15		ND		ND	0.56	J	0.64	J		ND
		19-Oct-15		ND		ND	0.67	J	0.56	J		ND

Table 8-4
LTM Program Groundwater Sampling Results: VOCs
Groundwater Operable Unit
Wright-Patterson AFB, Ohio

Sample Location (Sample Frequency)	Management Area	Sample Date	cis-1,2-DCE µg/L		trans-1,2-DCE µg/L		PCE µg/L		TCE µg/L		Vinyl Chloride µg/L	
		MCL	70		100		5		5		2	
			Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
CW03-077		25-Apr-16		ND		ND	0.49	J	0.45	J		ND
(continued)		21-Oct-16		ND		ND	0.31	J		ND		ND
		08-May-17		ND		ND	0.54	J		ND		ND
		19-Oct-17		ND		ND	0.59	J	0.53	J		ND
		18-Apr-18		ND		ND	0.57	J	0.44	J		ND
		15-Oct-18		ND		ND	0.57	J	0.56	J		ND
		22-Apr-19		ND		ND	0.52	J	0.63	J		ND
EFD04-MW06	**OU9**	12-May-09		ND		ND		ND		ND		ND
(Annual)		14-Apr-10		ND		ND		ND		ND		ND
		04-May-11		ND		ND		ND		ND		ND
		11-Apr-12		ND		ND		ND		ND		ND
		03-Apr-13		ND		ND		ND		ND		ND
		08-May-14		ND		ND		ND		ND		ND
		15-Apr-15		ND		ND		ND		ND		ND
		25-Apr-16		ND		ND		ND		ND		ND
		08-May-17		ND		ND		ND		ND		ND
		23-Apr-18		ND		ND		ND		ND		ND
		Spring 2019	Not Sampled per 2017 Annual LTM Report									
EFD09-M575	**OU9** Duplicate	14-Apr-10		ND		ND		ND		ND		ND
(Annual)		14-Apr-10		ND		ND		ND		ND		ND
	Duplicate	13-May-11		ND		ND		ND		ND		ND
		13-May-11		ND		ND		ND		ND		ND
	Duplicate	20-Apr-12		ND		ND		ND		ND		ND
		20-Apr-12		ND		ND		ND		ND		ND
	Duplicate	04-Apr-13		ND		ND		ND	0.17	J		ND
		04-Apr-13	0.2	J		ND		ND		ND		ND
	Duplicate	13-May-14		ND		ND		ND		ND		ND
		13-May-14		ND		ND		ND		ND		ND
	Duplicate	23-Apr-15		ND		ND		ND		ND		ND
		23-Apr-15		ND		ND		ND		ND		ND
		25-Apr-16		ND		ND		ND		ND		ND
		08-May-17		ND		ND		ND		ND		ND
		23-Apr-18		ND		ND		ND		ND		ND
		Spring 2019	Not Sampled per 2017 Annual LTM Report									
GR-333	**OU10**	28-Apr-10		ND		ND	0.7	J	0.36	J		ND
(Annual)		18-Oct-10		ND		ND	0.83	J	0.39	J		ND
		16-May-11		ND		ND	0.89	J	0.4	J		ND
		23-Apr-12		ND		ND	0.9	J	0.33	J		ND
		04-Apr-13		ND		ND	0.73	J	0.31	J		ND
		12-May-14		ND		ND	0.86	J	0.28	J		ND
		20-Apr-15		ND		ND	0.78	J		ND		ND
		02-May-16		ND		ND	0.83	J		ND		ND
		17-May-17		ND		ND	0.75	J		ND		ND
		19-Apr-18		ND		ND	0.81	J		ND		ND
		29-Apr-19		ND		ND	0.72	J		ND		ND
OU10-MW-01I	**OU10**	02-May-17		ND		ND		ND		ND		ND
(Semiannual)		17-Oct-17		ND		ND		ND		ND		ND
OU10-MW-02S		26-Oct-16		ND		ND	**5.0**			ND		ND
(Semiannual)		02-May-17		ND		ND	**7.6**			ND		ND
		19-Oct-17		ND		ND	**8.7**			ND		ND
		16-Apr-18		ND		ND	**7.5**			ND		ND
		17-Oct-18		ND		ND	**8.6**			ND		ND
		24-Apr-19		ND		ND	**8.4**			ND		ND
OU10-MW-03S	**OU10**	21-Apr-10		ND		ND	4.3			ND		ND
(Annual)		11-Oct-10		ND		ND	**6**			ND		ND
		29-Apr-11		ND		ND	3			ND		ND
		19-Oct-11		ND		ND	4.2			ND		ND
		13-Apr-12		ND		ND	4.3			ND		ND
		03-Apr-13	1			ND	4.3		0.64	J		ND
		30-Apr-14	1.2			ND	4.5		3.4			ND
		20-Apr-15	0.32	J		ND	3.7		1.2	J		ND
		02-May-16		ND		ND	4.8		1.4			ND

Table 8-4
LTM Program Groundwater Sampling Results: VOCs
Groundwater Operable Unit
Wright-Patterson AFB, Ohio

Sample Location (Sample Frequency)	Management Area	Sample Date	cis-1,2-DCE µg/L		trans-1,2-DCE µg/L		PCE µg/L		TCE µg/L		Vinyl Chloride µg/L	
		MCL	70		100		5		5		2	
			Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
OU10-MW-03S (continued)		02-May-17		ND		ND	**6.6**		1.7			ND
		16-Apr-18		ND		ND	**6.0**		1.8			ND
		24-Apr-19		ND		ND	**5.0**		1.0			ND
OU10-MW-04S (Semiannual)	**OU10**	22-Apr-15		ND		ND	1.8			ND		ND
		20-Oct-15		ND		ND	2.0			ND		ND
	Duplicate	29-Apr-16		ND		ND	1.9			ND		ND
		29-Apr-16		ND		ND	1.9			ND		ND
		25-Oct-16		ND		ND	2.0			ND		ND
	Duplicate	03-May-17		ND		ND	2.2			ND		ND
		03-May-17		ND		ND	2.0			ND		ND
		17-Oct-17		ND		ND	2.3			ND		ND
		17-Apr-18		ND		ND	1.8			ND		ND
	Duplicate	17-Apr-18		ND		ND	2.0			ND		ND
		17-Oct-18		ND		ND	2.3			ND		ND
		24-Apr-19		ND		ND	1.8			ND		ND
OU10-MW-06D (Annual)	**OU10**	13-Apr-10		ND		ND		ND		ND		ND
		11-Oct-10		ND		ND	2			ND		ND
		25-Apr-11		ND		ND	1.7			ND		ND
		13-Apr-12		ND		ND		ND		ND		ND
		02-Apr-13		ND		ND		ND		ND		ND
		30-Apr-14		ND		ND		ND		ND		ND
		17-Apr-15		ND		ND	0.90	J		ND		ND
		29-Apr-16		ND		ND		ND		ND		ND
		02-May-17		ND		ND		ND		ND		ND
		16-Apr-18		ND		ND		ND		ND		ND
		24-Apr-19		ND		ND		ND		ND		ND
OU10-MW-06S (Annual)	**OU10**	26-Apr-10		ND		ND	1.7		**9**			ND
	Duplicate	26-Apr-10		ND		ND	1.7		**9**			ND
		11-Oct-10		ND		ND	3.4		**8.6**			ND
	Duplicate	25-Apr-11		ND		ND	3.1		**9.1**			ND
		25-Apr-11		ND		ND	3.1		**8.8**			ND
	Duplicate	13-Apr-12		ND		ND	1.8		**11**			ND
		13-Apr-12		ND		ND	1.8		**11**			ND
	Duplicate	02-Apr-13		ND		ND	1		**10**			ND
		02-Apr-13		ND		ND	1.2		**10**			ND
	Duplicate	30-Apr-14		ND		ND	1.1		**9.1**			ND
		30-Apr-14		ND		ND	1.2		**8.9**			ND
	Duplicate	17-Apr-15		ND		ND	**6.4**		**6.5**			ND
		17-Apr-15		ND		ND	**6.8**		**6.6**			ND
	Duplicate	29-Apr-16		ND		ND	**9.3**		**5.1**			ND
		29-Apr-16		ND		ND	**8.6**		**5**			ND
	Duplicate	02-May-17		ND		ND	**5.6**		**7.1**			ND
		02-May-17		ND		ND	**5.9**		**7.5**			ND
		16-Apr-18		ND		ND	**7.6**		**5.9**			ND
	Duplicate	16-Apr-18		ND		ND	**8.1**		**6.3**			ND
		24-Apr-19		ND		ND	**8.1**		**6.1**			ND
	Duplicate	24-Apr-19		ND		ND	**8.6**		**6.0**			ND
OU10-MW-11D (Annual)	**OU10**	13-Apr-10		ND		ND	**6.2**		2.8			ND
		11-Oct-10		ND		ND	**6.6**		2.8			ND
		28-Apr-11		ND		ND	5		2.5			ND
		13-Apr-12		ND		ND	**7.5**		2			ND
		02-Apr-13		ND		ND	**5.8**		1.5	J		ND
		05-May-14		ND		ND	**6.3**		1.2	J		ND
		14-Apr-15		ND		ND	**6.4**		0.74	J		ND
		02-May-16		ND		ND	**7.8**		0.52	J		ND
		02-May-17		ND		ND	**8.9**		0.54	J		ND
		17-Apr-18		ND		ND	**9.5**		0.43	J		ND
		23-Apr-19		ND		ND	**7.9**		0.45	J		ND
OU10-MW-11S (Annual)	**OU10**	20-Apr-10		ND		ND	**13**			ND		ND
		11-Oct-10		ND		ND	**14**			ND		ND
		28-Apr-11		ND		ND	**11**			ND		ND
		13-Apr-12		ND		ND	**13**			ND		ND
		02-Apr-13		ND		ND	**10**			ND		ND

Table 8-4
LTM Program Groundwater Sampling Results: VOCs
Groundwater Operable Unit
Wright-Patterson AFB, Ohio

Sample Location (Sample Frequency)	Management Area	Sample Date	cis-1,2-DCE µg/L		trans-1,2-DCE µg/L		PCE µg/L		TCE µg/L		Vinyl Chloride µg/L	
		MCL	70		100		5		5		2	
			Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
OU10-MW-11S		05-May-14		ND		ND	**11**		0.21	J		ND
(continued)		14-Apr-15		ND		ND	**12**			ND		ND
		02-May-16		ND		ND	**12**			ND		ND
		02-May-17		ND		ND	1.2			ND		ND
		17-Apr-18		ND		ND	**10.5**			ND		ND
		23-Apr-19		ND		ND	**11**			ND		ND
OU10-MW15S	**OU10**	22-Apr-15		ND		ND		ND	4.8			ND
(Semiannual)		20-Oct-15		ND		ND		ND	**7.0**			ND
		02-May-16		ND		ND		ND	**7.3**			ND
		26-Oct-16		ND		ND		ND	**5.1**			ND
		03-May-17		ND		ND		ND	**7.9**			ND
		25-Oct-17		ND		ND		ND	**7.0**			ND
		17-Apr-18		ND		ND		ND	**7.9**			ND
		22-Oct-18		ND		ND		ND	**11.4**			ND
		23-Apr-19		ND		ND		ND	**11.1**			ND
OU10-MW-19D	**OU10**	27-Apr-10		ND		ND		ND	1.9	J		ND
(Semiannual)		11-Oct-10		ND		ND		ND	2.1			ND
		05-May-11		ND		ND		ND	1.9	J		ND
		17-Oct-11		ND		ND		ND	1.5	J		ND
		17-Apr-12		ND		ND		ND	1.7	J		ND
		11-Oct-12		ND		ND		ND	1.9	J		ND
		03-Apr-13		ND		ND		ND	1.5	J		ND
		08-Oct-13		ND		ND		ND	1.4	J		ND
		09-May-14		ND		ND		ND	1.5	J		ND
		20-Oct-14		ND		ND	0.20	J	1.4	J		ND
		20-Apr-15		ND		ND		ND	1.3	J		ND
		20-Oct-15		ND		ND		ND	1.3	J		ND
		02-May-16		ND		ND		ND	1.1			ND
		25-Oct-16		ND		ND		ND	0.90	J		ND
		17-May-17		ND		ND		ND	1.4			ND
		02-Nov-17		ND		ND		ND	1.1			ND
		24-Apr-18		ND		ND		ND	1.1			ND
		23-Oct-18		ND		ND		ND	0.96	J		ND
		24-Apr-19		ND		ND		ND	0.93	J		ND
OU10-MW-21S	**OU10**	22-Apr-10		ND		ND		ND	3.3			ND
(Semiannual)		21-Oct-10		ND		ND		ND	3.4			ND
		10-May-11		ND		ND		ND	2.5			ND
		19-Oct-11		ND		ND		ND	2.8			ND
		19-Apr-12		ND		ND		ND	2.6			ND
		12-Oct-12		ND		ND		ND	2.8			ND
		18-Apr-13		ND		ND		ND	2.3			ND
		08-Oct-13		ND		ND		ND	2			ND
		12-May-14		ND		ND		ND	2.2			ND
		21-Oct-14		ND		ND		ND	1.9	J		ND
		21-Apr-15		ND		ND		ND	1.6	J		ND
		21-Oct-15		ND		ND		ND	1.7	J		ND
		02-May-16		ND		ND		ND	1.4			ND
		27-Oct-16		ND		ND		ND	1.3			ND
		17-May-17		ND		ND		ND	1.4			ND
		31-Oct-17		ND		ND		ND	1.5			ND
		17-Apr-18		ND		ND		ND	1.0			ND
		18-Oct-18		ND		ND		ND	1.1			ND
		24-Apr-19		ND		ND		ND	1.0			ND
OU10-MW-25S	**OU10**	20-Apr-10		ND		ND	4			ND		ND
(Semiannual)	Duplicate	11-Oct-10		ND		ND	4.1			ND		ND
		11-Oct-10		ND		ND	4.1			ND		ND
		25-Apr-11		ND		ND	3.7			ND		ND
	Duplicate	19-Oct-11		ND		ND	4			ND		ND
		19-Oct-11		ND		ND	4			ND		ND
		17-Apr-12		ND		ND	**5.3**			ND		ND
	Duplicate	10-Oct-12		ND		ND	**5.4**			ND		ND
		10-Oct-12		ND		ND	**5.1**			ND		ND
		02-Apr-13		ND		ND	4.6			ND		ND
		08-Oct-13		ND		ND	4.6			ND		ND

Table 8-4
LTM Program Groundwater Sampling Results: VOCs
Groundwater Operable Unit
Wright-Patterson AFB, Ohio
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Sample Location (Sample Frequency)	Management Area	Sample Date	cis-1,2-DCE µg/L		trans-1,2-DCE µg/L		PCE µg/L		TCE µg/L		Vinyl Chloride µg/L	
		MCL	70		100		5		5		2	
			Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
OU10-MW-25S (continued)		09-May-14		ND		ND	**5.9**			ND		ND
	Duplicate	21-Oct-14		ND		ND	**6.1**			ND		ND
		21-Oct-14		ND		ND	**5.9**			ND		ND
		20-Apr-15		ND		ND	**5**			ND		ND
	Duplicate	20-Oct-15		ND		ND	**6.3**			ND		ND
		20-Oct-15		ND		ND	**6.4**			ND		ND
		29-Apr-16		ND		ND	**5.8**			ND		ND
	Duplicate	26-Oct-16		ND		ND	4.4			ND		ND
		26-Oct-16		ND		ND	4.4			ND		ND
		03-May-17		ND		ND	4.8			ND		ND
		19-Oct-17		ND		ND	**6.4**			ND		ND
		16-Apr-18		ND		ND	**5.0**			ND		ND
		22-Oct-18		ND		ND	**6.4**			ND		ND
	Duplicate	22-Oct-18		ND		ND	**6.4**			ND		ND
		22-Apr-19		ND		ND	**6.2**			ND		ND
LF512-MW-14 (Semiannual)	**OU10**	26-Oct-16		ND		ND	**6.8**			ND		ND
		03-May-17		ND		ND	**8.8**			ND		ND
		19-Oct-17		ND		ND	**9.8**			ND		ND
		19-Oct-17		ND		ND	**9.8**			ND		ND
		16-Apr-18		ND		ND	**9.2**			ND		ND
		22-Oct-18		ND		ND	**9.6**			ND		ND
		24-Apr-19		ND		ND	**8.7**			ND		ND
23-578-M (Semiannual)	**OU10 (CHP4)**	15-Oct-08		ND		ND	2.1		1.3	J		ND
		11-May-09		ND		ND	1.9		1.3	J		ND
		05-Oct-09		ND		ND	2		1.6	J		ND
		26-Apr-10		ND		ND	1.7		2.1			ND
		11-Oct-10		ND		ND	2.1		2.2			ND
		25-Apr-11		ND		ND	1.9		1.8	J		ND
		19-Oct-11		ND		ND	1.6		1.1	J		ND
		13-Apr-12		ND		ND	1.5		1.2	J		ND
		09-Oct-12		ND		ND	1.7		1	J		ND
		03-Apr-13		ND		ND	1.1		1	J		ND
		08-Oct-13		ND		ND	1.2		1.1	J		ND
		30-Apr-14		ND		ND	1.1		1.6	J		ND
		20-Oct-14		ND		ND	1.1		1.4	J		ND
		20-Apr-15		ND		ND	1.1		0.90	J		ND
		19-Oct-15		ND		ND	1.1		1.0	J		ND
		02-May-16		ND		ND	1.2		1.1			ND
		21-Oct-16		ND		ND	0.54	J	0.50	J		ND
		03-May-17		ND		ND	1.1		1.1			ND
		17-Oct-17		ND		ND	0.74	J	0.82	J		ND
		16-Apr-18		ND		ND	1.0		1.4			ND
		16-Oct-18		ND		ND	1.1		1.2			ND
		24-Apr-19		ND		ND	1.1		1.8			ND
CHP4-MW01 (Annual)	**OU10 (CHP4)**	26-Apr-10		ND		ND	0.6	J		ND		ND
		11-Oct-10		ND		ND	0.78	J		ND		ND
		25-Apr-11		ND		ND	0.54	J		ND		ND
		11-Apr-12	Not sampled due to construction in the vicinity of the well location.									
		03-Apr-13		ND		ND	0.66	J		ND		ND
		09-May-14	Not sampled, well buried during area construction.									
		20-Apr-15	Not sampled, well buried during area construction.									
		02-May-16	Not sampled, well buried during area construction.									
		03-May-17		ND		ND	0.55	J		ND		ND
		17-Oct-17		ND		ND	0.43	J		ND		ND
		16-Apr-18		ND		ND		ND		ND		ND
		16-Oct-18		ND		ND	0.32	J		ND		ND
		Spring 2019	Not Sampled per 2017 Annual LTM Report									
GR-330 (Semiannual)	**OU10 (CHP4)**	27-Apr-10		ND		ND	**7.2**			ND		ND
		11-Oct-10		ND		ND	1.6			ND		ND
		28-Apr-11		ND		ND	0.65	J		ND		ND
		19-Oct-11		ND		ND	1.2			ND		ND
		19-Apr-12		ND		ND	0.82	J		ND		ND
		09-Oct-12		ND		ND	1.1			ND		ND
		04-Apr-13		ND		ND	0.63	J		ND		ND

Table 8-4
LTM Program Groundwater Sampling Results: VOCs
Groundwater Operable Unit
Wright-Patterson AFB, Ohio
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Sample Location (Sample Frequency)	Management Area	Sample Date	cis-1,2-DCE µg/L		trans-1,2-DCE µg/L		PCE µg/L		TCE µg/L		Vinyl Chloride µg/L	
		MCL	70		100		5		5		2	
			Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
GR-330		08-Oct-13		ND		ND	0.4	J		ND		ND
(continued)		09-May-14		ND		ND	1.1			ND		ND
		23-Oct-14		ND		ND	0.77	J		ND		ND
		20-Apr-15		ND		ND	1.8			ND		ND
		19-Oct-15		ND		ND	0.78	J		ND		ND
		02-May-16		ND		ND	1.0			ND		ND
		25-Oct-16		ND		ND	0.80	J		ND		ND
		03-May-17		ND		ND	1.9			ND		ND
		17-Oct-17		ND		ND	0.86	J		ND		ND
		17-Apr-18		ND		ND	0.42	J		ND		ND
		16-Oct-18		ND		ND	0.86	J		ND		ND
		24-Apr-19		ND		ND		ND		ND		ND
B59-MW02	**Building 59**	12-Apr-05	**3,100**		13			ND	**4,000**		**50**	
(Semiannual)		08-Jun-05	Oxidant Injection Pilot Test Conducted in Well B59-MW02									
		23-Apr-07	Oxidant present in well - not sampled									
		19-Apr-12	Oxidant present in well - not sampled									
		10-May-17	**3,150**		68.7			ND	**625**		**319**	
		24-Oct-18	**2,550**		35.2			ND	**249**		**55.2**	
		22-Apr-19	**2,310**		79.2			ND	**466**		**297**	
B59-MW03	**Building 59**	12-Apr-05	**160**	D	7.1			ND	**46**	D	**41**	D
(Semiannual)		23-Apr-07	**160**	D	10			ND	**130**	D	**33**	
	Duplicate	23-Apr-07	**170**	D	11			ND	**130**	D	**35**	
		19-Apr-12	**150**	D	5.8			ND	4.6		**15**	
		08-May-17	**359**		20.6			ND	**15.5**		**16.1**	
		24-Oct-18	**283**		13.4			ND	**17.4**		**22.1**	
		22-Apr-19	**393**		19.1			ND	**98.2**		**12.3**	
B79C/D-MW01	**Building 79**	13-Apr-10	12	D	1.5	D		ND D	**41**	D	0.31	J D
(Semiannual)		21-Oct-10	12		1.6			ND	**50**		0.4	J
		11-May-11	11	D	1.7	D		ND D	**52**	D	0.39	J D
		18-Apr-12	13		2.2			ND	**58**		0.37	J
		02-Apr-13	15	H	2.3	H		ND	**65**	D	0.51	J H
		19-Nov-13	13	D	1.9	D		ND D	**58**	D		ND D
		06-May-14	17		2.2			ND	**45**	D	0.28	J
		20-Oct-14	17		2.3			ND	**50**			ND
Injection pilot test conducted Nov. 2014.												
		13-Apr-15	61		2.9			ND	1.3	J	0.65	J
		19-Oct-15	62		1.5			ND		ND	**3.4**	
	Duplicate	25-Apr-16	15		0.40	J		ND		ND	**21**	
		25-Apr-16	16		0.41	J		ND		ND	**19**	
		19-Oct-16	5.1		0.39	J		ND		ND	**2.3**	
	Duplicate	03-May-17	2.7		0.24	J		ND		ND	**2.8**	
		03-May-17	2.6			ND		ND		ND	**2.9**	
	Duplicate	18-Oct-17	2.9			ND		ND		ND	**3.4**	
		18-Oct-17	3.4		0.35	J		ND		ND	**3.4**	
		20-Apr-18	1.7			ND		ND		ND	**2.3**	
	Duplicate	20-Apr-18	1.6			ND		ND		ND	**2.1**	
		23-Oct-18	7.4		0.53	J		ND		ND	**7.3**	
	Duplicate	23-Oct-18	7.3		0.59	J		ND		ND	**7.4**	
		18-Apr-19	2.5		0.31	J		ND		ND	**3.8**	
	Duplicate	18-Apr-19	2.4		0.35	J		ND		ND	**4.0**	
B79C/D-MW02	**Building 79**	19-Apr-10		ND		ND		ND	**33**			ND
(Annual)		14-Oct-10		ND		ND		ND	**28**			ND
		11-May-11		ND		ND		ND	**32**			ND
		18-Apr-12		ND		ND		ND	**26**			ND
		02-Apr-13		ND		ND		ND	**27**			ND
		19-Nov-13		ND		ND		ND	**25**			ND
		06-May-14		ND		ND		ND	**25**			ND
		13-Apr-15		ND		ND		ND	**27**			ND
		25-Apr-16		ND		ND		ND	**20**			ND
		03-May-17		ND		ND		ND	**28.8**			ND
		20-Apr-18		ND		ND		ND	**22.8**			ND
		18-Apr-19		ND		ND		ND	**23.8**			ND

Table 8-4
LTM Program Groundwater Sampling Results: VOCs
Groundwater Operable Unit
Wright-Patterson AFB, Ohio
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Sample Location (Sample Frequency)	Management Area	Sample Date	cis-1,2-DCE µg/L		trans-1,2-DCE µg/L		PCE µg/L		TCE µg/L		Vinyl Chloride µg/L	
		MCL	70		100		5		5		2	
			Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
B79C/D-MW03	**Building 79**	13-Apr-10		ND		ND		ND	4.6			ND
(Annual)	Duplicate	14-Oct-10		ND		ND		ND	**10**			ND
		14-Oct-10		ND		ND		ND	**9.6**			ND
		13-May-11	0.24	J		ND		ND	**12**			ND
		18-Apr-12		ND		ND		ND	**7.5**			ND
		02-Apr-13		ND		ND		ND	**6**			ND
		19-Nov-13		ND		ND		ND	4.6			ND
		06-May-14		ND		ND		ND	3.6			ND
		13-Apr-15	0.27	J		ND		ND	**11**			ND
		25-Apr-16		ND		ND		ND	1.6			ND
		03-May-17		ND		ND		ND	2.6			ND
		20-Apr-18		ND		ND		ND	3.8			ND
		18-Apr-19		ND		ND		ND	**8.1**			ND
B79C/D-MW04	**Building 79**	13-Apr-10	0.75			ND		ND	**24**			ND
(Annual)		14-Oct-10	1.1		0.41	J		ND	**40**			ND
		11-May-11	0.22	J		ND		ND	1.4	J		ND
		18-Apr-12	0.71		0.2	J		ND	**14**			ND
		02-Apr-13	1.4		0.33	J		ND	**17**			ND
	Duplicate	19-Nov-13	0.91		0.31	J		ND	**14**			ND
		19-Nov-13	0.91		0.26	J		ND	**14**			ND
		06-May-14	1.7		0.35	J		ND	**28**			ND
		13-Apr-15	0.28	J		ND		ND	**7.1**			ND
		25-Apr-16	0.98	J	0.17	J		ND	**14**			ND
		03-May-17		ND		ND		ND	4.4			ND
		20-Apr-18		ND		ND		ND	**10.5**			ND
		18-Apr-19		ND		ND		ND	**9.6**			ND
B79C/D-MW05	**Building 79**	19-Apr-10		ND		ND		ND		ND		ND
(Annual)		14-Oct-10		ND		ND		ND		ND		ND
		06-May-11		ND		ND		ND		ND		ND
		18-Apr-12		ND		ND		ND		ND		ND
		03-Apr-13		ND		ND		ND		ND		ND
		06-May-14		ND		ND		ND		ND		ND
		13-Apr-15		ND		ND		ND		ND		ND
		25-Apr-16		ND		ND		ND		ND		ND
		08-May-17		ND		ND		ND		ND		ND
		13-Apr-18		ND		ND		ND		ND		ND
		Spring 2019	Not Sampled per 2017 Annual LTM Report									
B79C/D-MW06	**Building 79**	20-Nov-13	3.1		0.39	J		ND	**11**			ND
(Semiannual)		06-May-14	3.1		0.41	J		ND	**10**			ND
		20-Oct-14	3.1		0.36	J		ND	**13**			ND
		15-Apr-15	3		0.40	J		ND	**12**			ND
		19-Oct-15	3.5		0.51			ND	**16**			ND
		02-May-16	2.9		0.43	J		ND	**11**			ND
		19-Oct-16	3.1		0.43	J		ND	**12**			ND
		08-May-17	2.9		0.54	J		ND	**12.9**			ND
		19-Oct-17	3.8		0.56	J		ND	**19.6**			ND
		13-Apr-18	3.0		0.44	J		ND	**15**			ND
		15-Oct-18	3.2		0.47	J		ND	**15.4**			ND
		18-Apr-19	2.7		0.62	J		ND	**14.9**			ND
B79C/D-MW07	**Building 79**	20-Nov-13		ND		ND		ND		ND		ND
(Semiannual)	Duplicate	07-May-14		ND		ND		ND		ND		ND
		07-May-14		ND		ND		ND		ND		ND
		20-Oct-14		ND		ND		ND		ND		ND
	Duplicate	15-Apr-15		ND		ND		ND		ND		ND
		15-Apr-15		ND		ND		ND		ND		ND
		19-Oct-15		ND		ND		ND		ND		ND
		02-May-16		ND		ND		ND		ND		ND
		19-Oct-16		ND		ND		ND		ND		ND
		08-May-17		ND		ND		ND		ND		ND
		19-Oct-17		ND		ND		ND		ND		ND
		13-Apr-18		ND		ND		ND		ND		ND
		15-Oct-18		ND		ND		ND		ND		ND

Table 8-4
LTM Program Groundwater Sampling Results: VOCs
Groundwater Operable Unit
Wright-Patterson AFB, Ohio

Sample Location (Sample Frequency)	Management Area	Sample Date	cis-1,2-DCE µg/L		trans-1,2-DCE µg/L		PCE µg/L		TCE µg/L		Vinyl Chloride µg/L	
		MCL	70		100		5		5		2	
			Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
BS5 P-1	**Burial Site 5**	21-Apr-10		ND		ND	3.8			ND		ND
(Annual)		15-Oct-10		ND		ND	4.5			ND		ND
		12-May-11		ND		ND	1.7			ND		ND
		23-Apr-12		ND		ND	1.6			ND		ND
		05-Apr-13		ND		ND	**5.5**			ND		ND
		07-May-14		ND		ND	4.2			ND		ND
		17-Apr-15		ND		ND	**5.2**			ND		ND
		26-Apr-16		ND		ND	2.3			ND		ND
		15-May-17		ND		ND	4.7			ND		ND
		25-Apr-18		ND		ND	2.2			ND		ND
		25-Apr-19		ND		ND	3.3			ND		ND
BS5 P-3	**Burial Site 5**	21-Apr-10		ND		ND	**14**			ND		ND
(Annual)		15-Oct-10		ND		ND	**14**			ND		ND
		12-May-11		ND		ND	**13**			ND		ND
		23-Apr-12		ND		ND	**13**			ND		ND
		05-Apr-13		ND		ND	**12**			ND		ND
		07-May-14		ND		ND	**10**			ND		ND
		17-Apr-15		ND		ND	**10**			ND		ND
		26-Apr-16		ND		ND	**10**			ND		ND
		15-May-17		ND		ND	**9.8**			ND		ND
		25-Apr-18		ND		ND	**10.8**			ND		ND
		25-Apr-19		ND		ND	**8.6**			ND		ND
BS5 P-4	**Burial Site 5**	21-Apr-10		ND		ND	**18**			ND		ND
(Annual)	Duplicate	21-Apr-10		ND		ND	**16**			ND		ND
		15-Oct-10		ND		ND	**18**			ND		ND
	Duplicate	12-May-11		ND		ND	**12**			ND		ND
		12-May-11		ND		ND	**13**			ND		ND
	Duplicate	23-Apr-12		ND		ND	**15**			ND		ND
		23-Apr-12		ND		ND	**14**			ND		ND
	Duplicate	05-Apr-13	1.2			ND	**8.3**		0.77	J		ND
		05-Apr-13	1.4			ND	**7.3**		0.93	J		ND
	Duplicate	07-May-14		ND		ND	**11**			ND		ND
		07-May-14		ND		ND	**10**			ND		ND
	Duplicate	17-Apr-15		ND		ND	**10**			ND		ND
		17-Apr-15		ND		ND	**11**			ND		ND
		26-Apr-16		ND		ND	**11**		0.34	J		ND
	Duplicate	15-May-17		ND		ND	**8.9**			ND		ND
		15-May-17		ND		ND	**8.9**			ND		ND
		25-Apr-18		ND		ND	**10.2**			ND		ND
	Duplicate	25-Apr-18		ND		ND	**9.5**			ND		ND
		25-Apr-19		ND		ND	**8.7**			ND		ND
	Duplicate	25-Apr-19		ND		ND	**8.9**			ND		ND
SP11-MW01	**FAA-B**	14-Apr-10	0.6		0.44	J		ND		ND	**3**	
(Annual)	Duplicate	14-Apr-10	0.55		0.49	J		ND		ND	**2.7**	
	Duplicate	27-Apr-11	0.74		0.49	J		ND		ND	**2**	
		27-Apr-11	0.7		0.48	J		ND		ND	**2.1**	
	Duplicate	11-Apr-12		ND	0.33	J		ND		ND	1.1	
		11-Apr-12		ND	0.36	J		ND		ND	1.2	
	Duplicate	03-Apr-13	0.29	J	0.24	J		ND		ND	1.1	
		03-Apr-13	0.33	J	0.25	J		ND		ND	0.99	J
	Duplicate	07-May-14	0.30	J	0.29	J		ND		ND	0.74	J
		07-May-14	0.32	J	0.31	J		ND		ND	0.85	J
	Duplicate	20-Apr-15		ND		ND		ND		ND	0.32	J
		20-Apr-15		ND		ND		ND		ND	0.37	J
	Duplicate	26-Apr-16		ND		ND		ND		ND		ND
		26-Apr-16		ND	0.17	J		ND		ND		ND
	Duplicate	08-May-17		ND		ND		ND		ND		ND
		08-May-17		ND		ND		ND		ND		ND
		24-Apr-18		ND		ND		ND		ND		ND
	Duplicate	24-Apr-18		ND		ND		ND		ND		ND
		Spring 2019	Not sampled per 2017 Annual LTM Report									

Table 8-4
LTM Program Groundwater Sampling Results: VOCs
Groundwater Operable Unit
Wright-Patterson AFB, Ohio

Sample Location (Sample Frequency)	Management Area	Sample Date	cis-1,2-DCE µg/L		trans-1,2-DCE µg/L		PCE µg/L		TCE µg/L		Vinyl Chloride µg/L	
		MCL	70		100		5		5		2	
			Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
SP11-MW02	**FAA-B**	23-Apr-10	9.7		0.32	J		ND		ND		ND
(Annual)		05-May-11	10		0.35	J		ND		ND		ND
		23-Apr-12	10		0.32	J		ND		ND	0.22	J
		05-Apr-13	6.9		0.24	J		ND		ND	0.23	J
		12-May-14	5.7		0.28	J		ND		ND		ND
		23-Apr-15	3.8			ND		ND		ND		ND
		26-Apr-16	3.1		0.17	J		ND		ND		ND
		08-May-17	2.5			ND		ND		ND		ND
		26-Apr-18	2.1			ND		ND		ND		ND
		Spring 2019	Not sampled per 2017 Annual LTM Report									
SP11-MW03	**FAA-B**	19-Apr-10	3.8	D		ND D		ND D	1	J D	**61**	D
(Annual)		27-Apr-11	14		0.61			ND	**6**		**32**	
		17-Apr-12	2.5			ND		ND	1	J	**33**	D
		03-Apr-13	1.7		0.2	J		ND	0.31	J	**36**	
		07-May-14	2.7		0.23	J		ND	0.38	J	**39**	
		23-Apr-15	1.3			ND		ND	0.54	J	**18**	
		26-Apr-16	1.5		0.18	J		ND		ND	**17**	
		08-May-17		ND		ND		ND		ND		ND
		24-Apr-18	1.1			ND		ND		ND	**26.2**	
		22-Apr-19	2.2			ND		ND	0.74	J	**19.7**	
SP11-MW05	**FAA-B**	25-Apr-18		ND		ND		ND		ND	**2.9**	
SP11-MW07	**FAA-B**	23-Apr-10	2.3		0.26	J		ND		ND	**14**	
(Annual)		10-May-11	1.1		0.29	J		ND		ND	**6.2**	
		20-Apr-12	1			ND		ND		ND	**8.3**	
		03-Apr-13	1.6			ND		ND		ND	**11**	
		12-May-14	0.91			ND		ND	0.32	J	0.95	J
		20-Apr-15	Well not sampled area flooded.+-									
		26-Apr-16		ND		ND		ND		ND	**3.3**	
		05-May-17	0.89	J		ND		ND		ND	1.7	
		24-Apr-18	1.2			ND		ND		ND	**3.3**	
		22-Apr-19	0.84	J		ND		ND		ND	1.3	
SP11-MW08	**FAA-B**	19-Apr-10	3.2		1.7			ND		ND	**2.6**	
(Annual)		27-Apr-11	2.5		1.5			ND		ND	1.5	
		17-Apr-12	1.8		1.4			ND		ND	1.4	
		03-Apr-13	1.6		1.9			ND		ND	1.4	
		12-May-14	1.7		2			ND		ND	1.4	
		20-Apr-15	0.99		1.6			ND		ND	0.87	J
		25-Apr-16	0.88	J	1.4			ND		ND	0.58	J
		08-May-17	0.86	J	1.3			ND		ND	1.3	
		24-Apr-18	1.0		0.84	J		ND		ND	1.3	
		22-Apr-19	0.96	J		ND		ND		ND	0.96	J
SP11-MW09	**FAA-B**	23-Apr-10	37	D	1.7	D		ND D	2.8	J D	**11**	D
(Annual)		05-May-11	10		0.21	J		ND	3.5		0.82	J
		23-Apr-12	31		1.7			ND	1.7	J	**16**	
		05-Apr-13	5.9		0.28	J		ND	3.9		1.9	
		13-May-14	8.6		0.55			ND	1.8	J	**7.2**	
		23-Apr-15	2.5			ND		ND	1.8	J	0.5	J
		26-Apr-16	3.4		0.30	J		ND	1.3		**7.0**	
		08-May-17	1.2			ND		ND	1.4		1.5	
		26-Apr-18	1.0			ND		ND	1.2		0.86	J
		3-May-19	1.0	J		ND		ND	0.58	J	1.3	

Table 8-4
LTM Program Groundwater Sampling Results: VOCs
Groundwater Operable Unit
Wright-Patterson AFB, Ohio
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Sample Location (Sample Frequency)	Management Area	Sample Date	cis-1,2-DCE µg/L		trans-1,2-DCE µg/L		PCE µg/L		TCE µg/L		Vinyl Chloride µg/L	
		MCL	70		100		5		5		2	
			Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Ambient Blanks												
HD-13S[a]	**Ambient Blanks**	10-Apr-13		ND		ND		ND		ND		ND
		09-Oct-13		ND		ND		ND		ND		ND
		08-May-14		ND		ND		ND		ND		ND
		22-Oct-14		ND		ND		ND		ND		ND
		15-Apr-15		ND		ND		ND		ND		ND
		22-Oct-15		ND		ND		ND		ND		ND
		27-Apr-16		ND		ND		ND		ND		ND
		24-Oct-16		ND		ND		ND		ND		ND
		09-May-17		ND		ND		ND		ND		ND
		23-Oct-17		ND		ND		ND		ND		ND
		18-Apr-18		ND		ND		ND		ND		ND
		18-Oct-18		ND		ND		ND		ND		ND
		2-May-19		ND		ND		ND		ND		ND
Monitoring Wells Proposed for Abandonment												
SP11-MW04	**FAA-B**	25-Apr-18		ND		ND		ND		ND		ND
CW14-016	**OU5**	24-Oct-18		Dry								
CW19-017	**OU5**	24-Oct-18		ND		ND		ND		ND		ND
CW20-019	**OU5**	24-Oct-18		ND		ND		ND		ND		ND

1,2-DCA - 1,2-Dichloroethane
B - Method Blank Detection
cis-1,2-DCE - cis-1,2-Dichloroethene
CHP4 - Central Heating Plant 4
D - Result obtained from the analysis of a dilution
DB - Diffusion Bag
GWOU - Groundwater Operable Unit
J - estimated

ND - Not detected
OU - Operable Unit
ug/L - Micrograms per liter
PCE - Tetrachloroethylene
TCE - Trichloroethylene
trans-1,2-DCE - trans-1,2-Dichloroethene
Bolded values are greater than the MCL

[a] = City of Dayton well
1 = Upper portion of screened interval.
2 = Lower portion of screened interval.

Table 8-5
Site Inspection Summary and Land Use
Groundwater Operable Unit
Wright-Patterson AFB, Ohio

IRP Site	OU	Inspect. Date	Former Land Use	Current Land Use and Site Controls	Allowable Land Use - Restrictions(1)	Is Current Land Use Consistent with Allowable Land Use?
Bldg 59	8	10Oct.2019	The Building 59 Complex was a former aircraft propulsion test and development facility, Building 20059 was comprised of three sections referred to as 59A, 59B, and 59C. TCE was used in the building for degreasing engine parts and was subsequently detected in the Building 59A basement water when it flooded, and in the shallow subsurface soils beneath Building 59B.	The former Building 59 Complex area is now an asphalt parking lot with no access restrictions other than the Base perimeter fence.	Research and Development - 2	Yes – no change from previous Five-Year Review.
Bldg 79/95	9	10Oct.2019	The Building 79/95 Complex was a former rocket propulsion test facility, Buildings 20079A, B, C, and D (79A-D) were completed in April 1944. The two test cell buildings, 79B and C, were used to conduct jet engine firing tests through the end of World War II and possibly during the beginning of the Cold War. In 1959, the Rocket Test Laboratory was relocated to Edwards AFB due to safety concerns (NPS, 2000). Experimental propulsion research continued at the facility through the 1980's.	The former Building 79/95 Complex area is now an open field with no access restrictions other than the Base perimeter fence. An entomology laboratory (Building 73) with parking lot was built near the western boundary of the site. A soil gas study was conducted in April 2010 at Building 79 prior to construction of Building 73. Because the study indicated that benzene exceeded the soil vapor screening level, a vapor barrier was added to the Building 73 foundation as an added precaution.	Industrial/ Research and Development - 2	Yes – no change from previous Five-Year Review

Table 8-5
Site Inspection Summary and Land Use
Groundwater Operable Unit
Wright-Patterson AFB, Ohio

IRP Site	OU	Inspect. Date	Former Land Use	Current Land Use and Site Controls	Allowable Land Use - Restrictions(1)	Is Current Land Use Consistent with Allowable Land Use?
FAA-A	5	18Oct.2019	FAA-A is defined as the region extending downgradient (southwest) from approximately the western boundary of LF5 in Area A, across the Miami Conservancy District (MCD) Huffman Reserve property, to the Huffman Dam Wellfield, west of Huffman Dam. The Huffman Reserve was opened to the public on April 1, 1967 and the land is part of the Mad River flood control system created in 1922 by the MCD.	The land is heavily forested with several access roads throughout. Access roads are sporadically maintained by the City of Dayton Water Department and the WPAFB LTM Program. Access has limited restrictions by Dayton MetroParks and the MCD. WPAFB has an access agreement with MCD to maintain wells and conduct remediation activities.	Industrial (LF5) – 1 Outdoor Recreation (MCD) - NA	Yes – no change from previous Five-Year Review
FAA-B	9	10Oct.2019	FAA-B is located in Area B, between 10th and 11th Street, just west of Skyline Drive, and adjacent to Facility 92 (a drum storage area). The site was originally identified during an investigation of Spill Site 11 located due west and within the Aircraft Survivability Test Range.	FAA-B is a combination of lawn, roadway (G Street), Facility 92 (fenced drum storage area) and the eastern edge of the Test Range. Access to the Test Range is by a locked gate along the eastern fenceline; the key is controlled by Building 94 personnel. Access to Facility 92 is controlled by Building 18 personnel.	Research and Development - 2	Yes – no change from previous Five-Year Review

Table 8-5
Site Inspection Summary and Land Use
Groundwater Operable Unit
Wright-Patterson AFB, Ohio

Abbreviations:

Bldg 59	= Former Building 59 Complex
Bldg 79/95	= Former Building 79/95 Complex
FAA-A	= Further Action Area A
FAA-B	= Further Action Area B
LF	= Landfill
LTM	= Long-Term Monitoring
MCD	= Miami Conservancy District
NA	= Not applicable, not on WPAFB
TCE	= Trichloroethylene

(1) **Land Use Key:**

1 – No digging, building, construction, etc. or otherwise disturbing landfill covers.

2 – Digging, construction and other soil disturbances allowable after approval by Environmental Branch personnel; area subject to use restriction.

Table 8-6
Comparison of Groundwater VOC Concentrations to VISLs
Groundwater Operable Unit
Wright-Patterson AFB, Ohio

Location Evaluated	Sample Date	VOCs[c] Cis-1,2-DCE[1]	Trans-1,2-DCE[1]	PCE	TCE	Vinyl Chloride	Figure Showing Well and VI Radius of Influence
Residential VISL[a] (µg/L)		No VISL	No VISL	5.76	0.52	0.15	
Commercial VISL[a] (µg/L)				24.2	2.18	2.45	
MCL[b]		70	100	5	5	2	
OU10-MW-06S (Annual)	02-May-17	ND	ND	5.9	**7.5**	ND	8-24
	16-Apr-18	ND	ND	8.1	**6.3**	ND	
	24-Apr-19	ND	ND	8.6	**6.1**		
OU10-MW-15S (Semiannual)	17-Apr-18	ND	ND	ND	**7.9**	ND	8-24
	22-Oct-18	ND	ND	ND	**11.4**	ND	
	24-Apr-19	ND	ND	ND	**11.1**	ND	
	22-Nov-19	ND	ND	ND	**9.4**	ND	
OU10-MW-19D (Semiannual)	24-Apr-18	ND	ND	ND	**1.1**	ND	8-24
	23-Oct-18	ND	ND	ND	**0.96 J**	ND	
	24-Apr-19	ND	ND	ND	**0.93 J**	ND	
	22-Nov-19	ND	ND	ND	**0.85 J**	ND	
B79C/D-MW06 (Semiannual)	13-Apr-18	3.0	0.44 J	ND	**15.0**	ND	8-28
	15-Oct-18	3.2	0.47 J	ND	**15.4**	ND	
	18-Apr-19	2.7	0.62 J	ND	**14.9**	ND	
	19-Nov-19	3.3	0.43 J	ND	**19.0**	ND	
B59-MW02 (Semiannual)	24-Oct-18	283	13.4	ND	**249**	**55.2**	8-31
	22-Apr-19	393	19.1	ND	**466**	**297**	
	19-Nov-19	180	8.2	ND	**175**	**280**	
B59-MW03 (Semiannual)	24-Oct-18	283	13.4	ND	**17.4**	**22.1**	8-31
	22-Apr-19	393	19.1	ND	**98.2**	**12.3**	
	19-Nov-19	180	8.2	ND	**19.9**	**13.4**	

Notes:

DCA = Dichloroethane
DCE = Dichloroethylene
MCL = Maximum Contaminant Level
µg/L = micrograms per liter
ND = Not detected
PCE = Tetrachloroethylene
TCE = Trichloroethylene
VI = Vapor Intrusion
VISL = Vapor Intrusion Screening Level
VOC = Volatile organic compound

[1]No VISL is calculated due to the lack of a toxicity value.
[a] VISL calculated using the USEPA VISL calculator (Accessed on-line: December 2019).
Value represents the target groundwater concentration based on a total cancer risk = 1E-06 and hazard quotient = 0.1.
[b] The MCLs are provided only for comparison with the groundwater VISLs.
[c] **Bold**/shaded concentration exceeds the commercial VISL.
[d] **Bold**/boxed concentration exceeds the residential VISL.

Legend

- Further Action Area A
- WPAFB Building with Building Numbers
- Restoration Site (Access and Restriction Area)
- Operable Unit (OU) Boundary
- WPAFB Base Boundary
- County Boundary
- Fence
- Citations

N

700 350 0 700

Feet

Source: WPAFB Land Use Control Plan (Labat, 2012)

WRIGHT-PATTERSON AIR FORCE BASE, OHIO

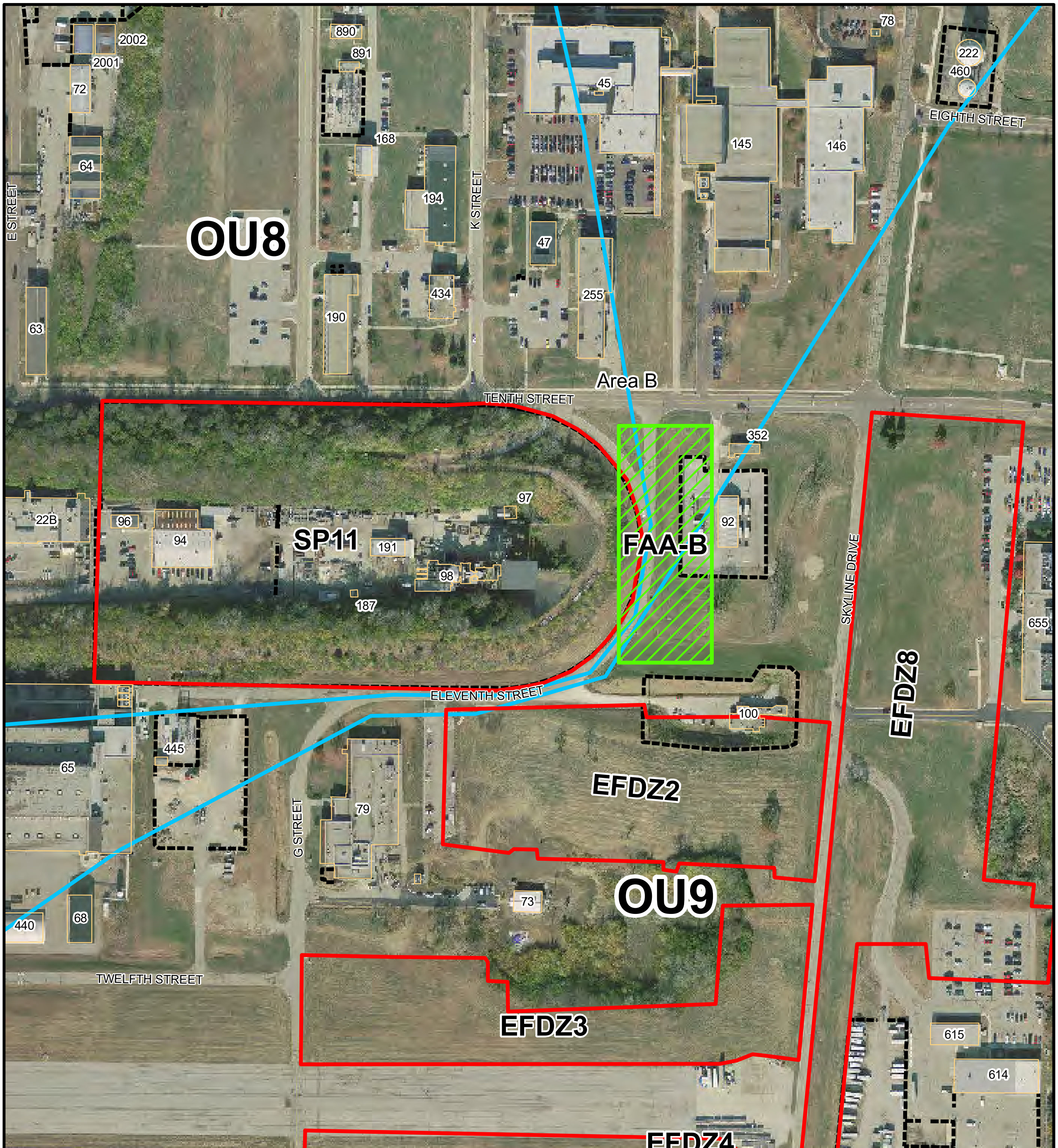
FIFTH FIVE-YEAR ROD REVIEW

FIGURE NUMBER 8-1

Further Action Area A Site Location Map, Southwest Area A

APTIM
5050 Section Avenue
Cincinnati, Ohio 45212

G:\WPAFB\GIS_Documents\Project_Maps\501363.03000000\WPAFB_5yrROD_08-1_FAA-A_Site_Loc_Map_SW_AreaA.mxd; Analyst: ; Date: 11/8/2019 7:51:22 AM



Legend

WPAFB Building with Building Numbers

Further Action Area B

Restoration Site
(Access and Restriction Area)

Operable Unit (OU) Boundary

WPAFB Base Boundary

Fence

N

300 150 0 300

Feet

Source: WPAFB Land Use Control Plan (Labat, 2012)

WRIGHT-PATTERSON
AIR FORCE BASE,
OHIO

FIFTH FIVE-YEAR ROD REVIEW

FIGURE NUMBER

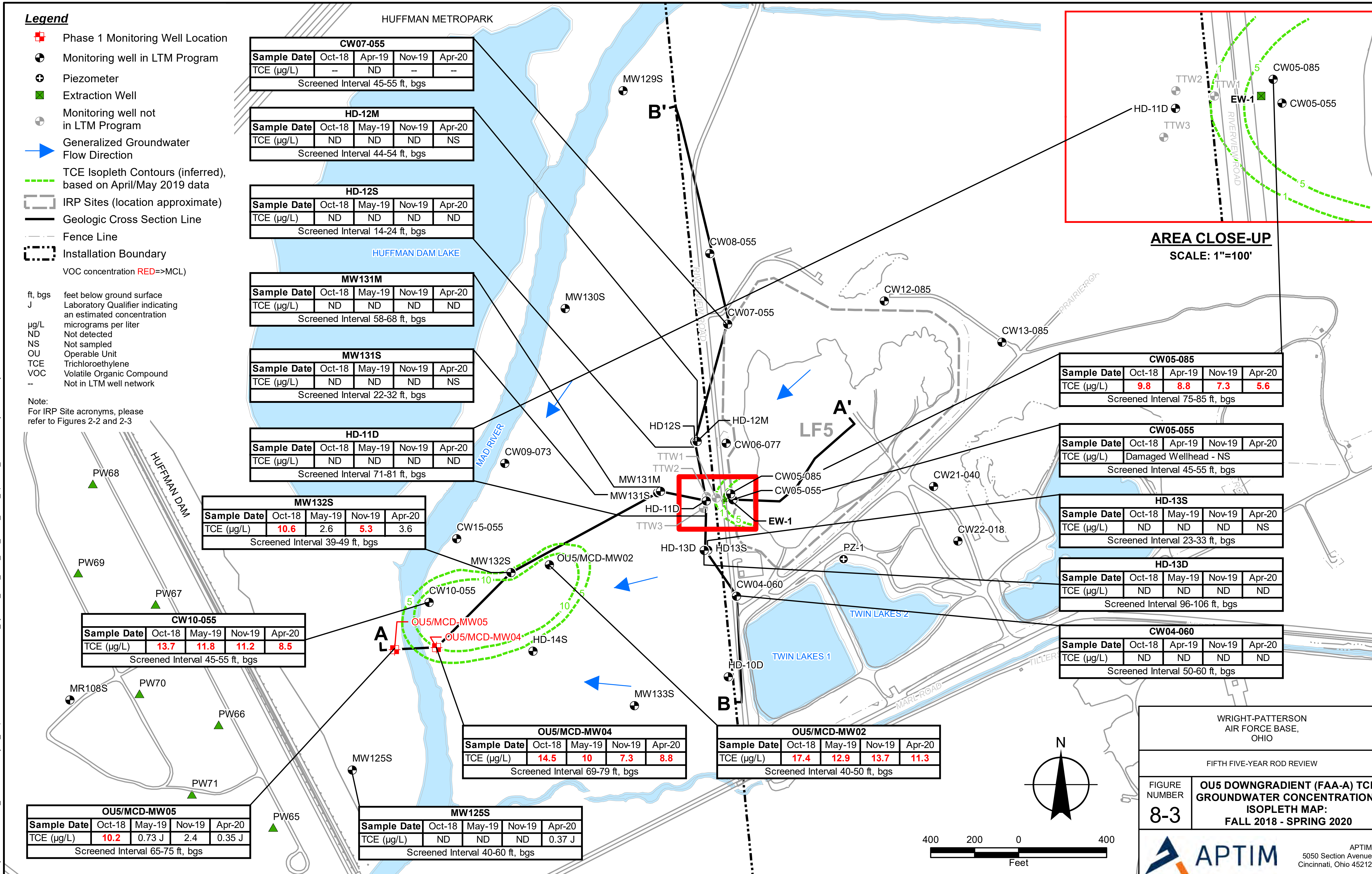
8-2

Further Action Area B
Site Location Map,
Central Area B

APTIM

APTIM
5050 Section Avenue
Cincinnati, Ohio 45212

G:\WPAFB\GIS_Documents\Project_Maps\501363.03000000\WPAFB_5yrROD_08-2_FAA-B_Site_Loc_Map_Cen_AreaB.mxd; Analyst: ; Date: 11/8/2019 8:16:51 AM



CW07-055				
Sample Date	Oct-18	Apr-19	Nov-19	Apr-20
TCE (µg/L)	--	ND	--	--
Screened Interval 45-55 ft, bgs				

HD-12M				
Sample Date	Oct-18	May-19	Nov-19	Apr-20
TCE (µg/L)	ND	ND	ND	NS
Screened Interval 44-54 ft, bgs				

HD-12S				
Sample Date	Oct-18	May-19	Nov-19	Apr-20
TCE (µg/L)	ND	ND	ND	ND
Screened Interval 14-24 ft, bgs				

MW131M				
Sample Date	Oct-18	May-19	Nov-19	Apr-20
TCE (µg/L)	ND	ND	ND	ND
Screened Interval 58-68 ft, bgs				

MW131S				
Sample Date	Oct-18	May-19	Nov-19	Apr-20
TCE (µg/L)	ND	ND	ND	NS
Screened Interval 22-32 ft, bgs				

HD-11D				
Sample Date	Oct-18	May-19	Nov-19	Apr-20
TCE (µg/L)	ND	ND	ND	ND
Screened Interval 71-81 ft, bgs				

MW132S				
Sample Date	Oct-18	May-19	Nov-19	Apr-20
TCE (µg/L)	10.6	2.6	5.3	3.6
Screened Interval 39-49 ft, bgs				

CW10-055				
Sample Date	Oct-18	May-19	Nov-19	Apr-20
TCE (µg/L)	13.7	11.8	11.2	8.5
Screened Interval 45-55 ft, bgs				

OU5/MCD-MW05				
Sample Date	Oct-18	May-19	Nov-19	Apr-20
TCE (µg/L)	10.2	0.73 J	2.4	0.35 J
Screened Interval 65-75 ft, bgs				

MW125S				
Sample Date	Oct-18	May-19	Nov-19	Apr-20
TCE (µg/L)	ND	ND	ND	0.37 J
Screened Interval 40-60 ft, bgs				

OU5/MCD-MW04				
Sample Date	Oct-18	May-19	Nov-19	Apr-20
TCE (µg/L)	14.5	10	7.3	8.8
Screened Interval 69-79 ft, bgs				

OU5/MCD-MW02				
Sample Date	Oct-18	May-19	Nov-19	Apr-20
TCE (µg/L)	17.4	12.9	13.7	11.3
Screened Interval 40-50 ft, bgs				

CW05-085				
Sample Date	Oct-18	Apr-19	Nov-19	Apr-20
TCE (µg/L)	9.8	8.8	7.3	5.6
Screened Interval 75-85 ft, bgs				

CW05-055				
Sample Date	Oct-18	Apr-19	Nov-19	Apr-20
TCE (µg/L)	Damaged Wellhead - NS			
Screened Interval 45-55 ft, bgs				

HD-13S				
Sample Date	Oct-18	May-19	Nov-19	Apr-20
TCE (µg/L)	ND	ND	ND	NS
Screened Interval 23-33 ft, bgs				

HD-13D				
Sample Date	Oct-18	May-19	Nov-19	Apr-20
TCE (µg/L)	ND	ND	ND	ND
Screened Interval 96-106 ft, bgs				

CW04-060				
Sample Date	Oct-18	Apr-19	Nov-19	Apr-20
TCE (µg/L)	ND	ND	ND	ND
Screened Interval 50-60 ft, bgs				

WRIGHT-PATTERSON AIR FORCE BASE, OHIO

FIFTH FIVE-YEAR ROD REVIEW

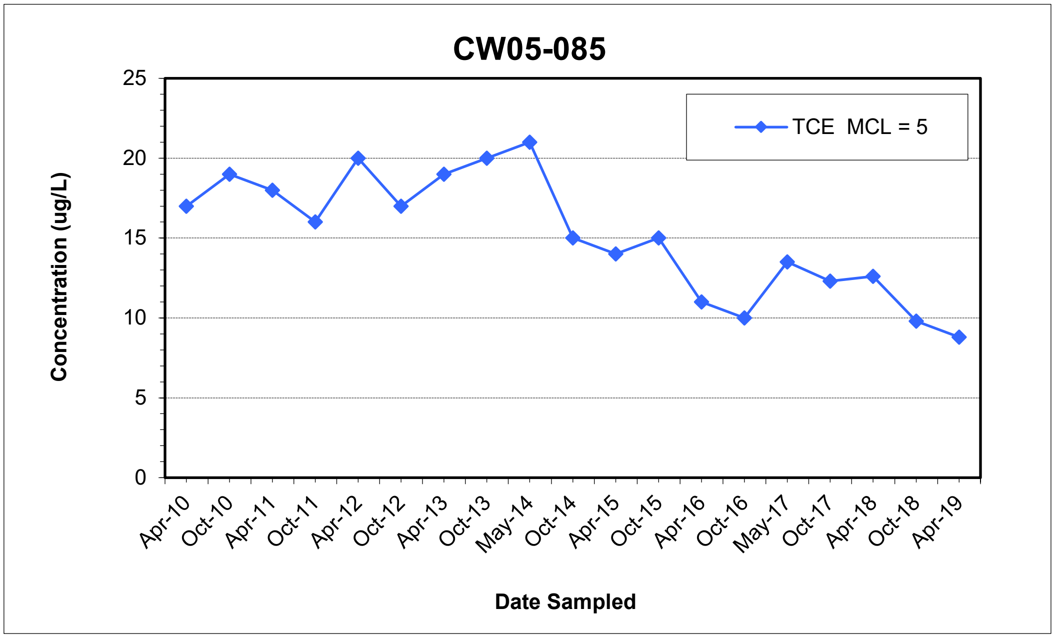
FIGURE NUMBER 8-3

OU5 DOWNGRADIENT (FAA-A) TCE GROUNDWATER CONCENTRATIONS ISOPLETH MAP: FALL 2018 - SPRING 2020

APTIM
5050 Section Avenue
Cincinnati, Ohio 45212

F:\Projects\WPAFB\GIS_Documents\Project_Maps\501363.03000000\WPAFB_5yrROD_08-3_OU5_GW_VOCs_Cntrs_Apr2019_R1.mxd; Analyst: Mike.Najar; Date: 10/21/2020 2:12:24 PM

FIGURE 8-4
LONG-TERM MONITORING GRAPHS:
Chemicals of Concern
OU5 (FAA-A): Wells CW05-085 and HD-11
WPAFB - LTM Program



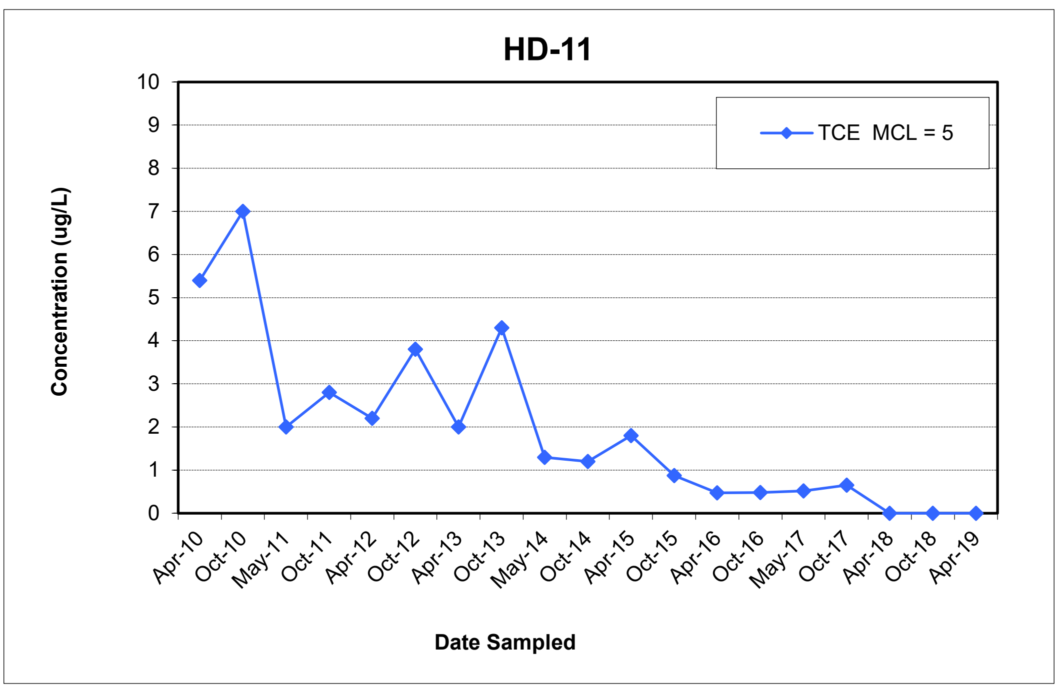
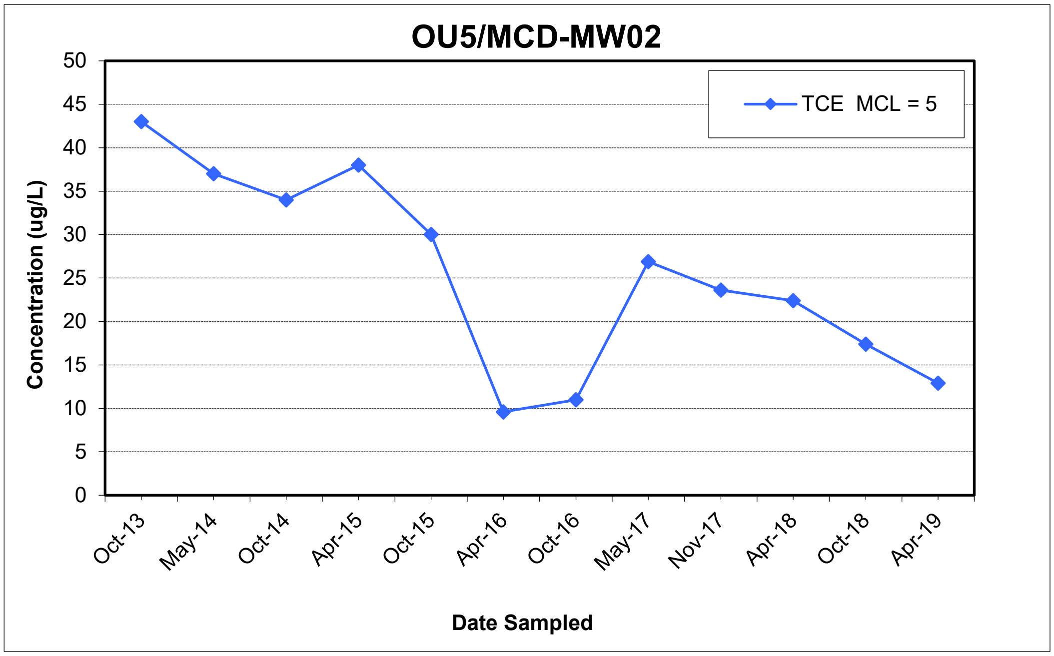


FIGURE 8-5
LONG-TERM MONITORING GRAPHS:
Chemicals of Concern
OU5 (FAA-A): Wells OU5/MCD-MW02 and MW132S
WPAFB - LTM Program



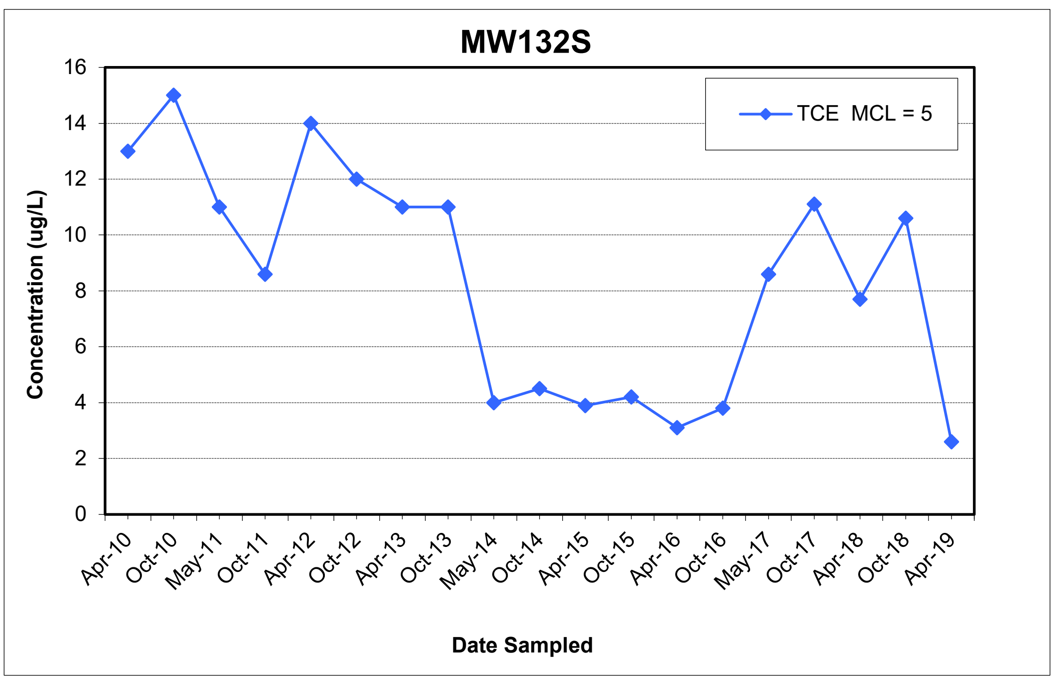


FIGURE 8-6
LONG-TERM MONITORING GRAPHS:
Chemicals of Concern
OU5 (FAA-A): Well CW10-055
WPAFB - LTM Program

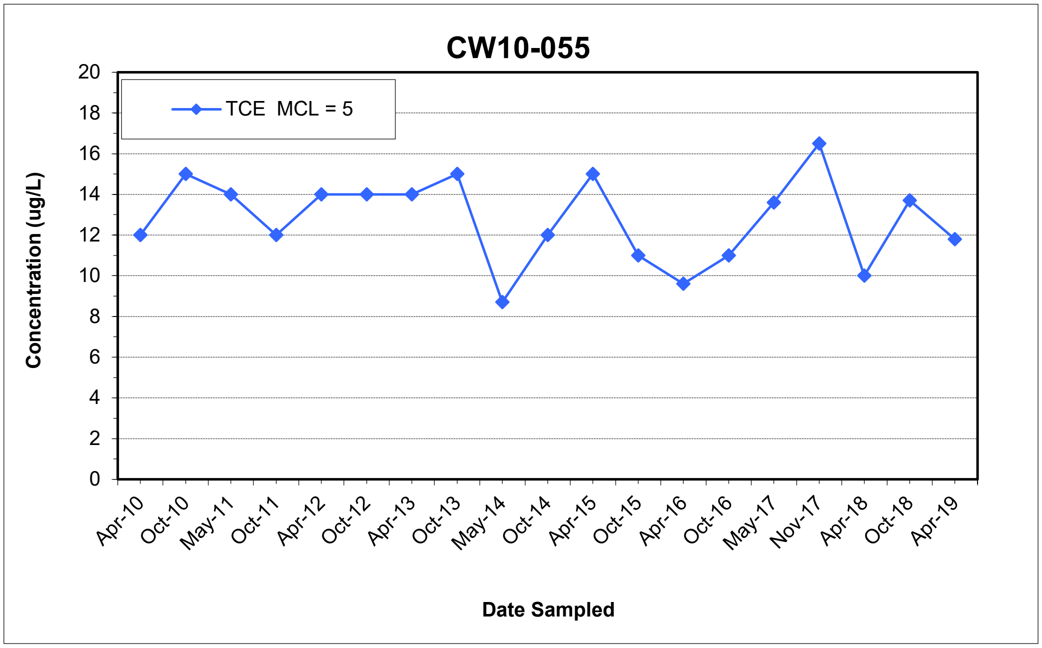
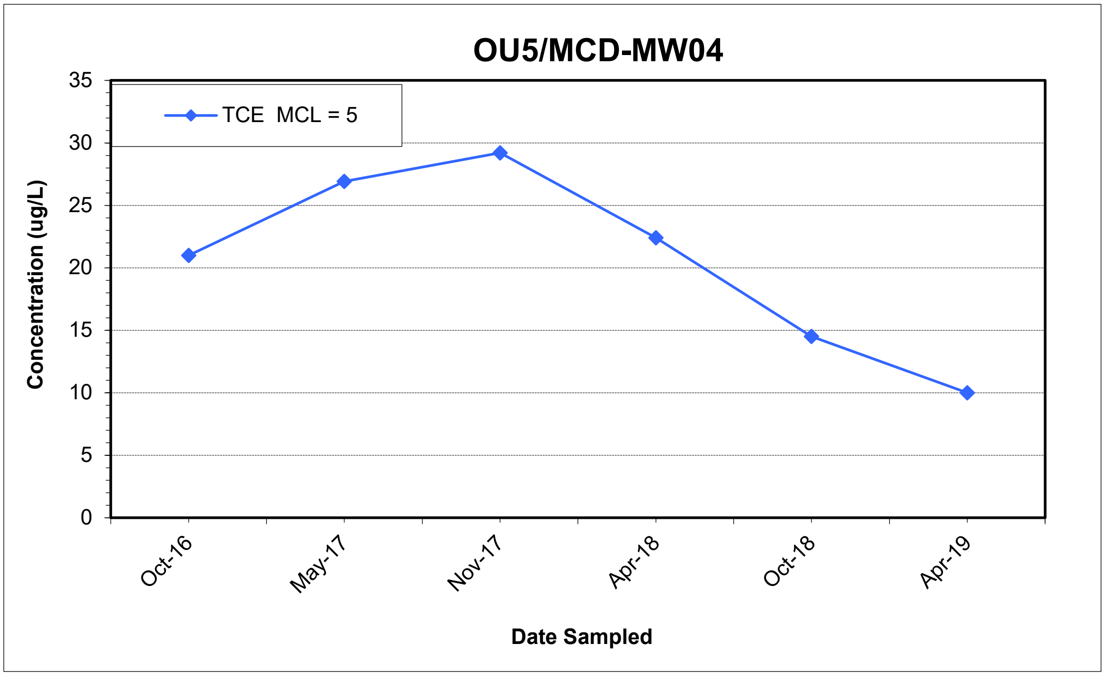


FIGURE 8-7
LONG-TERM MONITORING GRAPHS:
Chemicals of Concern
OU5 (FAA-A): Wells OU5/MCD-MW04 and OU5/MCD-MW05
WPAFB - LTM Program



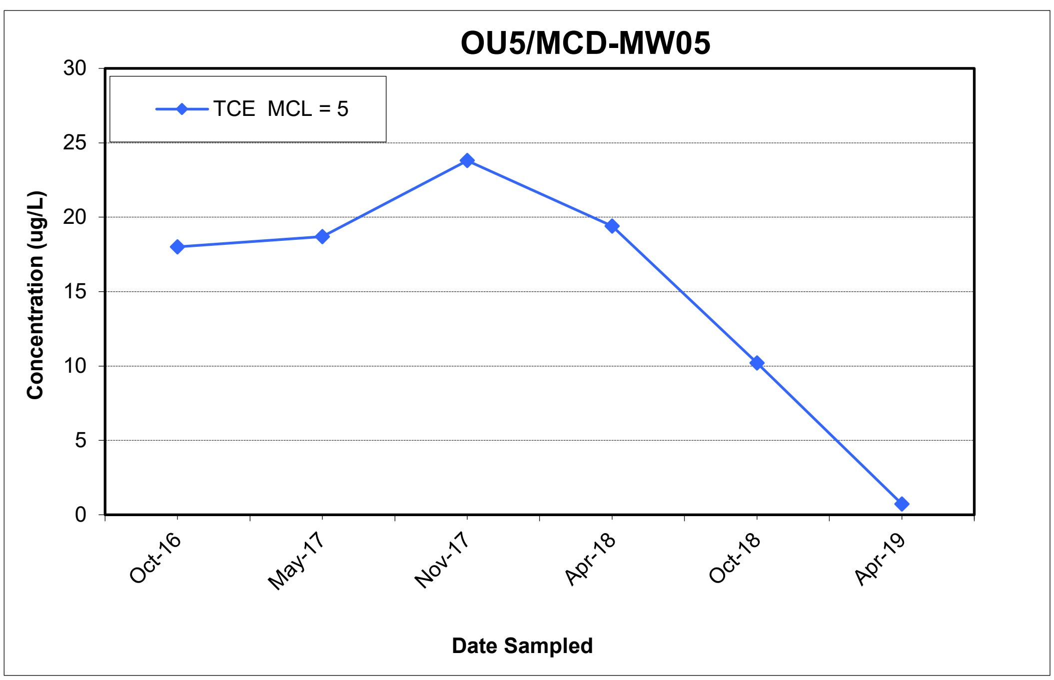
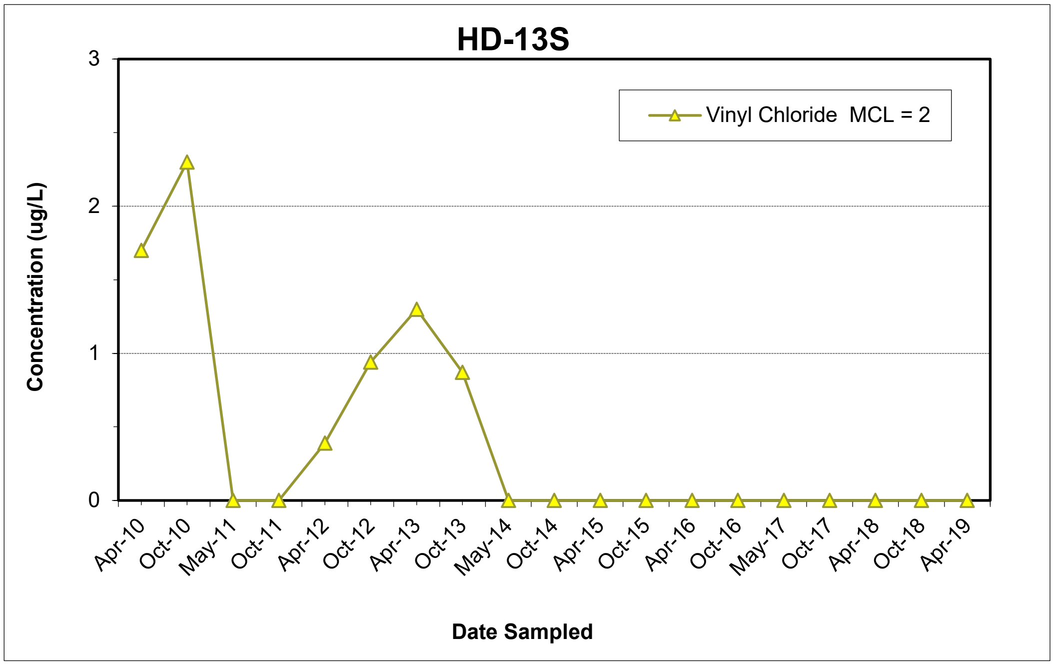
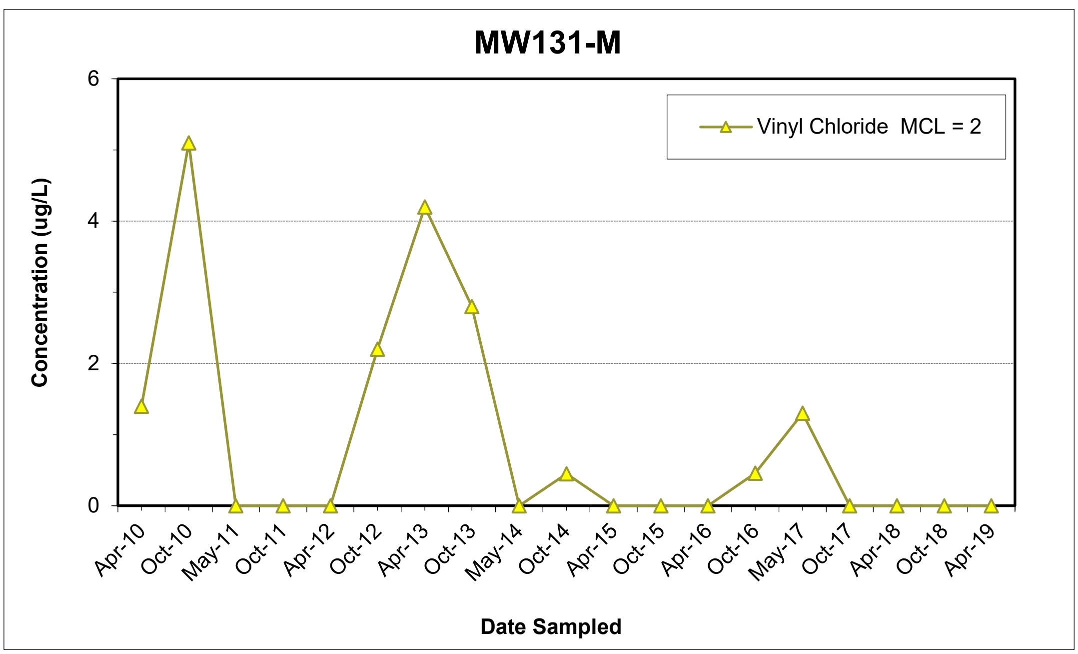
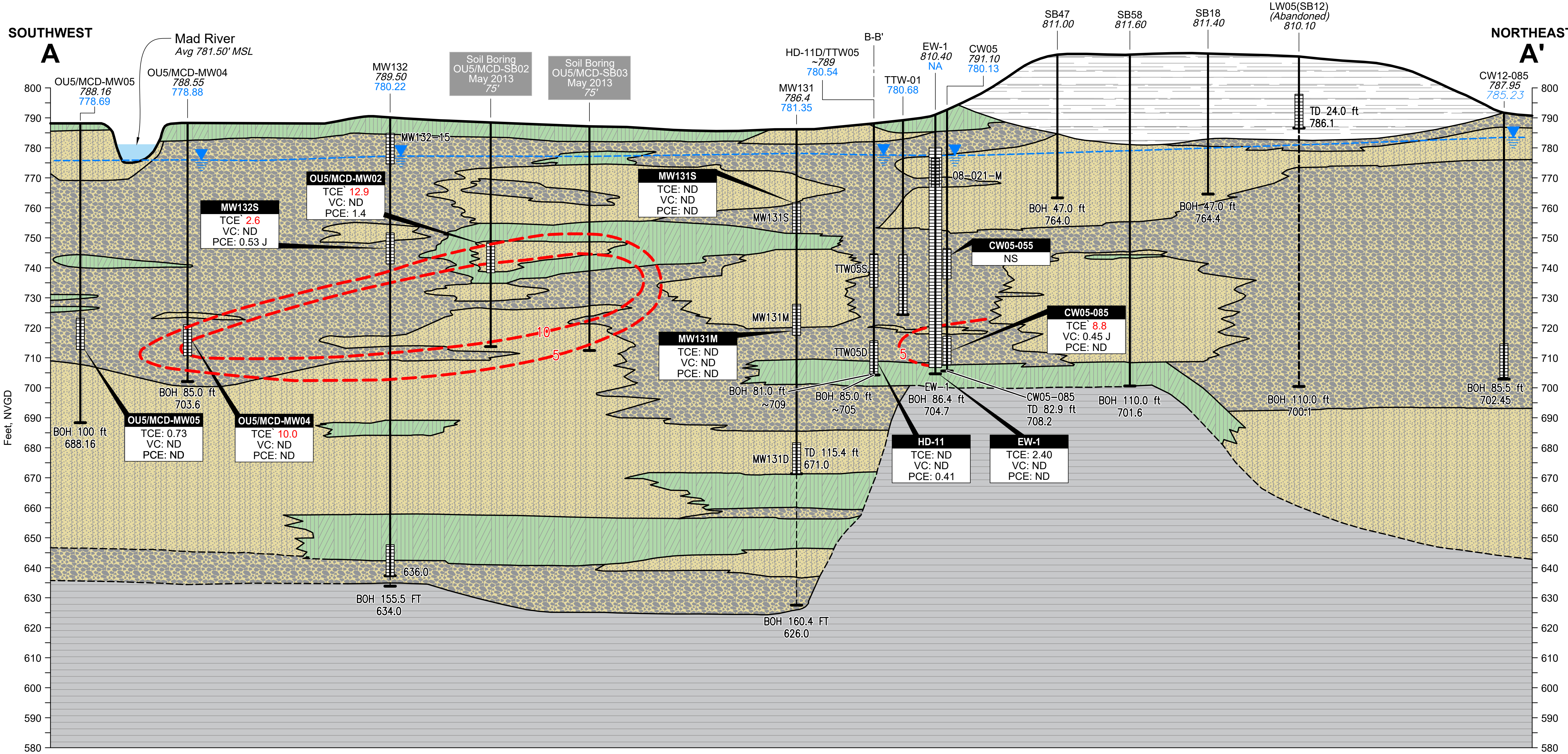


FIGURE 8-8
LONG-TERM MONITORING GRAPHS:
Chemicals of Concern
OU5 (FAA-A): Wells HD-13S and MW131-M
WPAFB - LTM Program







Well ID
(Ground elevation)
Screened Interval

Dashed where inferred

Clays and Silts (ML, CL)

Fill

Gravel/Sand & Gravel (GW, GP, GM, GC)

Sand (SW, SP, SM, SC)

Shale

Potentiometric Surface
May 2019

TCE Concentration in
Groundwater Contour Line (µg/L)

Notes

OU5/MCD = Operable Unit 5/Miami Conservancy District Property
BOH = Bottom of Hole
TD = Total Well Depth
NGVD = National Geodetic Vertical Datum
NA = Not Applicable
ND = Not Detected
NS = Not Sampled, well head damaged
.= Groundwater Treatment System (GWTS) influent sample (CAM Management and Services)
PCE = Tetrachloroethylene
TCE = Trichloroethylene
VC = Vinyl chloride
OSFL = On-Site Field Laboratory
(mL, CL) = United Soil Classification System Soil Code

Vertical Exaggeration: x10
Looking Northwest.

Vertical Scale in Feet
0 15 30 60

Horizontal Scale in Feet
0 100 200 400

WRIGHT-PATTERSON
AIR FORCE BASE,
OHIO

FIFTH FIVE-YEAR ROD REVIEW

FIGURE NUMBER
8-9

FAA-A GEOLOGIC CROSS-SECTION A-A' CONTAMINANTS OF CONCERN CONCENTRATIONS IN GROUNDWATER: APRIL 2019

APTIM
5050 Section Avenue
Cincinnati, Ohio 45212

C:\CAD-GIS\AcadGIS 2019\501363.03000000 WPAFB 5th 5yr ROD\WPAFB_5yrROD_08-9_OU5_Cross_Section_A-A'.dwg Wednesday, October 02, 2019

FIGURE 8-10
LONG-TERM MONITORING GRAPHS:
Chemicals of Concern
FAA-B: Well SP11-MW01
WPAFB - LTM Program

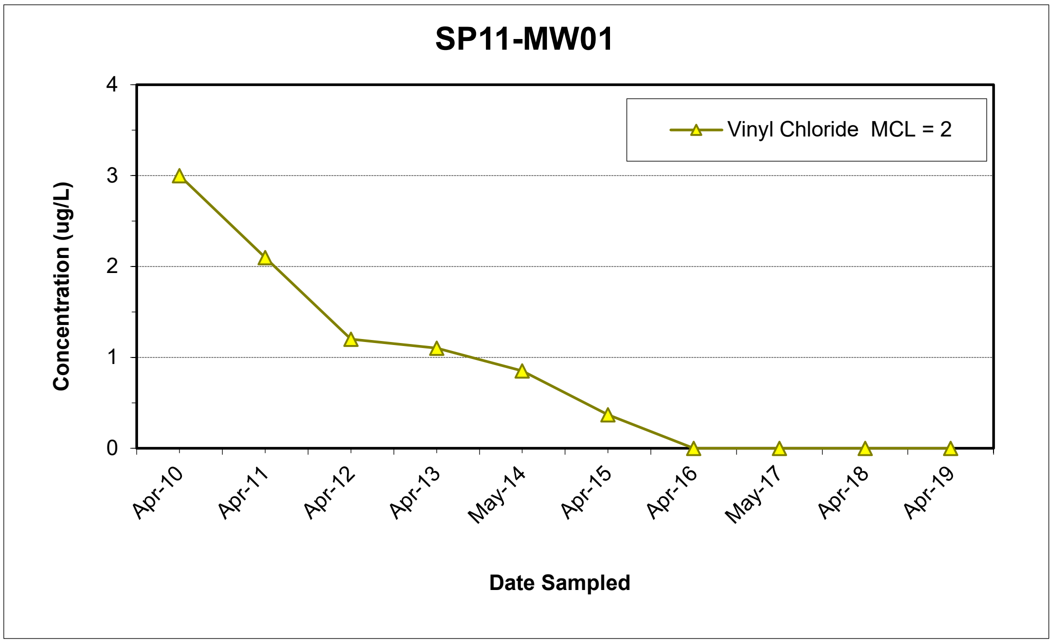
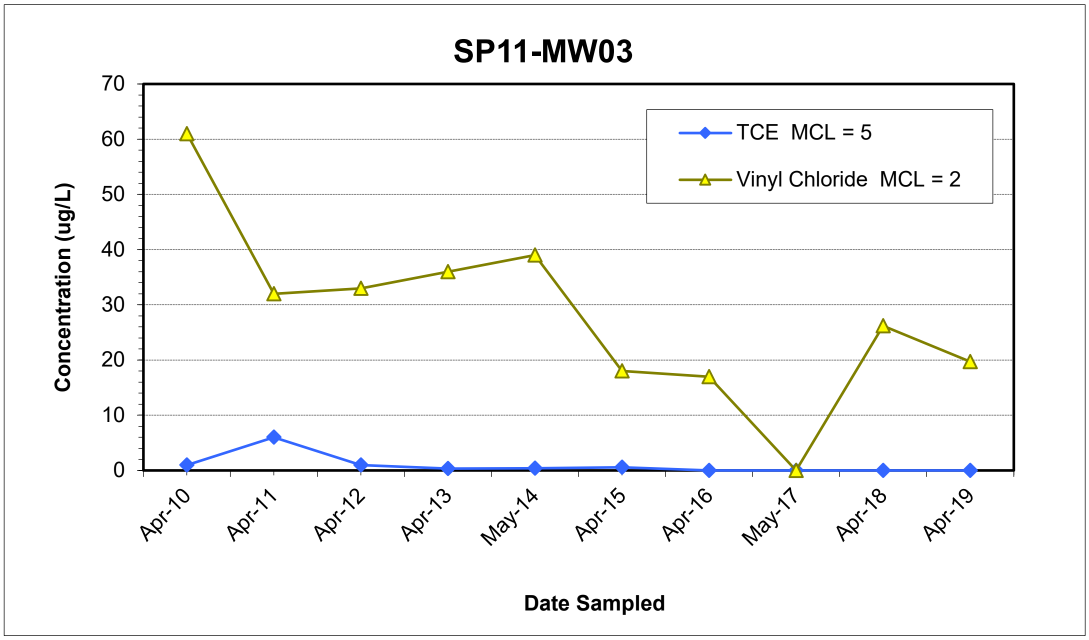


FIGURE 8-11
LONG-TERM MONITORING GRAPHS:
Chemicals of Concern
FAA-B: Wells SP11-MW03 and SP11-MW07
WPAFB - LTM Program



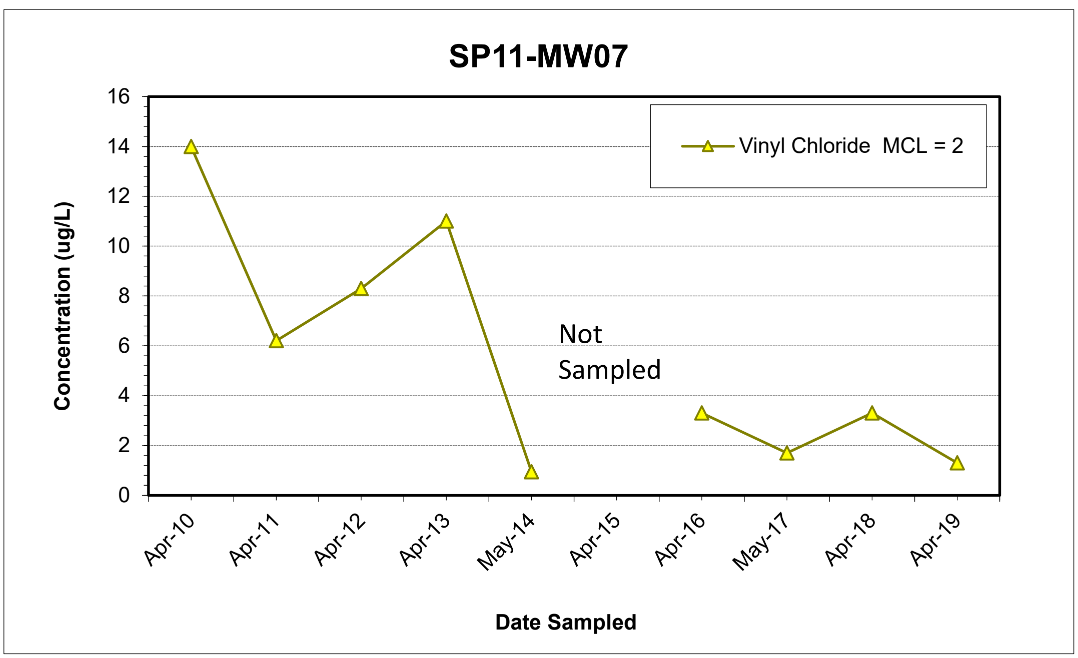
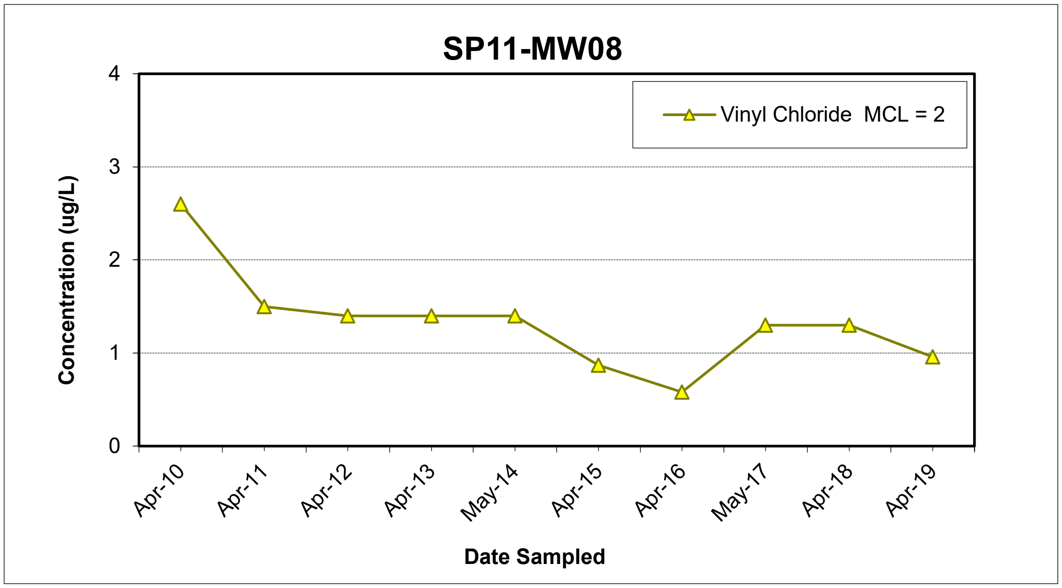
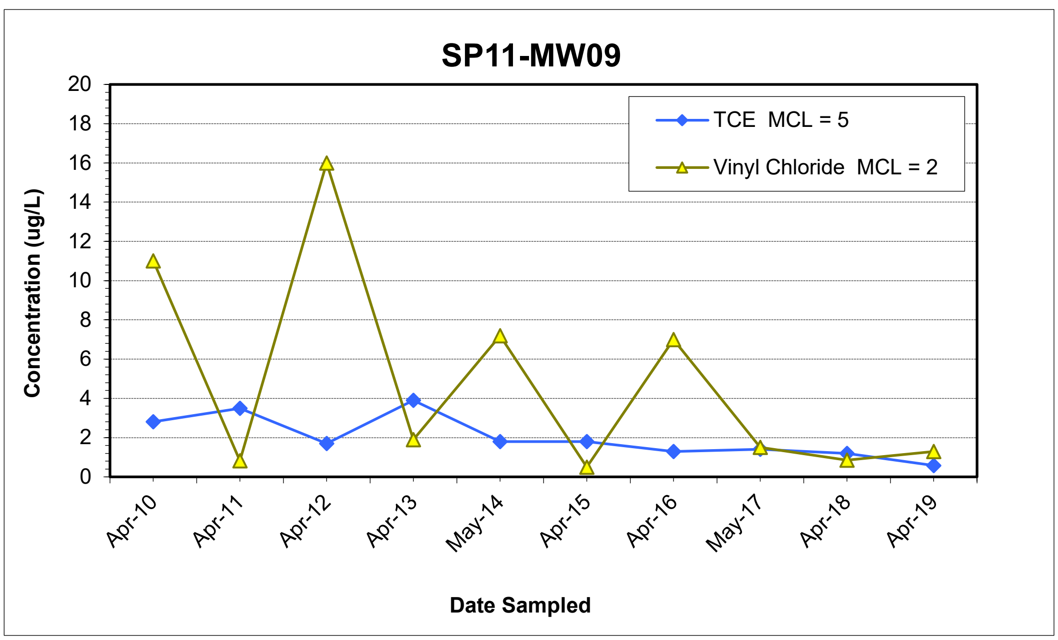
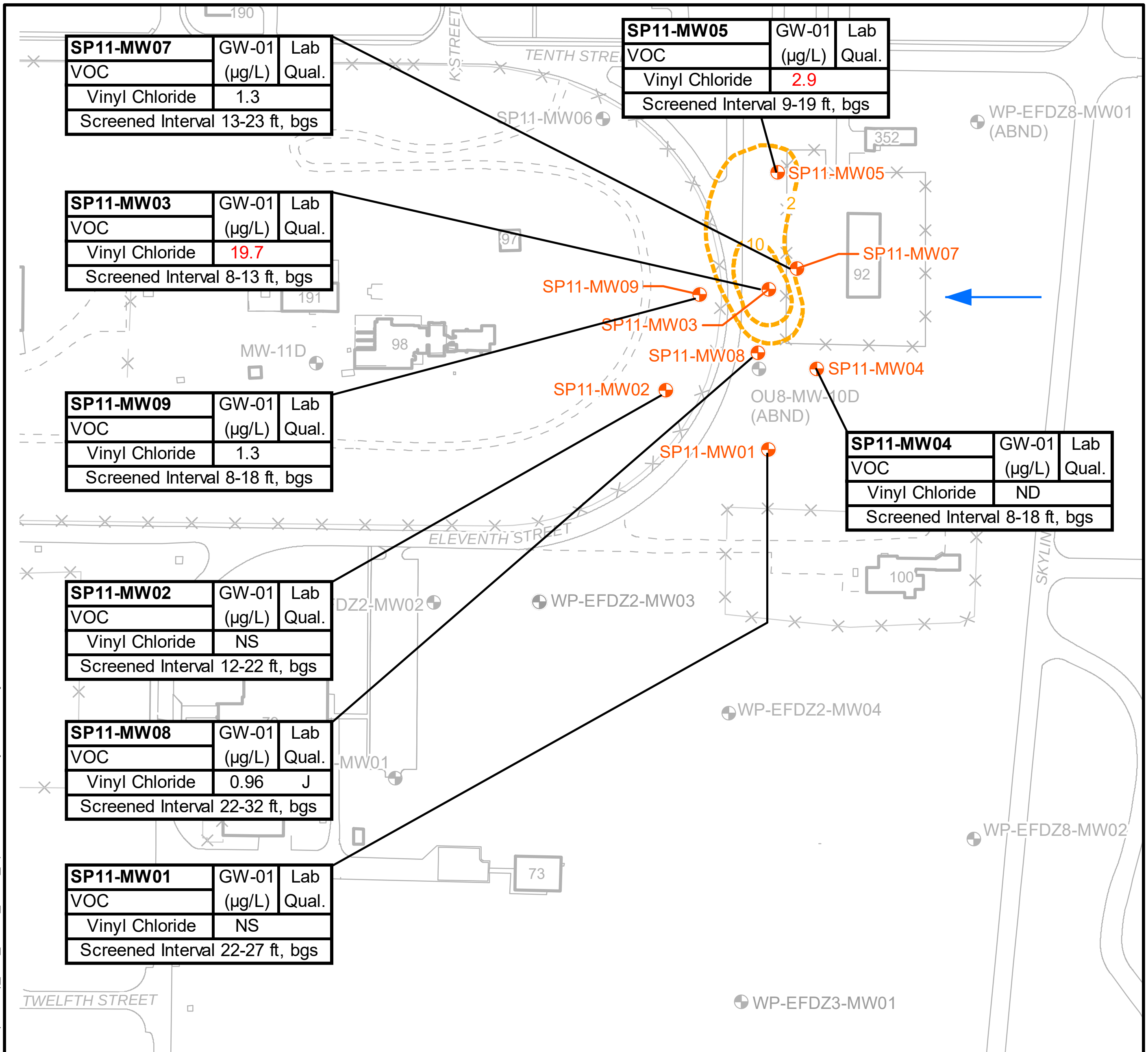


FIGURE 8-12
LONG-TERM MONITORING GRAPHS:
Chemicals of Concern
FAA-B: Wells SP11-MW08 and SP11-MW09
WPAFB - LTM Program







Legend

- Monitoring Wells with Annual VOCs Analysis
- Monitoring Wells not sampled under LTM Program
- Vinyl Chloride Isopleth (PPB) (dashed where inferred)
- Fence Line
- Groundwater Flow Direction Arrow Size Corresponds to Flow Velocity

VOC concentrations in RED = > MCL

(ABND)	abandoned
ft, bgs	feet below ground surface
J	Laboratory Qualifier indicating an estimated concentration
µg/L	micrograms per liter
ND	Not Detected
NS	Not Sampled Spring 2019
VOC	Volatile Organic Compound

Note:
For IRP Site acronyms, please refer to Figures 2-2 and 2-3

0 100 200 400
Feet

N

WRIGHT-PATTERSON AIR FORCE BASE, OHIO

FIFTH FIVE-YEAR ROD REVIEW

FIGURE NUMBER 8-13

SPILL SITE 11 (FAA-B) VINYL CHLORIDE GROUNDWATER CONCENTRATIONS ISOPLETH MAP: APRIL 2019

APTIM

APTIM
5050 Section Avenue
Cincinnati, Ohio 45212

G:\WPAFB\GIS_Documents\Project_Maps\501363.03000000\WPAFB_5yrROD_08-13_SS11(FAA-B)_GW_VOCs_Cntrs_Apr2019.mxd; Analyst: mike.najar; Date: 10/2/2019 2:20:15 PM

FIGURE 8-14
LONG-TERM MONITORING GRAPHS:
Chemicals of Concern
OU2: Well NEA-MW27-3I
WPAFB - LTM Program

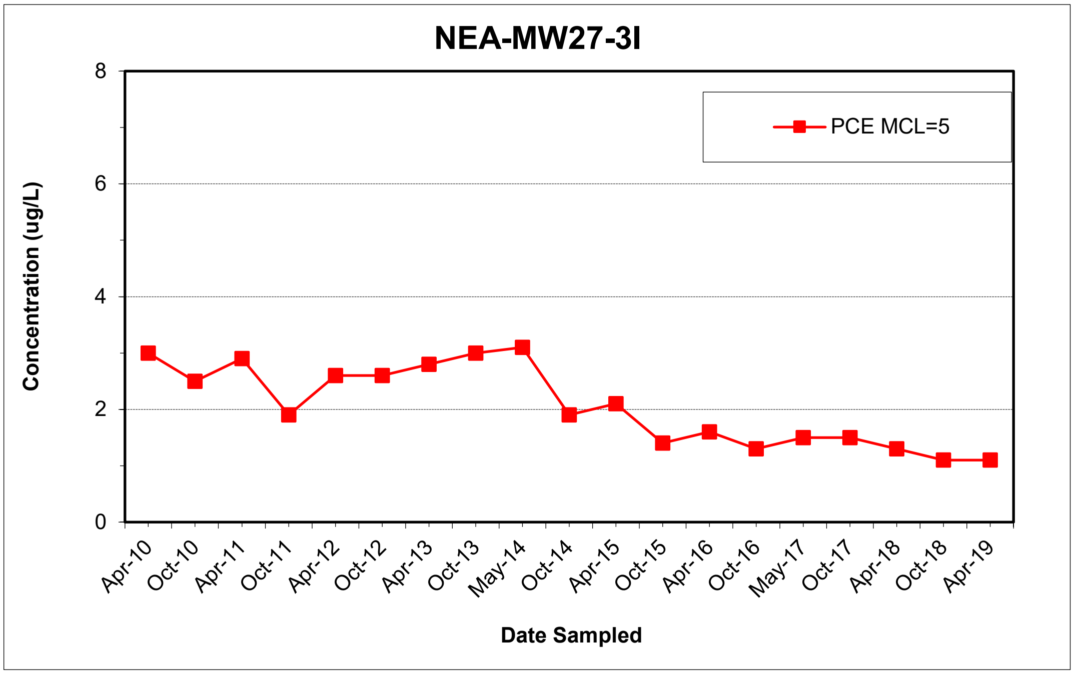
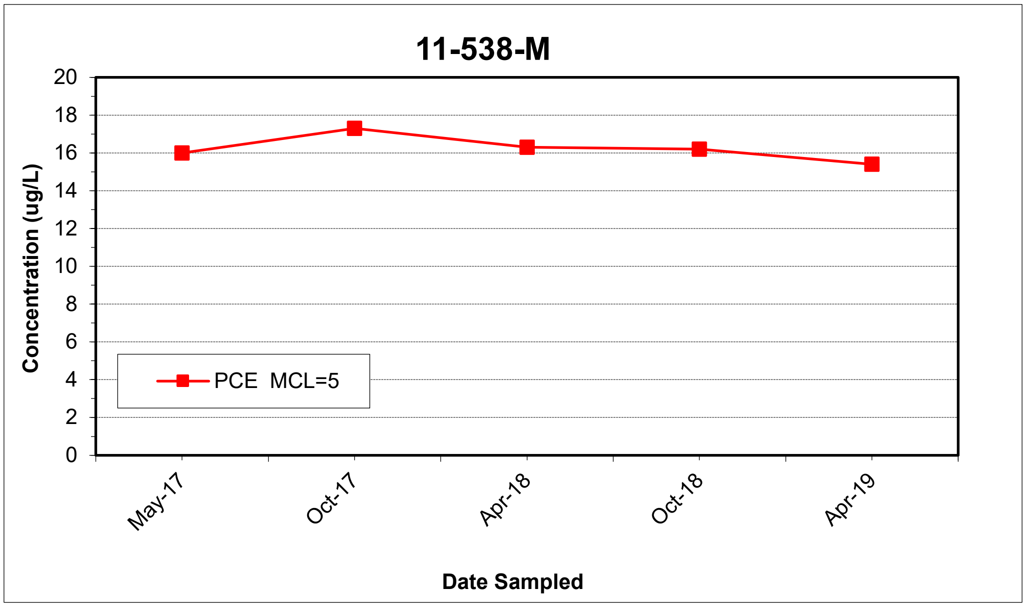


FIGURE 8-15
LONG-TERM MONITORING GRAPHS:
Chemicals of Concern
OU4: Wells 11-538-M and OU4-MW-12B
WPAFB - LTM Program



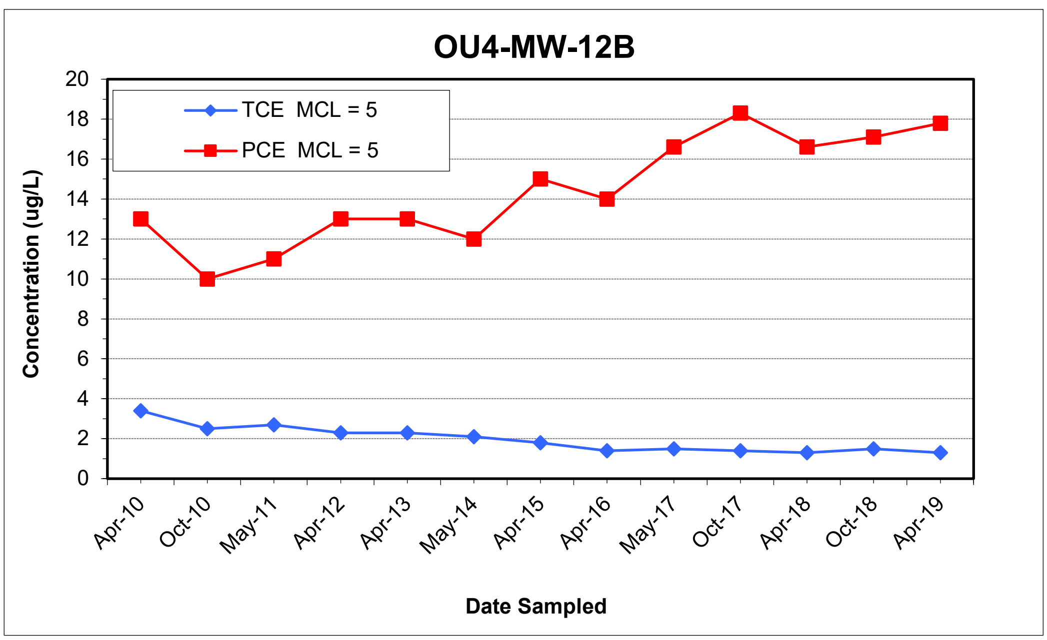
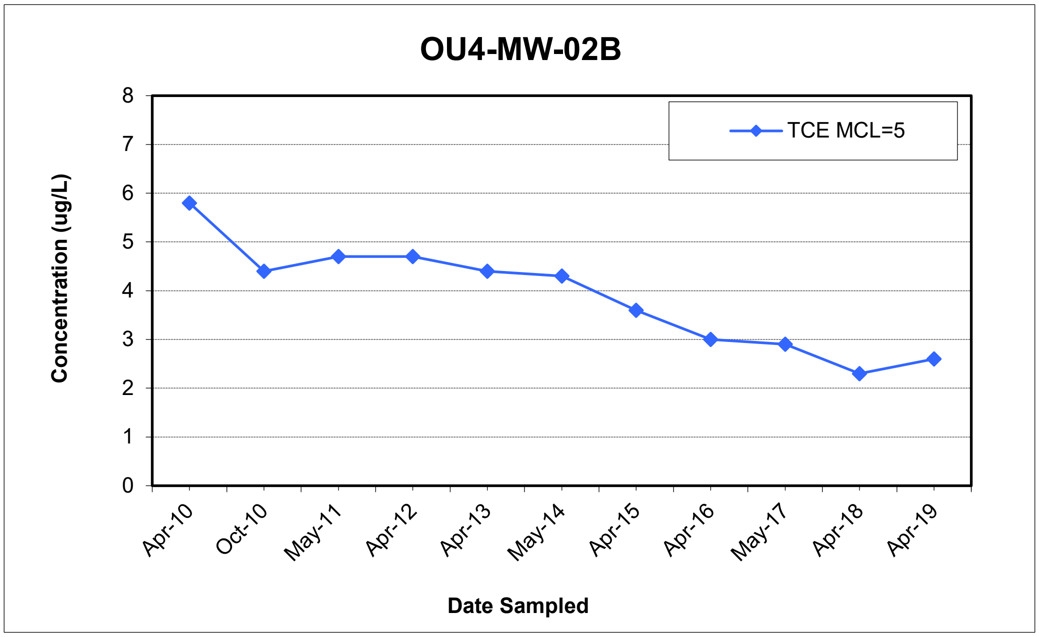
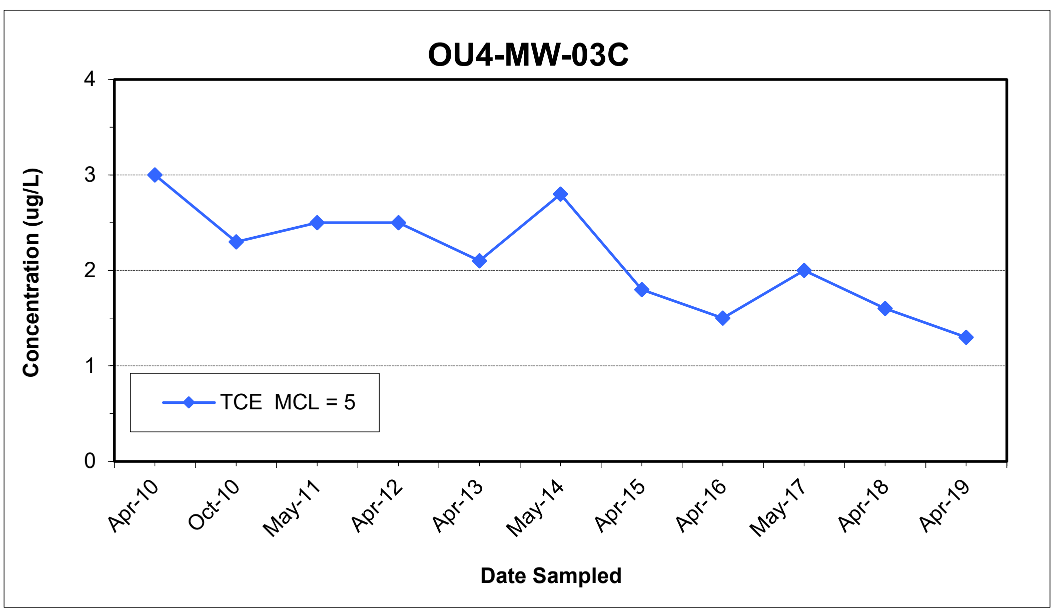
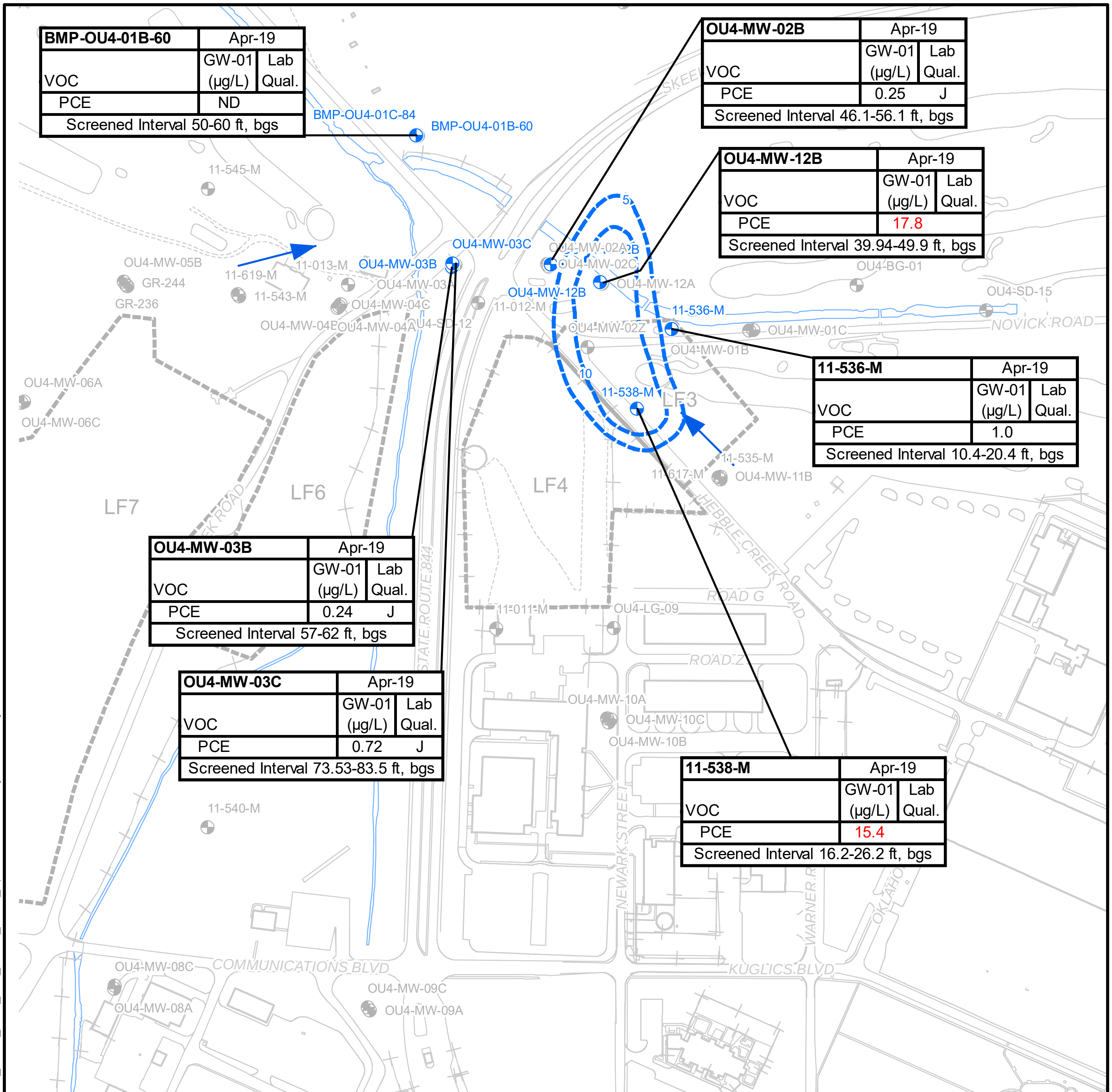


FIGURE 8-16
LONG-TERM MONITORING GRAPHS:
Chemicals of Concern
OU4: Wells OU4-MW-02B and OU4-MW-03C
WPAFB - LTM Program







0 200 400 800
Feet

Legend

- Monitoring Wells with VOCs Analysis
- Monitoring Wells not sampled under LTM Program
- PCE Concentration Isopleth-April (µg/L, dashed where inferred)
- Groundwater Flow Direction
- IRP Sites (Locations Approximate)
- Fence Line

ft, bgs	feet below ground surface
J	Laboratory Qualifier indicating an estimated concentration
µg/L	micrograms per liter
OU	Operable Unit
PCE	Tetrachloroethylene
VOC	Volatile Organic Compound

Note:
For IRP Site acronyms, please refer to Figures 1-3 and 1-4

VOC concentration (RED=>MCL)

N

WRIGHT-PATTERSON AIR FORCE BASE, OHIO

FIFTH FIVE-YEAR ROD REVIEW

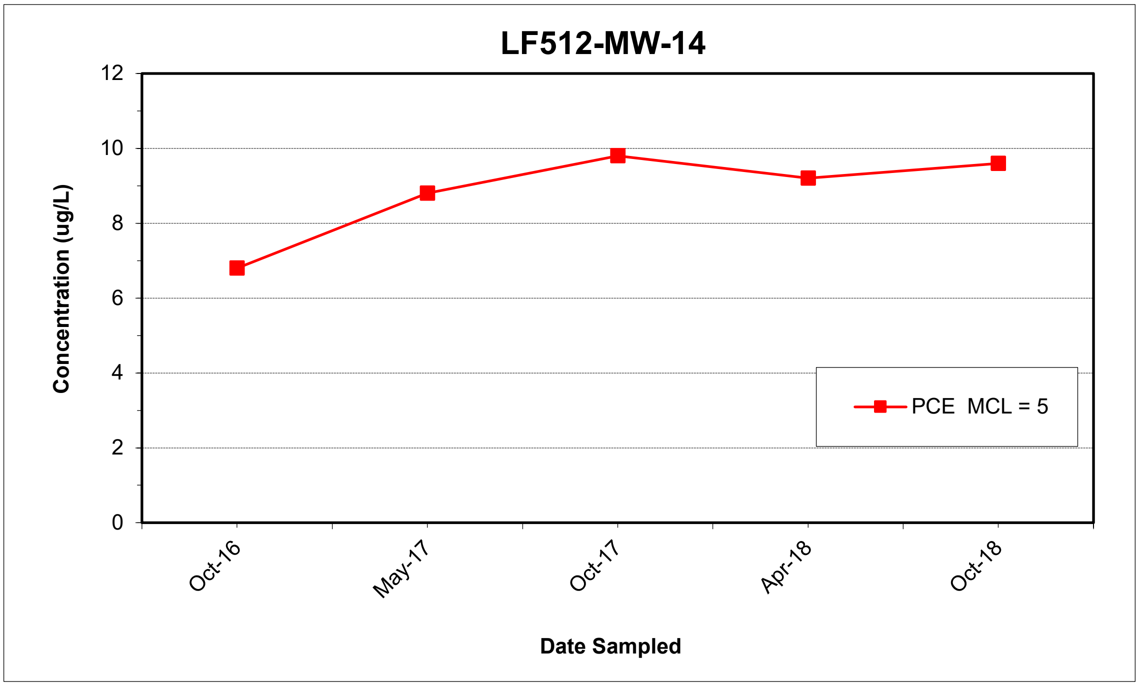
FIGURE NUMBER 8-17

OU4 PCE GROUNDWATER CONCENTRATIONS ISOPLETH MAP: APRIL 2019

APTIM
5050 Section Avenue
Cincinnati, Ohio 45212

G:\WPAFB\GIS_Documents\Project_Maps\501363.03000000\WPAFB_5yrROD_08-17_OU4_GW_VOCs_Cntrs_Apr2019.mxd; Analyst: mike.najar; Date: 10/8/2019 1:26:44 PM

FIGURE 8-18
LONG-TERM MONITORING GRAPHS:
Chemicals of Concern
OU10: Wells LF512-MW-14 and OU10-MW-02S
WPAFB - LTM Program



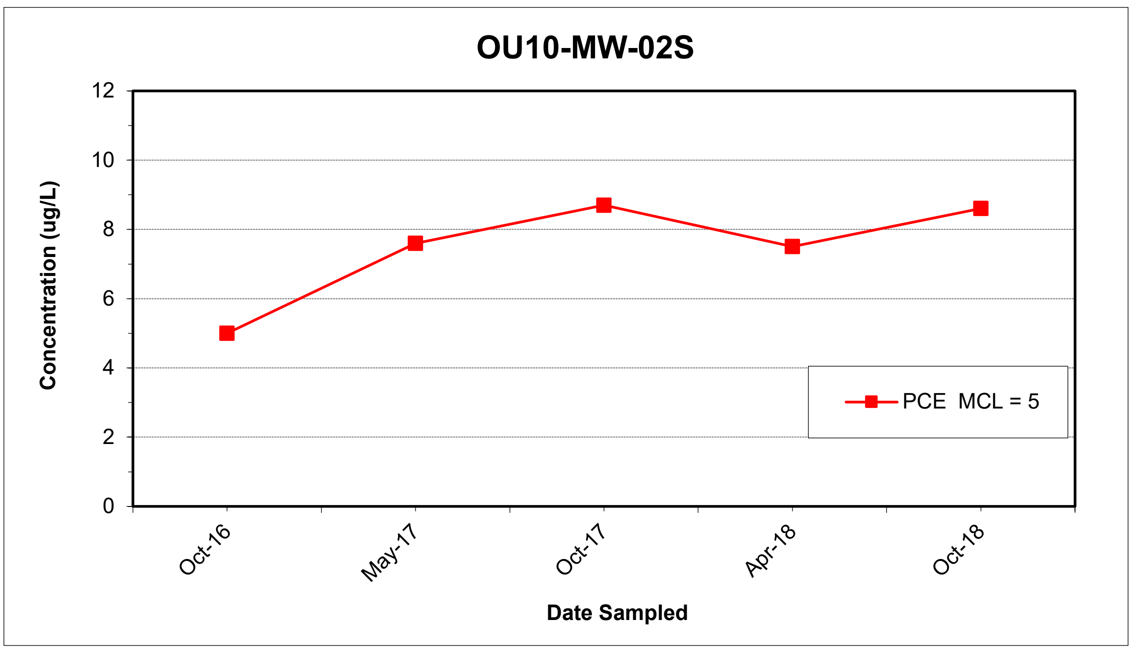
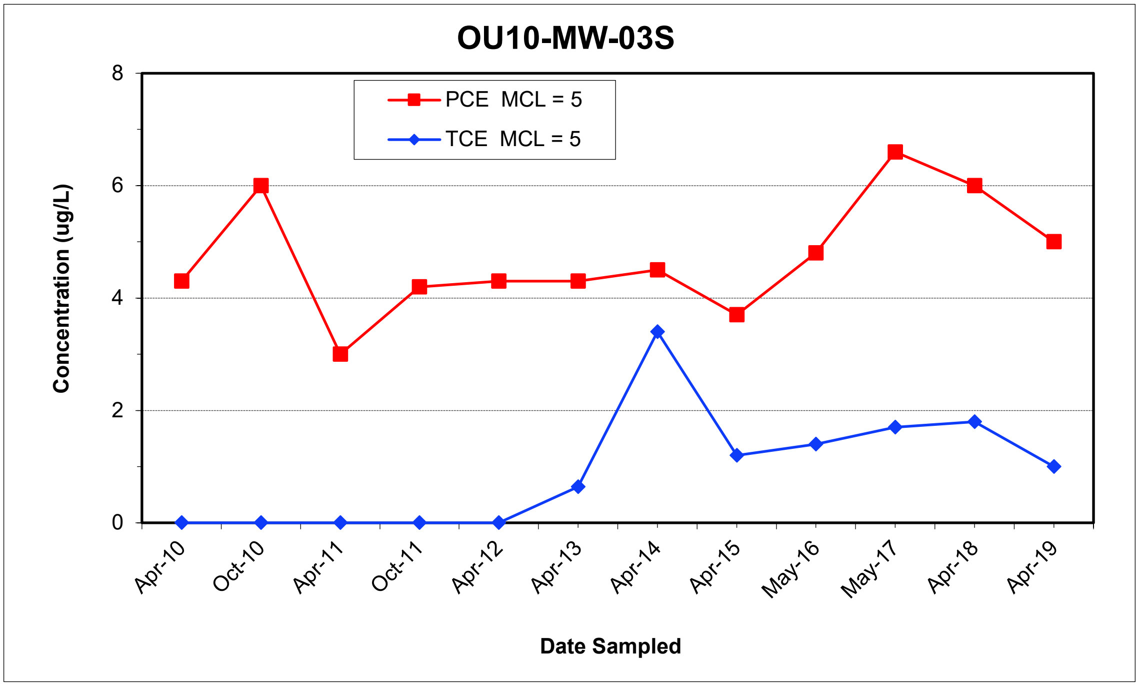


FIGURE 8-19
LONG-TERM MONITORING GRAPHS:
Chemicals of Concern
OU10: Wells OU10-MW-03S and OU10-MW-06S
WPAFB - LTM Program



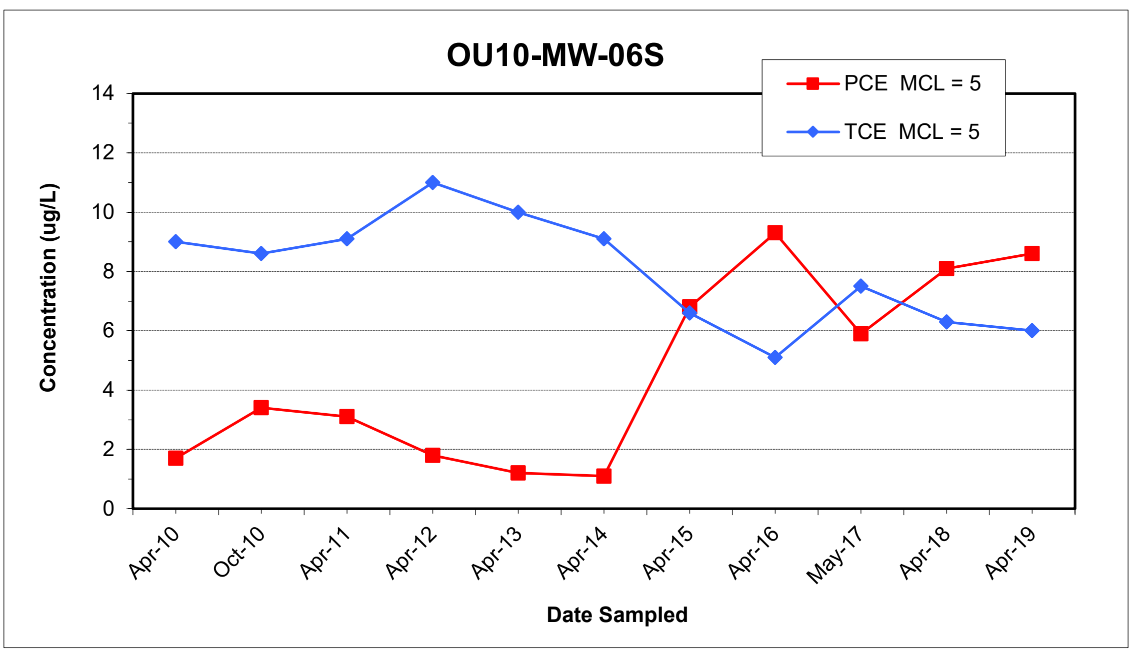
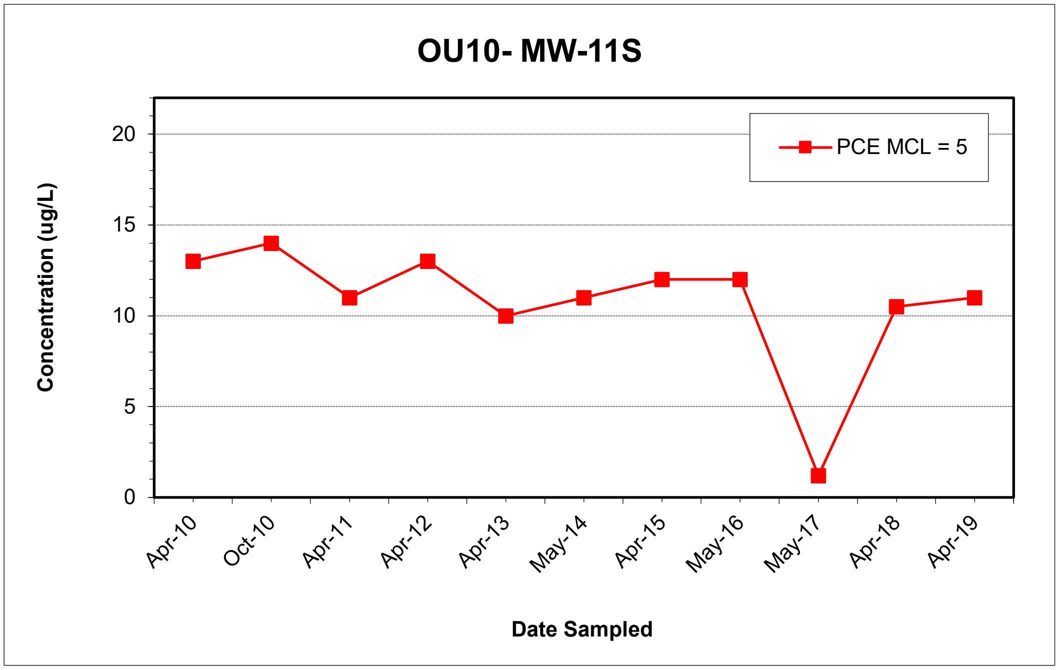


FIGURE 8-20
LONG-TERM MONITORING GRAPHS:
Chemicals of Concern
OU10: Wells OU10-MW-11S and OU10-MW-11D
WPAFB - LTM Program



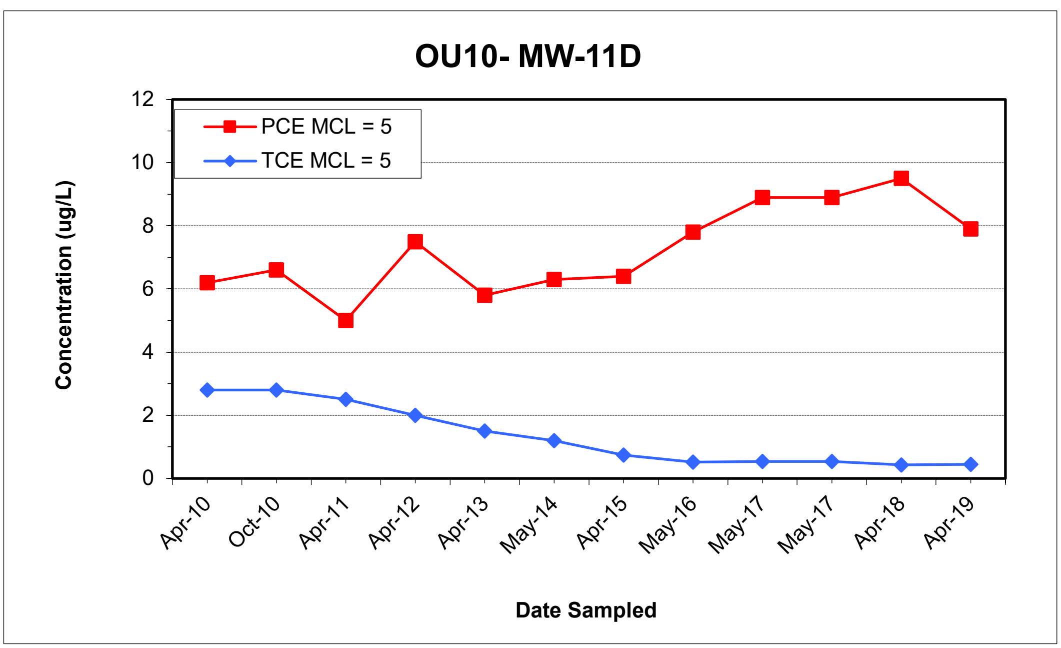
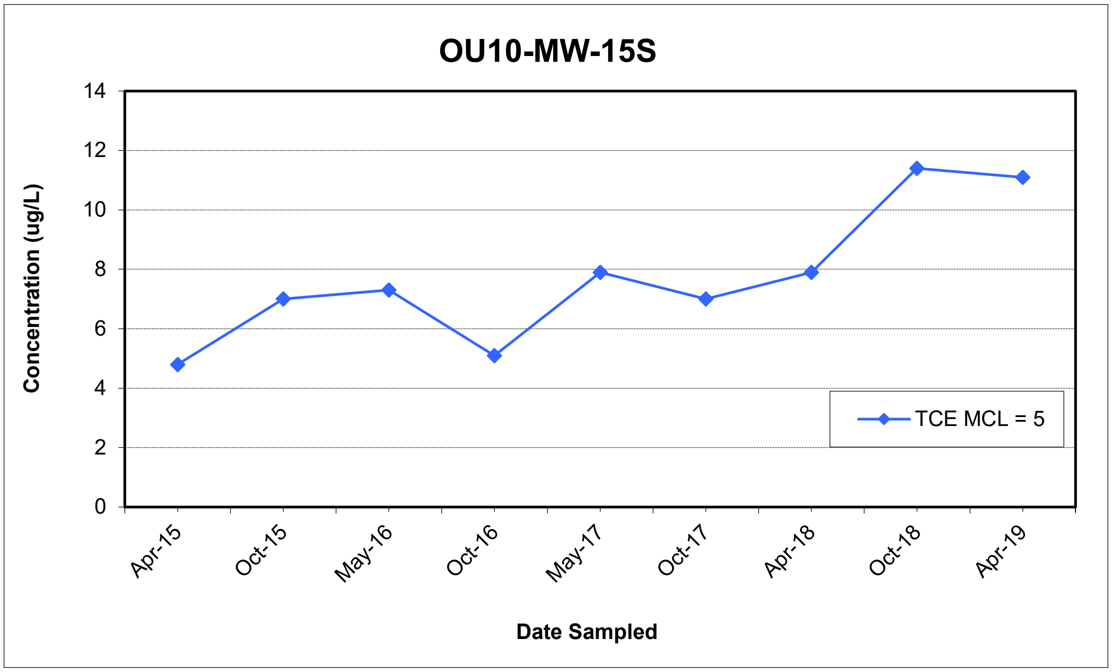


FIGURE 8-21
LONG-TERM MONITORING GRAPHS:
Chemicals of Concern
OU10: Wells OU10-MW-15S and OU10-MW-19D
WPAFB - LTM Program



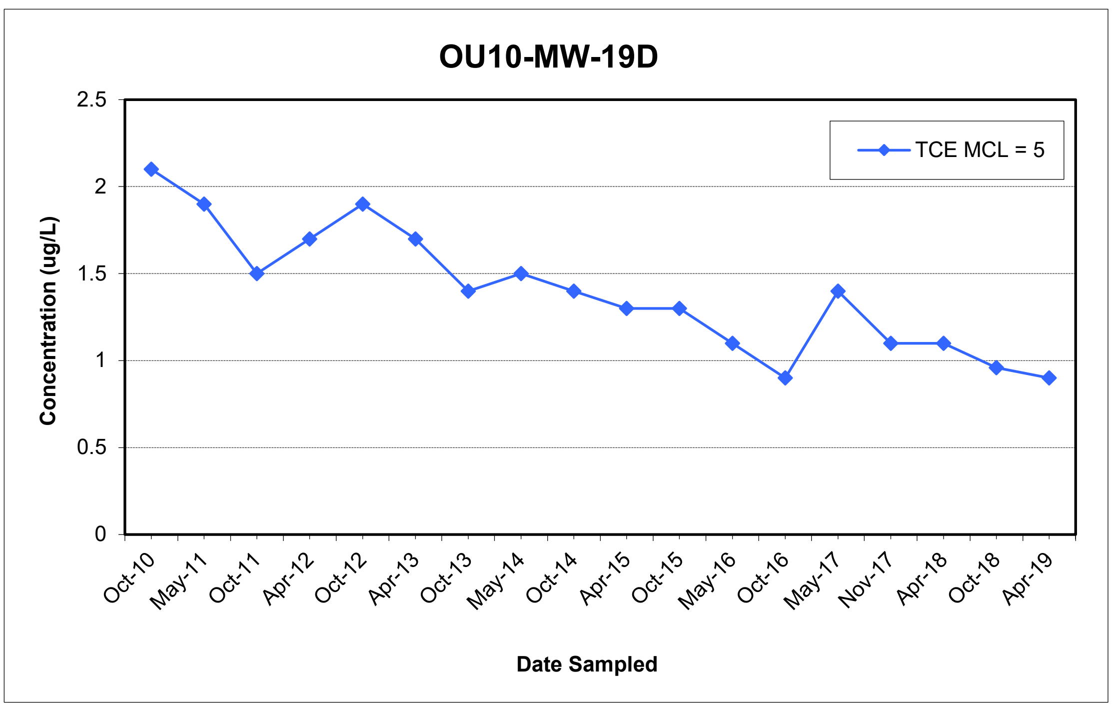
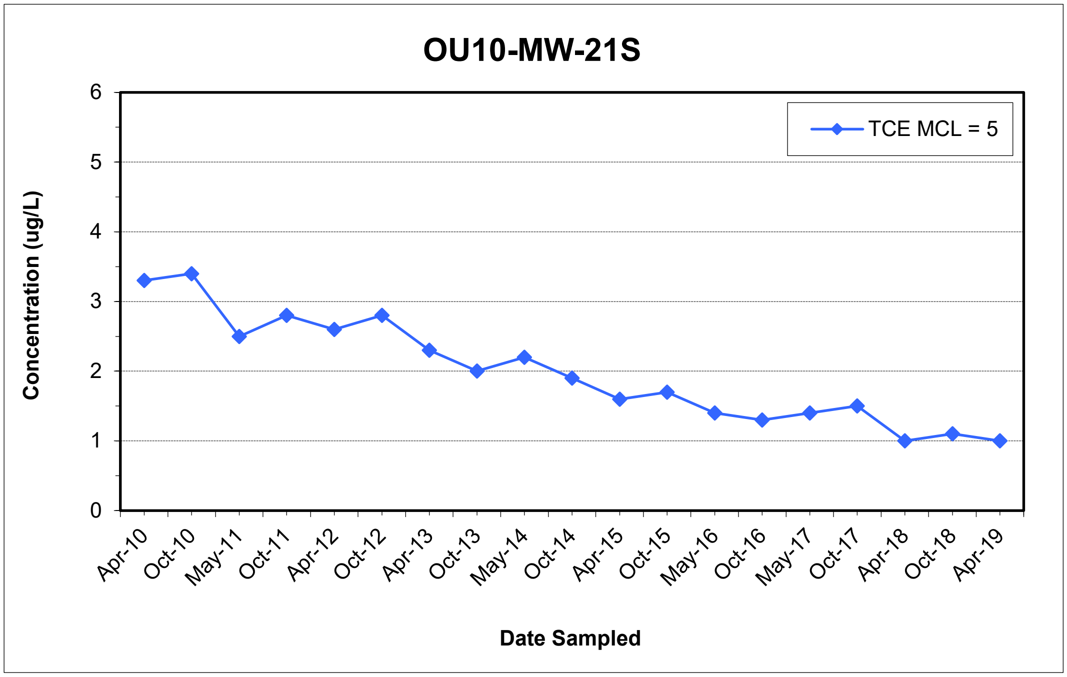


FIGURE 8-22
LONG-TERM MONITORING GRAPHS:
Chemicals of Concern
OU10: Wells OU10-MW-21S and OU10-MW-25S
WPAFB - LTM Program



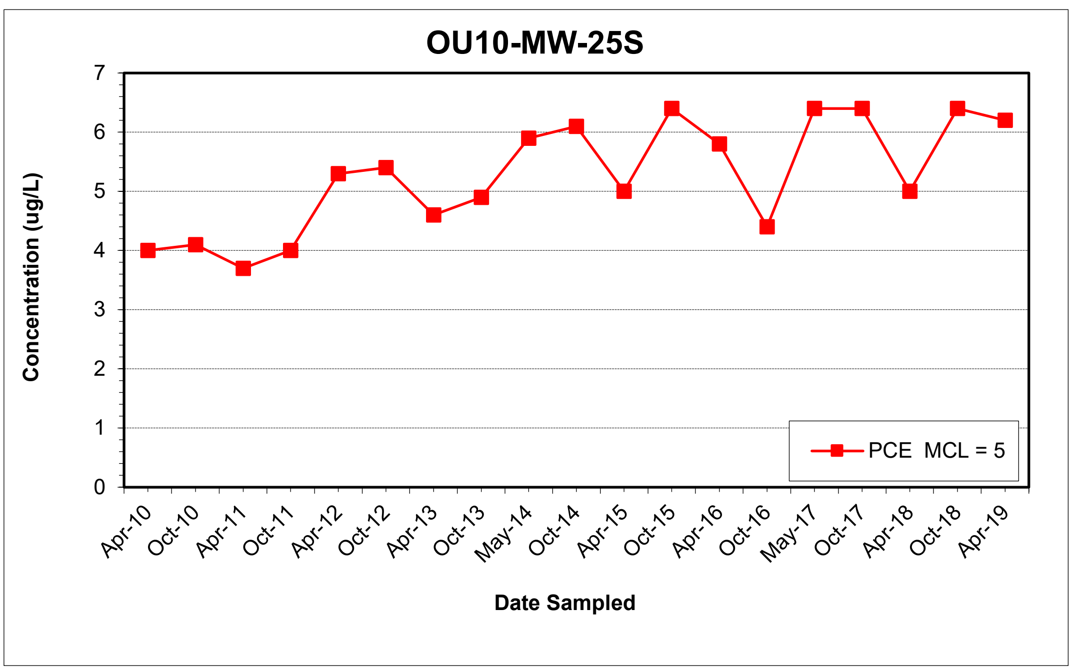
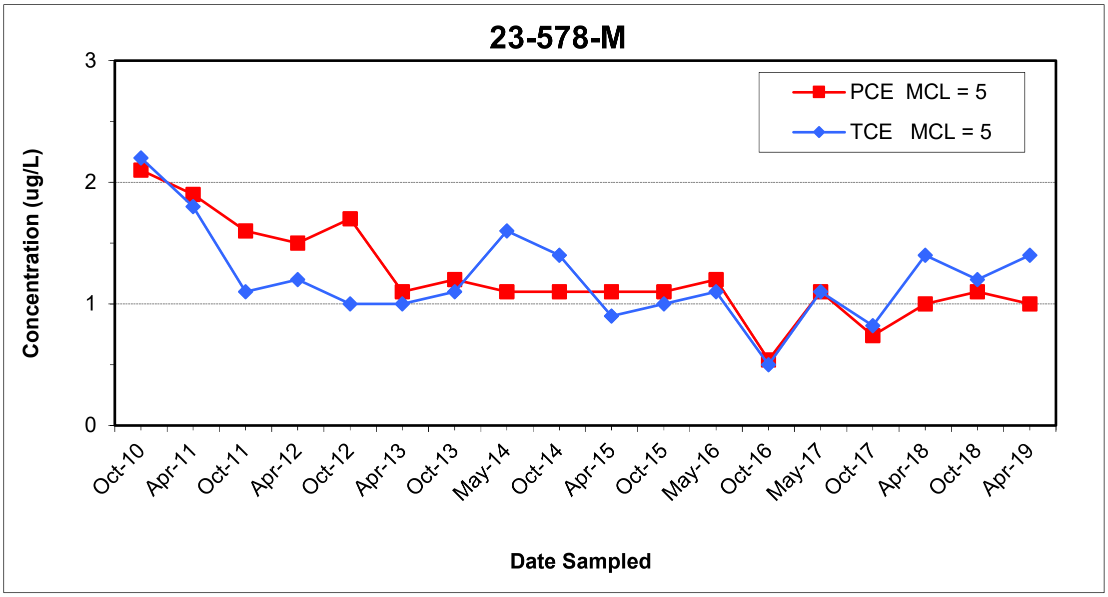
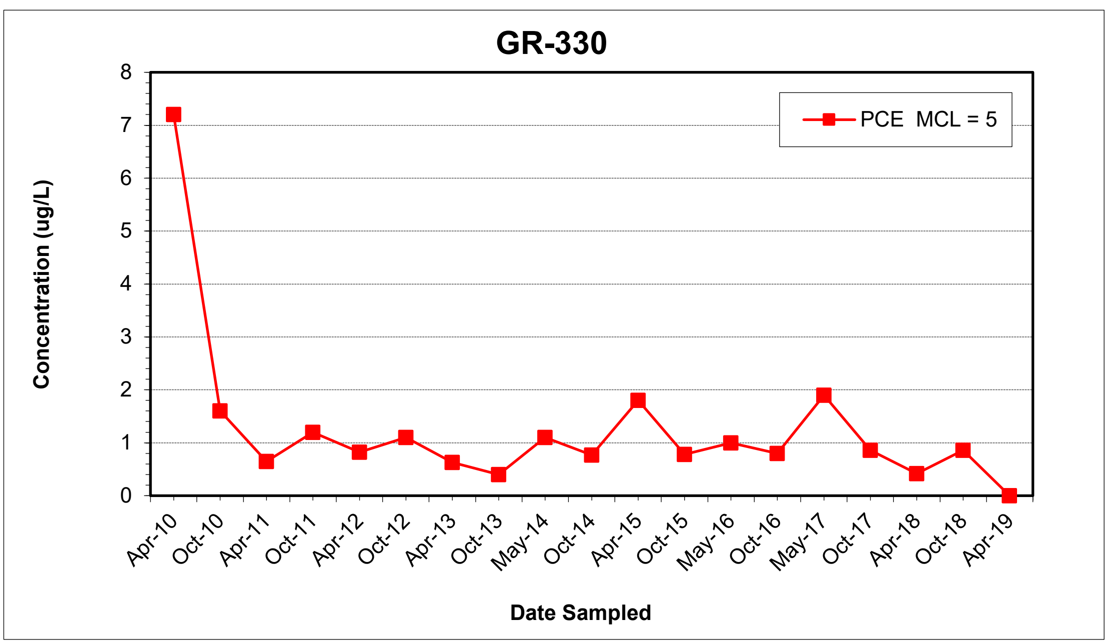
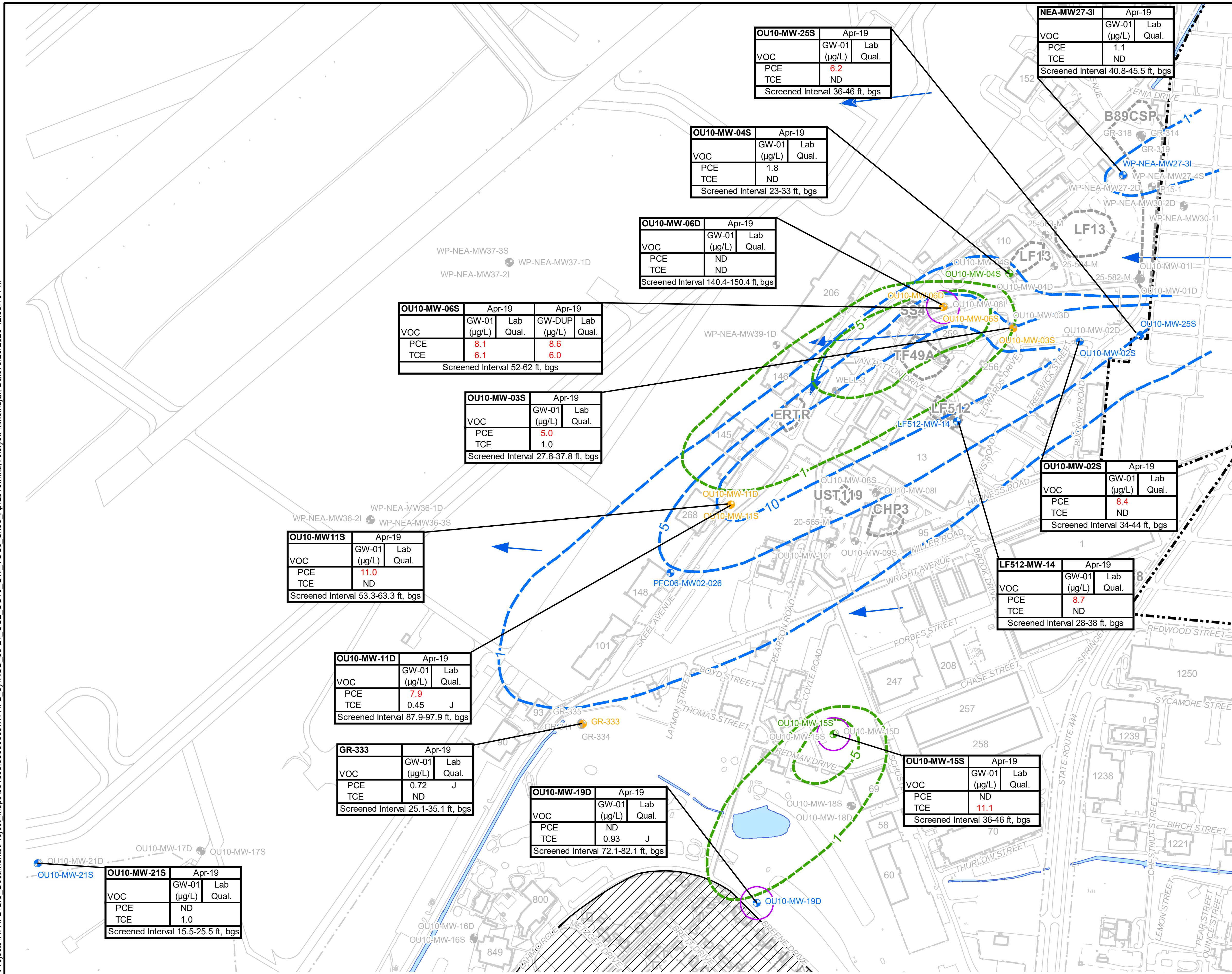


FIGURE 8-23
LONG-TERM MONITORING GRAPHS:
Chemicals of Concern
OU10 (CHP4): Wells 23-578-M and GR-330
WPAFB - LTM Program





F:\Projects\WPAFB\GIS_Documents\Project_Maps\501363.03000000\WPAFB_5yrROD_08-24_OU2_OU10_GW_VOCs_Cntrs_Apr2019.mxd; Analyst: mike.najar; Date: 9/29/2020 12:55:10 PM



Legend

- Monitoring Wells with Annual VOCs Analysis
- Monitoring Wells with Semi-Annual VOCs Analysis
- Additional Monitoring Wells Sampled for Potential Abandonment
- Monitoring Wells not sampled under LTM Program
- 100-foot Vapor Intrusion Radius
- TCE Isopleth (ppb) (dashed where inferred)
- PCE Isopleth (ppb) (dashed where inferred)
- Residential Area
- IRP Sites (locations approximate)
- Installation Boundary
- Fence Line
- Groundwater Flow Direction

ft, bgs feet below ground surface
J Laboratory Qualifier indicating an estimated concentration
µg/L micrograms per liter
ND Not detected
OU Operable Unit
PCE Tetrachloroethylene
TCE Trichloroethylene
VOC Volatile Organic Compound

Note:
For IRP Site acronyms, please refer to Figures 2-2 and 2-3

N

0 300 600 1,200
Feet

WRIGHT-PATTERSON AIR FORCE BASE, OHIO

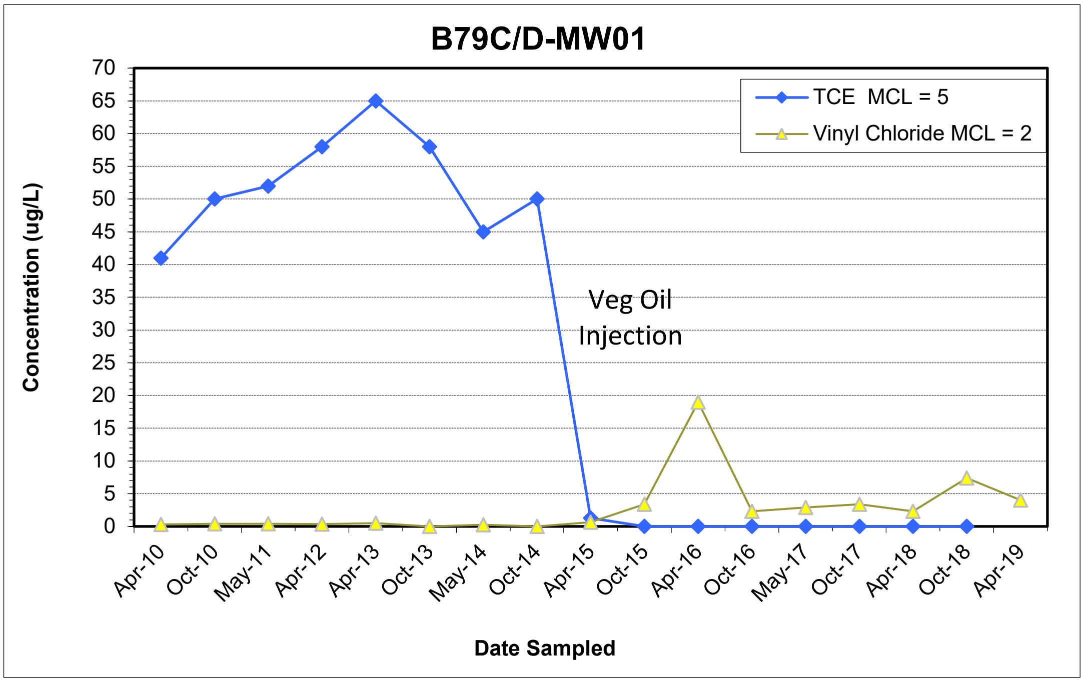
FIFTH FIVE-YEAR ROD REVIEW

FIGURE NUMBER 8-24

OU2 AND OU10 PCE AND TCE GROUNDWATER CONCENTRATIONS ISOPLETH MAP: APRIL 2019

APTIM
5050 Section Avenue
Cincinnati, Ohio 45212

FIGURE 8-25
LONG-TERM MONITORING GRAPHS:
Chemicals of Concern
Building 79: Wells B79C/D-MW01 and B79C/D-MW02
WPAFB - LTM Program



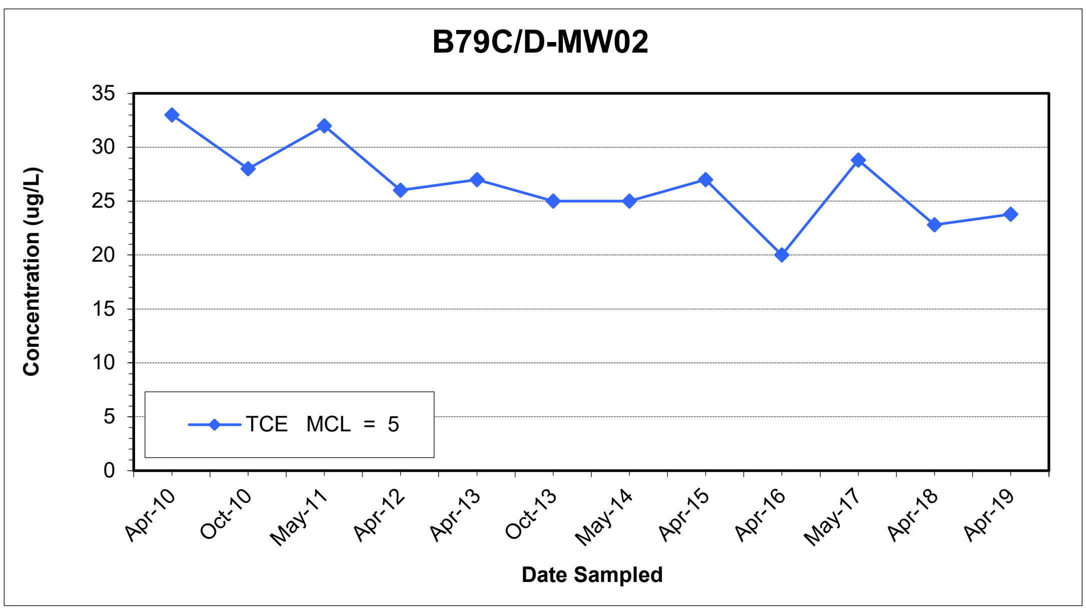
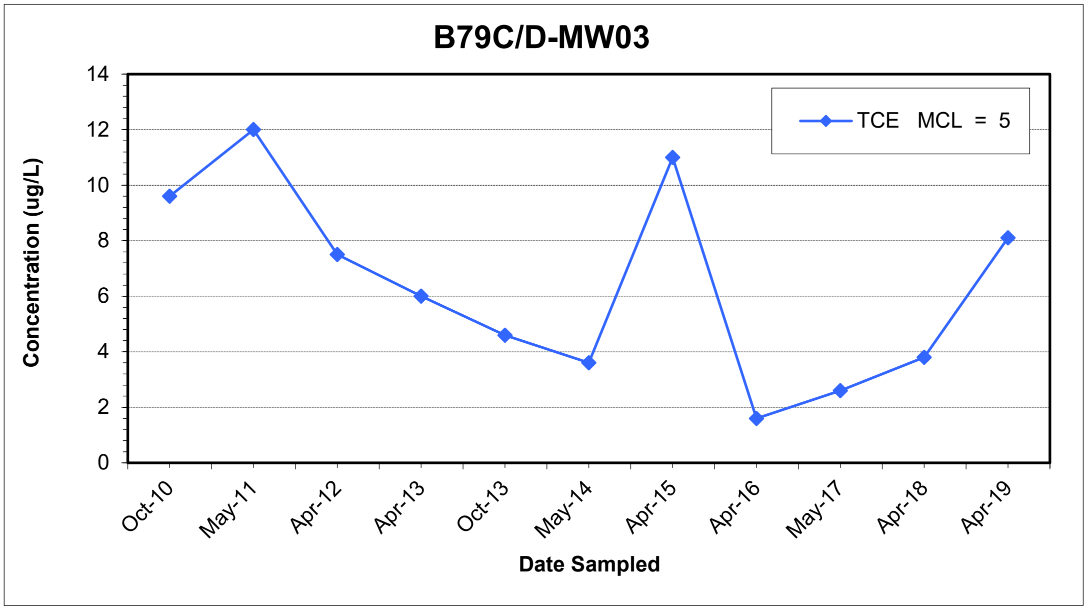


FIGURE 8-26
LONG-TERM MONITORING GRAPHS:
Chemicals of Concern
Building 79: Wells B79C/D-MW03 and B79C/D-MW04
WPAFB - LTM Program



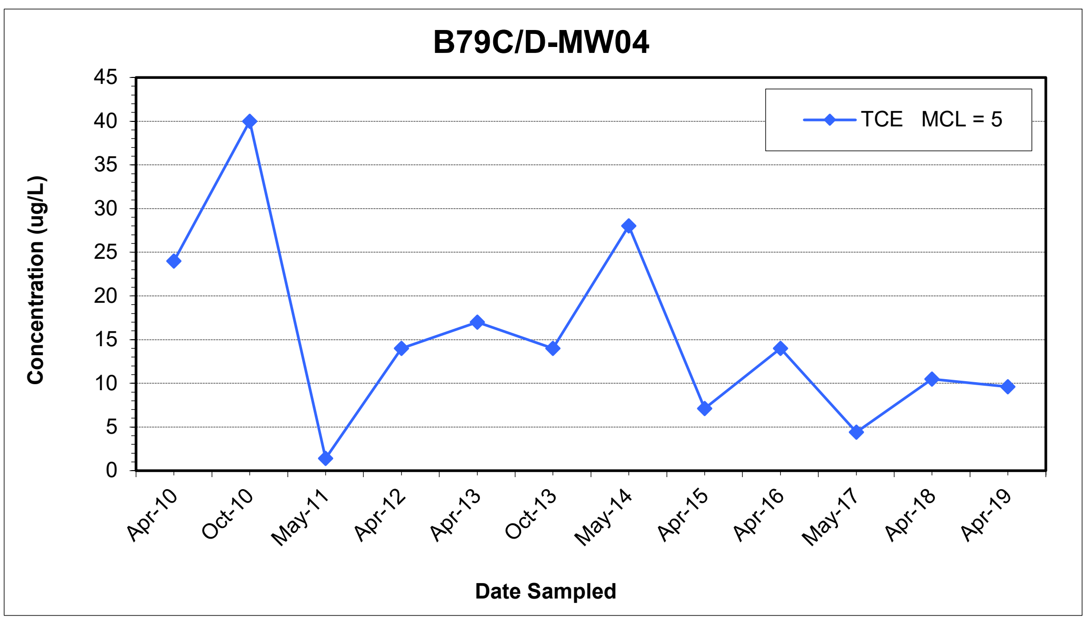
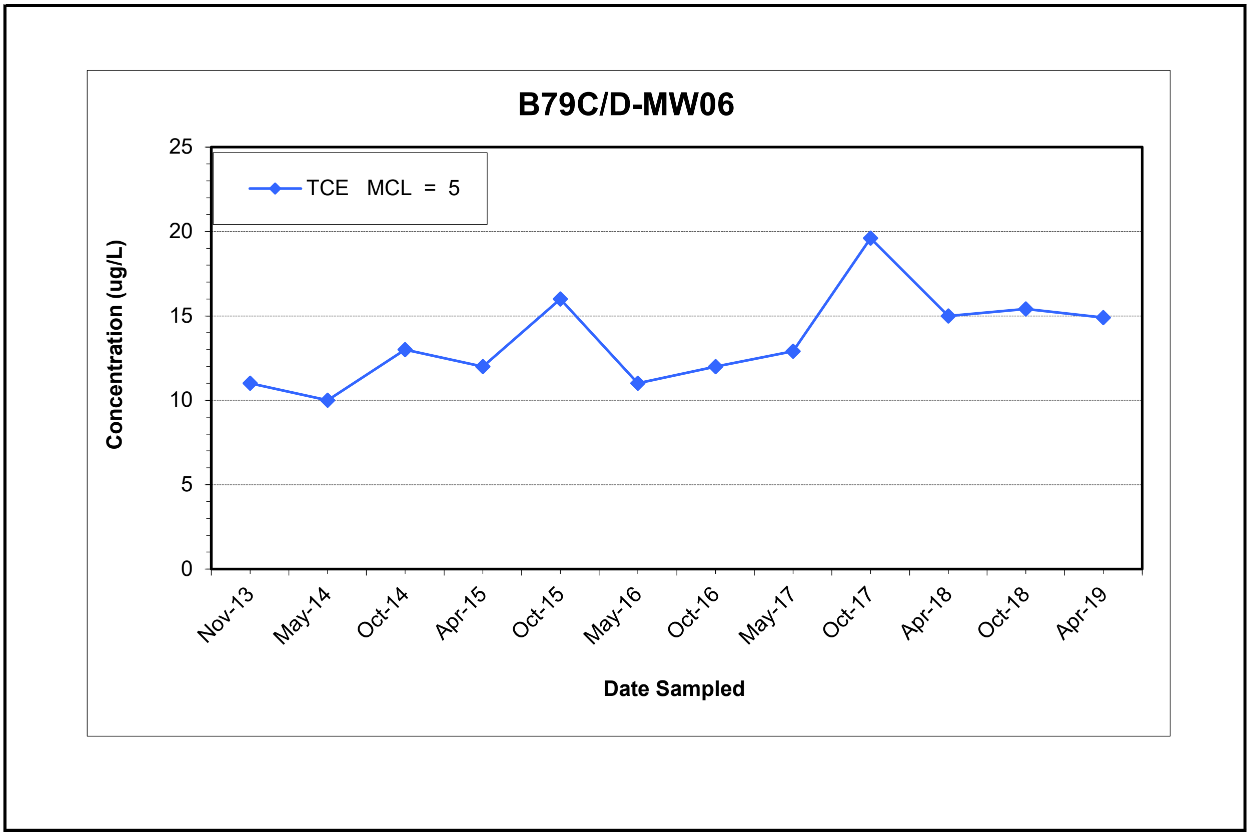
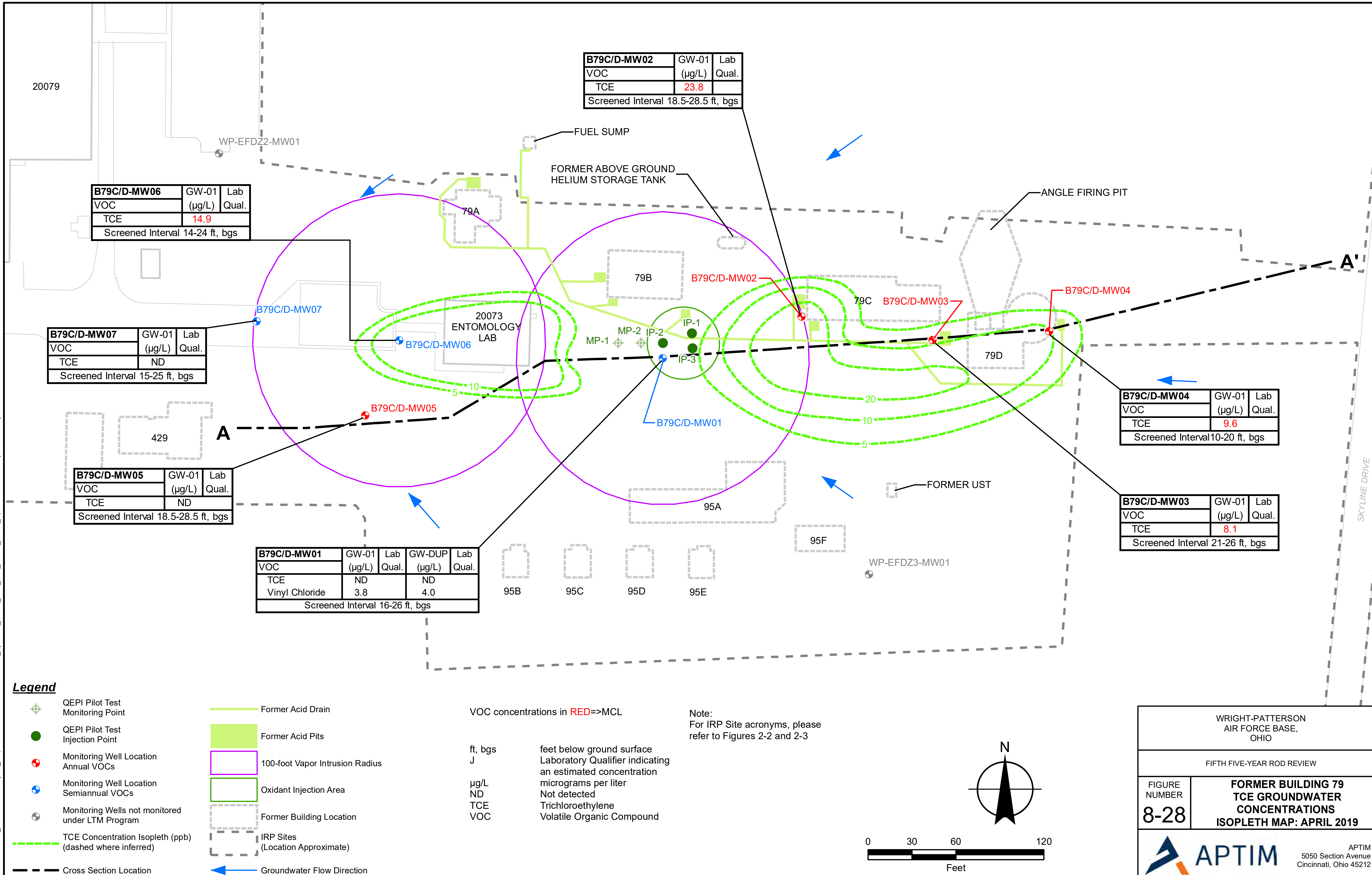


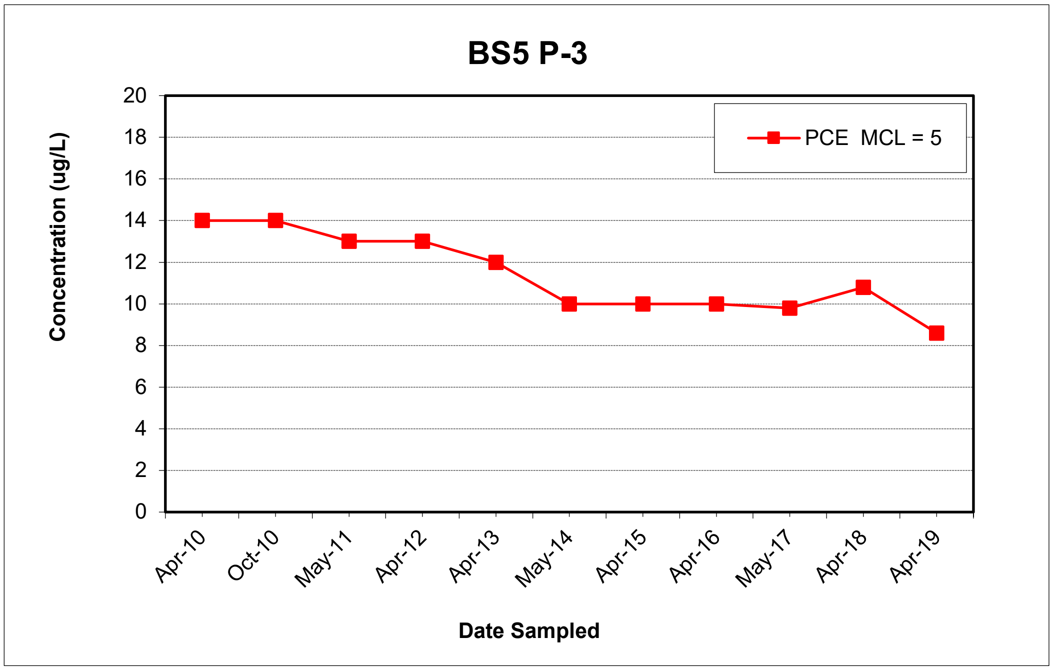
FIGURE 8-27
LONG-TERM MONITORING GRAPHS:
Chemicals of Concern
Building 79: Well B79C/D-MW06
WPAFB - LTM Program

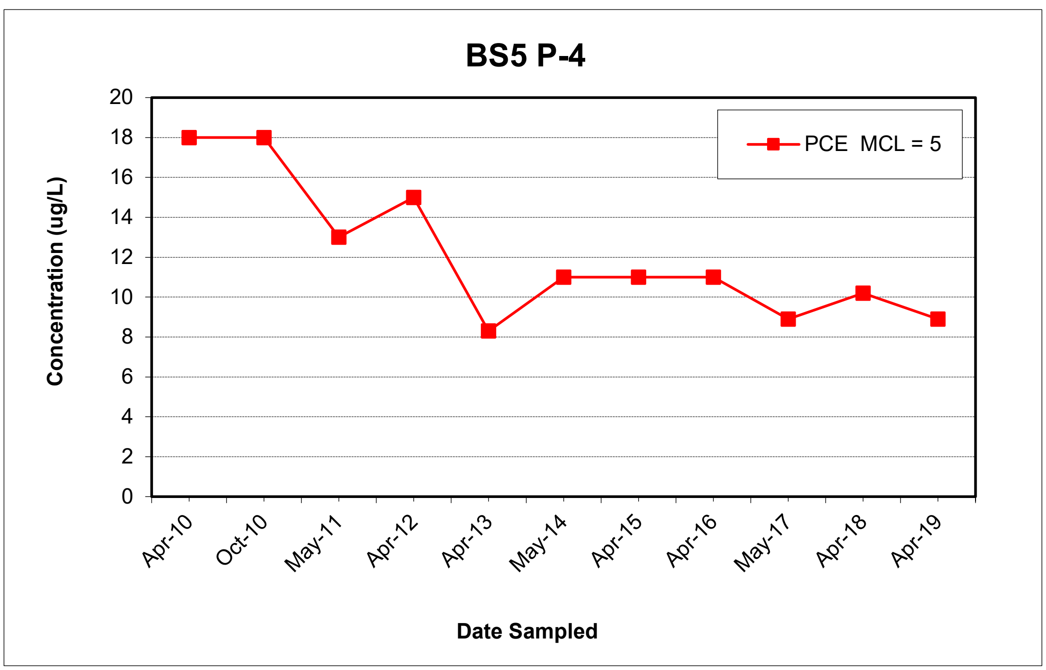


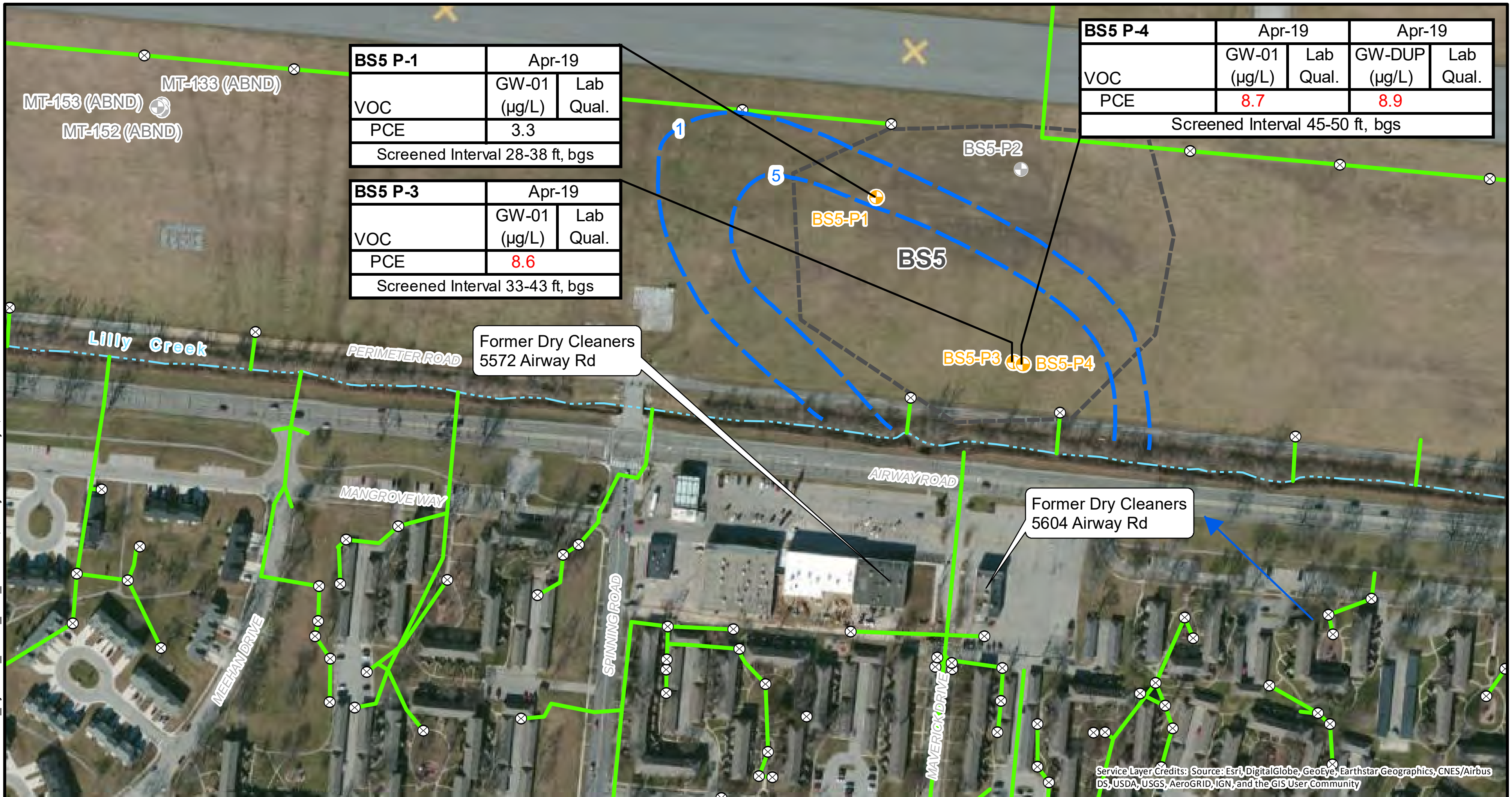


B79C/D-MW02 | GW-01 (µg/L) | Lab Qual.
VOC
TCE 23.8
Screened Interval 18.5-28.5 ft, bgs
B79C/D-MW06 | GW-01 (µg/L) | Lab Qual.
VOC
TCE 14.9
Screened Interval 14-24 ft, bgs
B79C/D-MW07 | GW-01 (µg/L) | Lab Qual.
VOC
TCE ND
Screened Interval 15-25 ft, bgs
B79C/D-MW05 | GW-01 (µg/L) | Lab Qual.
VOC
TCE ND
Screened Interval 18.5-28.5 ft, bgs
B79C/D-MW01 | GW-01 (µg/L) | Lab Qual. | GW-DUP (µg/L) | Lab Qual.
VOC
TCE ND ND
Vinyl Chloride 3.8 4.0
Screened Interval 16-26 ft, bgs
B79C/D-MW04 | GW-01 (µg/L) | Lab Qual.
VOC
TCE 9.6
Screened Interval10-20 ft, bgs
B79C/D-MW03 | GW-01 (µg/L) | Lab Qual.
VOC
TCE 8.1
Screened Interval 21-26 ft, bgs
20079
WP-EFDZ2-MW01
FUEL SUMP
FORMER ABOVE GROUND HELIUM STORAGE TANK
ANGLE FIRING PIT
79A
79B
79C
79D
20073 ENTOMOLOGY LAB
429
95A
95B
95C
95D
95E
95F
FORMER UST
WP-EFDZ3-MW01
SKYLINE DRIVE
MP-1
MP-2
IP-1
IP-2
IP-3
A
A'
Legend
QEPI Pilot Test Monitoring Point
QEPI Pilot Test Injection Point
Monitoring Well Location Annual VOCs
Monitoring Well Location Semiannual VOCs
Monitoring Wells not monitored under LTM Program
TCE Concentration Isopleth (ppb) (dashed where inferred)
Cross Section Location
Former Acid Drain
Former Acid Pits
100-foot Vapor Intrusion Radius
Oxidant Injection Area
Former Building Location
IRP Sites (Location Approximate)
Groundwater Flow Direction
VOC concentrations in RED=>MCL
ft, bgs feet below ground surface
J Laboratory Qualifier indicating an estimated concentration
µg/L micrograms per liter
ND Not detected
TCE Trichloroethylene
VOC Volatile Organic Compound
Note:
For IRP Site acronyms, please refer to Figures 2-2 and 2-3
N
0 30 60 120
Feet
WRIGHT-PATTERSON AIR FORCE BASE, OHIO
FIFTH FIVE-YEAR ROD REVIEW
FIGURE NUMBER 8-28
FORMER BUILDING 79 TCE GROUNDWATER CONCENTRATIONS ISOPLETH MAP: APRIL 2019
APTIM
APTIM 5050 Section Avenue Cincinnati, Ohio 45212
G:\WPAFB\GIS_Documents\Project_Maps\501363.03000000\WPAFB_5yrROD_08-28_B79_GW_VOCs_Cntrs_Apr2019.mxd; Analyst: mike.najar; Date: 12/19/2019 1:25:27 PM

FIGURE 8-29
LONG-TERM MONITORING GRAPHS:
Chemicals of Concern
Burial Site 5: Wells BS5 P-3 and BS5 P-4
WPAFB - LTM Program







BS5 P-1	Apr-19	
VOC	GW-01 (µg/L)	Lab Qual.
PCE	3.3	
Screened Interval 28-38 ft, bgs		

BS5 P-3	Apr-19	
VOC	GW-01 (µg/L)	Lab Qual.
PCE	8.6	
Screened Interval 33-43 ft, bgs		

BS5 P-4	Apr-19		Apr-19	
VOC	GW-01 (µg/L)	Lab Qual.	GW-DUP (µg/L)	Lab Qual.
PCE	8.7		8.9	
Screened Interval 45-50 ft, bgs				

Legend

- Monitoring Wells with Annual VOCs Analysis
- Groundwater Flow Direction
- PCE Concentration Isopleth (µg/L) (ppb) (dashed where inferred)
- Storm Sewer Inlet Point
- Storm Sewer Line

(ABND) Abandoned
ft, bgs feet below ground surface
GW groundwater
µg/L micrograms per liter
PCE Tetrachloroethylene
VOC Volatile Organic Compound
VOC concentration (RED=>MCL)

N

0 150 300 600
Feet

WRIGHT-PATTERSON
AIR FORCE BASE,
OHIO

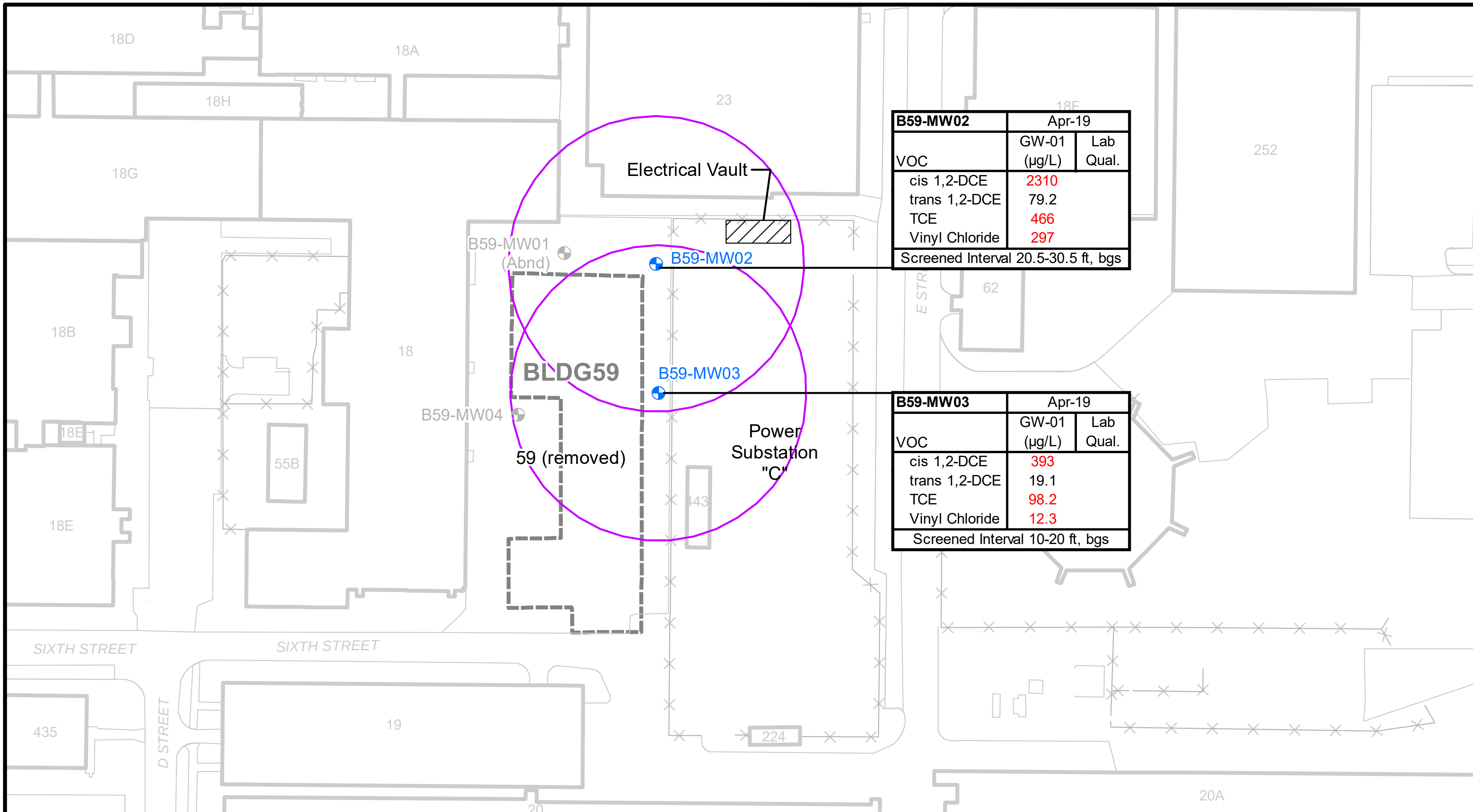
FIFTH FIVE-YEAR ROD REVIEW

FIGURE NUMBER
8-30

**BURIAL SITE 5
PCE GROUNDWATER
CONCENTRATIONS
ISOPLETH MAP: APRIL 2019**

APTIM
5050 Section Avenue
Cincinnati, Ohio 45212

G:\WPAFB\GIS_Documents\Project_Maps\501363.03000000\WPAFB_5yrROD_08-30_BS5_Utils.mxd; Analyst: mike.najar; Date: 11/4/2019 9:46:28 AM



B59-MW02	Apr-19	
VOC	GW-01 (µg/L)	Lab Qual.
cis 1,2-DCE	2310	
trans 1,2-DCE	79.2	
TCE	466	
Vinyl Chloride	297	
Screened Interval 20.5-30.5 ft, bgs		

B59-MW03	Apr-19	
VOC	GW-01 (µg/L)	Lab Qual.
cis 1,2-DCE	393	
trans 1,2-DCE	19.1	
TCE	98.2	
Vinyl Chloride	12.3	
Screened Interval 10-20 ft, bgs		

Legend

Monitoring Wells with Semi-Annual VOCs Analysis

100-foot Vapor Intrusion Radius

Fence Line

Abnd	Abandoned
cis 1,2-DCE	cis 1,2-Dichloroethene
ft, bgs	feet below ground surface
J	Laboratory Qualifier indicating an estimated cocentration
µg/L	micrograms per liter
TCE	Trichloroethylene
trans 1,2-DCE	Trans 1,2-Dichloroethene
VOC	Volatile Organic Compound

VOC concentration (RED=>MCL)

N

0 50 100 200

Feet

WRIGHT-PATTERSON
AIR FORCE BASE,
OHIO

FIFTH FIVE-YEAR ROD REVIEW

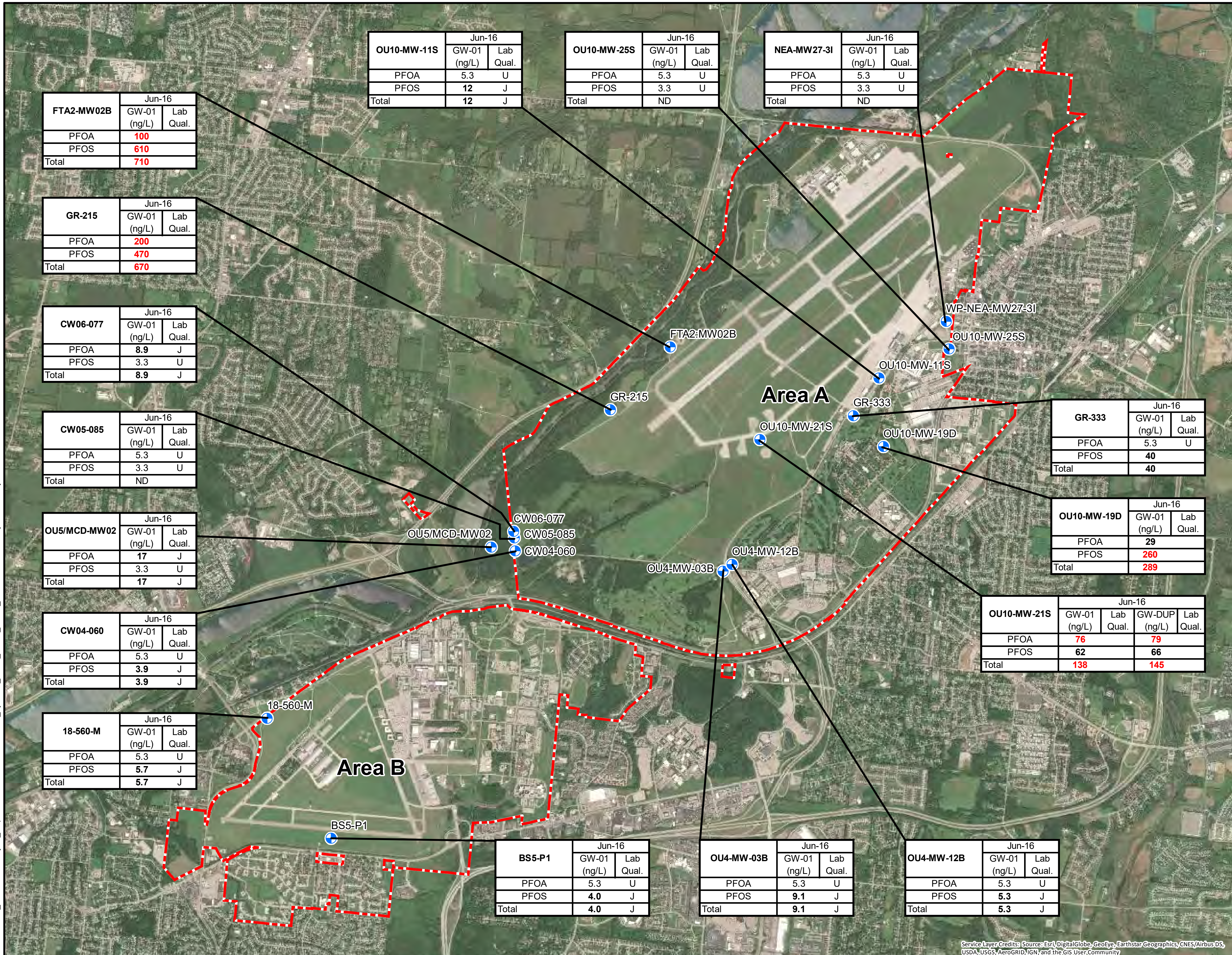
FIGURE NUMBER

8-31

FORMER BUILDING 59 GROUNDWATER CONCENTRATIONS OF VOCS: APRIL 2019

APTIM

APTIM
5050 Section Avenue
Cincinnati, Ohio 45212



FTA2-MW02B	Jun-16	
	GW-01 (ng/L)	Lab Qual.
PFOA	100	
PFOS	610	
Total	710	

GR-215	Jun-16	
	GW-01 (ng/L)	Lab Qual.
PFOA	200	
PFOS	470	
Total	670	

CW06-077	Jun-16	
	GW-01 (ng/L)	Lab Qual.
PFOA	8.9	J
PFOS	3.3	U
Total	8.9	J

CW05-085	Jun-16	
	GW-01 (ng/L)	Lab Qual.
PFOA	5.3	U
PFOS	3.3	U
Total	ND	

OU5/MCD-MW02	Jun-16	
	GW-01 (ng/L)	Lab Qual.
PFOA	17	J
PFOS	3.3	U
Total	17	J

CW04-060	Jun-16	
	GW-01 (ng/L)	Lab Qual.
PFOA	5.3	U
PFOS	3.9	J
Total	3.9	J

18-560-M	Jun-16	
	GW-01 (ng/L)	Lab Qual.
PFOA	5.3	U
PFOS	5.7	J
Total	5.7	J

OU10-MW-11S	Jun-16	
	GW-01 (ng/L)	Lab Qual.
PFOA	5.3	U
PFOS	12	J
Total	12	J

OU10-MW-25S	Jun-16	
	GW-01 (ng/L)	Lab Qual.
PFOA	5.3	U
PFOS	3.3	U
Total	ND	

NEA-MW27-3I	Jun-16	
	GW-01 (ng/L)	Lab Qual.
PFOA	5.3	U
PFOS	3.3	U
Total	ND	

GR-333	Jun-16	
	GW-01 (ng/L)	Lab Qual.
PFOA	5.3	U
PFOS	40	
Total	40	

OU10-MW-19D	Jun-16	
	GW-01 (ng/L)	Lab Qual.
PFOA	29	
PFOS	260	
Total	289	

OU10-MW-21S	Jun-16			
	GW-01 (ng/L)	Lab Qual.	GW-DUP (ng/L)	Lab Qual.
PFOA	76		79	
PFOS	62		66	
Total	138		145	

BS5-P1	Jun-16	
	GW-01 (ng/L)	Lab Qual.
PFOA	5.3	U
PFOS	4.0	J
Total	4.0	J

OU4-MW-03B	Jun-16	
	GW-01 (ng/L)	Lab Qual.
PFOA	5.3	U
PFOS	9.1	J
Total	9.1	J

OU4-MW-12B	Jun-16	
	GW-01 (ng/L)	Lab Qual.
PFOA	5.3	U
PFOS	5.3	J
Total	5.3	J

Legend

WPAFB Monitoring Wells

WPAFB Boundary

J Estimated Concentration
PFOA Perfluoro-n-Octanoic Acid
PFOS Perfluorooctane Sulfonate
ng/L nanograms per liter (exceedances of HAL are denoted in red)
U Undetected at the stated detection limit

Note: USEPA Health Advisory Limit (HAL) for PFOS/PFOA: 70 ng/L.

N

3,400 1,700 0 3,400
Feet

WRIGHT-PATTERSON AIR FORCE BASE, OHIO

FIFTH FIVE-YEAR ROD REVIEW

FIGURE NUMBER 8-32

PFOS/PFOA MONITORING WELL LOCATIONS AND GROUNDWATER CONCENTRATIONS JUNE 2016

APTIM
5050 Section Avenue
Cincinnati, Ohio 45212

G:\WPAFB\GIS_Documents\Project_Maps\501363.03000000\WPAFB_5yrROD_08-32_PFOS_PFOA_June2016.mxd; Analyst: Mike.Najar; Date: 11/4/2019 7:15:08 AM

PFCLTM-MW02	Feb-17	
PFC	GW-01 (ng/L)	Lab Qual.
PFBS	17	
PFOA	5.8	
PFOS	ND	
PFOA & PFOS	5.8	
Screened: 45 to 55 ft, bgs		

FTA2:MW02B	Oct-17	
PFC	GW-01 (ng/L)	Lab Qual.
PFBS	177	
PFOA	246	
PFOS	1,450	D
PFOA & PFOS	1,696	D
Screened: 20 to 25 ft, bgs		

PFCLTM-MW03	Feb-17	
PFC	GW-01 (ng/L)	Lab Qual.
PFBS	31	
PFOA	14	
PFOS	ND	
PFOA & PFOS	14	
Screened: 45 to 55 ft, bgs		

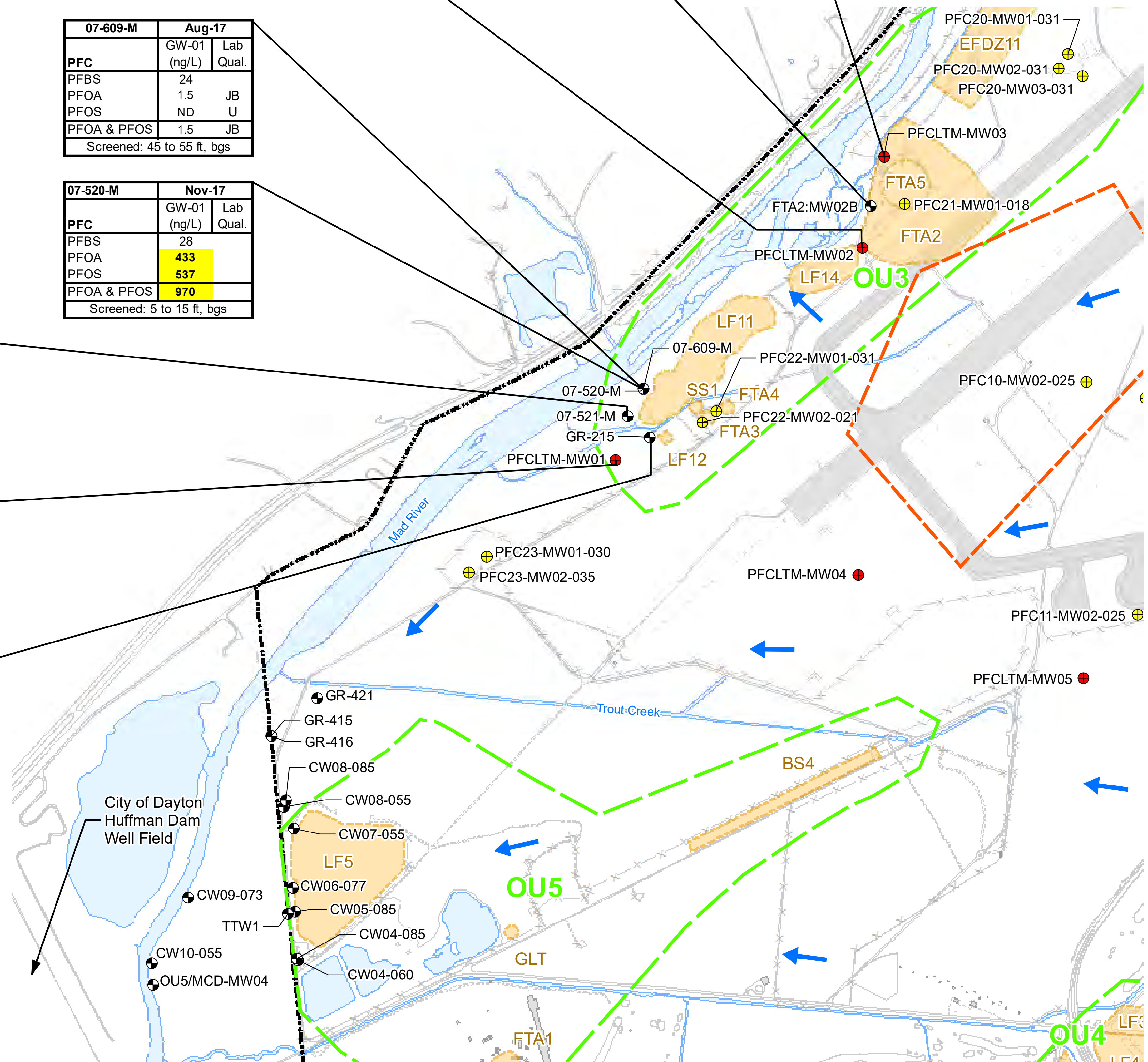
07-609-M	Aug-17	
PFC	GW-01 (ng/L)	Lab Qual.
PFBS	24	
PFOA	1.5	JB
PFOS	ND	U
PFOA & PFOS	1.5	JB
Screened: 45 to 55 ft, bgs		

07-520-M	Nov-17	
PFC	GW-01 (ng/L)	Lab Qual.
PFBS	28	
PFOA	433	
PFOS	537	
PFOA & PFOS	970	
Screened: 5 to 15 ft, bgs		

07-521-M	Nov-17	
PFC	GW-01 (ng/L)	Lab Qual.
PFBS	15.5	
PFOA	18.1	
PFOS	70.7	
PFOA & PFOS	89	
Screened: 6 to 16 ft, bgs		

PFCLTM-MW01	Nov-17	
PFC	GW-01 (ng/L)	Lab Qual.
PFBS	18	
PFOA	3.61	J
PFOS	0.933	JB
PFOA & PFOS	3.61	J
Screened: 45 to 55 ft, bgs		

GR-215	Nov-17	
PFC	GW-01 (ng/L)	Lab Qual.
PFBS	19.2	
PFOA	125	
PFOS	367	
PFOA & PFOS	492	
Screened: 20 to 25 ft, bgs		



Legend

- Existing Monitoring Well: PFC LTM Sampling
- New Monitoring Well: PFC LTM Sampling
- New Monitoring Well: PFC SI
- Boundary of MRS MU897
- Operable Units
- IRP Sites (Locations Approximate)
- Installation Area
- Groundwater Flow Direction

B	Sample qualified because of blank (method, prep, and field) interference
BS	Burial Site
CCSA	Coal and Chemical Storage Area
CDA	Chemical Disposal Area
CHP	Central Heating Plant
EFDZ	Earthfill Disposal Zone
FTA	Fire Training Area
J	Result is estimated
LF	Land Fill
LTM	Long-Term Monitoring
MRS	Munition Response Site
MSL	Mean Sea Level
ND	Not detected
ng/L	nanograms per liter (parts per trillion)
PFC	Perfluorinated Compound
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctane Sulfonate
SS	Spill Site
TCSP	Temp Coal Storage Pile
U	Not detected (qualifier)
UST	Underground Storage Tank

Notes:

1) Highlighted concentrations exceed the U.S. EPA Health Advisory Level for drinking water (May 2016) of 70 ng/L.
2) EPA's health advisories are non-enforceable and non-regulatory and provide technical information to states agencies and other public health officials on health effects, analytical methodologies, and treatment technologies associated with drinking water contamination.

0 600 1,200 2,400 Feet

WRIGHT-PATTERSON AIR FORCE BASE, OHIO

FIFTH FIVE-YEAR ROD REVIEW

FIGURE NUMBER 8-33

PFOS/PFOA QUARTERLY GROUNDWATER ANALYTICAL RESULTS: OU3

APTIM
5050 Section Avenue
Cincinnati, Ohio 45212

CW08-055	Jun-19	
PFC	GW-01 (ng/L)	Lab Qual.
PFBS	63	
PFOA	13	J
PFOS	ND	
PFOA & PFOS	13.0	J
Screened: 45 to 55 ft, bgs		

CW08-085	Jun-19	
PFC	GW-01 (ng/L)	Lab Qual.
PFBS	42	
PFOA	27	
PFOS	ND	
PFOA & PFOS	27	
Screened: 75 to 85 ft, bgs		

GR-416	Jun-19	
PFC	GW-01 (ng/L)	Lab Qual.
PFBS	50	
PFOA	57	
PFOS	ND	
PFOA & PFOS	57	
Screened: 56 to 66 ft, bgs		

GR-415	Aug-17	
PFC	GW-01 (ng/L)	Lab Qual.
PFBS	ND	
PFOA	0.90	JB
PFOS	ND	
PFOA & PFOS	0.90	JB
Screened: 100 to 110 ft, bgs		

GR-421	Jun-19	
PFC	GW-01 (ng/L)	Lab Qual.
PFBS	44	
PFOA	84	
PFOS	9.8	J
PFOA & PFOS	94	J
Screened: 55 to 65 ft, bgs		

CW07-055	Oct-17	
PFC	GW-01 (ng/L)	Lab Qual.
PFBS	71	
PFOA	8.38	
PFOS	ND	
PFOA & PFOS	8.38	
Screened: 45 to 55 ft, bgs		

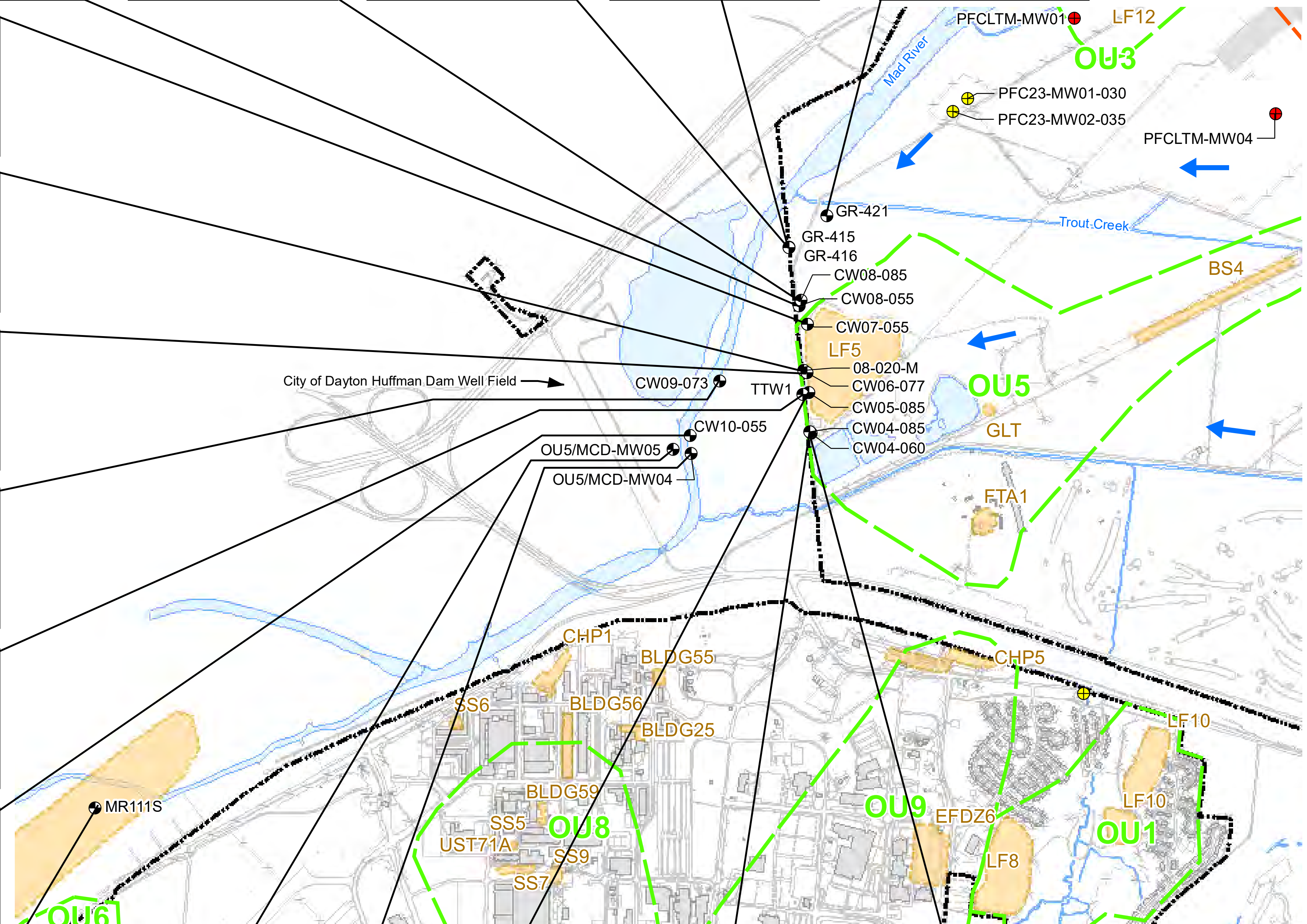
08-020-M	Jun-19	
PFC	GW-01 (ng/L)	Lab Qual.
PFBS	8	J
PFOA	12	J
PFOS	ND	
PFOA & PFOS	12	J
Screened: 11 to 21 ft, bgs		

CW06-077	Oct-17	
PFC	GW-01 (ng/L)	Lab Qual.
PFBS	6.34	
PFOA	6.27	
PFOS	ND	
PFOA & PFOS	6.27	
Screened: 67 to 77 ft, bgs		

CW09-073	Jun-19	
PFC	GW-01 (ng/L)	Lab Qual.
PFBS	40	
PFOA	ND	
PFOS	ND	
PFOA & PFOS	ND	
Screened: 63 to 73 ft, bgs		

TTW-1	Jun-19	
PFC	GW-01 (ng/L)	Lab Qual.
PFBS	ND	
PFOA	11	J
PFOS	ND	
PFOA & PFOS	11.0	J
Screened: 45 to 65 ft, bgs		

CW10-055	Jun-19	
PFC	GW-01 (ng/L)	Lab Qual.
PFBS	21	
PFOA	8.7	J
PFOS	ND	
PFOA & PFOS	8.7	J
Screened: 45 to 55 ft, bgs		



MR111S	Jun-19	
PFC	GW-01 (ng/L)	Lab Qual.
PFBS	ND	
PFOA	21	
PFOS	29	
PFOA & PFOS	50	
Screened: 32 to 40 ft, bgs		

OU5/MCD-MW05	Jun-19	
PFC	GW-01 (ng/L)	Lab Qual.
PFBS	14	J
PFOA	ND	
PFOS	ND	
PFOA & PFOS	ND	
Screened: 65 to 75 ft, bgs		

OU5/MCD-MW04	Jun-19	
PFC	GW-01 (ng/L)	Lab Qual.
PFBS	9.8	J
PFOA	9.2	J
PFOS	ND	
PFOA & PFOS	9.2	J
Screened: 69 to 79 ft, bgs		

CW05-085	Jul-17	
PFC	GW-01 (ng/L)	Lab Qual.
PFBS	5.3	J
PFOA	7.7	
PFOS	ND	
PFOA & PFOS	7.7	
Screened: 75 to 85 ft, bgs		

CW04-085	Oct-17	
PFC	GW-01 (ng/L)	Lab Qual.
PFBS		
PFOA	5.28	
PFOS	2.85	JB
PFOA & PFOS	5.28	
Screened: 74 to 84 ft, bgs		

CW04-060	Jun-19	
PFC	GW-01 (ng/L)	Lab Qual.
PFBS	ND	
PFOA	ND	
PFOS	ND	
PFOA & PFOS	ND	
Screened: 50 to 60 ft, bgs		

Legend

- Existing Monitoring Well: PFC LTM Sampling
- New Monitoring Well: PFC LTM Sampling
- New Monitoring Well: PFC SI
- Boundary of MRS MU897
- Operable Units
- IRP Sites (Locations Approximate)
- Installation Area
- Groundwater Flow Direction

B	Sample qualified because of blank (method, prep, and field) interference
BS	Burial Site
CCSA	Coal and Chemical Storage Area
CDA	Chemical Disposal Area
CHP	Central Heating Plant
EFDZ	Earthfill Disposal Zone
FTA	Fire Training Area
J	Result is estimated
LF	Land Fill
LTM	Long-Term Monitoring
MRS	Munition Response Site
MSL	Mean Sea Level
ND	Not detected
ng/L	nanograms per liter (parts per trillion)
PFC	Perfluorinated Compound
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctane Sulfonate
SS	Spill Site
TCSP	Temp Coal Storage Pile
U	Not detected (qualifier)
UST	Underground Storage Tank

Notes:
1) Highlighted concentrations exceed the U.S. EPA Health Advisory Level for drinking water (May 2016) of 70 ng/L.
2) EPA's health advisories are non-enforceable and non-regulatory and provide technical information to states agencies and other public health officials on health effects, analytical methodologies, and treatment technologies associated with drinking water contamination.

0 800 1,600 3,200 Feet

WRIGHT-PATTERSON AIR FORCE BASE, OHIO

FIFTH FIVE-YEAR ROD REVIEW

FIGURE NUMBER 8-34

PFOS/PFOA QUARTERLY GROUNDWATER ANALYTICAL RESULTS: OU5

APTIM
5050 Section Avenue
Cincinnati, Ohio 45212

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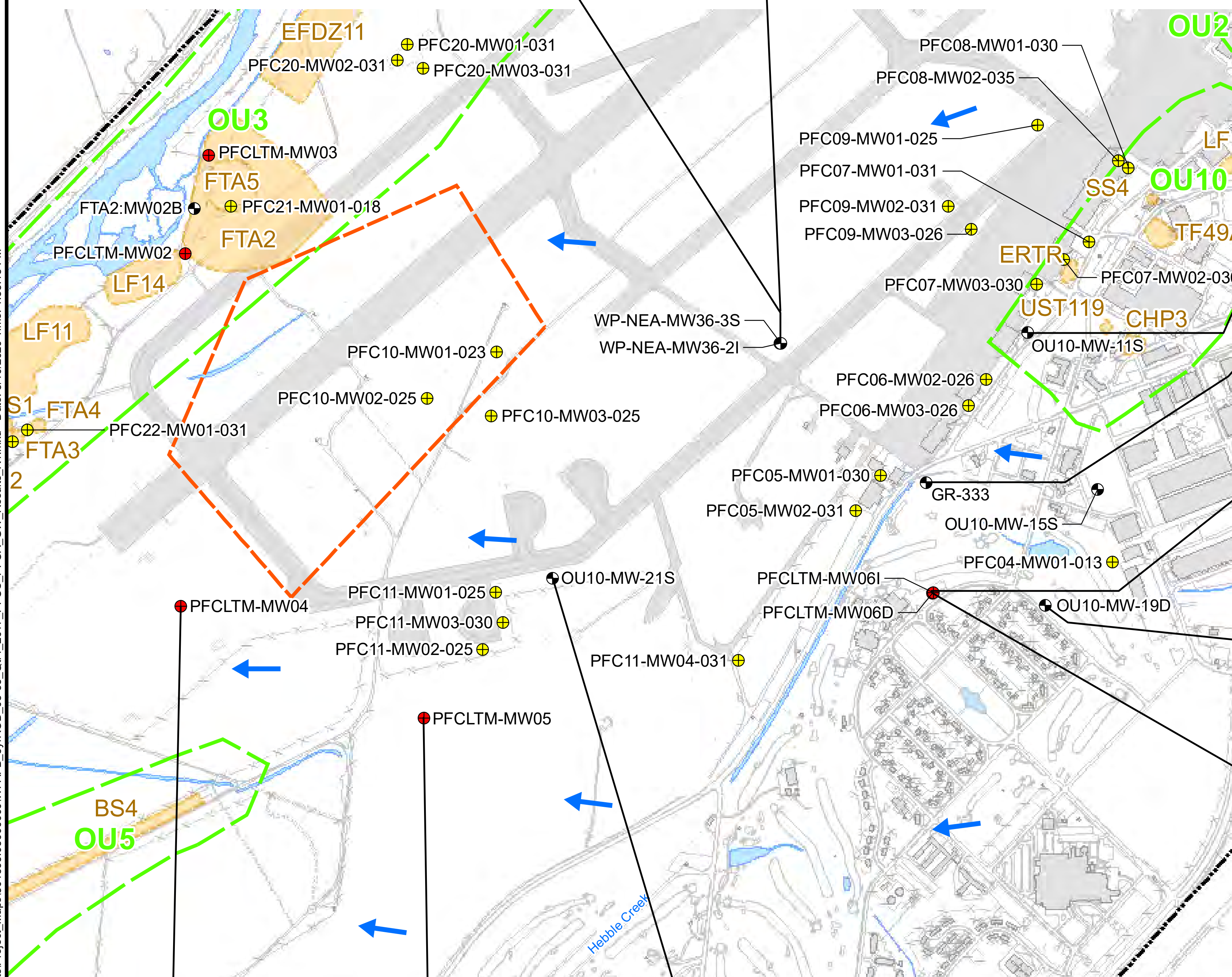

WP-NEA-MW36-2I	Oct-17	
PFC	GW-01 (ng/L)	Lab Qual.
PFBS	6.72	
PFOA	30.5	
PFOS	**305**	
PFOA & PFOS	**336**	
Screened: 45 to 55 ft, bgs		

WP-NEA-MW36-3S	Oct-17	
PFC	GW-01 (ng/L)	Lab Qual.
PFBS	11.5	
PFOA	39.3	
PFOS	**542**	
PFOA & PFOS	**581**	
Screened: 8 to 18 ft, bgs		

OU10-MW-11S	Oct-17	
PFC	GW-01 (ng/L)	Lab Qual.
PFBS	3.65	
PFOA	4.44	
PFOS	13.6	
PFOA & PFOS	18	
Screened: 53 to 63 ft, bgs		

GR-333	Oct-17	
PFC	GW-01 (ng/L)	Lab Qual.
PFBS	5.13	
PFOA	8.76	
PFOS	45.6	
PFOA & PFOS	54	
Screened: 25 to 35 ft, bgs		

PFCLTM-MW06I	Jun-19	
PFC	GW-01 (ng/L)	Lab Qual.
PFBS	17	J
PFOA	40	
PFOS	**480**	
PFOA & PFOS	**520**	
Screened: 31 to 41 ft, bgs		

OU10-MW-19D	Jun-19	
PFC	GW-01 (ng/L)	Lab Qual.
PFBS	8.1	J
PFOA	18	J
PFOS	**180**	
PFOA & PFOS	**198**	J
Screened: 72 to 82 ft, bgs		

PFCLTM-MW06D	Nov-17	
PFC	GW-01 (ng/L)	Lab Qual.
PFBS	19.2	
PFOA	ND	
PFOS	ND	
PFOA & PFOS	ND	
Screened: 70 to 80 ft, bgs		

PFCLTM-MW04	Oct-17	
PFC	GW-01 (ng/L)	Lab Qual.
PFBS	34.8	
PFOA	14.6	
PFOS	0.547	J
PFOA & PFOS	15	J
Screened: 45 to 55 ft, bgs		

PFCLTM-MW05	Jan-17	
PFC	GW-01 (ng/L)	Lab Qual.
PFBS	ND	
PFOA	0.35	J
PFOS	ND	U
PFOA & PFOS	0.35	J
Screened: 20 to 30 ft, bgs		

OU10-MW-21S	Oct-17	
PFC	GW-01 (ng/L)	Lab Qual.
PFBS	62	
PFOA	**80.6**	
PFOS	**76.3**	
PFOA & PFOS	**157**	
Screened: 16 to 26 ft, bgs		

Legend

- Existing Monitoring Well: PFC LTM Sampling
- New Monitoring Well: PFC LTM Sampling
- New Monitoring Well: PFC SI
- Boundary of MRS MU897
- Operable Units
- IRP Sites (Locations Approximate)
- Installation Area
- Groundwater Flow Direction

B	Sample qualified because of blank (method, prep, and field) interference
BS	Burial Site
CCSA	Coal and Chemical Storage Area
CDA	Chemical Disposal Area
CHP	Central Heating Plant
EFDZ	Earthfill Disposal Zone
FTA	Fire Training Area
J	Result is estimated
LF	Land Fill
LTM	Long-Term Monitoring
MRS	Munition Response Site
ng/L	nanograms per liter (parts per trillion)
PFC	Perfluorinated Compounds
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctane Sulfonate
SS	Spill Site
TCSP	Temp Coal Storage Pile
UST	Underground Storage Tank

Notes:
1) Highlighted concentrations exceed the U.S. EPA Health Advisory Level for drinking water (May 2016) of 70 ng/L.
2) EPA's health advisories are non-enforceable and non-regulatory and provide technical information to states agencies and other public health officials on health effects, analytical methodologies, and treatment technologies associated with drinking water contamination.

0 600 1,200 2,400 Feet

WRIGHT-PATTERSON AIR FORCE BASE, OHIO

FIFTH FIVE-YEAR ROD REVIEW

FIGURE NUMBER 8-35

PFOS/PFOA QUARTERLY GROUNDWATER ANALYTICAL RESULTS: OU10

APTIM
5050 Section Avenue
Cincinnati, Ohio 45212

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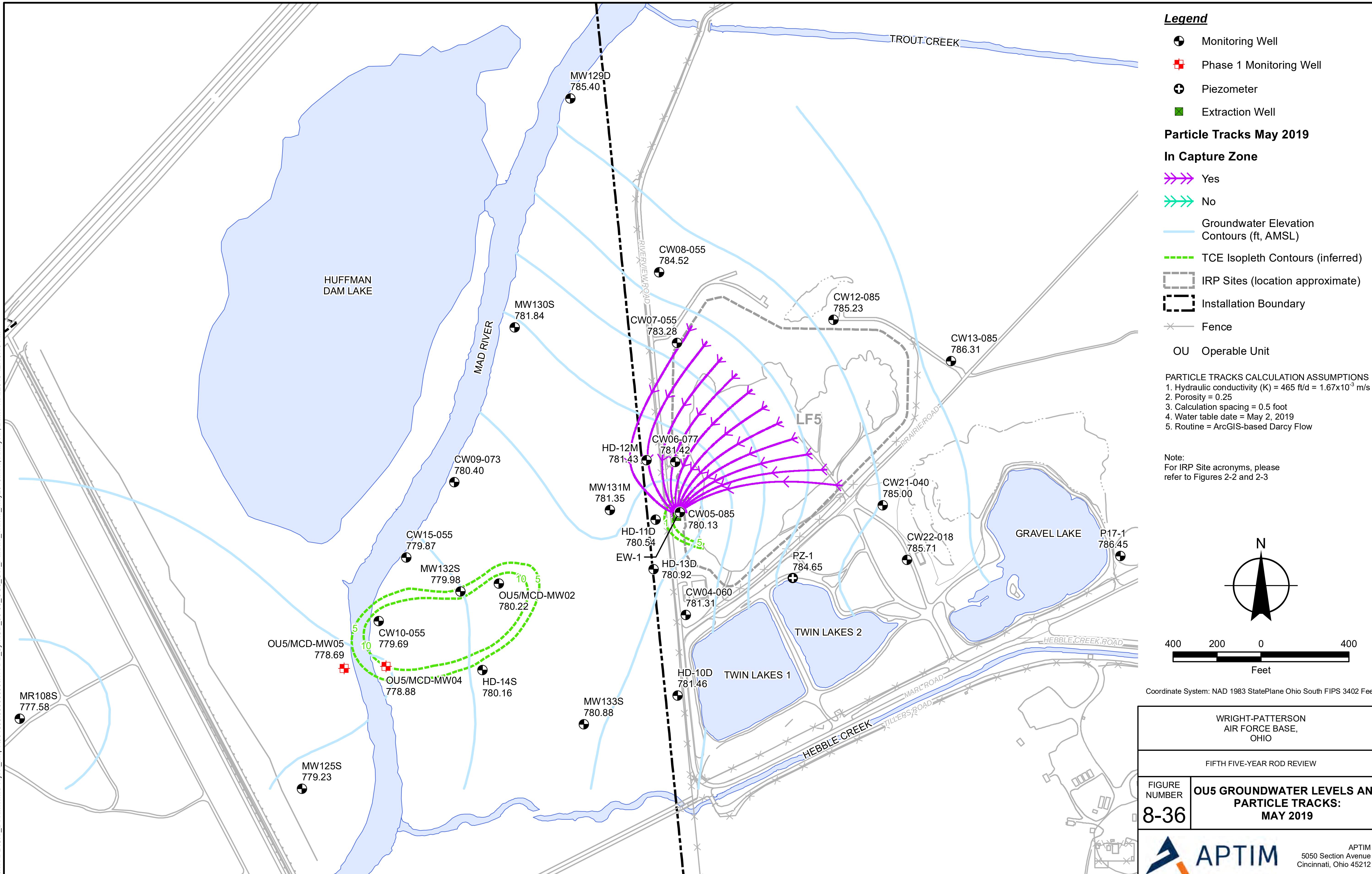

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9.0 Protectiveness Statements

A five-year review makes the determination that a remedy is or will be when complete, protective of human health and the environment. This determination has been tailored for each of the six RODs reviewed in this document for this period. The ROD for SPs 2, 3, and 10 within OU2 achieved remedial action completion in August 2020. Per the Remedial Action Completion Report: Record of Decision for Spill Sites 2, 3, and 10 (Within Operable Unit 2), no further remedial actions under this ROD are required (WPAFB, 2018). The determinations presented in the following sections are consistent with the requirements in the Comprehensive Five-Year Guidance (USEPA, 2001) and the USEPA Memorandum, Clarifying the Use of Protectiveness Determinations for CERCLA Five-Year Reviews (USEPA, 2012a).

9.1 SCOU ROD

The remedy at the SCOU is short-term protective of human health and the environment. Due to elevated methane levels in the residential backyards at 5 DuPont Way and 7 DuPont Way, and the issuance of an NOV, a source area investigation and remedial action was initiated in spring 2019 (Versar, 2019). Elevated methane levels were remediated; in addition, a soil vapor mitigation system was installed at 7 DuPont Way to prevent potential soil vapor intrusion. Methane has not been detected in the sub-slab vapor at 7 DuPont Way, and a ROV was issued by the OEPA. Additionally, new monitoring probes have been incorporated into the existing LF8 LFG monitoring network to ensure the remediated area of elevated methane levels does not reocccur. Continued performance of the existing remedy and ICs will prevent exposure to contaminated media that could result in an unacceptable risk.

9.2 OSOU ROD

The remedy at the OSOU is short-term protective of human health and the environment. Implemented ICs prevent exposure to contaminated groundwater and the remedial action implemented at the SCOU has reduced the potential for migration of contaminants to the OSOU. An investigation conducted in 2012 identified the potential for vapor intrusion to a residence adjacent to LF8 (Shaw, 2013a). A vapor mitigation system was installed at the residence at 5 DuPont Way to reduce VOC concentrations and is operating as designed. Sub-slab sampling of this house is conducted annually and the extraction system vacuum is monitored quarterly. Based on the annual analytical results the mitigation system is keeping all VOCs below or near the residential sub-slab soil vapor screening levels.

9.3 21 NA Sites ROD

The 21 NA Sites ROD documents the selected remedy for soils contamination only at the subject 21 IRP sites to be “no action.” However, ICs and ECs were already in place at the 21 IRP sites when the ROD was written in 1996. Therefore, the selected remedy is considered a “limited action” according to USEPA IC guidance document (USEPA, 2010a) rather than a “no action” remedy.

The remedy is protective at 19 of the 21 sites. However, PFOS/PFOA has been detected in soil at concentrations exceeding calculated screening levels at two of the sites (FTA 3 and FTA 4 located in OU3). A protectiveness determination of the selected remedy for soil at these two sites cannot be made at this time because there are no proposed or promulgated cleanup levels for PFOS/PFOA or other PFAS parameters in soil and no screening levels published in USEPA’s RSL table. Currently, PFBS is the only PFAS listed in the RSL generic tables (USEPA, 2019a). Although there are no IRIS-verified toxicity values or PPRTVs, candidate toxicity values have been derived for PFOS/PFOA in support of USEPA’s HAL. These values were used to calculate RSLs using USEPA’s RSL calculator.

9.4 SPs 2, 3, and 10 ROD

A Final Remedial Action Completion Report (RACR) was signed by OEPA on September 11, 2018, by the USEPA Remedial Program Manager on September 17, 2018, and by the USEPA Region V Branch Chief on August 19, 2020, which makes the RACR a final USEPA approved document. The site is now going through the NPL deletion process.

The remedy for SPs 2, 3, and 10 continues to be protective of human health and the environment.

9.5 41 NA Sites ROD

The remedy for the sites included in the 41 NA Sites ROD is protective of human health and the environment because ICs are in place to control exposure to contaminated media that could result in unacceptable risks.

The monitoring of LG-10 will continue quarterly under the LTM Program and will be capable of detecting changes in site conditions and groundwater concentrations. Therefore, the remedy will remain protective of human health and the environment under current and future land use.

9.6 GWOU ROD

The remedy for the GWOU is short-term protective of human health and the environment because ICs and ECs are in place to manage exposure pathways that could result in unacceptable risks.

However, in order for the remedy to remain protective long-term, the following actions need to be taken to ensure protectiveness: additional construction actions, similar to the Area A GAC unit groundwater treatment system, may be necessary to address groundwater in areas impacted by PFOS/PFOA or other contaminants (such as TCE and PCE). Furthermore, PFOS/PFOA are emerging contaminants and a drinking water standard has not yet been proposed or promulgated. USEPA's 2016 HAL is currently in effect as a measure of protectiveness; however, the evaluation of toxicity information on PFOS/PFOA is on-going.

WPAFB has evaluated the TCE concentrations in FAA-A and found that, statistically, the TCE trends in this area are overall decreasing within this five-year review period (APTIM, 2017-2019). TCE concentration fluctuations in this area appear to be a result of matrix diffusion as the aquifer system attempts to achieve chemical equilibrium. In addition, the reduction in groundwater production from the City of Dayton Huffman Dam Wellfield has altered the downgradient extent of the FAA-A TCE plume. As of the spring 20120 LTM Program sampling event, the downgradient boundary of the FAA-A TCE plume that exceeds the MCL is no longer west (downgradient) of the Mad River (**Section 8.4.4.1**). TCE concentrations in the downgradient portion of the FAA-A TCE plume at the Mad River have been stable above the MCL in well CW10-055, but have shown a decreasing trend since the fall 2017 in wells OU5/MCD-MW04 and OU5/MCD-MW05. TCE concentrations in well MW125S located downgradient of the FAA-A TCE plume continue to be non-detect and below the MCL for this five-year period.

Data reviewed during the five-year review process indicate that the current RAOs address vapor intrusion and are being met by the remedy. Although VOCs are present in groundwater in FAA-A and FAA-B, data collected and assessed show that a vapor intrusion exposure pathway does not currently exist. Should it become evident that VOCs are migrating toward on-site buildings or off-site residences, potential vapor intrusion would be evaluated on a site-specific basis.

10.0 Next Review

The next five-year ROD Report for the sites at WPAFB will be due on 9 December 2025.

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Appendix A

Detailed Evaluation for Technical Assessment - Question B

Introduction

This appendix provides the details of the technical assessment for Question B: "Are the exposure assumptions, toxicity data, cleanup levels, and Remedial Action Objectives (RAOs) used at the time of the remedy still valid?" This assessment was performed by reviewing pertinent information from the six Records of Decision (RODs) as well as observations from the Fourth Five-Year Review (Wright-Patterson Air Force Base [WPAFB], 2016a). In addition, applicable regulations, policies, and guidance that have been issued since the previous review have been consulted to determine whether any changes or new information impact the conclusions of the RODs or the protectiveness of the remedies. Although the exposure assumptions and toxicity criteria associated with screening levels and risk assessment are generally discussed, this assessment is primarily focused on the chemicals of concern (COC) identified in the RODs. For the purpose of this Five-Year Review, COC are defined as chemicals that have been evaluated through risk assessment and found to exceed the acceptable levels for cancer risk and/or noncancer hazards. These COC were carried forward for further action as addressed in the RODs.

In conducting this Fifth Five-Year Review, it was found that some of the changes in information and guidance pertained to all or most of the RODs. This introduction to the technical assessment for Question B presents a more detailed explanation of the following changes as they pertain to each of the components of Question B:

- Changes to Applicable or Relevant and Appropriate Requirements (ARARs) and To be Considered (TBC)
    - Explanation of Significant Differences (ESD) – Compliance Levels for Operable Unit 1 (OU1)
- Changes in Land-Use and Exposure Assumptions
    - ESD – Implementations of Institutional Controls (ICs) for Six RODs
    - U.S Environmental Protection Agency (USEPA) Standard Default Exposure Factors
    - Vapor Intrusion Pathways
- Changes to Toxicity Values
    - USEPA Hierarchy of Toxicity Values
    - Inhalation Toxicity Values
    - Dermal Toxicity Values

- Emerging Contaminants

- Changes in RAOs and Cleanup Goals

    - Guidance for Determining Protectiveness

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Changes in ARARs and To Be Considered (TBCs)

The purpose of the ARARs review is to determine whether recently promulgated or modified requirements of federal or State of Ohio environmental regulations are ARAR; and if modifications of regulations during the past five years call into question the protectiveness of the remedy (USEPA, 2001, 2012a).

As part of previous Five-Year Reviews (IT, 2000; Shaw, 2006; WPAFB, 2011), it was recommended that the compliance levels for OU 1 (Landfills 8 and 10) be reevaluated and an ESD prepared, as necessary. An ESD was approved in 2012 to address RODs for the *Source Control Operable Unit (SCOU) – Landfills 8 and 10 (OU1); Off-Source Operable Unit and Final Remedial Action Landfills 8 and 10; 21 No Action Sites; Spill Sites 2, 3, and 10 (OU2); 41 No Action Sites; and Groundwater Operable Unit* (WPAFB, 2012a). The purpose of this ESD was to document a change in compliance levels for COC in groundwater at OU1 and to clarify the implementation of ICs at WPAFB.

Many of the established compliance levels in *Table 8, Compliance Levels for the Chemicals of Concern* in the SCOU ROD were either less than the Maximum Contaminant Levels (MCL), less than the applicable detection limits (e.g., vinyl chloride), or were not established for various COC. In addition, some of the COC had been deleted from the sampling protocol due to years of acceptable analytical results and non-detects. The ESD modified the compliance levels for the remaining COC originally listed in *Table 8* of the SCOU ROD, as applied to OU1, in order to correct these inconsistencies and to bring the compliance levels for the SCOU in line with the regulatory limits (MCLs) for the COC (WPAFB, 2012a). The MCLs have not changed since the ESD was signed in 2012 and the Fourth Five-Year was completed in 2016.

As discussed in the Fourth Five-Year Review (WPAFB, 2016a), the dioxin constituents were eliminated from the monitoring program in 2008 as jointly agreed upon by WPAFB, Ohio Environmental Protection Agency (OEPA) and USEPA (Shaw, 2008). In accordance with the current System Performance Monitoring Plan (SPMP) (Shaw, 2009b) it was agreed that the deletion of dioxins/furans from the monitoring requirements, and the five-year cycle for monitoring pesticides/polychlorinated biphenyls (PCBs), and semi volatile compounds (SVOC) still allowed for the selected remedial action to remain protective of human health and the environment. During this five-year period, these constituents were included in the April 2017 sampling round.

Table A-1 provides a comparison of the ROD compliance levels with the current compliance levels for the SCOU (OU1). This table includes the COC that were listed in Tables 2 and 8 of the SCOU ROD (WPAFB, 1993a).

Although there are currently no promulgated standards for perfluorooctanesulfonic (PFOS) acid/perfluorooctanoic acid (PFOA) are on the Contaminant Candidate List (CCL) for rulemaking under the Safe Drinking Water Act (SDWA). The SDWA, as amended in 1996, requires USEPA to publish a list of unregulated contaminants every five years that are not subject to any proposed or promulgated national primary drinking water regulations, are known or anticipated to occur in public water systems, and might require regulation under the SDWA. Such contaminants are listed on a CCL. USEPA must periodically publish the CCL and decide whether to regulate at least five or more contaminants on the list. A regulatory determination is a formal decision on whether to initiate the rulemaking process. PFOS/PFOA were originally included on the Final CCL 3 (October 2009) and have since been carried forward to the Final CCL 4 (November 2016).

USEPA must begin developing a national primary drinking water regulation when the Agency makes a determination to regulate based on three criteria:

- The contaminant may have an adverse effect on the health of persons.
- The contaminant is known to occur or there is substantial likelihood the contaminant will occur in public water systems with a frequency and at levels of public health concerns.
- In the sole judgment of the Administrator, regulating the contaminant presents a meaningful opportunity for risk reductions.

To make these determinations, USEPA uses data to analyze occurrence of these compounds in finished drinking water and data on human health effects.

As part of related responsibilities under SDWA, USEPA is required to implement a monitoring program for unregulated contaminants. USEPA selects contaminants for monitoring largely based on the CCL. In 2012, USEPA included PFOS/PFOA in its third Unregulated Contaminant Monitoring Rule (UCMR 3).

While there are currently no promulgated standards for perfluorinated compounds (PFCs) in environmental media, the USEPA has established a drinking water Health Advisory Limit (HAL) for PFOS and PFOA (and in combination) of 70 parts per trillion (ppt), or 0.070 micrograms per liter (µg/L), or 70 nanograms per liter (ng/L) (USEPA, 2016) in May 2016.

Changes in Land-Use and Exposure Assumptions

In addition to the changes made in the compliance levels for OU1, the ESD (WPAFB, 2012a) clarified changes in the IC requirements set forth in the six RODs issued for WPAFB. These provisions included the following:

- The Land Use Control (LUC) Plan (Labat, 2012) was the primary administrative mechanism employed by WPAFB to ensure that ICs are in place at the Site. The previous LUC Plan was completed in 2012 and was used to manage site LUCs consisting of both engineering controls (ECs) and institutional controls (ICs). Since the last Five-Year Review, the LUC Plan has been replaced by the LUC Implementation Plan (LUCIP; Tetra Tech, 2019). The LUCIP includes updated site maps, updated Installation Restoration Program (IRP) site location maps using WPAFB CE grid coordinates, updated tables, updated site photographs with captions, and 2017 site inspection reports. The LUCIP document is now used to manage and enforce LUCs at WPAFB.

- If WPAFB transfers real property to another federal agency that is subject to ECs and/or ICs under any ROD at the Site, the transfer documents will require that the federal transferee identify such controls and any applicable resource restriction use in its resource use plan or equivalent resource use mechanism (WPAFB, 2012a).

- Prior to proposing a different land use at WPAFB, an amended risk assessment must be performed to evaluate the new land use.

The ESD removed the requirement to implement deed restrictions set forth in the RODs and established that the LUC Plan would be used to manage and enforce LUCs (i.e., activity and use restrictions) and site controls (e.g., fencing, signage, caps). The LUCIP (Tetra Tech, 2019) is now used to manage and enforce LUCs at WPAFB. The performance objectives of the current LUCIP include:

- Prevent unauthorized access to a restricted area;

- Prevent any digging or drilling that could reach groundwater without the permission of Air Force Civil Engineer Center (AFCEC)/Environmental Directorate Operations Midwest (CZOM);

- Maintain the integrity of current remedial or monitoring systems;

- Prohibit the development and use of the property for residential housing, elementary, or secondary schools, childcare facilities or playgrounds on areas only cleared for industrial use;

- Prevent the use of contaminated soil and ensure that in the event of excavation, soils are sample and disposed appropriately; and

Maintain the integrity of landfill covers to prevent direct exposure and water infiltration. The LUCIP was intended to reduce the potential for current and future human exposures. Changes in land use at WPAFB would be addressed by amending previous risk assessments to reflect any new data and updated regulations and guidance.

As described in the Fourth Five-Year Review (WPAFB, 2016a),. USEPA's National Center for Environmental Assessment, Office of Research and Development (NCEA/ORD) issued a substantive update to its exposure assessment recommendations in September 2011. The USEPA recommended changes to several of the default exposure factors that are assumed in the development of human health risk screening levels (i.e., USEPA Regional Screening Levels [RSLs]) and used in quantitative human health risk assessments. The *Exposure Factors Handbook – 2011 Edition* (USEPA, 2011a) provides information and recommendations on various physiological and behavioral factors commonly used in the assessing exposures of adults and children to environmental chemicals. The recommended values are based upon available data and results of studies deemed to be the most up-to-date and scientifically sound as of July 2011. The objective of this guidance is to reduce variability and uncertainty in the exposure assumptions used to characterize exposures to human populations. In February 2014, USEPA issued Office of Solid Waste and Emergency Response (OSWER) Directive 9200.1-120 (USEPA, 2014b) to adopt the recommendations from the 2011 *Exposure Factors Handbook* and update the guidance for standard default exposure factors used in human health risk assessments. The purpose of the directive was to update OSWER Directive 9285.6-03, *Interim Final Standard Exposure Factors Guidance* (USEPA, 1991a) and to supplement the Risk Assessment Guidance for Superfund (RAGS): Human Health Evaluation Manual, Parts A through E (USEPA, 1989, 1991b, 1991c, 2001b, and 2004). In particular, the directive superseded and replaced portions of *Interim Final Standard Exposure Factors Guidance* (USEPA, 1991a) and updated RAGS, Part E, *Supplemental Guidance for Dermal Risk Assessment* (USEPA, 2004). As summarized in **Table A-2**, the default exposure factors that had changed since the baseline Human Health Risk Assessment (HHRA) and previous Five-Year Reviews were evaluated in the Fourth Five-Year Review (WPAFB, 2016a).

To evaluate the impact of the changes specifically associated with the exposure factors, a hypothetical quantitative risk assessment was run to calculate risks and hazard indices two ways. The first set of calculations was based on the previous USEPA default exposure factors, which were more similar to what was used in the original risk assessment. The second set of calculations used USEPA's 2014 standard default factors. Based on the results of the evaluation (WPAFB, 2016a), most risks and hazard indices based on the 2014 exposure factors were similar or lower than those based on the previous exposure factors. The exceptions were the hazard indices for groundwater exposures by the lifetime resident, which resulted in an increase of the cumulative hazard index by 7 percent. This evaluation continues to be valid as neither the *Exposure Factors Handbook* (USEPA, 2011a) nor the default exposure factors (USEPA, 2014b) have changed since the last Five-Year Review (WPAFB, 2016a).

Overall, there have been no changes to the exposure pathways that were evaluated for direct contact since the Fourth Five-Year Review (WPAFB, 2016a). Given that land use for WPAFB is industrial, the conclusions of the original HHRA and previous Five-Year Reviews remain valid and the remedy for soil remains protective. In addition, groundwater use continues to be restricted. Therefore, the remedy for groundwater remains protective.

Guidance for inhalation risk assessment was issued in 2009 (USEPA, 2009). This guidance recommended that estimates of risk via inhalation should be based on the concentration of the chemical in air as the exposure metric (e.g., milligrams per cubic meter [mg/m^3]) rather than inhalation intake of a contaminant in air based on an inhalation rate and a body weight (e.g., milligrams per kilogram – day [mg/kg-day]). The guidance regarding the exposure metrics has not changed since the Fourth Five-Year Review and the current equations used to estimate exposure concentrations for use in risk and hazard calculations reflect this approach. There have been no changes to USEPA's 2014 standard default exposure parameters used in inhalation risk assessment since the last review (**Table A-2**). Given that land use for WPAFB is industrial, the conclusions of the original HHRA and previous Five-Year Reviews remain valid and the remedy for soil remains protective. In addition, groundwater use is restricted. Therefore, the remedy for groundwater remains protective for potable use. The vapor intrusion pathway is evaluated below.

With regard to exposure assumptions in the quantitative risk assessment, the guidance for dermal risk assessment was published in 2004 (USEPA, 2004). Exposure factor assumptions such as the dermal absorption factor for some chemicals, oral absorption factors for some chemicals, soil-to-skin dermal adherence factor, and skin surface areas were updated in 2014. Exposures to groundwater associated with industrial or domestic water consumption have been prevented by providing city water for the properties near the SCOU and treatment for groundwater downgradient of FAA-B. The water pumped for on-Base use from on-Base production wells is treated prior to distribution.

On the basis of these changes in exposure assumptions alone (i.e., notwithstanding changes to toxicity values or chemical/physical parameters), the noncancer hazard index (HI) for the adult resident would be slightly higher. All other risks/hazards for soil and groundwater would be nearly equal or lower. Therefore, when combined in the risk and HI calculations, the updated default exposure factors alone have little or no impact on the overall conclusions of the original risk assessment. Similarly, as a result of the updated exposure factors, some of the screening levels would now be more stringent or would result in a higher risk/hazard estimate, while others would result in a less stringent screening level or lower risk/hazard estimate. As the net effect of these changes does not significantly higher or lower risk and hazard, the overall conclusions of the original HHRA and previous Five-Year Reviews remain valid. In any case, the remedies for soil and groundwater were intended to address exceedances and, therefore, remain protective.

Since the preparation of the RODs under review, the USEPA, OEPA, Department of Defense (DoD), and others had published guidance regarding the evaluation of vapor intrusion (USEPA, 2002; DoD, 2009; Interstate Technical and Regulatory Council [ITRC], 2007). The USEPA's current guidance is the *OSWER Technical Guidance for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air* (USEPA, 2015), which was issued in 2015. The OEPA is in the process of updating their guidance, *Sample Collection and Evaluation of Vapor Intrusion to Indoor Air* (OEPA, 2010); a draft version of the updated guidance was issued in June 2019. These documents present methods for estimating potential exposures to volatile organic compounds (VOCs) from groundwater and soil that could migrate through building foundations via vapor intrusion. These guidance documents (USEPA, 2015 and OEPA, 2010) remain in effect.

The USEPA continues to maintain and update its vapor intrusion screening levels (VISLs) for the applicable media (indoor air, sub-slab soil gas, and groundwater). These VISLs were derived using USEPA's on-line VISL Calculator (USEPA, 2019c), which is based on USEPA's most recent vapor intrusion guidance (USEPA, 2015) and current RSLs (USEPA, 2019a). It also incorporates current default exposure factors and toxicity values. As part of this Fifth Five-Year Review, screening levels were developed for sub-slab soil gas and groundwater using the VISL calculator. The vapor intrusion pathway was evaluated by comparing site soil gas or groundwater data with the calculated screening values.

The USEPA provides recommendations for assessing protectiveness at sites for vapor intrusion as a supplement to the *Comprehensive Five-Year Review Guidance* (USEPA, 2001, 2012b). This guidance provides protectiveness statement options and describes how possible situations may affect protectiveness determinations. To satisfy the determination for protectiveness, the data collected and assessed would show that no potential or actual vapor intrusion exposure pathway exists based on:

- Data reviewed during the five-year process which indicate that the current remedial action objectives (RAOs) address vapor intrusion and are being met by the remedy;
- The vapor intrusion remedy is functioning as intended to meet RAOs; or
- Other remedy components (that do not explicitly address the vapor intrusion pathway) effectively mitigate the vapor intrusion risk; for example, ICs and other constraints prohibiting construction in locations such as floodplains, threatened and endangered species habitat, and clear zones/glide slopes.

These guidelines were applied in the evaluation of the vapor intrusion pathway in this Five-Year Review.

Changes in Toxicity Values

Several of the original HHRAs were performed using a semi-quantitative or qualitative methodology and comparing site concentrations with Region 9 Preliminary Remediation Goals

(PRGs). In the risk assessments conducted for remedial investigations (RIs), the PRGs were used as risk-based screening concentrations to identify COC. While the general concept and methodology for deriving PRGs has not changed, USEPA consolidated the risk-based screening levels for USEPA Regions 3, 6, and 9 in 2008 and provided a uniform set of screening values that is applied across all regions. The RSLs are updated approximately every 6 months to incorporate new information on exposure factors, toxicity criteria, and chemical/physical properties. As of the initiation of this Five-Year Review, the current version is dated November 2019 (USEPA, 2019a).

For purposes of this Fifth Five-Year Review, the Integrated Risk Information System (IRIS) updates to toxicity criteria were reviewed. The USEPA's toxicity criteria were used to derive the PRGs and, subsequently, the RSLs. Therefore, the IRIS database (USEPA, 2019b) was reviewed to determine whether the toxicity data had changed since the qualitative risk assessment had been conducted. The IRIS database is considered to be the first tier in USEPA's hierarchy of sources of toxicity values (USEPA, 2003b). The second tier of toxicity criteria consist of Provisional Peer-Reviewed Toxicity Values (PPRTVs), which have been developed specifically for USEPA's Superfund Program. These values have not undergone the multi-program review and consensus required for values to be placed in IRIS; however, they do provide provisional values for use in risk assessment. Finally, USEPA has identified Tier 3 sources as other EPA and non-EPA sources, such as the Agency for Toxic Substances Disease Registry (ATSDR) and the California Environmental Protection Agency (CalEPA) that be used for cases where IRIS-verified values or PPRTVs are not available. This hierarchy of sources for toxicity data remains in effect. For this Five-Year Review, comparisons are made to the toxicity values that are listed in the RSL table (USEPA, 2019a). In the event that it would be necessary to perform an amended risk assessment, changes to screening levels and toxicity values would be incorporated at that time.

Toxicity criteria have not yet been developed for the dermal absorption pathway. Instead, oral toxicity criteria are adjusted to assess this pathway. The method for modifying oral toxicity criteria involves the determination of absolute oral absorption factors that are applied to the oral toxicity criteria. The dermal risk assessment guidance that was applied in the Second, Third, and Fourth Five-Year (USEPA, 2004) has not changed. As discussed in the previous reviews, there were changes to some of the factors and assumptions used to calculate dermal toxicity values in the original risk assessment. These changes primarily affected two metals (barium and chromium VI).

The primary chemical-specific changes to toxicity values since the Fourth Five-Year Review are discussed in the paragraphs below.

One of the predominant COCs addressed in this review is trichloroethylene (TCE) in groundwater. The final version of the *Toxicological Review of Trichloroethylene*, the support document for summary information for the IRIS database, was issued in September 2011 (USEPA, 2011b). The verified oral and inhalation toxicity criteria were also posted in September 2011. It is noted that USEPA has also provided guidance on applying the 2011 TCE IRIS assessment in decision-making on early or interim actions (USEPA, 2014c). According to this guidance, USEPA "…expects to take early actions at Superfund sites where appropriate to eliminate, reduce, or control the hazards posed by the site. In assessing such cases, USEPA will act with a bias for initiating response actions to ensure protection of human health." These health effects include teratogenic and developmental effects. For noncancer effects, IRIS developed a chronic inhalation reference concentration (RfC) for noncancer effects of TCE, which is 2 $\mu g/m^3$. This value is based in part on the developmental toxicity endpoint of increased incidence of fetal cardiac malformations.

Since the Fourth Five-Year Review (WPAFB, 2016a), OEPA has also addressed potential fetal cardiac effects from short-term inhalation exposures during early pregnancy. The OEPA Division of Environmental Response and Revitalizations (DERR) has developed imminent hazard indoor air response action levels for TCE. If TCE is detected in indoor air in structures, prompt action is needed depending on the concentration level and the receptors present. The August 2016 OEPA *Guidance Document Recommendations Regarding Response Action Levels and Timeframes for Common Contaminants of Concern at Vapor Intrusion Sites in Ohio*, (OEPA, 2016) or any subsequent updated versions, discusses action levels and timeframes, and advises prompt responses including temporary relocations of building occupants, ventilation, indoor air treatment, and/or engineering controls depending on the situation. The response action levels are derived for accelerated, urgent, and imminent timeframes, as defined by OEPA. The accelerated response action levels for TCE in indoor air in residential and commercial buildings are 2.1 $\mu g/m^3$ and 8.8 $\mu g/m^3$, respectively. The corresponding response action levels for vapor intrusion from TCE in groundwater underlying residential and commercial buildings (fine-course soil scenario) are 21 µg/L and 89 µg/L, respectively. Furthermore, Ohio DERR's August 2016 document established the following chronic response action levels for vapor intrusion chemicals of concern in groundwater under a commercial scenario: vinyl chloride (VC) (74 micrograms per liter [µg/L], or 70 nanograms per liter (ng/L µg/L), tetrachloroethylene (PCE) (1,100 µg/L), chloroform (130 µg/L), carbon tetrachloride (70 µg/L), and naphthalene (1,200 µg/L). Response actions may include additional sampling, mitigation, and/or other activities to reduce exposure to elevated indoor air concentrations of COCs resulting from vapor intrusion.

Several high molecular weight polycyclic aromatic hydrocarbons (PAHs) were identified as COCs in soil and/or groundwater at some OUs at WPAFB. Since the last Fourth Five-Year Review (WPAFB, 2016a), USEPA has issued an updated *Toxicological Review of Benzo(a)pyrene* under the IRIS Program in January 2017 for the carcinogenic PAHs (USEPA, 2017). This review updated the previous IRIS assessment of benzo(a)pyrene, which had been used since 1987. It was based on studies conducted after 1987 and the 2011 recommendations for the improvement of IRIS toxicity assessments.

Benzo(a)pyrene is now identified as "carcinogenic to humans" rather than the 1987 "probable human carcinogen" weight-of-evidence classification. For purposes of the toxicity assessment, benzo(a)pyrene continues to be used as an index chemical from which the cancer slope factors (SFs) and inhalation unit risks (IURs) are estimated for six other high priority carcinogenic PAHs. USEPA (2019b, 2017) provides a verified oral cancer SF for benzo(a)pyrene of 1.0E+0 per mg/kg-day and a verified IUR factor of 6.0E-4 per µg/m^3. Oral cancer SFs and IURs for the remaining six EPA cancer weight-of-evidence Group B2 PAHs (benz[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, chrysene, dibenz[a,h]anthracene, and indeno[1,2,3-cd]pyrene) have traditionally been derived by applying the USEPA (1993) TEFs to the verified oral cancer SF and IUR for benzo(a)pyrene. The TEFs from 1993 have not changed.

Although the IRIS database currently indicates that the toxicity criteria for benzo(a)pyrene have been "suspended" (USEPA, 2019b), the oral cancer SF of 1.0E+0 per mg/kg-day and the IUR factor of 6.0E-4 for benzo(a)pyrene continue to be included in the current RSL table (USEPA, 2019a) and applied in the RSL calculator (USEPA, 2019d). In addition, the USEPA (1993) toxicity equivalency factors (TEFs) are used to develop oral cancer SFs and IUR factors for the other six USEPA cancer weight-of-evidence Group B2 PAHs for the RSLs in the calculator. The resulting oral and inhalation toxicity values are compared with the previous toxicity values for the carcinogenic PAHs. As shown in the table, the updated toxicity values are less stringent.

Compound	EPA (1993) Toxicity Equivalency Factor	Oral Cancer Slope Factor (mg/kg-day)$^{-1}$	Inhalation Cancer Unit Risk Factor (µg/m^3)$^{-1}$
Benz(a)anthracene	0.1	1.0E-1	6.0E-5
Benzo(a)pyrene	1	1.0E+0 [a]	6.0E-4 [a]
Benzo(b)fluoranthene	0.1	1.0E-1	6.0E-5
Benzo(k)fluoranthene	0.01	1.0E-2	6.0E-6
Chrysene	0.001	1.0E-3	6.0E-7
Dibenz(a,h)anthracene	1	1.0E+0	6.0E-4
Indeno(1,2,3-cd)pyrene	0.1	1.0E-1	6.0E-5
[a] Values from Toxicological Review for Benzo(a)pyrene (USEPA, 2017).			

It is also noted that the RSL table now includes a reference dose (RfD) (3.0E-4 mg/kg-day) and a reference concentration (RfC) (2.0E-6 mg/m^3). Previously, there were no noncancer toxicity values available for benzo(a)pyrene. Both of these toxicity values are based on developmental effects. It is noted that no RfDs or RfCs are derived for the other six PAHs above because the TEFs do not apply to noncancer effects.

Toxicity criteria have not yet been developed for the dermal absorption pathway. Instead, oral toxicity criteria are adjusted to assess this pathway. The method for modifying oral toxicity criteria involves the determination of absolute oral absorption factors that are applied to the oral toxicity criteria. The dermal risk assessment guidance that was applied in the Second through Fourth Five-Year Reviews (USEPA, 2004) has not changed. As discussed in the previous reviews, there were changes to some of the factors and assumptions used to calculate dermal toxicity values in the original risk assessment. These changes primarily affected two metals (barium and chromium VI).

As described in **Section 2.6** of this report, emerging contaminants identified for further investigation at WPAFB include 1,4-dioxane and PFCs. The USEPA defines an emerging contaminant as a chemical or material that is characterized by a perceived, potential, or real threat to human health or the environment or by a lack of published health standards. A contaminant may also be “emerging” because a new source or a new pathway to humans has been discovered or a new detection method or treatment technology has been developed (USEPA, 2014a).

1,4-Dioxane is a cyclic ether that was historically utilized as an additive to chlorinated solvent formulations to increase shelf life and prevent corrosion of metal surfaces during various degreasing operations. 1,4-Dioxane is listed as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) and was identified as a high risk to DoD cleanup programs in 2007. The U.S. Air Force (USAF) has issued interim guidance on sampling and response actions for 1,4-dioxane at operational and Base Realignment and Closure installations (DoD, August 2013). The guidance indicates that 1,4-dioxane is considered an emerging contaminant based on changing health screening levels, and the USAF has an obligation to address environmental releases of 1,4-dioxane above acceptable risk levels. While there is no MCL for 1,4-dioxane, there is a USEPA Tapwater Screening Level (0.46 µg/L).

A confirmation round of sampling was conducted for 1,4-dioxane in fall 2019. Results from the fall 2019 sampling event indicate that 1,4-dioxane was not detected in the three wells identified for confirmation sampling. 1,4-Dioxane was detected in two wells at the Former Building 79/95

Complex in Area B; however, this portion of Area B is not in a Drinking Water Source Protection Area and will not be re-sampled under the GWOU or LTM Program. Therefore, groundwater sampling for 1,4-dioxane is being proposed for deletion from the LTM Program.

Other emerging contaminants detected in soil and groundwater at WPAFB include PFCs. These compounds are a class of synthetic fluorinated chemicals used in many industrial and consumer products, including defense-related applications. PFCs are persistent, found in low levels in the environment, and bioaccumulate. PFCs have demonstrated toxicity, but levels that cause effects are not yet established. In 1970, the USAF began using Aqueous Film Forming Foam (AFFF) firefighting agents containing PFCs to extinguish petroleum fires. AFFF can contain and degrade into PFOS and may further degrade into PFOA. During fire training, equipment maintenance, and use, AFFF was released directly to the environment.

The USAF issued interim guidance on sampling and response actions for PFCs at operational and Base Realignment and Closure installations in August 2012. The guidance indicated PFCs are considered an emerging contaminant based on increasing regulatory interest, potential risk to human health and the environment, and evolving regulatory standards. However, there is currently no federally promulgated regulatory cleanup level.

While there are currently no promulgated standards for PFCs in environmental media, the USEPA established a drinking water HAL for PFOS and PFOA (and in combination) of 70 ppt, or 0.070 μg/L, or 70 ng/L (USEPA, 2016) in May 2016. According to the USEPA, the HAL for PFOA and PFOS offers a margin of protection throughout a person's life from adverse health effects resulting from exposure to PFOA and PFOS in drinking water. No other PFCs have HALs. The USAF currently utilizes these values for screening values to determine if PFC contamination is present at a site.

As part of the development of the HAL, USEPA applied candidate toxicity values in the derivation of toxicity values for PFOS/PFOA. The HAL was based on a candidate RfD of 2.0E-05 milligram per kilogram per day (mg/kg/day) and an SF of 7.0E-02 $(mg/kg/day)^{-1}$. Although the RfD and SF are available in USEPA's on-line RSL calculator (USEPA, 2019d), these values have not yet been peer reviewed at the level required to be considered an IRIS value or further evaluated as PPRTVs. With the exception of RSLs for a related compound (perfluorobutane sulfonic acid or PFBS), however, there are no RSLs for tap water or soil listed in the RSL table for PFOS, PFOA, or a combination of these compounds (USEPA, 2019a). The DoD issued guidance on October 15, 2019 to address investigations of sites with per- and polyfluoroalkyl substances within the DoD Cleanup Program (DoD, 2019). As part of this guidance, DoD derived conservative screening levels using USEPA's on-line RSL calculator (USEPA, 2019d). The resulting residential screening level for PFOS or PFOA in soil is 0.13 milligram per kilogram (mg/kg) while the industrial screening level is 1.6 mg/kg. For PFOS/PFOA in groundwater, the calculated tap water RSL is 0.040 μg/L. In accordance with the memo, these toxicity values and screening levels are recommended for use in site-specific risk assessments.

Other changes in toxicity values are addressed in this appendix as they apply to specific RODs.

Changes in RAOs and Cleanup Goals

The USEPA issued a memorandum in September 2012 to clarify the use of protectiveness determinations in CERCLA Five-Year Reviews (USEPA, 2012a). This information is intended to supplement, not supersede, the language in the *Comprehensive Five-Year Review Guidance* (USEPA, 2001). Protectiveness is generally defined in the National Contingency Plan (NCP) by the risk range for carcinogens and the HI for non-cancer effects. Evaluation of the remedy and the determination of protectiveness should be based on and sufficiently supported by data and observations.

A protectiveness determination of "protective" may be appropriate for remedies where:

- Construction activities are complete and remedy is operating; or
- Construction activities are complete, RAOs have been achieved, and operation and maintenance are occurring.

A protectiveness determination of "protective" is typically used when the answers to Questions A, B, and C provide sufficient data and documentation to conclude that the remedy is functioning as intended and all human and ecological risks are currently under control and are anticipated to be under control in the future.

The following sections provide the detailed evaluations of the risk assessment assumptions specific to each of the individual RODs under this review. Each section is intended to address Question B: "Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?"

A.1 Source Control Operable Unit (SCOU)

Both landfills (LFs) 8 and 10 were included for evaluation under the Groundwater Operable Unit (GWOU) as OU1. In accordance with the SCOU ROD, however, the compliance monitoring parameters and requirements for OU1 are specific and unique from the remainder of the GWOU sites (Shaw, 2009b). Therefore, under the Long-Term Monitoring (LTM) Program, OU1 is sampled and reported in the annual LTM reports as a discrete OU, separate from the other GWOU sites. Therefore, discussions on the OU1 site specific parameters of pesticides/PCBs and SVOCs will be limited to the SCOU.

The following documents were reviewed with respect to risk assessment data and assumptions:

- *Human Health Evaluation Manual, Part B, Development of Risk-Based Preliminary Remediation Goals* (USEPA, 1991b).
- *Focused Remedial Investigation Report for Landfills 8 and 10* (ES, 1992a).
- *Focused Feasibility Study for Landfills 8 and 10* (ES, 1992b).
- *Off-Source Remedial Investigation Report for Landfills 8 and 10* (ES, 1993).
- *Record of Decision, Source Control Operable Unit – Landfills 8 and 10* (WPAFB, 1993a).
- *Guidance Manual for the Integrated Exposure Uptake Biokinetic (IEUBK) Model for Lead in Children*, USEPA, Office of Emergency and Remedial Response, EPA/540/R-93/081 (USEPA, 1994a).
- *Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities* (USEPA, 1994b). USEPA, Office of Emergency and Remedial Response, Clarification to this document released in August 1998.
- *Record of Decision, Off-Source Operable Unit and Final Remedial Action, Landfills 8 and 10* (WPAFB, 1994).
- *PCBs: Cancer Dose-Response Assessment and Application to Environmental Mixtures.* USEPA, National Center for Environmental Assessment (NCEA), Office of Research and Development (ORD), EPA/600/P-96/001F (USEPA, 1996a).
- *Soil Screening Guidance: Technical Background Guidance*. USEPA Office of Solid Waste and Emergency Response (OSWER), EPA/540/R95/128 (USEPA, 1996b).
- *Explanation of Significant Differences: Source Control Operable Unit – Landfills 8 and 10* (WPAFB, 1997a).
- *Five-Year Review, Record of Decisions for 21 No Action Sites, 41 No Action Sites, Source Control Operable Unit, Landfills 8 & 10, Off-Source Operable Unit, and Spill Sites 2,3 and 10 (OU2)* (IT, 2000).
- *Comprehensive Five-Year Review Guidance* (USEPA, 2001).
- *Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risks Associated with Adult Exposure to Lead in Soil*. USEPA Technical Review Workgroup for Lead, EPA-V40-R-03-001 (USEPA, 2003a).

- *Human Health Toxicity Values in Superfund Risk Assessments* (USEPA, 2003b).
- *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, Part E, Supplemental Guidance for Dermal Risk Assessment, Final* (USEPA, 2004).
- *Final Second Five-Year Record of Decision Review Report* (Shaw, 2006).
- *Technical and Regulatory Guidance. Vapor Intrusion Pathway: A Practical Guideline*, (ITRC, 2007).
- *User's Guide for the Integrated Exposure Uptake Biokinetic (IEUBK) Model for Lead in Children*, USEPA, Office of Solid Waste and Emergency Response (USEPA, 2007).
- *Final Technical Site File Document for Operable Unit 1* (Shaw, 2008).
- *DoD Vapor Intrusion Handbook* (DoD, 2009).
- *Operable Unit 1, Landfills 8 and 10, Operation and Maintenance Plan, Volume V, Part 4 – Systems Performance Monitoring Plan* (Shaw, 2009b).
- *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, Part F, Supplemental Guidance for Inhalation Risk Assessment*, *Final* (USEPA, 2009).
- *Sample Collection and Evaluation of Vapor Intrusion to Indoor Air. For Remedial Response and Voluntary Action Programs. Guidance Document.* Ohio Environmental Protection Agency (OEPA, 2010).
- *Integrated Exposure Uptake Biokinetic Model for Lead Windows Version* - IEUBKwin V1.1 Build 11 (USEPA, 2010c).
- *Exposure Factors Handbook – 2011 Edition, Final* (USEPA, 2011a).
- *Toxicological Review of Trichloroethylene. In Support of Summary Information on the Integrated Risk Information System (IRIS),* Final, (USEPA, 2011b).
- *Third Five-Year Record of Decision Review Report*, (WPAFB, 2011).
- *Land Use Control Plan, Wright-Patterson Air Force Base, Ohio. Final (*Labat, 2012).
- *Memorandum: Clarifying the Use of Protectiveness Determinations for CERCLA Five-Year Reviews* (USEPA, 2012a).
- *Assessing Protectiveness at Sites for Vapor Intrusion: Supplement to the "Comprehensive Five-Year Review Guidance*" (USEPA, 2012b).
- *Explanation of Significant Differences: Source Control Operable Unit - Landfills 8 and 10; Off-Source Operable Unit and Final Remedial Action Landfills 8 and 10; 21 No Action Sites; Spill Sites 2, 3, and 10 (Operable Unit 2); 41 No Action Sites; and Groundwater Operable Unit* (WPAFB, 2012a).

- *Soil, Groundwater, Soil Gas, and Indoor Air Sampling Report, DuPont Way and Welcome Way* (Shaw, 2013a).

- *Memorandum: Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors* (USEPA, 2014b).

- *OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air* (USEPA, 2015).

- *Fourth Five-Year Record of Decision Review Report*, Wright-Patterson Air Force Base, Ohio, December (WPAFB, 2016a).

- Storm Water Management Plan, Wright-Patterson Air Force Base. September (WPAFB, 2016b).

- *Toxicological Review of Benzo(a)pyrene***,** Integrated Risk Information System, January (USEPA, 2017).

- *2018 Edition of the Drinking Water Standards and Health Advisories Tables.* EPA 822-F-18-001, Office of Water. On-line: http://www.epa.gov/sites/production/files/2018-03/documents/dwtable2018.pdf (USEPA, 2018).

- Internal Draft Annual Long-Term Groundwater Monitoring Report: 2019, Wright-Patterson Air Force Base, Ohio, July (APTIM, 2019b).

- *Notice of Violation* – Landfill Gas Exceedance at LF8, April 2019 (OEPA, 2019b).

- *Resolution of Violation* - Landfill Gas Exceedance at LF8, September 2019 (OEPA, 2019c).

- *Land Use Control Implementation Plan at Wright Patterson Air Force Base, Ohio*, TetraTech, Inc., February 2019 (TetraTech, 2019).

- U.S. Environmental Protection Agency (USEPA) Regions 3, 6, and 9. Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites. November. http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm (USEPA, 2019a).

- Integrated Risk Information System (IRIS), USEPA, Office of Research and Development, On-line: www.epa.gov/iris. Accessed: November 2019 (USEPA 2019b).

- Vapor Intrusion Screening Level (VISL) Calculator, Accessed: November 2019 (USEPA, 2019c).

- Regional Screening Level (RSL) Calculator, Accessed: November 2019 (USEPA, 2019d).

The SCOU ROD addresses the remediation for LFs 8 and 10, which comprise OU1 (WPAFB, 1994). The HHRA for the SCOU was performed using a qualitative methodology, based on USEPA guidance for development of PRGs (WPAFB, 1993a; USEPA, 1991b). The PRGs were based on state and federal regulations, and/or risk-based concentrations (RBC) calculated for the SCOU risk assessment using specific exposure pathways and land use scenarios. Contaminant concentrations from the site were then compared with the PRGs. The qualitative risk assessment for the SCOU ROD addressed only risk attributed to the actual LFs themselves and was performed for screening purposes to determine if early remedial actions were necessary to reduce the human health risk. A baseline or quantitative risk assessment was performed in conjunction with the Off-Source RI (ES, 1993).

Changes in ARARs and To Be Considered (TBCs)

As described in **Section 3.2.2**, the remedial actions selected in the SCOU ROD incorporate the following components (WPAFB, 1993a):

- Low permeability clay cap
- Leachate collection and treatment system
- Release of treated leachate into surface water through National Pollutant Discharge Elimination System (NPDES) permit
- Landfill gas (LFG) collection and treatment
- LTM of leachate, gas collection, and treatment systems
- Public water supply for private well users
- Access restrictions.

The purpose of the ARARs review is to determine whether recently promulgated or modified requirements of federal or State of Ohio environmental regulations are ARAR; and if modifications of regulations during the past five years call into question the protectiveness of the remedy (USEPA, 2001, 2012a). Changes to the ARARs since the last five-year review are discussed in this section.

With respect to requirements under the NPDES (40 Code of Federal Regulations [CFR] 122), stormwater protection for industrial activities are addressed by WPAFB's Stormwater Pollution Prevention Plan. The current permit for WPAFB (NPDES Permit No. 1IO00001*GD) is under revision. Storm water discharge at OU1 was monitored at Outfall 5 for the general storm water monitoring requirements; however, the limits previously specified in the NPDES permit for Outfall 5 are no longer in place. Therefore, stormwater discharge for OU1 is not currently being monitored. The engineering controls in place for the SCOU (**Section 3.2.3**, Remedy Implementation) remain protective of runoff water emanating from the site.

The leachate collection system discharges to the Fairborn sanitary sewer system. As discussed in **Section 3.2.2**, the ESD described modifications to the leachate collection and treatment process for the site (WPAFB, 1997a); however, requirements for hazardous waste management remained in effect. As discussed in **Section 3.4.4.3**, due to the nonhazardous quality of the leachate collected from LFs 8 and 10, no treatment was necessary prior to discharge off-site to the City of Fairborn publicly owned treatment works (POTW) facility. To comply with the conditions specified in the City of Fairborn sewer discharge permit, one sample per quarter is collected from the effluent discharge line of the leachate collection system. The quarterly analytical data are presented to the Water Projects Coordinator for the City of Fairborn to confirm compliance with the discharge permit. Monitored discharge parameters consist of VOCs, inorganics, oil and grease, total suspended solids, carbon oxygen demand (COD), and pH. All concentrations of the detected parameters have been below City of Fairborn requirements with the exception of arsenic, which has infrequently and temporarily exceeded the discharge requirement. These temporary exceedances of arsenic are typically associated with low water levels in the leachate collection sump, which concentrates the suspended solids in the collected leachate. At times of low water in the sump, the sump pump must be manually activated. If an exceedance occurs, it is first reported to WPAFB IRP personnel and the landfill maintenance contractor to verify that all extraction wells are operating effectively. When the system has been verified as operating properly, a confirmation leachate sample is collected. The quarterly City of Fairborn effluent sampling analytical results for this Five-Year reporting period are provided in **Table 3-3**.

As part of the post-closure of these LFs, a ground water monitoring program was instituted under the ROD and continues to be subject to Ohio Administrative Code (OAC) 3745-27-10. Chemical-specific ARARs are specified for purposes of the groundwater monitoring program. As discussed in previous Five-Year Reviews (IT, 2000; Shaw, 2006; WPAFB, 2011: WPAFB, 2016a), the MCLs under 40 CFR 141 SDWA are relevant and appropriate for most constituents. For chemicals that did not have MCLs, RBCs or detection limits were recommended as values "To Be Considered". The USEPA Region 9 PRGs were previously used as TBCs at WPAFB. Monitoring requirements for groundwater compliance were established within the SCOU ROD (WPAFB, 1993a). The COCs for the SCOU were also identified as chemicals that were detected at concentrations that exceeded limits established by one or more of the following: state or federal environmental regulations or a human health risk analysis. According to *Table 7, Performance Standards for the Selected Remedy* in the ROD, the stated groundwater monitoring requirements were to monitor COC in groundwater beyond the LF boundaries for exceedances of the MCLs or PRG. *Table 8, Compliance Levels for the Chemicals of Concern* lists monitoring levels for both groundwater and soil.

The ROD-based compliance limits were evaluated as part of the first, second, and third Five-Year Reviews (IT, 2000; Shaw, 2006; WPAFB, 2011). It was concluded in the ESD (WPAFB, 2012a) that, although MCLs should be considered first as the monitoring requirements for the COC, many of the compliance levels that were established in the ROD were less than the MCL or applicable detection limits (for example, beryllium, benzene, chloroform, 1,2-dichlorothylene [1,2-DCE], VC, 2,3,7,8-tetrachlorodibenzodioxin (TCDD), and 2,3,7,8-tetrachlorodibenzofuran [TCDF]). With the exception of dioxin congeners other than TCDD, MCLs are available for most COC for which compliance levels were established. In addition, compliance levels were not established for cadmium, copper, iron, lead, zinc, cyanide, ammonia, ethyl benzene, toluene, diethyl phthalate, 4-methylphenol, and naphthalene, although these compounds are monitored. Some parameters do not have compliance levels but are monitored based on the requirements of the SCOU ROD.

The compliance levels listed in the SCOU ROD were considered the final cleanup standards for OU1 groundwater; however, these levels had since been updated as part of the ESD (WPAFB, 2012a). As shown in **Table A-1**, the original compliance levels are compared with the current compliance levels, which consist of the MCLs (USEPA, 2018). The SCOU ROD also included compliance levels for COCs in soil. Although the landfills are capped and there are no direct exposures to soil, the compliance levels for soil are provided and compared with TBCs in **Table 3-9** and **Table A-3**. Overall, the current RSLs are less stringent than the original compliance levels. Furthermore, the current RSL for benzo(a)pyrene is less stringent than the value cited in the previous Five-Year Review (WPAFB, 2016a). No other RSLs have changed.

As discussed in the introduction to this section, the monitoring data for the SCOU, LF8 and LF10 had been reevaluated since the ROD was issued. Based on the evaluation of the LTM compliance data from the Technical Site File Document (TSFD) and as presented in the revised SPMP (Shaw, 2009b), the monitoring program was modified with the TSFD (Shaw, 2008) from a mix of semiannual and annual sampling to an annual frequency for all wells. Pesticides/PCBs and SVOCs are now analyzed every five years. Metals and dioxins/furans have been eliminated from the LTM Program. The current compliance levels for groundwater are summarized in **Table 3-8** and **Table A-1**. Exceedances of MCLs are captured in the LTM and reported in the LTM reports. Groundwater monitoring will be continued until the compliance levels are met. The remedy is protective because exposures to groundwater due to industrial or domestic water use consumption are prevented (for example, by providing city water for the properties near the SCOU and treatment for groundwater downgradient of FAA-A).

Changes in Land-Use and Exposure Assumptions

The HHRA, as stated above, was performed using a qualitative methodology based on USEPA guidance for development of PRGs (WPAFB, 1993a; USEPA, 1991b). These PRGs were based on a residential land use scenario (WPAFB, 1993a). The exposure pathways considered were the direct ingestion of soil, ground water (leachate), and inhalation of volatile contaminants from the use of household water. Although USEPA has updated the specific guidance for evaluating inhalation exposures since the original HHRA was performed (USEPA, 2009), the remedy remains protective because household use of SCOU groundwater is prevented. It is noted that the dermal absorption pathway was not included in the derivation of these PRG; however, exposures via this pathway are prevented by the remedy.

There have been no changes to the exposure pathways that were evaluated for direct contact at the SCOU since the Fourth Five-Year Review (WPAFB, 2016a); however, USEPA replaced the PRGs with the RSLs in 2008. The most recent version of the RSLs (USEPA, 2019a) reflects substantial changes to exposure factors and toxicity values. Changes to the exposure factors are discussed in the next paragraph. Changes in toxicity values are discussed in the applicable section below.

As discussed in the introduction to this appendix, the default exposure factors assumed in the development of human health RSLs and used in HHRAs have been updated since the original risk assessments were performed. In September 2011, USEPA's NCEA/ORD issued a substantive update to its exposure assessment recommendations in its *Exposure Factors Handbook* (USEPA, 2011a). In February 2014, USEPA issued OSWER Directive 9200.1-120 (USEPA, 2014b) to update the guidance for standard default exposure factors used in CERCLA HHRAs. The default exposure factors that had changed since the baseline HHRA and previous Five-Year Reviews are summarized in **Table A-2**. The updated factors were evaluated as part of the Fourth Five-Year Review (WPAFB, 2016a). Depending upon the exposure scenario, some of the screening levels were more stringent or resulted in a higher risk/hazard estimate than was estimated in the original risk assessment. Conversely, some screening levels were less stringent or resulted in a lower risk/hazard estimate. To demonstrate the impact of the changes specifically associated with the exposure factors, a hypothetical quantitative risk assessment was run to calculate risks and hazard indices two ways. The first set of calculations was based on the previous USEPA default exposure factors, which are more similar to what was used in the original risk assessment. The second set of calculations used USEPA's 2014 standard default factors. Based on the evaluation (WPAFB, 2016a), most risks and hazard indices based on the 2014 exposure factors were similar or lower than those based on the previous exposure factors. The exceptions were the hazard indices for groundwater exposures by the lifetime resident, which resulted in an increase of the cumulative hazard index by 7 percent. This evaluation continues to be valid as neither the *Exposure Factors Handbook* (USEPA, 2011a) nor the default exposure factors (USEPA, 2014b) have changed since the last Five-Year Review (WPAFB, 2016a). Also, given that land use for the SCOU is industrial, the conclusions of the original HHRA and previous Five-Year Reviews remain valid and the remedy for soil remains protective. In addition, groundwater use is restricted. Therefore, the remedy for groundwater remains protective.

During this five-year period, soil gas investigations were conducted to evaluate the potential for exposure via the vapor intrusion pathway. Since the preparation of the SCOU ROD (WPAFB, 1993a), USEPA, OEPA, DoD, and others have published guidance regarding the evaluation of vapor intrusion (USEPA, 2015; OEPA, 2020; DoD, 2009; ITRC, 2007). These guidance documents remain in effect. In addition, USEPA continues to maintain and update its vapor intrusion screening levels (VISLs) for the applicable media (indoor air, sub-slab soil gas, and groundwater). The VISLs are derived using USEPA's on-line VISL Calculator (USEPA, 2019c), which is based on USEPA's most recent vapor intrusion guidance (USEPA, 2015) and current RSLs (USEPA, 2019a). In addition, USEPA issued recommendations for assessing protectiveness at sites for vapor intrusion as a supplement to the Comprehensive Five-Year Review Guidance (USEPA, 2012b).

For the SCOU, this evaluation also involved the migration of explosive landfill LFG as well as VOCs into nearby residences at DuPont Way. The vapor intrusion pathway was also evaluated by reviewing VOC results for soil gas and groundwater at SCOU.

With respect to LFG, active LFG control eliminates explosion, fire, and inhalation risk associated with LFG. To verify the effectiveness of the LFG collection system, the LFs 8 and 10 landfill gas monitoring networks (**Figures 3-2** and **3-3**) are monitored semiannually. As described in **Section 3.4.4.5**, soil gas monitoring results indicate that the LF8 LFG collection system continues to operate effectively over the LF.

Soil gas monitoring results at permanent soil gas probe LF8-MP010 located outside the landfill boundary (**Figure 3-2**) indicated methane levels at sustained concentrations of 11.8 and 10.5 percent in spring and fall 2018, which exceeded the lower explosive limit (LEL) of 5 percent for methane. This monitoring probe has a history of elevated methane concentrations and was the only location to have elevated methane readings during this five-year period (APTIM, 2019b). Results of adjacent monitoring points demonstrate that the elevated readings at LF8-MP010 are localized. To ensure that methane is not migrating into the adjacent houses or surrounding utility lines, punchbar locations provide added monitoring data in areas near utility lines or other potential vapor conduits. Methane/explosive gas has not been detected at any of the punchbar locations. Also, due to the proximity of LF8, a methane monitor was installed in 7 DuPont Way (**Figure 3-2**) and is inspected quarterly. In addition, a multimedia investigation was conducted in this area of DuPont Way and no methane was detected in the sub-slab sampling (Shaw, 2013a). Due to the VOCs observed in one of the samples, an indoor air mitigation system was installed at 5 DuPont Way. Its performance is monitored with annual indoor air monitoring of the residence. The results of the October 2019 sampling (**Table 3-6**) indicate the sub-slab soil vapor mitigation system has reduced VOC concentrations to below regulatory levels and is operating as designed.

An indoor air mitigation system was installed at 5 DuPont Way because of soil vapor concentrations observed in the sub-slab at this location. The results of the October 2019 sampling (**Table 3-6**) indicate the sub-slab soil vapor mitigation system has reduced VOC concentrations to below regulatory levels and is operating as designed.

To ensure that methane has not migrated to the sub-slab below the residential dwellings surrounding monitoring probe LF08-MP010, two permanent soil vapor probes were installed: LF08-MP010A was installed adjacent to the back wall of 7 DuPont Way in April 2018 and LF08-MP010B was installed near the northeast corner of 5 DuPont Way in September 2018. Punchbar locations LF08-PT10A, LF08-PT10B, and LF08-PT10C (located in the vicinity of the front of the house at 7 DuPont Way) will no longer be monitored. Methane was not detected in probe LF08-PT10A during the spring or fall 2019 LTM monitoring events, however, in the spring 2019 methane was detected in LF08-PT10B at a concentration of 7.9 percent, which exceeds the LEL (see **Section 3.4.4.5**). As discussed in **Section 3.4.4.5,** the LF10 primary LFG collection system continues to operate effectively over the LF. The gas barrier trench (GBT), a secondary LFG collection system, is located along the eastern boundary of the LF (**Figure 3-3**), was monitored quarterly through 2007 and semiannually thereafter. Results of the LF10 LFG monitoring indicate that although methane was detected in the south end of the GBT, methane was not detected in the surrounding soil vapor monitoring points or the punchbar locations. Therefore, the GBT is performing its intended function of preventing methane migration away from the landfill.

To address the potential for exposures to VOCs due to vapor intrusion, WPAFB conducted a multimedia investigation of a wide area at the south end of DuPont Way in 2012. An indoor air mitigation system was installed at 5 DuPont Way because of soil vapor concentrations observed in the sub-slab at this location (**Figure 3-2**). Annual sub-slab soil vapor sampling was conducted over this five-year period. As seen in **Table 3-6**, VOC concentrations are below RSLs with the exception of concentrations of chloroform (6.5 $\mu g/m^3$ in January 2018 and 5.5 $\mu g/m^3$ in October

2019) that exceeded an RSL of 4.1 $\mu g/m^3$ based on a risk level of 1 x 10^{-6}. As these concentrations only slightly exceeded 1 x 10^{-6}, risks associated with chloroform are at the lower end of USEPA's acceptable risk range of 1 x 10^{-6} to 1 x 10^{-4}. Sub-slab soil vapor sampling to monitor performance of the system will continue annually. Therefore, the mitigation system is operating as designed.

The groundwater data from the LTM program at the SCOU were also evaluated to determine the potential for vapor intrusion. These data were compared with groundwater VISLs, which were derived using USEPA's VISL calculator as described in the introduction to this appendix. Those monitoring wells with at least one exceedance of a VISL are shown in **Tables A-4 and A-5** for LF8 and LF10, respectively. Exceedances of the industrial VISL for VC were found for one well at LF8 during this five-year period; the residential VISL for VC was exceeded in three wells. There were no exceedances of VISLs for wells at LF10 during this five-year period.

According to the guidelines for determining protectiveness (USEPA, 2012b), the measures for DuPont Way are considered to be protective because a mitigation system was installed and is functioning as intended. In particular, performance of the indoor air mitigation system at the 5 DuPont Way residence is monitored with annual sub-slab gas monitoring. Follow-up samples indicate that the mitigation system is operating as designed (**Tables 3-6** and **A-6**). Should new building construction be considered or monitoring results indicate migration of VOCs toward nearby buildings in the future, additional soil gas investigations and risk assessment would be performed.

Recent vapor intrusion guidance indicates that non-detect analytical soil concentration results do not necessarily indicate a lack of a soil gas source due to potential volatilization during sample collection, handling, and analysis (ITRC, 2007). However, the selected remedy still addresses the potential vapor intrusion pathway by restricting residential development and on-going LTM of groundwater.

Continued potential contamination of groundwater, and other risks associated with the generation and spread of leachate is reduced by the clay cap, leachate collection and treatment measures, and conversion of private well users to public water supplies. There is no exposure to groundwater because local residences continue to use water supplied by a municipal water system. The LTM Program also remains in effect.

In addition to the changes made in the compliance levels for the SCOU, the ESD (WPAFB, 2012a) clarified changes in the IC requirements set forth in the six RODs issued for WPAFB. According to the ESD, the LUC Plan (Labat, 2012) was the primary administrative mechanism employed by

WPAFB to ensure that ICs were in place at each site. The ESD removed the requirement to implement deed restrictions set forth in the RODs and established that the LUC Plan would be used to manage and enforce LUCs (i.e., activity and use restrictions) and site controls (e.g., fencing, signage, caps). Since the last Five-Year Review, the LUC Plan was replaced by the LUCIP (TetraTech, 2019). The LUCIP is now the primary administrative mechanism employed by WPAFB to determine which ICs are protective for the site, and ensure that current ICs remain environmentally compatible with future land use and are properly implemented. The LUCIP is intended to reduce the potential for human exposures.

As described in **Section 3.1** and **Table 3-7**, the current land use at LFs 8 and 10 is described as an open, grassy area, adjoining residential and wooded areas. Land use at LFs 8 and 10 has not changed since the remedy was implemented. Human and environmental contact with LF contents, contaminated soil, and leachate is prevented by the presence of the clay caps. The ICs include provisions that prevent future use by prohibiting construction, mining, drilling, installation of wells, and other activities that interfere with the remedy, or would allow humans to come into contact with the contamination on-site. In addition, access restrictions are maintained around the LFs. The access restrictions include fencing, posted warning, and security patrols. Prior to proposing a different land use at WPAFB, an amended risk assessment would be performed to evaluate the new land use.

Changes in Toxicity Values

As stated previously, the HHRA was performed using a qualitative methodology based on USEPA guidance for development of PRG (WPAFB, 1993a; USEPA, 1991b). For exposures to groundwater (leachate), MCLs were established as cleanup levels. In cases where no MCL was available, the PRGs were also used as cleanup levels for groundwater. For chemicals that were subsequently identified as COC, these PRGs served as cleanup levels for soil. In the risk assessment conducted for the RI, the PRGs were used as risk-based screening concentrations to identify COC. While the general concept and methodology for deriving PRGs has not changed, USEPA currently provides a uniform set of screening values that is applied across all regions as discussed above. As described in the introduction to this appendix, the RSLs (USEPA, 2019a) and associated IRIS updates to toxicity criteria (USEPA, 2019b) were reviewed for this technical assessment. The IRIS database is considered the first tier in USEPA's hierarchy of sources of toxicity values (USEPA, 2003b). The review of toxicity values indicated the following:

- As discussed in the Fourth Five-Year Review (WPAFB, 2016a), the PRGs used in the original risk assessment have been replaced by RSLs. The RSLs are updated every 6 months and reflect changes in exposure factors and toxicity criteria.

- Several individual toxicity values that were used to develop PRGs for the COC associated with the SCOU have changed since the last review. For the groundwater, most of the COC also have MCLs, so the impact due to changes in the toxicity values is not an issue. The compliance levels for groundwater are further discussed below.

- For the soil, the cumulative impact of the more stringent toxicity values would be expected to be offset by the effects of those values that are now less stringent. Moreover, LF 8 and LF 10 are capped and there is no current contact with surface soil. The compliance levels for soil are discussed below.

- The PAHs were identified as COCs in soil at the SCOU. As discussed in the introduction to **Appendix A**, USEPA issued an updated *Toxicological Review of Benzo(a)pyrene* under the IRIS Program in January 2017 (USEPA, 2017). This review updated the previous IRIS assessment of benzo(a)pyrene, which had been used since 1987. It was based on studies conducted after 1987 and the 2011 recommendations for the improvement of IRIS toxicity assessments.

  Benzo(a)pyrene is now identified as "carcinogenic to humans" rather than the 1987 "probable human carcinogen" weight-of-evidence classification. USEPA (2019b, 2017) provided a verified oral cancer slope factor for benzo(a)pyrene of 1.0E+0 per mg/kg-day and a verified IUR of 6.0E-4 per µg/m^3 in 2017.

  Although the IRIS database currently indicates that the toxicity criteria for benzo(a)pyrene have been "suspended" (USEPA, 2019b), the updated oral cancer SF (1.0E+0 per mg/kg-day) and the IUR (6.0E-4 per µg/m^3) continue to be included in the current RSL table (USEPA, 2019a) and applied in the RSL calculator (USEPA, 2019d). When compared with the previous oral SF (7.30E+0 per mg/kg-day), the current toxicity value represents less potency and, therefore, is less stringent. It is noted, however, there was previously no IRIS-verified IUR for benzo(a)pyrene.

  There are no IRIS-verified toxicity values for the remaining carcinogenic PAHs; however, these values have been derived from the SF and IUR for benzo(a)pyrene using their corresponding relative potency factors (RPFs). The resulting values are used to develop RSLs for these compounds.

  In addition, the RSL table now includes an RfD (3.0E-4 mg/kg-day) and an RfC (2.0E-6 mg/m^3) for benzo(a)pyrene. Previously, there were no noncancer-based toxicity values available. Both toxicity values are based on developmental effects.

- Toxicity values are now available for some chemicals that did not have toxicity criteria at the time of the qualitative risk assessment. In particular, several toxicity values are now available for the inhalation pathway.

- Some toxicity criteria are considered provisional peer-reviewed toxicity values (PPRTVs) (USEPA, 2003b), which represent the second-tier of human health toxicity values. In addition, USEPA has identified Tier 3 or other EPA and non-EPA sources, which were also used. Oral toxicity criteria are adjusted to assess the dermal absorption pathway

(USEPA, 2004). As discussed in previous Five-Year Reviews, there were changes to some of the factors and assumptions used to calculate dermal toxicity values in the original risk assessment. Of these, the oral absorption factors for barium and chromium VI are more stringent; however, these metals were not identified as COC.

The purpose of **Table A-7** is to determine whether changes in toxicity values result in any new COCs in the SCOU (OU1) under the LTM Program. The maximum detected concentrations (MDCs) of chemicals detected in groundwater samples collected in April 2019 were compared with current MCLs and RSLs. This comparison is shown in **Table A-7**. Three chemicals (chloromethane, trans-1,2-dichloroethene, and mercury) that had not been detected as part of the Fourth Five-Year Review were detected in April 2019 and evaluated for this review. Two chemicals (trans-1,2-dichloroethene and mercury) were below their respective MCLs. There is no MCL for chloromethane; however, the MDC was below the current tap water RSL. Therefore, no new COCs were identified during this five-year period.

The remedy remains protective because the potential exposures to groundwater will continue to be managed through ICs.

As previously discussed, the SCOU ROD included compliance levels for COCs in soil. Although the landfills are capped and there are no direct exposures to soil, the compliance levels for soil are compared with current RSLs in **Table A-3**. All of the current industrial RSLs are higher (and less conservative) than the compliance levels established in the SCOU ROD. In particular, the toxicity values for benzo(a)pyrene have been updated and the resulting RSLs are now less stringent since the Fourth Five-Year Review (WPAFB, 2016a). Except for dieldrin, the current residential RSLs are also less conservative than the ROD compliance levels. Therefore, most compliance levels in the ROD are still considered to be protective. Although the ROD compliance level for dieldrin is no longer protective for unrestricted land use, the SCOU is currently subject to LUCs. These LUCs are expected to remain in effect for the foreseeable future.

As discussed in the introduction of this appendix, TCE did not have IRIS-verified toxicity values at the time the ROD was issued (WPAFB, 1993a). The verified oral and inhalation toxicity criteria were posted in September 2011 (USEPA, 2011b). This new information did not change the conclusions regarding the remedy for groundwater because TCE concentrations at the SCOU are ultimately compared with the MCL and groundwater is currently restricted as a drinking water source. In addition, TCE was not been detected in wells associated with LF8 (**Table 3-4**) or LF10 (**Table 3-5**) during this five-year period. For inhalation pathways associated with soil gas and indoor air, toxicity values are used to develop screening levels. Although TCE has been detected in soil gas samples, the concentrations in soil gas samples collected since the Fourth Five-Year Review have been below the screening levels.

There is no toxicity value for lead and there was no PRG developed for lead in soil at the time the qualitative risk assessment was performed (ES, 1992a). Conversely, lead was not included in the SCOU ROD as a COC. A residential lead level of 400 mg/kg was subsequently established for soil using the (Integrated Exposure Uptake Biokinetic (IEUBK) model (USEPA, 1994a,b; 2007, 2010c). In addition, USEPA developed the Adult Lead Model (ALM) to evaluate occupational exposures to lead (USEPA, 2003a) and a PRG of 800 mg/kg was established for industrial soil. Both of these values were adopted as RSLs for lead in 2008 and neither of them has changed (USEPA, 2019a). As discussed in the Fourth Five-Year Review (WPAFB, 2016a), lead was evaluated as part of the Focused RI (ES, 1992a). The maximum detected concentration of lead (930 mg/kg) identified in LF8 Test Pit Soil would exceed the current residential and industrial lead levels. If the IEUBK model and ALM were to be applied to the soil in place at LF8, however, the model inputs would be based on the arithmetic mean rather than the maximum detected concentration. In addition, the selected remedy prevents exposure to LF8 soil; therefore, the remedial efforts at LF8 are still protective. The maximum detected concentration of lead in the LF10 Test Pit Soil does not exceed either lead level.

Risk assessment guidance documents for assessing the toxicity of specific classes of chemicals have been revised since the ROD was issued (WPAFB, 1993a). For example, 2,3,7,8-TCDD is listed in the ROD as a COC for soil at the SCOU; however, there are no dioxin congeners identified for soil at the SCOU. While several dioxin congeners were listed in the ROD as COC for groundwater, dioxins/furans are no longer included in the LTM Program based on the ESD (WPAFB, 2012a). The compliance levels established in the Source Control Operable Unit ROD were based on the direct ingestion of soil and leachate water, and inhalation of VOCs from household use. Currently, there are no remaining households in the vicinity of LFs 8 and 10 using private wells as a source of water. Therefore, in accordance with the Final Explanation of Significant Differences: Source Control Operable Unit – Landfills 8 and 10; Off-Source Operable Unit and Final Remedial Action, Landfills 8 and 10; 21 No Action Sites; Spill Sites 2, 3, and 10 (Operable Unit 2); 41 No Action Sites; and Groundwater Operable Unit, Wright-Patterson Air Force Base, Ohio (WPAFB. 2012): "Dioxins/furans have been permanently deleted from the OU1 LTM Program, as approved by USEPA and Ohio EPA in April 2007." Therefore, the changes in the guidance for dioxin no longer apply to either soil or groundwater at the SCOU.

Several PCB compounds are shown in the ROD as COC for soil at the SCOU. As described in the previous Five-Year Reviews (Shaw, 2006; WPAFB, 2011; WPAFB, 2016a), USEPA had developed an approach to evaluating PCB compounds (USEPA, 1996a) since the original risk assessment was performed. The guidance entitled PCBs: Cancer Dose-Response Assessment and Application to Environmental Mixtures, is still considered to be current. Previous risk assessments developed a single-dose response slope factor (7.7 per milligram per kilogram per day [mg/kg/day]) for evaluating PCB cancer risks. With no agreed-upon basis for reflecting differences among environmental mixtures, this toxicity value was used by default for any mixture. The approach to PCB assessment has not changed since the Fourth Five-Year Review. This approach distinguishes among PCB mixtures by using information on environmental processes. This assessment considered all cancer studies (based on commercial mixtures only) to develop a range of dose-responses slope factors. The cancer potency of PCB mixtures is determined using a tiered approach. The first tier, also used as the default, is invoked when information on the mixture of interest is limited. The upper reference point (2 per mg/kg/day) is appropriate for food chain exposure, sediment or soil ingestion, and dust or aerosol inhalation; and applicable to the exposures that were evaluated in the SCOU risk assessment. The values used in the SCOU are still protective of human health because the current value (2 per mg/kg/day) is less conservative than the previous default value (7.7 per mg/kg/day). The RSLs for PCBs in residential soil range from 0.12 to 0.41 mg/kg. The compliance level for PCBs in the ROD (0.0831 mg/kg) is more conservative. It is noted, however, that PCBs are considered to be volatile by USEPA's definition for volatility (USEPA, 2019a). Given the time that has passed since OU1 was investigated, it is possible that PCB concentrations may be decreasing.

Based on current guidance for dermal risk assessment (USEPA, 2004), there were changes to some of the exposure factors and assumptions used to calculate dermal toxicity values in the original risk assessment. In addition, USEPA issued Office of Solid Waste and Emergency Response (OSWER) Directive 9200.1-120 (USEPA, 2014a). Some of the updated factors would be used in a dermal risk assessment; however, the impacts of these changes would be expected to be minimal. There have been no changes to the default exposure factors during this five-year period. Therefore, the approach to evaluating dermal risk remains valid.

Finally, USEPA developed the Soil Screening Guidance (USEPA, 1996b) as a framework for screening contaminated soils that encompasses both simple (i.e., screening-level) and more detailed approaches for calculating site-specific Soil Screening Levels (SSLs). In particular, this guidance presents methodologies to address the leaching of contaminants through soil to an underlying potable aquifer and the methodologies are still current. The SSLs are back-calculated for migration to groundwater pathways using groundwater contamination limits, such as MCLs, non-zero maximum contaminant level goals (MCLG), health-based criteria, based on 1 x 10^{-6}

cancer risk, or Hazard Quotient (HQ) of 1. This methodology has not changed since the SSL Guidance was issued. Although it is possible that soil concentrations associated with the SCOU would exceed the SSLs for migration to groundwater, use of the SSLs would have no effect on the remedy. Given the period of time the LFs have existed, migration of chemicals from the LF has most likely occurred. The LFs are capped, and groundwater is being monitored under the LTM Program. Furthermore, there is no current exposure to groundwater.

Changes in RAOs and Cleanup Goals

Based on the proximity of homes to LFs 8 and 10, WPAFB, OEPA, and USEPA jointly deemed that remedial actions aimed at controlling any current or potential risk posed by contamination migrating from the LFs was warranted. In general, the cleanup goals for the SCOU are to prevent direct contact with on-site contaminants. An additional goal was to manage the potential for exposure to site-related contaminants through the use of private sources for drinking water and showering.

As discussed in **Section 3.2.2**, the overall goal of the SCOU for the remedial response actions at LFs 8 and 10 was to protect human health and the environment. In general terms, the cleanup goals for the SCOU are to prevent direct contact with on-site contaminants, and to prevent contamination from spreading (WPAFB, 1993a). The principal media and general RAOs for the SCOU are summarized as follows:

- Soil/LF Contents
  - To prevent direct contact, dermal absorption, and ingestion of the contaminated soils and LF contents; control surface water runoff, ponding, and erosion.
  - To prevent or reduce infiltration and production of leachate.
  - To control dust emissions to meet ambient air exposure criteria.
- LFG/Soil Gas
  - To prevent inhalation of gases and the potential for explosion by controlling LFG.
  - To meet ambient air exposure criteria.
- Leachate/Leachate Seeps
  - To prevent ingestion, dermal absorption, and inhalation of contaminants.
  - To prevent contaminants of interest in leachate from migrating to surface waters and ground waters.
  - To prevent dermal absorption and ingestion of leachate.

- To reduce/eliminate on-site leachate generation.

- Private Wells (Ground Water)
    - To prevent ingestion, dermal absorption, and inhalation of contaminants.

The RAOs for the SCOU remain valid.

A residential land use scenario was used to determine compliance levels. For soils, risk-based concentrations were calculated and used to develop the list of chemicals. While the RSLs (USEPA, 2019a) reflect updated exposure assumptions and toxicity values, the remedy is still protective because direct contact with soil is prevented. For water, only MCLs are now used as compliance levels as documented in the ESD (WPAFB, 2012a). The LTM of groundwater and institutional controls described in the SCOU ROD (WPAFB, 1993a) continue to be protective because exposure pathways for groundwater are managed. Exceedances of MCLs are captured in the LTM and reported in the LTM reports. Groundwater monitoring will be continued until the compliance levels are met. In addition, the remedy is protective because exposure to groundwater due to industrial or domestic water consumption are prevented by providing city water for the properties near the SCOU and treatment for groundwater downgradient of FAA-B. There are no RAOs that specifically address vapor intrusion in the ROD; however, follow-up samples indicate that the mitigation system at 5 DuPont Way is protective because it is operating as designed.

A.2 Off-Source Operable Unit (OSOU)

The following documents were reviewed with respect to risk assessment data and assumptions:

- *A PC Software Application of the Lead Uptake/Biokinetic Model* (USEPA, 1991d).
- *Focused Remedial Investigation Report for Landfills 8 and 10* (ES, 1992a).
- *Off-Source Remedial Investigation Report for Landfills 8 and 10 at Wright-Patterson Air Force Base, Ohio* (ES, 1993).
- *Record of Decision, Source Control Operable Unit – Landfills 8 and 10* (WPAFB, 1993a).
- *Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities* (USEPA, 1994b).
- *Record of Decision, Off-Source Operable Unit and Final Remedial Action, Landfills 8 and 10* (WPAFB, 1994).
- *PCBs: Cancer Dose-Response Assessment and Application to Environmental Mixtures* (USEPA, 1996a).
- *Soil Screening Guidance: Technical Background Guidance* (USEPA, 1996b).

- *Record of Decision, Groundwater Operable Unit, Groundwater Basewide Monitoring Program* (WPAFB, 1999).
- *Comprehensive Five-Year Review Guidance* (USEPA, 2001).
- *Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risks Associated with Adult Exposure to Lead in Soil* (USEPA, 2003a).
- *Human Health Toxicity Values in Superfund Risk Assessments* (USEPA, 2003b).
- *Final Second Five-Year Record of Decision Review Report* (Shaw, 2006).
- *Vapor Intrusion Pathway: A Practical Guideline* (ITRC, 2007).
- *User's Guide for the Integrated Exposure Uptake Biokinetic Model for Lead in Children, Windows® Version* (USEPA, 2007).
- *DoD Vapor Intrusion Handbook* (DoD, 2009).
- *User's Guide for the Integrated Exposure Uptake Biokinetic Model for Lead in Children, Windows® Version* (USEPA, 2007).
- *Integrated Exposure Uptake Biokinetic Model for Lead Windows Version* - IEUBKwin V1.1 Build 11 (USEPA, 2010c).
- *Exposure Factors Handbook* (USEPA, 2011a).
- *Toxicological Review of Trichloroethylene. In Support of Summary Information on the Integrated Risk Information System (IRIS)* Final (USEPA, 2011b).
- *Third Five-Year Record of Decision Review Report* (WPAFB, 2011).
- *Land Use Control Plan* (Labat, 2012).
- *Memorandum: Clarifying the Use of Protectiveness Determinations for Comprehensive Environmental Response, Compensation, and Liability Act Five-Year Review*s (USEPA, 2012a).
- *Assessing Protectiveness at Sites for Vapor Intrusion: Supplement to the "Comprehensive Five-Year Review Guidance*" (USEPA, 2012b).
- *Explanation of Significant Differences: Source Control Operable Unit - Landfills 8 and 10; Off-Source Operable Unit and Final Remedial Action Landfills 8 and 10; 21 No Action Sites; Spill Sites 2, 3, and 10 (Operable Unit 2); 41 No Action Sites; and Groundwater Operable Unit* (WPAFB, 2012a).
- *Soil, Groundwater, Soil Gas, and Indoor Air Sampling Report DuPont Way and Welcome Way, Wright-Patterson Air Force Base* (Shaw, 2013a).

- *OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air* (USEPA, 2015).
- *Fourth Five-Year Record of Decision Review Report* (WPAFB, 2016a).
- *2018 Edition of the Drinking Water Standards and Health Advisories Tables.* EPA 822-F-18-001, Office of Water. On-line: http://www.epa.gov/sites/production/files/2018-03/documents/dwtable2018.pdf (USEPA, 2018).
- *Land Use Control Implementation Plan at Wright Patterson Air Force Base, Ohio*, TetraTech, Inc., February 2019 (TetraTech, 2019).
- *U.S. Environmental Protection Agency (USEPA) Regions 3, 6, and 9. Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites.* http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm (USEPA, 2019a).
- Integrated Risk Information System (IRIS), On-line: www.epa.gov/iris. U.S. Environmental Protection Agency, Office of Research and Development, Accessed: December 2019 (USEPA, 2019b).
- Vapor Intrusion Screening Level (VISL) Calculator, Accessed: November 2019 (USEPA, 2019c).
- *Sample Collection and Evaluation of Vapor Intrusion to Indoor Air*, Ohio Environmental Protection Agency, March (OEPA, 2020).

A baseline or quantitative risk assessment was performed in conjunction with the Off-Source RI (ES, 1993). This risk assessment addressed risk associated with the LFs, as well as risk from any contaminants that may have migrated beyond the LF boundaries. The baseline risk assessment evaluated risks using residential current and future land use scenarios. For the human health risk assessment, 13 exposure pathways were quantified using adult and child receptors for a 30-year residential exposure duration.

Changes in ARARS and TBCs

The purpose of the ARARs review is to determine whether recently promulgated or modified requirements of federal or State of Ohio environmental regulations are ARAR, and if modifications of regulations during the past five years call into question the protectiveness of the remedy (USEPA, 2001, 2012a). Because the No Action (NA) alternative was selected as the remedy for the Off-Source Operable Unit (OSOU), there were no ARARs specified in the OSOU ROD (WPAFB, 1994).

Major groundwater contaminants detected in groundwater MWs located adjacent to the site are presented in *Table 2* of the OSOU ROD. These contaminants (benzene, 1,2-DCE, VC, barium, and arsenic) were compared with MCLs (USEPA, 2018). The only change since the last review was the listing of the compliance levels for the individual congeners for 1,2-DCE. While there is no MCL for total 1,2-DCE, there are MCLs for each of these congeners (cis-1,2-DCE and trans-1,2-DCE). As discussed in **Section 3.4.4.4** and **Section A.1** of this appendix, groundwater monitoring has continued in the SCOU with implications for the OSOU.

As stated in the introduction of this appendix, monitoring requirements for groundwater compliance were established within the SCOU ROD and the compliance levels listed in the SCOU ROD were considered to be the final cleanup standards for OU1 groundwater. An ESD was approved in 2012 to address multiple RODs, including the ROD for the OSOU (WPAFB, 2012a). The purpose of this ESD was to clarify the implementation of ICs at WPAFB and to document a change in compliance levels for COC in groundwater at OU1. The ESD modified the compliance levels for the SCOU in line with the regulatory limits (MCLs) used for the COC (WPAFB, 2012a). The MCLs have not changed since the ESD was signed in 2012. These MCLs are shown as the current compliance levels for the SCOU (OU1) in **Table 3-8**. As stated in **Section 4.4.4**, monitoring results of the perimeter wells for the SCOU also impact the OSOU.

Monitoring of additional wells at OU1, other than the SCOU perimeter wells, was conducted during this five-year period. As noted in **Section 3.4.4.4**, VC has been detected above the MCL in the two wells near the northeast corner of LF8, in the vicinity of the east end of DuPont Way (Shaw, 2013a). Over the last five years, VC concentrations have ranged from nondetect to 3.4 μg/L at two wells in this area with the highest concentration observed in monitoring well LF08-MW10B in April 2019 (**Table 3-4**). The presence of VOCs in this area may be artifacts; therefore, no further conclusions were drawn from the multimedia investigation conducted in the area (Shaw, 2013a). As discussed in **Section A.1** for the SCOU, the monitoring data were subsequently reevaluated. The MCLs are the current compliance levels for groundwater and are summarized in **Table 3-8** and **Table A-1**. Exceedances of MCLs are captured in the LTM and reported in the LTM reports. Groundwater monitoring will be continued until the compliance levels are met. In addition, the remedy is protective because exposures to groundwater due to industrial or domestic water use consumption are prevented (for example, by providing city water for the properties near the SCOU and treatment for groundwater downgradient of FAA-A).

Changes in Land-Use and Exposure Assumptions

As stated above, the quantitative risk assessment identified contaminated groundwater, sediment, and soil as posing an unacceptable risk through both the ingestion and dermal exposure (direct contact) routes (WPAFB, 1994). Inhalation of indoor and outdoor air, and direct contact with surface water and leachate seeps were also identified as potential sources of elevated risk.

For purposes of the risk assessment, the exposed individual (the most at risk) was assumed to be a current resident who lives adjacent to the LFs for a period of 30 years and spends a certain amount of time trespassing on the LFs, resulting in direct contact with, and ingestion of, contaminated soil, sediment, and surface water. For the future land use scenario, the individual at most risk was a future resident who might build a home in such close proximity to the LFs as to be in direct contact via ingestion, inhalation of VOCs or particulates, or dermal absorption of contaminated soil, sediment, surface water, and/or groundwater, and live in the residence for 30 years.

By implementing the remedy described in the SCOU ROD, human and environmental contact with LF contents, contaminated soil, and leachate is prevented by the presence of the engineered cap. Continued contamination of groundwater and other risks associated with the generation and spread of leachate is reduced by the LF cap, leachate collection and treatment measures, and conversion of private well users to public water supplies. Active LFG control eliminates explosion fire, and inhalation risk associated with LFG. As stated in **Section 4.4**, groundwater continues to be monitored under the LTM. With respect to exposures to VOCs during construction or excavation work, the areas associated with these plumes are restricted from digging. Because excavation is not permitted, no structures have been constructed in these areas.

There has been no change in assumptions associated with the use of groundwater at WPAFB. As discussed in the introduction to this appendix and shown in **Table A-2**, however, USEPA had revised their default exposure factors since the ROD was issued. The updated factors were evaluated as part of the Fourth Five-Year Review (WPAFB, 2016a). On the basis of these changes alone (i.e., notwithstanding changes to toxicity values or chemical/physical parameters), the noncancer hazard index for the adult resident would be slightly higher. All other risks/hazards for soil and groundwater would be nearly equal or lower. Based on the evaluation, most risks and hazard indices based on the 2014 exposure factors were similar or lower than those based on the previous exposure factors. The exceptions were the hazard indices for groundwater exposures by the lifetime resident, which resulted in an increase of the cumulative hazard index by 7 percent. This evaluation continues to be valid as neither the *Exposure Factors Handbook* (USEPA, 2011a) nor the default exposure factors (USEPA, 2014b) have changed since the last Five-Year Review (WPAFB, 2016a). Also, given that land use for the SCOU is industrial, the conclusions of the original HHRA and previous Five-Year Reviews remain valid and the remedy for soil remains protective. In addition, groundwater use is restricted and the remedy for groundwater remains protective. Therefore, the changes to the default exposure factors for groundwater have little or no impact on the conclusions of the original risk assessment. Furthermore, these changes have no effect on the risk assessment because the compliance levels are based on the MCLs. The hypothetical receptors that were evaluated in the risk assessment are still valid and there are no new receptors to consider.

As discussed in **Section A.1**, the ESD (WPAFB, 2012a) removed the requirement to implement deed restrictions set forth in the RODs and established that the LUC Plan (Labat, 2012) would be used to manage and enforce land use controls (i.e., activity and use restrictions). Since the last Five Year Review, the LUC Plan has been replaced by the LUCIP (TetraTech, 2019). The LUCIP is now the primary administrative mechanism employed by WPAFB to determine which ICs are protective for the site and ensure that the current ICs remain environmentally compatible with future land use and are properly implemented. The ICs in place for the site include access and land use restrictions that limit potential exposure to contaminated media. Exceedances of MCLs are captured in the LTM and reported in the LTM reports. Groundwater monitoring will be continued until the compliance levels are met. In addition, the remedy is protective because exposures to groundwater due to industrial or domestic water use consumption are prevented (for example, by providing city water for the properties near the SCOU and treatment for groundwater downgradient of FAA-A).

Since the preparation of the OSOU ROD (WPAFB, 1994), USEPA, OEPA, DoD, and others have published guidance regarding the evaluation of vapor intrusion (USEPA, 2015; OEPA, 2020; DoD, 2009; ITRC, 2007). These guidance documents remain in effect. In addition, USEPA continues to maintain and update its VISLs for the applicable media (indoor air, sub-slab soil gas, and groundwater). The VISLs are derived using USEPA's on-line VISL Calculator (USEPA, 2019c), which is based on USEPA's most recent vapor intrusion guidance (USEPA, 2015) and current RSLs (USEPA, 2019a). Although VOCs are present in groundwater in Further Action Areas A and B, the areas associated with these plumes are restricted from excavation and construction work.

Migration toward on-site buildings or off-site residences and the potential for vapor intrusion continued to be monitored during this five-year period. Because of its proximity to LF8, 7 DuPont Way has a methane monitor, which is inspected quarterly. In addition, VOCs were observed in some of the soil gas sub-slab samples and an indoor air mitigation system was installed at a residence located at 5 DuPont Way (**Section 3.3**). The analytical results for sub-slab samples collected at 5 DuPont Way were compared with sub-slab screening levels (**Table 3-6**).

The system's performance is monitored with annual sub-slab soil gas monitoring of the residence. Low levels of several chemicals were detected (i.e., below their respective screening levels) in follow-up samples (**Table 3-6**). As seen in **Table 3-6**, VOC concentrations are below RSLs with the exception of concentrations of chloroform (6.5 $\mu g/m^3$ in January 2018 and 5.5 $\mu g/m^3$ in

October 2019) that exceeded an RSL of 4.1 μg/m^3 based on a risk level of 1 x 10^{-6}. As these concentrations only slightly exceeded 1 x 10^{-6}, risks associated with chloroform are at the lower end of USEPA's acceptable risk range of 1 x 10^{-6} to 1 x 10^{-4}. Sub-slab soil vapor sampling to monitor performance of the system will continue annually. Therefore, the mitigation system is operating as designed. According to the guidelines for determining the protectiveness of vapor intrusion, the measures implemented for DuPont Way are considered to be protective because a mitigation system was installed and has been shown to be functioning as intended to meet RAOs.

The groundwater data collected for the LTM program at the OSOU from 2015 to 2019 were also evaluated to determine the potential for vapor intrusion. These data were compared with groundwater VISLs, which were also derived using USEPA's calculator as described in the introduction of this appendix. Those monitoring wells with at least one exceedance of a VISL are shown in **Tables A-4** and **A-5** for LF8 and LF10, respectively. Exceedances of the industrial VISL for VC were found for one well at LF8 during this five-year period; the residential VISL for VC was exceeded in three wells. There were no exceedances of VISLs for wells at LF10 during this five-year period.

Based on the guidelines for determining protectiveness for the vapor intrusion pathway, the measures implemented for 5 DuPont Way are considered to be protective because a mitigation system was installed. In particular, performance of the indoor air mitigation system at the 5 DuPont Way residence is monitored with annual sub-slab gas monitoring. Follow-up samples indicate that the mitigation system is operating as designed.

As mentioned previously, ecological effects associated with surface water and sediment were subsequently addressed under the GWOU (WPAFB, 1999).

Changes in Toxicity Values

Toxicity values for cancer and non-cancer effects were used in the risk calculations for quantitative risk assessment for the OSOU. Current values in IRIS (USEPA, 2019b) were reviewed to determine whether the toxicity data had changed since the quantitative risk assessment had been conducted. Because USEPA's toxicity criteria had also been used to derive the PRG applied in the qualitative risk assessment for the SCOU **(Section 3.5.2.3**), many of the changes to the toxicity values were similar. Changes that are common to both the qualitative and quantitative risk assessments are summarized as follows:

- Several individual toxicity values that were used to calculate risk in the quantitative risk assessment for OSOU have changed. For the groundwater, most of the COCs also have

MCLs so the impact due to changes in the toxicity values is not an issue. For the soil, the cumulative impact of the more stringent toxicity values would be expected to be offset by the effects of those values that are now less stringent.

- Toxicity values are now available for some chemicals that did not have toxicity criteria at the time of the qualitative risk assessment.

- The selection of toxicity criteria for PCBs is based on a tiered approach (USEPA, 1996a). The current slope factor for PCB (2 per mg/kg/day), is less conservative than the previous value (7.7 per mg/kg/day).

- Oral toxicity criteria are adjusted to assess the dermal absorption pathway. As discussed in the Second, Third, and Fourth Five-Year Reviews, there were changes to some of the factors and assumptions used to calculate dermal toxicity values in the original risk assessment. Of these, the oral absorption factors for barium and chromium VI are more stringent. Although barium was a COC in OSOU groundwater, metals have since been eliminated from the LTM Program. Therefore, the impacts of these changes are still considered to be minimal. These changes would not be expected to change the overall conclusions of the quantitative risk assessment because there is no direct human contact with the media evaluated for the OSOU (i.e., groundwater, sediment, and soil).

- Some toxicity criteria are considered to be PPRTVs (USEPA, 2003b). According to USEPA's hierarchy, PPRTVs are Tier 2 sources because they have not undergone the multi-program review and consensus required for values to be placed in IRIS. In addition, some criteria are from Tier 3 sources, which have been developed by other EPA or non-EPA agencies. This hierarchy remains in effect.

- The SSLs have been developed to evaluate the potential for leaching of contaminants from soil to groundwater (USEPA, 1996b). There has been no change in this methodology since the Fourth Five-Year Review (WPAFB, 2016a). The presence of the LF caps that were installed as part of the remedy, however, reduces infiltration of water through soil associated with the LF. In addition, constituents that leach to groundwater would be addressed under the LTM Program.

As discussed in **Section A.1**, the purpose of **Table A-7** is to determine whether changes in toxicity values result in any new COCs in the LTM program. The MDCs of chemicals detected in groundwater samples collected in April 2019 were compared with current MCLs and RSLs. This comparison is shown in **Table A-7**. Three chemicals (chloromethane, trans-1,2-dichloroethene, and mercury) that had not been detected as part of the Fourth Five-Year Review were detected in April 2019 and evaluated for this review. Two chemicals (trans-1,2-dichloroethene and mercury) were below their respective MCLs. There is no MCL for chloromethane; however, the MDC was below the current tap water RSL. Therefore, no new COCs were identified during this five-year period. The remedy remains protective because the potential exposures to groundwater will continue to be managed through ICs.

In addition, TCE did not have IRIS-verified toxicity values at the time the ROD was established (WPAFB, 1994). The final version of the *Toxicological Review of Trichloroethylene* was issued in September 2011 (USEPA, 2011b). The verified oral and inhalation toxicity criteria were also posted in IRIS in September 2011. This new information does not change the conclusions of the original risk assessment for groundwater because TCE concentrations at the SCOU are ultimately compared with the MCL. In addition, TCE was not detected in wells for LF8 (**Table 3-4**) or LF10 (**Table 3-5**) as reported in this Five-Year Review. Although TCE was detected in recent soil gas samples, the concentrations in soil gas samples collected since the Fourth Five-Year Review have been below the screening levels.

As previously discussed, the SCOU ROD included compliance levels for COCs in soil. Although the landfills are capped and there are no direct exposures to soil, the compliance levels for soil are compared with current RSLs in **Table 3-9** and **Table A-3**. All of the current industrial RSLs are higher (and less conservative) than the compliance levels established in the SCOU ROD. Except for dieldrin, the current residential RSLs are also less conservative than the ROD compliance levels. Therefore, most compliance levels in the ROD are still considered to be protective. Although the ROD compliance level for dieldrin is no longer protective for unrestricted land use, the SCOU is currently subject to LUCs. These LUCs are expected to remain in effect for the foreseeable future.

There is no toxicity value for lead. For the quantitative risk assessment, lead was evaluated using the IEUBK model (Version 0.5, USEPA, 1991d; ES, 1993). The model results for the maximum soil and groundwater lead values for LFs 8 and 10 did not exceed the USEPA's 10 microgram(s) per deciliter (μg/dL) criterion for blood lead. The IEUBK model has been updated since the quantitative risk assessment was performed and the current version of the model is IEUBKwin V1.1-Build 11 (USEPA, 2007, 2010c). The conclusions of the original lead evaluation, however, are not affected. The maximum concentration of lead surface soil at LFs 8 and 10 was 32.7 mg/kg, which is below USEPA's current residential lead level of 400 mg/kg (USEPA, 1994b). Although the maximum detected concentration of lead in subsurface soil at LFs 8 and 10 (930 mg/kg in LF8 Test Pit Soil) exceeded the residential lead level, this elevated concentration represented the only sample out of 200 subsurface soil samples that was greater than 354 mg/kg (ES, 1993). The 95 percent upper confidence limit (UCL) on the arithmetic mean lead concentration for subsurface soil was 60.9 mg/kg, which is below the residential lead level of 400 mg/kg. In addition, USEPA developed the ALM to evaluate occupational exposures to lead (USEPA, 2003a) and the RSL of 800 mg/kg for industrial soil has not changed (USEPA, 2019a). While the input parameters for models evaluating the uptake of lead in children and adults have changed, the action level for lead in soil (400 mg/kg) has not changed and is considered to be protective. If the IEUBK model and ALM were to be applied to the soil in place at LF8, however, the model inputs would be based on the arithmetic mean rather than the maximum detected concentration or the 95 percent UCL. Furthermore, the selected remedy prevents exposure to LF8 soil, therefore, the remedial efforts at LF8 are still considered to be protective.

Changes in RAOs and Cleanup Goals

The NA alternative was selected for the OSOU because the SCOU remedial action was considered to be comprehensive and would address all exposure pathways where a risk was identified; therefore, there are no RAOs or cleanup levels for the OSOU. The remedy described in the OSOU ROD (WPAFB, 1994) continues to be protective because exposure to groundwater is managed. The mitigation system implemented to address vapor intrusion at 5 DuPont Way has been effective in reducing VOCs in sub-slab soil vapor to concentrations at or below the screening levels.

A.3 21 No Action Sites

The 21 No Action (NA) sites were reviewed with respect to the ARARs, the exposure assumptions, and the toxicity data that were in effect at the time of the decision for the site. No numerical RAOs were specified for the site because the remedy called for institutional controls. However, the narrative RAO was to prevent human exposure to contaminants at levels above ARARs and/or residential risk-based levels. The risk results for each site are summarized in **Table 5-3**. **Table 5-6** provides a summary of the technical assessment for each site. A brief overview of the evaluation is provided in the sections below. The following documents were reviewed with respect to risk assessment data:

- *Record of Decision for 21 No Action Sites* (WPAFB, 1996).
- *Guidance Manual for the Integrated Exposure Uptake Biokinetic (IEUBK) Model for Lead in Children* (USEPA, 1994a).
- *Soil Screening Guidance: Technical Background Guidance* (USEPA, 1996b).
- *Petroleum UST Corrective Action, Guidance Document, Version 5.0*. Ohio Department of Commerce, Division of State Fire Marshal, Bureau of Underground Storage Tank Regulation (BUSTR) (ODC), 1999).
- *Record of Decision, Groundwater Operable Unit, Groundwater Basewide Monitoring Program, Wright-Patterson Air Force Base* (WPAFB, 1999).
- *Technical Guidance Manual for 1999 Closure and Corrective Action Rules*, BUSTR (ODC, 2001).

- *Comprehensive Five-Year Review Guidance* (USEPA, 2001).
- *Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risks Associated with Adult Exposure to Lead in Soil* (USEPA, 2003a).
- *Human Health Toxicity Values in Superfund Risk Assessments* (USEPA, 2003b).
- *Risk Assessment Guidance for Superfund (RAGS), Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment)* (USEPA, 2004).
- *Technical Guidance Manual for Closure, Corrective Action, and Petroleum Contaminated Soil Rules*, BUSTR (ODC, 2005).
- *Final Second Five-Year Record of Decision Review Report* (Shaw, 2006).
- *User's Guide for the Integrated Exposure Uptake Biokinetic (IEUBK) Model for Lead in Children Windows® Version* (USEPA, 2007).
- *Institutional Controls: A Guide to Planning, Implementing, Maintaining, and Enforcing Institutional Controls at Contaminated Sites, Interim Final*, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, OSWER 9355.0-89, EPA-540-R-09-001, November (USEPA, 2010a).
- Integrated Exposure Uptake Biokinetic Model for Lead Windows Version - IEUBKwin V1.1 Build 11 (USEPA, 2010c).
- *Exposure Factors Handbook – 2011 Edition, Final,* (USEPA, 2011a).
- *Toxicological Review of Trichloroethylene. In Support of Summary Information on the Integrated Risk Information System (IRIS)* (USEPA, 2011b).
- *Third Five-Year Record of Decision Review Report* (WPAFB, 2011).
- *Memorandum Clarifying the Use of Protectiveness Determinations for Comprehensive Environmental Response, Compensation, and Liability Act Five-Year Reviews* (USEPA, 2012a).
- T*oxicological Review of Tetrachloroethylene (Perchloroethylene)*. In Support of Summary Information on the IRIS, USEPA, EPA/635/R-08/011F (USEPA, 2012c).
- *Explanation of Significant Differences: Source Control Operable Unit - Landfills 8 and 10; Off-Source Operable Unit and Final Remedial Action Landfills 8 and 10; 21 No Action Sites; Spill Sites 2, 3, and 10 (Operable Unit 2); 41 No Action Sites; and Groundwater Operable Unit* (WPAFB, 2012a).
- *Technical Guidance Manual for Closure, Corrective Action, and Petroleum Contaminated Soil Rules*, BUSTR (ODC, 2014).

- *Memorandum: Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors* (USEPA, 2014b).
- *Fourth Five-Year Record of Decision Review Report* (WPAFB, 2016a).
- *Bureau of Underground Storage Tank Regulation (BUSTR) Technical Guidance Manual for Closure, Corrective Action, and Petroleum Contaminated Soil Rules*, Ohio Department of Commerce (ODC), Division of State Fire Marshal, Bureau of Underground Storage Tank Regulation (ODC, 2017).
- *Toxicological Review of Benzo(a)pyrene***,** Integrated Risk Information System, January (USEPA, 2017).
- *Final Site Inspection (SI) Report of Aqueous Film Forming Foam Areas at Wright-Patterson Air Force Base, Ohio* (Aerostar, 2018).
- *Memorandum for Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program,* 15 October (DoD, 2019).
- *Land Use Control Implementation Plan at Wright Patterson Air Force Base, Ohio*, TetraTech, Inc., February 2019 (TetraTech, 2019).
- *U.S. Environmental Protection Agency (USEPA) Regions 3, 6, and 9. Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites. http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm* (USEPA, 2019a).
- Integrated Risk Information System (IRIS). On-line. *Drinking Water Standards and Health Advisories.* http://water.epa.gov/drink/contaminants/index.cfm (USEPA, 2019b).
- Regional Screening Level (RSL) Calculator, On-line. http://www.epa.gov/oswer/vaporintrusion/guidance.html#Item6. Accessed: November 2019 (USEPA, 2019d).

Site-specific documents reviewed for this evaluation are listed in **Table 5-6**.

Changes in ARARS and TBCs

The purpose of the ARARs review is to determine whether recently promulgated or modified requirements of federal or state of Ohio environmental regulations are applicable or relevant and appropriate, and if modifications of regulations during the past five years call into question the protectiveness of the remedy (USEPA, 2001, 2012a). Changes to the ARARs since the Fourth Five-Year Review (WPAFB, 2016a) are discussed in this section.

Three of the NA sites (FTA5, TR49A, and UST30119) were closed in accordance with the Bureau of Underground Storage Tank (BUSTR). The BUSTR regulations (OAC 1301:7-9-13) were revised in 1999, 2001, 2005, 2014, and 2017 (ODC 1999, 2001, 2005, 2014, 2017). As part of the revisions to these regulations, the action levels for protection of human health were expanded to address specific exposure pathways. Corrective actions completed prior to March 31, 1999 are not affected by the updated rules. Therefore, the NA alternative is still protective.

No new ARARs were promulgated for the COCs listed in the ROD for the remaining 18 sites.

Information TBCs in the original risk assessment included toxicity values from USEPA's IRIS and risk-based screening values based on PRG from USEPA Region 9. The changes to the toxicity values and risk-based screening levels since the Fourth Five-Year Review (WPAFB, 2016a) are discussed in the introduction to this appendix. Site-specific changes are discussed below.

As discussed in **Section 2.6**, PFCs are considered emerging contaminants. PFOS/PFOA have been detected in soil and groundwater at WPAFB. In particular, PFOS/PFOA are typically associated with AFFF used at Fire Training Areas (FTAs). As mentioned previously, there are currently no promulgated standards for PFOS/PFOA in soil or groundwater. Furthermore, there are no screening levels published in USEPA's RSL table and no IRIS-verified toxicity values or PPRTVs.

To evaluate the soil concentrations, screening levels were calculated for PFOS/PFOA using toxicity values derived by the Office of Water in support of the HAL and default exposure assumptions for potential receptor scenarios as contained in EPA's on-line RSL calculator (DoD, 2019). The calculated RSL for soil was applied to the SI data at the FTAs for screening purposes. As some concentrations of PFOS/PFOA at the FTAs have exceeded the calculated RSL for soil (0.13 mg/kg), further evaluation will be performed through risk assessment as part of on-going investigations. An ESI was conducted in 2019 at 7 sites including AFFF Area 21 (FTAs 2 and 5), which has not been finalized, and an RI is programmed for FY21 to evaluate the potential PFOS/PFOA contamination at these sites.

The PFOS/PFOA in the soil at the FTAs are a source of groundwater contamination and the presence of PFOS/PFOA in the groundwater is an indication that these compounds have leached from the soil. Currently, the drinking water HAL for PFOS and PFOA (and in combination) of 70 ppt (0.070 µg/L or 70 ng/L) (USEPA, 2016) is a TBC value in the interim. No other perfluorinated compounds have HALs. There has been no change in the HAL since the Fourth Five-Year Review (WPAFB, 2016a) or the completion of the SI (Aerostar, 2018). Groundwater associated with the 21 NA sites is monitored as part of the LTM program and is addressed in **Section 8.0** of this Five-Year Review under the GWOU.

Changes in Land-Use and Exposure Assumptions

Exposure scenarios and assumptions varied by site. In general, a commercial/industrial land use scenario was assumed for sites being evaluated by a semi-quantitative risk assessment (i.e., screening assessment using PRG). Usually, the only receptors considered were industrial workers. For sites evaluated by a quantitative risk assessment, an industrial land use scenario was also used. Receptors considered for evaluation to potential exposure of contaminants included combinations of the following: industrial worker, maintenance worker, construction worker, and trespasser. At some sites, a potential recreational scenario was also assumed.

With regard to exposure assumptions in the quantitative risk assessment, there have been no changes to the exposure pathways that were evaluated for direct contact since the Fourth Five-Year Review (WPAFB, 2016a); however, USEPA replaced the PRGs with the RSLs in 2008. The RSLs are updated approximately every 6 months and the most current version of the RSLs is November 2019 (USEPA, 2019a).

In addition, as described in the introduction to this appendix, the USEPA issued a substantive update to its exposure assessment recommendations in September 2011 (USEPA, 2011a). In February 2014, USEPA issued OSWER Directive 9200.1-120 (USEPA, 2014b) to adopt the updated guidance for standard default exposure factors for use in the CERCLA risk assessments. The default exposure factors that had changed since the baseline HHRA and previous Five-Year Reviews are summarized in **Table A-2**. The updated factors were evaluated as part of the Fourth Five-Year Review (WPAFB, 2016a). Based on the evaluation, most risks and hazard indices based on the 2014 exposure factors were similar or lower than those based on the previous exposure factors. The exceptions were the hazard indices for groundwater exposures by the hypothetical lifetime resident, which resulted in an increase of the cumulative hazard index by 7 percent. This evaluation remains valid as neither the *Exposure Factors Handbook* (USEPA, 2011a) nor the default exposure factors (USEPA, 2014b) have changed since the last Five-Year Review (WPAFB, 2016a). In summary, although some of the land use designations for the 21 NA Sites have changed since the previous Five-Year Review, the allowable land uses that were originally evaluated at these sites are essentially the same. The industrial exposure scenario used in the original HHRA was sufficiently conservative to cover the current mix of industrial use at the 21 NA Sites. Similarly, land uses at those sites that included a recreational exposure scenario have not changed since the previous review. Therefore, the conclusions of the original HHRA and previous Five-Year Reviews remain valid.

An ESD was approved in 2012 to address six RODs including the 21 NA Sites (WPAFB, 2012a). As described in the introduction to this appendix, this ESD clarified the implementation of ICs for each of the RODs. The LUCIP (TetraTech, 2019) is the primary administrative mechanism employed by WPAFB to determine which ICs are protective for the site and ensure that current ICs remain environmentally compatible with future land use and are properly implemented.

Land use of the 21 NA sites includes industrial, industrial training-areas, commercial, and recreational (TetraTech, 2019). There are currently two systems in place for alerting the IRP office that land use could change. The first system is through the use of Form 103, a clearance required whenever digging will occur anywhere at WPAFB. Form 103 must be submitted to the Office of Civil Engineering prior to excavating or digging. The site is then evaluated for potential risks, including environmental exposures. The second system requires the submittal of Form 813 to the IRP office prior to construction activities at WPAFB. The IRP office reviews the information and determines if the proposed construction is located at, or near, an IRP site, or if construction activities will affect an IRP site. Based on the future land use for these sites in the WPAFB Base Comprehensive Plan and on information provided by these two systems and site visits that are conducted at the base as part of on-going environmental programs, land use is expected to remain unchanged at all of the sites covered in the 21 Sites ROD.

With respect to potential exposures to VOCs in soil and groundwater during construction or excavation work, the areas associated with residual contamination from these compounds are restricted from digging. The exposure scenarios continue to remain valid for the foreseeable future because the land use for these sites will continue to be classified as industrial. There are no current exposures resulting from the migration of VOCs from groundwater into buildings via vapor intrusion. With the exception of LTCSA and BS1, there are currently no buildings or structures located at these sites. It is also likely that concentrations of VOCs at these sites have continued to decline over the past several years; therefore, the remedy remains effective.

As discussed in **Section 5.5.2.2**, the LTCSA and BS1 sites have been excavated/developed since the Fourth Five-Year Review. These areas have recently undergone excavation and construction for development of a new entry control point/Gate 26A, which is also referred to as a commercial truck inspection gate. This commercial truck inspection facility recently relocated from State Route 444 and Communications Boulevard. The inspection facility and paved roadways leading to and from the facility cover most of BS1 and part of the northeastern corner of the LTCSA. For Gate 26A, it is noted that the monitoring wells have been abandoned because there has been no groundwater contamination found in this area. Therefore, exposures due to vapor intrusion are not expected to occur at BS1 and LTSCA.

Exposures to groundwater associated with drinking water or other domestic purposes, also continue to be prevented because exposures to groundwater due to industrial or domestic water use consumption are prevented. Water pumped from on-Base production wells is treated prior to distribution. Furthermore, groundwater is monitored in accordance with the GWOU ROD (WPAFB, 1999).

Changes in Toxicity Values

The IRIS database (USEPA, 2019b) was reviewed to determine whether the toxicity data had changed since the quantitative risk assessments had been conducted.

- Several individual toxicity values that were used in the quantitative risk assessments have changed. The cumulative impact of the more stringent toxicity values would be expected to be offset by the effects of those values that are now less stringent.

- Toxicity values are now available for some chemicals that did not have toxicity criteria at the time of the qualitative risk assessment. In particular, several toxicity values are now available for the inhalation pathway. For example, inhalation toxicity criteria are now available for several VOCs, including PCE (USEPA, 2012c) and TCE (USEPA, 2011b).

- The PAHs were identified as COCs in soil at BS1, LTCSA, TCSP, FTA2, FTA3, FTA4, FTA5, LF14, SP1, FTA1, and EFDZ1. As discussed in the introduction to **Appendix A**, USEPA issued an updated *Toxicological Review of Benzo(a)pyrene* under the IRIS Program in January 2017 (USEPA, 2017). This review updated the previous IRIS assessment of benzo(a)pyrene, which had been used since 1987. It was based on studies conducted after 1987 and the 2011 recommendations for the improvement of IRIS toxicity assessments.

  Benzo(a)pyrene is now identified as “carcinogenic to humans” rather than the 1987 “probable human carcinogen” weight-of-evidence classification. USEPA (2019b, 2017) provided a verified oral cancer SF for benzo(a)pyrene of 1.0E+0 per mg/kg-day and a verified IUR of 6.0E-4 per µg/m^3 in 2017.

  Although the IRIS database currently indicates that the toxicity criteria for benzo(a)pyrene have been “suspended” (USEPA, 2019b), the updated oral cancer SF (1.0E+0 per mg/kg-day) and the IUR (6.0E-4 per µg/m^3) continue to be included in the current RSL table (USEPA, 2019a) and applied in the RSL calculator (USEPA, 2019d). When compared with the previous oral SF (7.30E+0 per mg/kg-day), the current toxicity value represents a higher dose and, therefore, is less stringent. It is noted, however, that there was previously no IRIS-verified IUR for benzo(a)pyrene.

  There are no IRIS-verified toxicity values for the remaining carcinogenic PAHs; however, these values have been derived from the SF and IUR for benzo(a)pyrene using their corresponding RPFs. The resulting values are used to develop RSLs for these compounds.

In addition, the RSL table now includes an RfD (3.0E-4 mg/kg-day) and an RfC (2.0E-6 mg/m^3). Previously, there were no noncancer-based toxicity values available for benzo(a)pyrene. Both of these toxicity values are based on developmental effects.

- As described in **Section 2.6**, PFCs are considered emerging contaminants. As part of the development of the HAL, USEPA applied candidate toxicity values in the derivation of toxicity values for PFOS/PFOA. The HAL was based on a candidate RfD of 2.0E-05 mg/kg/day and a SF of 7.0E-02 $(mg/kg/day)^{-1}$. Although the RfD and SF are available in USEPA's on-line RSL calculator (USEPA, 2019c), these values have not yet been peer reviewed at the level required to be considered an IRIS value or further evaluated as PPTRVs. With the exception of RSLs for a related compound (PFBS), however, there are no RSLs for tap water or soil listed in the RSL table for PFOS, PFOA, or a combination of these compounds (USEPA, 2019a). The DoD issued guidance on October 15, 2019 to address investigations of sites with per- and polyfluoroalkyl substances within the DOD Cleanup Program (DoD, 2019). As discussed in **Section 2.6.2**, DoD derived conservative screening levels using USEPA's on-line RSL calculator as part of this guidance. The resulting residential screening level for PFOS and PFOA in soil is 0.13 mg/kg while the industrial screening level is 1.6 mg/kg. These values were applied in the SI conducted at AFFF areas at WPAFB (Aerostar, 2018).

- Oral toxicity criteria are adjusted to assess the dermal absorption pathway (USEPA, 2004). As discussed in the Second and Third Five-Year Reviews, there were changes to some of the factors and assumptions used to calculate dermal toxicity values in the original risk assessment.

- Some of the toxicity criteria are considered PPRTVs (USEPA, 2003b), which represent the second-tier of human health toxicity values. These values have been developed specifically for USEPA's Superfund Program and have not undergone the multi-program review and consensus required for values to be placed in IRIS. In addition, USEPA has identified Tier 3 or other EPA and non-EPA sources were also used.

The "no action" sites were evaluated to determine whether additional measures would be needed if changes in toxicity values resulted in exceedances of acceptable limits for cancer risk or noncancer hazard for the industrial/commercial scenario. Although the soil at the "No Action" sites is subject to the provisions of the LUCIP (TetraTech, 2019), the screening levels and/or toxicity values were evaluated at sites where exposures to surface soil could occur. Sites at which removal actions had been taken or soil had been capped were not included. In addition, sites where semi-quantitative risk assessment had indicated very low levels of contamination were not further assessed. The rationale for further evaluating screening levels or toxicity values for specific sites is provided in **Table A-8**. For the subset of sites evaluated, the screening levels used in the semi-quantitative risk assessments were compared with current screening levels in **Table A-9**. The comparisons of cancer and noncancer toxicity values for the oral/dermal and inhalation routes are provided in **Tables A-10** through **A-13**. In cases where the current screening levels and toxicity values were more stringent than those used in the original risk assessment, the exposure point concentrations (EPCs) from the original risk assessments were used to proportionally estimate the current cancer risk and noncancer hazard based on the current RSL (**Table A-14**). These calculations indicate that the more stringent toxicity values cumulatively resulted in cancer risks within or below the acceptable risk range. All noncancer hazard quotients were below 1.

For several sites, exposures to lead in soil were evaluated using the IEUBK Model, Version 0.99 (USEPA, 1994a), which does not address adult exposures to lead. Since the 21 NA sites risk assessments were performed, the IEUBK model has been updated to the IEUBKwin V1.1, Build 11 (USEPA, 2007, 2010c). In addition, the USEPA has since developed the ALM to evaluate occupational exposures to lead (USEPA, 2003a). The use of the ALM would not impact the remedy because the IEUBK model conservatively addresses potential exposures to the most sensitive population.

Finally, USEPA developed the *Soil Screening Guidance* (USEPA, 1996b) as a framework for screening contaminated soils that encompasses both simple (i.e., screening-level) and more detailed approaches for calculating site-specific SSLs. In particular, this guidance presents methodologies to address the leaching of contaminants through soil to an underlying potable aquifer. These methodologies have not changed since the Fourth Five-Year Review (WPAFB, 2016a). Given the period of time the sites have existed, migration of chemicals from the sites has most likely occurred. The use of the SSLs would have no effect on the remedy. Groundwater is being monitored under the LTM Program.

Changes in RAOs and Cleanup Goals

No numerical RAOs were specified for the site because the remedy called for institutional controls. However, the narrative RAO is to prevent human exposure to COCs in soil at these sites as identified in the ROD. The NA alternative was selected as remedy for all 21 NA sites (i.e., the USAF determined that no remedial action was necessary to ensure protection of human health and the environment at these sites). This decision was based on the evaluation of analytical data and current site conditions at the time of the site inspections. (Because institutional controls [ICs] and engineering controls [ECs] were already in place at the 21 IRP sites when the ROD was written (WPAFB, 1996), the selected remedy is considered a “limited action” according to USEPA IC guidance document [USEPA, 2010a] rather than a “no action” remedy.) The 21 NA Sites ROD states that groundwater, surface water, and sediment would be monitored under the LTM Program. Thus, the RAO for these sites is to prevent exposure to hazardous substances until and unless unlimited use and unrestricted exposure levels are attained at each individual site.

To prevent exposure to soil, ICs and access/land-use restrictions are in place at all of the sites (e.g., there are ICs in place [such as dig permits] at all of the sites). Additionally, some sites have fencing around them, further limiting access. Digging or excavation at any of the 21 sites, especially those with waste/contamination left in place (e.g., LF13, HP3, FTA5), is currently restricted by ICs prohibiting excavation, and is expected to remain restricted. Therefore, the RAO is still valid. If portions of WPAFB are sold, the proposed land use would need to be evaluated to determine if it was consistent with the ROD requirements.

A.4 Spill Sites SPs 2, 3, and 10

The ROD for SPs 2, 3, and 10 within Operable Unit 2 (WPAFB, 1997b) addressed the remediation of subsurface soil and groundwater at the Petroleum, Oil, and Lubricants (POL) Storage Area at WPAFB. A brief summary is provided in **Chapter 6.0** describing the history and chronological events leading to the Remedial Action Completion Report (RACR) that was approved by the OEPA and USEPA in September 2018.

A *Final Remedial Action Completion Report: Record of Decision for Spill Sites 2, 3, and 10 (Within Operable Unit 2)* was completed in July 2018 that documented WPAFB completed all response actions at SPs 2, 3, and 10 in accordance with Close Out Procedures for National Priority List (NPL) Sites. The RACR demonstrated the selected remedy achieved the goals for groundwater and soil and that benzene, toluene, ethylbenzene, and xylenes (BTEX) compounds were below drinking water MCLs at all groundwater monitoring locations for at least five years and had not leached from soils to groundwater. This five-year timeframe also indicated that rebound of BTEX concentrations had not occurred and had satisfied the ROD requirement (WPAFB, 2018). The RACR was signed by OEPA on September 11, 2018 and by USEPA on September 17, 2018. WPAFB expects that the USEPA will delete this site from the NPL. Therefore, no further technical assessment was performed for these sites as part of this Five-Year Review.

A.5 41 No Action Sites

The 41 NA sites were reviewed with respect to the ARARs, the exposure assumptions and the toxicity data that were in effect at the time of the decision for the site. No RAOs were specified for the sites because no remedy other than institutional controls was selected. The risk results are summarized in **Table 7-4**. **Table 7-7** provides the summary of the technical assessment for each site. A brief overview of the evaluation is provided in the sections below.

The following documents were reviewed with respect to risk assessment data:

- *Record of Decision for 41 No Action Sites at Wright-Patterson Air Force Base, Ohio,* (WPAFB, 1998).
- *Final Basewide Removal Action Plan for Landfill Capping* (IT, 1994).
- *Guidance Manual for the Integrated Exposure Uptake Biokinetic (IEUBK) Model for Lead in Children* (USEPA, 1994a).
- *Soil Screening Guidance: Technical Background Guidance* (USEPA, 1996b).
- *Petroleum UST Corrective Action, Guidance Document, Version 5.0,* BUSTR (ODC, 1999).
- *Technical Guidance Manual for 1999 Closure and Corrective Action Rules*, BUSTR (ODC, 2001).
- *Comprehensive Five-Year Review Guidance, U.S. Environmental Protection Agency,* (USEPA, 2001).
- *Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risks Associated with Adult Exposure to Lead in Soil* (USEPA, 2003a).
- *Human Health Toxicity Values in Superfund Risk Assessments* (USEPA, 2003b).
- *Risk Assessment Guidance for Superfund (RAGS), Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment)* (USEPA, 2004).
- *Technical Guidance Manual for Closure, Corrective Action, and Petroleum Contaminated Soil Rules*, BUSTR (ODC, 2005).
- *Final Second Five-Year Record of Decision Review Report* (Shaw, 2006).
- *User's Guide for the Integrated Exposure Uptake Biokinetic (IEUBK) Model for Lead in Children Windows® Version* (USEPA, 2007).
- *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, Part F, Supplemental Guidance for Inhalation Risk Assessment*, Final (USEPA, 2009).
- *Institutional Controls: A Guide to Planning, Implementing, Maintaining, and Enforcing Institutional Controls at Contaminated Sites, Interim Final* (USEPA, 2010a).
- *Toxicological Review of cis-1,2-Dichloroethylene and trans-1,2-Dichloroethylene. In Support of Summary Information on the IRIS* (USEPA, 2010b).
- Integrated Exposure Uptake Biokinetic Model for Lead Windows Version - IEUBKwin V1.1 Build 11 (USEPA, 2010c).
- *Exposure Factors Handbook – 2011 Edition, Final* (USEPA, 2011a).

- *Toxicological Review of Trichloroethylene. In Support of Summary Information on the Integrated Risk Information System (IRIS)* (USEPA, 2011b).

- *Third Five-Year Record of Decision Review Report* (WPAFB, 2011).

- *Memorandum Clarifying the Use of Protectiveness Determinations for Comprehensive Environmental Response, Compensation, and Liability Act Five-Year Reviews* (USEPA, 2012a).

- *Assessing Protectiveness at Sites for Vapor Intrusion: Supplement to the "Comprehensive Five-Year Review Guidance"* (USEPA, 2012b).

- *Toxicological Review of Tetrachloroethylene (Perchloroethylene). In Support of Summary Information on the IRIS* (USEPA, 2012c).

- *Recommendations for Default Value for Relative Bioavailability of Arsenic in Soil*. USEPA, Office of Solid Waste and Emergency Response, OSWER 9200.1-113 (USEPA, 2012d).

- *Explanation of Significant Differences: Source Control Operable Unit - Landfills 8 and 10; Off-Source Operable Unit and Final Remedial Action Landfills 8 and 10; 21 No Action Sites; Spill Sites 2, 3, and 10 (Operable Unit 2); 41 No Action Sites; and Groundwater Operable Unit* (WPAFB, 2012a).

- *Technical Guidance Manual for Closure, Corrective Action, and Petroleum Contaminated Soil Rules*, BUSTR (ODC, 2014).

- *Memorandum: Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors* (USEPA, 2014b).

- *Fourth Five-Year Record of Decision Review Report* (WPAFB, 2016a).

- *Technical Guidance Manual for Closure, Corrective Action, and Petroleum Contaminated Soil Rules*, BUSTR (ODC, 2017).

- *Toxicological Review of Benzo(a)pyrene***,** Integrated Risk Information System, January. (USEPA, 2017).

- *Land Use Control Implementation Plan at Wright Patterson Air Force Base, Ohio*, TetraTech, Inc., February 2019 (TetraTech, 2019).

- U.S. Environmental Protection Agency (USEPA) Regions 3, 6, and 9. Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites. http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm (USEPA, 2019a)

- Integrated Risk Information System (IRIS). On-line (USEPA, 2019b).

- Regional Screening Level (RSL) Calculator, On-line. http://www.epa.gov/oswer/vaporintrusion/guidance.html#Item6. Accessed: November 2019 (USEPA, 2019d).

Site-specific documents reviewed for this evaluation are listed in **Table 7-7**.

Changes in ARARS and TBCs

The purpose of the ARARs review is to determine whether recently promulgated or modified requirements of federal or state of Ohio environmental regulations are applicable or relevant and appropriate, and if modifications of regulations during the past five years call into question the protectiveness of the remedy (USEPA, 2001, 2012a). Changes to the ARARs since the last five-year review are discussed in this section.

While there were no chemical-specific ARARs or TBCs listed in the ROD for most of the 41 NA sites, ARARs or TBCs were applied as appropriate to each risk evaluation. The ARARs and/or TBCs for each site are described in **Table 7-7**.

No action-specific ARARs were listed in the ROD for the 41 sites. The remedy selected for each of the 41 sites addressed in the ROD is the NA alternative, which is based on restricted land use and ICs. There are no new action-specific ARARs that would impact the protectiveness of the remedy.

In addition to restricted land use and ICs, the NA alternative for LFs 1 through 7, 9, and 11 relied upon maintenance of the LF caps, implemented as presumptive remedies, to maintain protection to human health and the environment. As part of the requirements for capping, maintenance of the LF caps will be conducted as described in the Operation and Maintenance (O&M) Plans specific to each LF. ARARs for the presumptive remedies were discussed in the *Final Basewide Removal Action Plan for Landfill Capping* (IT, 1994). There are no changes in the action-specific ARARs that would impact the protectiveness of the presumptive remedy.

Prior to 1992, several NA sites (SP4, SP7, SP9, UST 71A, UST 4020, ERTR) were closed in accordance with BUSTR. The BUSTR regulations (OAC 1301:7-9-13) were revised in 1999, 2001, 2005, 2014, and 2017 (ODC, 1999, 2001, 2005, 2014, 2017). As part of the revisions to these regulations, the action levels for protection of human health were expanded to address specific exposure pathways. Corrective actions completed prior to March 31, 1999 are not affected by the new updated rules; thus, because these sites were closed prior to 1992, they were not impacted by the new rules.

Two of the NA sites (SPs 6 and 8) were evaluated in accordance with cleanup levels under the Toxics Substances Control Act (TSCA). There have been no changes to cleanup levels for PCBs under TSCA.

Information to be considered includes PRGs from Regions 3 and 9, as used in the original risk assessments, RSLs (USEPA, 2019a), and toxicity values from USEPA's IRIS (USEPA, 2019b). General changes to the information to be considered since the last five-year review are discussed in the introduction to this appendix. Site-specific changes are discussed below.

Changes in Land-Use and Exposure Assumptions

Land use of the 41 NA sites includes industrial (including lab), commercial, and recreational (TetraTech, 2019). There are currently two systems in place for alerting the IRP office that land use could change. The first system is through the use of Form 103, a clearance required whenever digging will occur anywhere at WPAFB. Form 103 must be submitted to the Office of Civil Engineering prior to excavating or digging. The site is then evaluated for potential risks, including environmental exposures. The second system requires the submittal of Form 813 to the IRP office prior to construction activities at WPAFB. The IRP office reviews the information and determines if the proposed construction is located at or near an IRP site, or if construction activities will affect an IRP site. Based on information provided by these two systems and site visits that are conducted at the base as part of on-going environmental programs, land use has remained unchanged at most of the sites covered in the 41 Sites ROD. With the exception of two sites, there were no changes in land use since the previous Five-Year Review (**Table 7-2**). All of the current uses are compatible with the allowable use. There have been changes observed at LF6 and LF7. LF6 was formerly a horse pasture and remains only a grassy area. LF7 is no longer used as an Equestrian Center. It remains a grassy area and is the southern portion of a driving range for the golf course. Land use at both locations is still considered outdoor recreation. The remedy remains protective at both sites.

Exposure scenarios and assumptions varied by site. In general, a commercial/industrial land use scenario was assumed for sites being evaluated by a semi-quantitative risk assessment (i.e., screening assessment using RSLs). Usually, the only receptor considered would be industrial workers. For sites evaluated by a quantitative risk assessment, an industrial land use scenario was also used. Receptors considered for evaluation to potential exposure of contaminants include some of the following: industrial worker, maintenance worker, construction worker, recreational visitor, and trespasser. Since land use for these sites will remain unchanged, exposure scenarios remain valid.

An ESD was approved in 2012 to address six RODs including the 41 NA Sites (WPAFB, 2012a). This ESD modified the IC provisions for all of the RODs. As a result, the LUCIP (TetraTech, 2019) is the primary administrative mechanisms employed by WPAFB to determine which ICs are protective for the site and ensure that current ICs remain environmentally compatible with future land use and are properly implemented. There are no current plans to transfer any of the properties associated with these sites; however, if a different land use were to be proposed, an amended risk assessment would be performed to evaluate the new land use.

There have been no changes to the exposure pathways that were evaluated for direct contact since the Fourth Five-Year Review (WPAFB, 2016a). As described in the introduction to this appendix, the USEPA has updated the default exposure factors used in the original risk assessment (USEPA, 2011a, 2014b). The default exposure factors that have changed since the baseline HHRA and previous Five-Year Reviews are summarized in **Table A-2.** The updated factors were evaluated as part of the Fourth Five-Year Review (WPAFB, 2016a). As a result of the updated exposure factors, some of the screening levels would now be more stringent or would result in a higher risk/hazard estimate, while others would result in a less stringent screening level or lower risk/hazard estimate. This evaluation remains valid as neither the *Exposure Factors Handbook* (USEPA, 2011a) nor the default exposure factors (USEPA, 2014b) have changed since the last Five-Year Review (WPAFB, 2016a). In summary, although some of the land use designations for the 41 NA Sites have changed since the previous Five-Year Review, the allowable land uses that were originally evaluated at these sites are essentially the same. The industrial exposure scenario used in the original HHRA was sufficiently conservative to cover the current mix of industrial use at the 41 NA Sites. Similarly, land uses at those sites that included a recreational exposure scenario have not changed since the previous review. Therefore, the conclusions of the original HHRA and previous Five-Year Reviews remain valid and the remedy for soil remains protective.

There are dig restrictions that prevent potential exposures to COC in soil and groundwater during construction or excavation work. There are no exposures resulting from the migration of VOCs from groundwater into buildings via vapor intrusion because there are currently no buildings located at these sites.

As discussed in the introduction of this appendix, USEPA has issued recommendations for assessing protectiveness at sites for vapor intrusion as a supplement to the Comprehensive Five-Year Review Guidance (USEPA, 2001, 2012b). This guidance provides protectiveness statement options and describes how possible situations may affect protectiveness determinations. The following evaluations have addressed the potential for soil gas migration at several landfills within OU4.

Soil gas monitoring at OU4 is conducted to evaluate the potential for methane migration into the surrounding buildings. However, the majority of the original buildings were removed prior to the Fourth Five-Year Review (WPAFB, 2016a) and there have been no other land use changes. Currently, soil gas monitoring at LF4 consists only of quarterly methane/landfill gas measurements at soil vapor probe LG-10 and Building 10879. It is noted that there are no toxicity values for methane. Therefore, changes to toxicity values do not apply to this soil gas evaluation. The remedy remains protective of human health and the environment under current and future land use.

Changes in Toxicity Values

The IRIS database (USEPA, 2019b) was reviewed to determine whether the toxicity data had changed since the quantitative risk assessments had been conducted.

- Several individual toxicity values that were used in the quantitative risk assessments have changed. The cumulative impact of the more stringent toxicity values would be expected to be offset by the effects of those values that are now less stringent.

- Toxicity values are now available for some chemicals that did not have toxicity criteria at the time of the qualitative risk assessment. In particular, several toxicity values are now available for the inhalation pathway. In support of the IRIS database, USEPA finalized the toxicological reviews for PCE and TCE and verified inhalation toxicity values (USEPA, 2012c, 2011b, respectively). As is the case for the current toxicity values, some of the proposed values are more stringent than those used in the baseline HHRA and some are less stringent.

- The PAHs were identified as COCs in soil at BS1, LTCSA, TCSP, FTA2, FTA3, FTA4, FTA5, LF14, SP1, FTA1, and EFDZ1. As discussed in the introduction to **Appendix A**, USEPA issued an updated *Toxicological Review of Benzo(a)pyrene* under the IRIS Program in January 2017 (USEPA, 2017). This review updated the previous IRIS assessment of benzo(a)pyrene, which had been used since 1987. It was based on studies conducted after 1987 and the 2011 recommendations for the improvement of IRIS toxicity assessments.

  Benzo(a)pyrene is now identified as “carcinogenic to humans” rather than the 1987 “probable human carcinogen” weight-of-evidence classification. USEPA (2019b, 2017) provided a verified oral cancer SF for benzo(a)pyrene of 1.0E+0 per mg/kg-day and a verified IUR of 6.0E-4 per $\mu g/m^3$ in 2017.

  Although the IRIS database currently indicates that the toxicity criteria for benzo(a)pyrene have been “suspended” (USEPA, 2019b), the updated oral cancer SF (1.0E+0 per mg/kg-day) and the IUR (6.0E-4 per $\mu g/m^3$) continue to be included in the current RSL table (USEPA, 2019a) and applied in the RSL calculator (USEPA, 2019d). When compared with the previous oral SF (7.30E+0 per mg/kg-day), the current toxicity value represents less potency and, therefore, is less stringent. It is noted, however, that there was previously no IRIS-verified IUR for benzo(a)pyrene.

There are no IRIS-verified toxicity values for the remaining carcinogenic PAHs; however, these values have been derived from the SF and IUR for benzo(a)pyrene using their corresponding RPFs. The resulting values are used to develop RSLs for these compounds.

In addition, the RSL table now includes an RfD (3.0E-4 mg/kg-day) and an RfC (2.0E-6 mg/m^3). Previously, there were no noncancer-based toxicity values available for benzo(a)pyrene. Both of these toxicity values are based on developmental effects.

- Oral toxicity criteria are adjusted to assess the dermal absorption pathway (USEPA, 2004). As discussed in previous Five-Year Reviews, there were changes to some of the factors and assumptions used to calculate dermal toxicity values in the original risk assessment.

- Some toxicity criteria are considered to be PPRTVs (USEPA, 2003b), which represent the second-tier of human health toxicity values. In addition, USEPA has identified Tier 3 or other EPA and non-EPA sources were also used.

For the HHRAs performed using a semi-quantitative or qualitative methodology, contaminant concentrations were originally compared with risk-based concentrations, such as the Region 9 industrial and/or residential soil PRGs, and in some cases, to the Region 3 RBCs. In 2008, USEPA consolidated the screening levels for all regions into a single set of values that have been designated as RSLs (USEPA, 2019a) and continues to update them every 6 months. For most sites, the changes to RSL values would not have changed the outcome of the qualitative risk assessment. The COC concentrations in soil left-in-place (as shown in **Table 7-4**) however, exceed the updated RSLs:

- The concentrations of arsenic in soil exceed background and the industrial RSL at a risk level 1 x 10^{-6} of at EFDZs 2, 3, 5, 6, 7, 8, 9, and 10. However, these concentrations are below RSLs at a risk level of 1 x 10^{-5}.

- The concentration of arsenic at EFDZ4 is above background and an industrial RSL of 1 x 10^{-6}, but below 1 x 10^{-5}. Benzo(a)pyrene in soil at EFDZ4 is only slightly above the RSL at 1 x 10^{-6}.

- The maximum concentration of elemental mercury in soil at HP2 exceeds the industrial RSL at 1 x 10^{-6}, but below 1 x 10^{-5}. In addition, due to the long period of time that has lapsed since analysis, elemental mercury has likely been transformed to an inorganic form and the concentration would be below the RSL for inorganic salts.

- Concentration of benzo(a)pyrene in soil at LF9 slightly exceed the residential RSL, but are below the industrial RSL It is noted that all residual contamination is below the cap.

- Concentrations of arsenic in soil at Burial Site 2 is above background, but only slightly exceeded the industrial RSL at 1 x 10^{-5}.

- Concentrations of arsenic, benzo(a)pyrene and dibenz(a,h)anthracene in soil at the Chemical Disposal Area (CDA) exceed background and the residential RSLs but are below the industrial RSL at 1 x 10^{-5}.

The "no action" sites were further evaluated to determine whether additional measures would be needed if changes in toxicity values resulted in exceedances of acceptable limits for cancer risk or noncancer hazard for the industrial/commercial scenario. Although the soil at the "No Action" sites is subject to the provisions of the ROD, the screening levels and/or toxicity values were evaluated at sites where exposures to surface soil could occur. Sites at which removal actions had been taken or soil had been capped were not included. In addition, sites where semi-quantitative risk assessment had indicated very low levels of contamination were not further assessed. The rationale for further evaluating screening levels or toxicity values for specific sites is provided in **Table A-15**. For the subset of sites evaluated, the screening levels used in the semi-quantitative risk assessments were compared with current screening levels in **Table A-16**. For this evaluation, there were no sites where comparisons of cancer and noncancer toxicity values for the oral/dermal and inhalation routes were applied. In cases where the current screening levels were more stringent than those used in the original risk assessment, the EPCs from the original risk assessments were used to proportionally estimate the current cancer risk and noncancer hazard based on the current RSL (**Table A-17**). These calculations indicate that the more stringent toxicity values cumulatively resulted in cancer risks within or below the acceptable risk range. All noncancer hazard quotients were below 1.

Since the original risk assessments, USEPA has published guidance regarding the assessment of bioavailability of arsenic in soil (USEPA, 2012d). The current default assumption for assessing risk from arsenic in soil is that the bioavailability of arsenic in soil is the same as bioavailability of arsenic in water (relative bioavailability [RBA] soil/water = 100 percent). However, recent bioavailability studies conducted in animal models show that the bioavailability of arsenic in soil is typically less than that of highly water soluble forms of arsenic (e.g., sodium arsenate dissolved in water). These results suggest that bioavailability of arsenic in soil will typically be less than that of arsenic dissolved in drinking water (i.e., RBA < 100 percent). At sites where this applies, assuming that the RBA is equal to 100 percent will result in an overestimation of risk. Based on this information, an oral RBA of 60 percent is now assumed in the derivation of the RSL for the ingestion of soil. As a result, the current RSL for arsenic is less stringent than the screening values used for arsenic. Similarly, risks and hazards calculated for arsenic in soil at the SCOU are likely to be slightly less than originally estimated. In addition, there is no change in the protectiveness of the remedy for soil because direct contact with soil is prevented.

For several sites, exposures to lead in soil were evaluated using the IEUBK Model, Version 0.99 (USEPA, 1994a), which does not address adult exposures to lead. Since the 41 NA sites risk assessments were performed, the IEUBK model has been updated (USEPA, 2007, 2010c). In addition, the USEPA has since developed the ALM to evaluate occupational exposures to lead (USEPA, 2003a). The use of the ALM would not impact the remedy because the IEUBK model conservatively addresses potential exposures to the most sensitive population.

Finally, USEPA developed the *Soil Screening Guidance* (USEPA, 1996b) as a framework for screening contaminated soils that encompasses both simple (i.e., screening-level) and more detailed approaches for calculating site-specific SSLs. In particular, this guidance presents methodologies to address the leaching of contaminants through soil to an underlying potable aquifer. These methodologies have not changed since the SSL Guidance was issued. Although it is possible that soil concentrations associated with NA sites would exceed the SSLs for migration to groundwater, use of the SSLs would have no effect on the remedy. Given the period of time the sites have existed, migration of chemicals from the LF has most likely occurred. Groundwater is being monitored under the LTM Program.

Changes in RAOs and Cleanup Goals

No numerical RAOs were specified for the 41 NA sites because the remedy called for institutional controls. However, the narrative RAO is to prevent human exposure to COCs in soil at these sites as identified in the ROD. The NA alternative was selected as remedy for all 41 sites (i.e., the USAF determined that no remedial action was necessary to ensure protection of human health and the environment at these sites). This decision was based on the evaluation of analytical data and current site conditions at the time of the site investigations. (Because ICs and ECs were already in place at the 41 IRP sites when the ROD was written (WPAFB,1998), the selected remedy is considered a “limited action” according to USEPA IC guidance document [USEPA, 2010a] rather than a “no action” remedy.) The 41 NA Sites ROD states that groundwater, surface water, and sediment would be monitored under the LTM Program. Thus, the RAO for these sites is to prevent exposure to hazardous substances until and unless unlimited use and unrestricted exposure levels are attained at each individual site.

To prevent exposure to soil, ICs and access/land use restrictions are in place at all of the sites (e.g., there are ICs in place [such as dig permits] at all of the sites). Additionally, some sites have fencing around them, further limiting access. Digging or excavation at any of the 41 sites, especially those with waste/contamination left in place, is currently restricted by ICs prohibiting excavation, and is expected to remain restricted. For the Explosives Ordnance Disposal (EOD) Range, land use restrictions would be placed to limit industrial uses.

A.6 Groundwater Operable Unit (GWOU)

The following documents were reviewed with respect to risk assessment data and assumptions:

- *Record of Decision, Source Control Operable Unit – Landfills 8 and 10* (WPAFB, 1993a).
- *Guidance Manual for the Integrated Exposure Uptake Biokinetic (IEUBK) Model for Lead in Children* (USEPA, 1994a).
- *Record of Decision, Off-Source Operable Unit and Final Remedial Action, Landfills 8 and 10* (WPAFB, 1994).
- *Final Current Conditions Health Risk Assessment Technical Memorandum* (IT, 1997d).
- *Final Future Conditions Health Risk Assessment, Technical Memorandum* (IT, 1998b).
- *Engineering Evaluation/Cost Analysis, Groundwater Basewide Monitoring Program* (IT, 1999a).
- *Final Basewide Ecological Risk Assessment Technical Memorandum* (IT, 1999b).
- Record of Decision, Groundwater Operable Unit, Groundwater Basewide Monitoring Program (WPAFB, 1999).
- *Comprehensive Five-Year Review Guidance* (USEPA, 2001).
- USEPA Region 5, RCRA Ecological Screening Levels, On-line: http://www.epa.gov/region5/waste/cars/pdfs/ecological-screening-levels-200308.pdf. Last updated: August 2003. Accessed: December 2019 (USEPA, 2003c).
- *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, Part E, Supplemental Guidance for Dermal Risk Assessment* (USEPA, 2004).
- *Final Second Five-Year Record of Decision Review Report* (Shaw, 2006).
- *Vapor Intrusion Pathway: A Practical Guideline* (ITRC, 2007).
- *DoD Vapor Intrusion Handbook* (DoD, 2009).
- *Final Remedial Process Optimization of the Groundwater Operable Unit* (Shaw, 2009a).

- *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, Part F, Supplemental Guidance for Inhalation Risk Assessment*, Final (USEPA, 2009).

- *Groundwater Treatment Optimization Study (GTOS) – Operable Unit 5, Wright Patterson Air Force Base, Ohio* (TetraTech, Inc. and CTI Associates (TetraTech, et. al.), 2010).

- *Toxicological Review of cis-1,2-Dichloroethylene and trans-1,2-Dichloroethylene. In Support of Summary Information on the IRIS* (USEPA, 2010b).

- *Exposure Factors Handbook – 2011 Edition, Final* (USEPA, 2011a).

- *Toxicological Review of Trichloroethylene. In Support of Summary Information on the Integrated Risk Information System (IRIS)* (USEPA, 2011b).

- *Third Five-Year Record of Decision Review Report* (WPAFB, 2011).

- *Land Use Control Plan, Wright-Patterson Air Force Base,* Ohio (Labat, 2012).

- *Memo to Site File for Monitoring, Sampling, and Reporting Revisions to the Groundwater Operable Unit, Record of Decision*, Wright-Patterson Air Force Base, January (Shaw, 2012).

- *Memorandum Clarifying the Use of Protectiveness Determinations for Comprehensive Environmental Response, Compensation, and Liability Act Five-Year Reviews* (USEPA, 2012a).

- *Assessing Protectiveness at Sites for Vapor Intrusion: Supplement to the "Comprehensive Five-Year Review Guidance"* (USEPA, 2012b).

- *Toxicological Review of Tetrachloroethylene (Perchloroethylene). In Support of Summary Information on the IRIS* (USEPA, 2012c).

- *Explanation of Significant Differences: Source Control Operable Unit - Landfills 8 and 10; Off-Source Operable Unit and Final Remedial Action Landfills 8 and 10; 21 No Action Sites; Spill Sites 2, 3, and 10 (Operable Unit 2); 41 No Action Sites; and Groundwater Operable Unit*, (WPAFB, 2012a).

- *Memorandum: Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors* (USEPA, 2014b).

- *Memorandum: Compilation of Information Relating to Early/Interim Actions at Superfund Sites and the TCE IRIS Assessment* (USEPA, 2014c).

- *Technical Fact Sheet – 1,4-Dioxane* (USEPA, 2014d).

- *OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air* (USEPA, 2015).

- Guidance Document Recommendations Regarding Response Action Levels and Timeframes for Common Contaminants of Concern at Vapor Intrusion Sites in Ohio, OEPA Division of Environmental Response and Revitalizations (DERR), August 2016 (OEPA, 2016).

- Federal Register, Volume 81, No. 101, Lifetime Health Advisories and Health Effects Support Documents for Perfluoroctanoic Acid and Perfluorooctane Sulfonate, May 25, 2016 (USEPA, 2016).

- *Fourth Five-Year Record of Decision Review Report* (WPAFB, 2016a).

- *State of Ohio Water Quality Standards*, Chapter 3745-1 of the Administrative Code. OAC Rule #3745-1-34 Water quality criteria for the Ohio River drainage basin, effective September 2017. OEPA, Division of Surface Water, Standards & Technical Support Section (OEPA, 2017).

- *Final Site Inspection Report of Aqueous Film Forming Foam Areas at Wright-Patterson Air Force Base, Ohio* (Aerostar, 2018).

- *2018 Edition of the Drinking Water Standards and Health Advisories Tables.* EPA 822-F-18-001, Office of Water. On-line: http://www.epa.gov/sites/production/files/2018-03/documents/dwtable2018.pdf (USEPA, 2018).

- Monthly Operating Reports, O&M, Landfill 5 Groundwater Treatment System, Wright-Patterson Air Force Base, Ohio. (CAM Management and Services [CAM], 2015-2019a).

- *Memorandum for Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program*, 15 October (DoD, 2019).

- *Land Use Control Implementation Plan at Wright Patterson Air Force Base, Ohio*, TetraTech, Inc., February, 2019. (TetraTech, 2019).

- *U.S. Environmental Protection Agency (USEPA) Regions 3, 6, and 9 Regional Screening Levels (RSLs) for Chemical Contaminants at Superfund Sites*. On-line: http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm (USEPA, 2019a).

- Integrated Risk Information System (IRIS), On-line (USEPA, 2019b).Vapor Intrusion Screening Level (VISL) Calculator, Accessed: December 2019 (USEPA, 2019c).

- Regional Screening Level (RSL) Calculator, Accessed: November 2019 (USEPA, 2019d).

- *Sample Collection and Evaluation of Vapor Intrusion to Indoor Air*, Ohio Environmental Protection Agency, March (OEPA, 2020).

A Current Conditions Risk Assessment (CCRA) was conducted to provide estimates of potential current human health risk associated with exposures to the groundwater (IT, 1997d). Potential future risk to human health (resulting from movement to groundwater) and the ecological risk assessment of surface water and sediment were evaluated in the Future Conditions Risk Assessment (FCRA) (IT, 1998b) and in the Basewide Ecological Risk Assessment (IT, 1999b).

Changes in ARARS and TBCs

The purpose of the ARARs review is to determine whether recently promulgated or modified requirements of federal or state of Ohio environmental regulations are applicable or relevant and appropriate, and if modifications of regulations during the past five years call into question the protectiveness of the remedy (USEPA, 2001, 2012a,). Changes to the ARARs since the previous Five-Year Review are discussed in this section.

Action-specific ARARs were applicable to the operation of the current groundwater treatment system (GWTS) and its associated air stripper. The requirements for hazardous waste management addressed the handling and disposal of spent treatment media. An RPO for the GWTS (TetraTech, et. al., 2010) was prepared in 2010 and recommended replacement of the GWTS with a more sustainable and cost effective system. As described in **Section 8.1.2**, the updated treatment system has been installed and operating as designed. The treated groundwater is discharged to West Twin Lake in compliance with NPDES Permit 1IN00156*FD effective October 1, 2014 (CAM, 2015-2019a).

There are no changes planned for the Temporary Air Stripper (TAS), which will remain the backup treatment system. The TAS originally discharged treated groundwater to an outfall at the Mad River, but the underground pipeline is damaged and cannot be used. A temporary aboveground pipeline was installed for the discharge of treated groundwater from the TAS to West Twin Lake. There are no changes to the action-specific ARARs that impact the short-term protectiveness of the remedy for the GWOU.

In December 2015, a new replacement GWTS was placed in operation. The new GWTS is a sliding tray air stripper type that has fewer components, is more efficient, and is less expensive to operate than the previous GWTS. The new GWTS in combination with extraction well EW-1 continues to provide hydraulic containment along the southwest boundary of LF5.

The National Ambient Air Quality Standards (NAAQS) specified in 40 CFR 50 and the National Emissions Standards for Hazardous Air Pollutants (NESHAPS) specified in 40 CFR 61 and 63 are considered applicable because air stripping is part of the selected remedy (WPAFB, 1999). Since the ARARs for ambient air were presented in the Engineering Evaluation/Cost Analysis (EE/CA) (IT, 1999a), standards for particulate matter equal to or less than 2.5 microns particle size and ozone (8-hour average) were added to USEPA's listing of NAAQS. The hazardous air pollutants include benzene and VC, which were selected as COC for the GWOU. No NAAQS or NESHAP that would apply to the GWOU have been added since the Fourth Five-Year Review. Overall, emissions from sources are *de minimis*. The Base, in its entirety, is considered a major source of hazardous air pollutants.

The MCLs were identified as chemical-specific ARARs for several of the COC in the ROD for the GWOU. As reported in previous Five-Year Reviews, the MCLs for arsenic and nickel had changed since the remediation goals (RGs) were established for the GWOU. As discussed in **Section A.1**, however, a Remedial Process Optimization (RPO) was completed for the GWOU monitoring in 2009. Recommendations from the RPO included the reduction of monitored parameters and reduction of the monitoring well network (Shaw, 2009a). These changes were approved by OEPA (September 10, 2008), and USEPA (August 31, 2009) and presented in the *Memo to Site File for Monitoring, Sampling, and Reporting Revisions to the Groundwater Operable Unit, Record of Decision* (Memo to Site File: GWOU ROD), (Shaw, 2012). As a result, metals sampling was eliminated from the LTM Program.

The compliance levels for the GWOU are shown in **Table 8-2**. It is noted that these compliance levels were originally presented in Table 1 of the GWOU ROD, but included COCs from OU1 and Spill Sites 2, 3, and 10 of OU2. The ROD for the Spill Sites has since been closed. Although the sampling and analysis for the COCs covered by all three RODs is carried out concurrently within the LTM Program, the results associated with each ROD are reported separately.

As discussed in **Section 8.4.4.1**, the majority of wells monitored under the LTM Program exhibit concentrations of the VOC COC that are either below their respective MCLs or are declining. The VOC concentrations for the LTM Program are presented in **Table 8-4**. For organic COC in groundwater, the RGs for 1,2-DCE (as cis-1,2-DCE and trans-1,2-DCE), PCE, TCE, and VC are based on MCLs and have not changed (USEPA, 2018).

In addition, during the previous review period, 1,4-dioxane was detected and tracked through the LTM Program as part of the DoD's Emerging Contaminants Program (USEPA, 2014d). 1,4-Dioxane was not detected in the April 2019 sampling round and is proposed to be deleted from subsequent sampling rounds.

In addition, limited sampling of PFOS/PFOA was conducted as part of the LTM Program from June 2016 to November 2017. As discussed in **Sections 2.6** and **8.1.1**, PFOS/PFOA are also considered emerging contaminants. While there are currently no promulgated standards for

PFOS/PFOA in environmental media, the drinking water HAL for PFOS and PFOA (and in combination) of 70 ppt (0.070 µg/L or 70 ng/L) (USEPA, 2016) is a TBC value in the interim. There has been no change in the HAL since the Fourth Five-Year Review (WPAFB, 2016a) or the completion of the SI (Aerostar, 2018). In addition, USEPA applied candidate toxicity values in the derivation of the HAL. These candidate values, an RfD of 2.0E-05 mg/kg/day and a SF of 7.0E-02 $(mg/kg/day)^{-1}$ would also be considered TBCs.

The RfD and SF have not yet been peer reviewed at the level required to be considered an IRIS value or further evaluated as PPTRVs. Except for the RSL for a related compound (PFBS), there are no RSLs for tap water listed in the RSL table for PFOS, PFOA, or a combination of these compounds (USEPA, 2019a). Given that these values are available in USEPA's on-line RSL calculator, however, screening levels can be calculated (USEPA, 2019d). The DoD issued guidance on October 15, 2019 to address investigations of sites with per- and polyfluoroalkyl substances within the DoD Cleanup Program (DoD, 2019). As discussed in **Section 2.6.2**, DoD derived conservative screening levels using USEPA's on-line RSL calculator as part of this guidance. For PFOS/PFOA in groundwater, the resulting tap water RSL was 0.040 µg/L.

Ecological risks were assessed for major surface water bodies within WPAFB (IT, 1999b). The evaluation focused on comparing detected chemical concentrations to surface water and sediment quality criteria. In addition, available ecological characterization information was used to determine whether predicted impacts were actually occurring in the environment to plant and animal species (including threatened and endangered species). Human health effects from chemicals, surface water, and sediment were evaluated previously during investigations conducted for the individual OUs. Although no further action was taken for the surface water and sediment in the GWOU, these standards remain in effect as ARARs because the selected remedy includes discharge of treated water to surface water. Furthermore, there is potential for discharge of contaminated groundwater to surface water via hydraulic connections.

The Ambient Water Quality Criteria and Water Quality Criteria (40 CFR 130 and 131) are established under the Clean Water Act (Sections 303 and 304) for protection of human health and aquatic organisms, which must be met or exceeded by the states in establishing water quality criteria. These criteria have been updated since the ROD was issued. The National Recommended Water Quality Criteria were last revised in 2015 and are currently accessible on-line. Criteria for three metals (aluminum, cadmium, and selenium) have been updated since the Fourth Five-Year Review (WPAFB, 2016a); however, none of these metals are of particular significance as COCs for surface water or sediment at WPAFB. With regard to state criteria, (OAC) 3745-1), Water Quality Standards, was reorganized in February 2017 and revised standards became effective in

September 2017 (OEPA, 2017). In particular, OAC 3745-1-34 and OAC 3745-1-35 provide criteria for human health and aquatic life and wildlife, respectively. Many of these values for both human health and ecological effects are more stringent than the values presented in the EE/CA for the GWOU (IT, 1999a). These criteria were referenced in the previous Five-Year Reviews and most of them have not changed.

For screening purposes, USEPA Region 5 Ecological Screening Levels (ESL) have been reviewed in the previous Five-Year reviews. The ESLs were developed to be protective benchmarks for water and sediment quality (USEPA, 2003c). These values are intended to serve the same purpose as the Surface Water Quality Benchmark Values and the Sediment Quality Benchmark Values that were applied in the ecological risk screening for surface water bodies at WPAFB. The purpose of a screening level risk assessment is to identify those contaminants that exceed the ESL benchmarks that will be retained for additional analysis and allow the investigation to focus on those areas that require further evaluation. Similar to the ambient water quality criteria, many of these values are more stringent than the benchmark values applied in the ecological risk assessment for the GWOU (IT, 1999b). The Region 5 ESLs have not changed since the Fourth Five-Year Review (WPAFB, 2016a).

Exceedances of ecological benchmarks were acknowledged in the GWOU ROD (WPAFB, 1999); however, the concentrations of these contaminants in surface water and sediment would have most likely changed over time. The ROD concluded that the uniformity of chemical patterns throughout the base surface water systems and the lack of correlation of these patterns with the activities historically conducted within the OUs, seem to imply sources present in the environment due to human activity, such as automobile or airplane exhaust, or pesticides used for agricultural purposes rather than an OU-related source. With the exception of acetone, neither surface water nor sediment was associated with solvent contamination that exceeds water quality standards. Other constituents that were found to exceed water quality standards were a variety of inorganics, phthalates, PAHs, and chlorinated pesticides. These constituents were found relatively uniformly throughout the base and are reflective of urban environments and anthropogenic activities and not generally associated with OU-related contamination. Although anthropogenic sources persist at the base (e.g., automobile and aircraft exhaust), the GWOU remedy continues to address OU-related contamination.

Changes in Land-Use and Exposure Assumptions

Hypothetical exposures to groundwater by on-base residents, on-base workers, and off-base residents were evaluated in the CCRA and FCRA (IT, 1997d and 1998b). Each potentially exposed population (off-base residents, on-base residents, and on-base workers) was estimated for risk under various scenarios (WPAFB, 1999):

- On-Base Resident – It was assumed that military personnel reside on base for limited periods of time, and these receptors obtain all household water from base supply wells. Exposure pathways included:
    - Ingestion of groundwater.
    - Inhalation of volatiles from groundwater.
    - Dermal contact with chemicals in groundwater.
    - Ingestion of home-produced foodstuffs including fruit and vegetables.
- On-Base Worker – It was assumed that non-military personnel work on the base, but reside off-base. Drinking water during work hours is obtained from base supply wells.
    - Ingestion of groundwater.
    - Inhalation of volatiles from groundwater.
    - Dermal contact with chemicals in groundwater.
- Off-Base Resident – This exposure assumes that the receptor obtains all household water from wells located at base boundary.
    - Ingestion of groundwater.
    - Inhalation of volatiles from groundwater.
    - Dermal contact with chemicals in groundwater.
    - Ingestion of home-produced foodstuffs including fruit and vegetables.

The greatest risk was found to be to the off-base resident from chemicals in the uppermost aquifer, because of higher exposure duration estimates and the potential number of pathways. For simplicity, only the evaluation of the off-base resident was presented in the GWOU ROD. For the CCRA (IT, 1997d), numerical risk estimates were calculated for 10 exposure location points in Area A (formerly Areas A and C), and 6 in Area B. These points are theoretical locations based on modeled estimates of areas where selected plumes crossed the base boundary and where supply wells are currently located.

To assess potential future conditions, groundwater risks were developed in the FCRA (IT, 1998b) for time periods of 30, 60, and 90 years using the worst-case transport model scenario where all Huffman Dam wells and the city of Fairborn’s north well field are “turned on”, and the

WPAFB EW-1 is "turned off" (i.e., the condition under which the greatest contaminant transport is likely to occur). In addition, COC concentrations and cumulative risk at specific locations associated with major contaminant plumes were estimated for a time period between current conditions and 30 years. Based on the transport model, the USEPA target risk range of 1 x 10^{-6} to 1 x 10^{-4} for carcinogens and HI of one for noncarcinogens would be expected to be reached within 30 years.

Although there has been no change in the land use classification, the following changes occurred in general land use since the Fourth Five-Year Review (WPAFB, 2016a). These changes were noted in the site inspection (**Table 8-5**):

- The former Building 59 complex is now an asphalt parking lot with no access restrictions other than the Base perimeter fence.
- The site of the former Building 79/95 complex is currently an open field with no access restrictions other than the Base perimeter fence. The former buildings have been demolished; however, a new Entomology Laboratory (Building 73) has been constructed in the area. A vapor intrusion investigation was performed and a vapor barrier was installed during the construction of this building. Also, an indoor air sample was taken after construction. The results were below the residential RSLs.

Although some of the buildings have been removed in these areas since the ROD for the GWOU was issued and access restrictions have changed, the current uses are consistent with the allowable land use for the area. Digging restrictions are in place; therefore, there is no potential contact with groundwater.

As described in the introduction to this appendix, an ESD was approved in 2012 to address six RODs including the GWOU (WPAFB, 2012a). The ESD modified the IC provisions for all of the RODs and established that the LUC Plan (Labat, 2012) would be used to manage and enforce land use controls. Since the last Five-Year Review, the LUC Plan has been replaced by the LUCIP (TetraTech, 2019). The LUCIP is now the primary administrative mechanism employed by WPAFB to determine which ICs are protective for the site and ensure that current ICs remain environmentally compatible with future land use and are properly implemented. As stated in the LUCIP and the GWOU ROD (WPAFB, 1999), WPAFB obtains its potable water from production wells located on the Base. Access restrictions are in place for the installation of any new public or private wells in accordance with the GWOU ROD. As cited in the Fourth Five-Year Review (WPAFB, 2016a), there has been no change in assumptions associated with the use of groundwater at WPAFB. The hypothetical receptors that were evaluated in the risk assessment are still valid and there are no new receptors to consider.

There have been no changes to the exposure pathways that were evaluated for direct contact since the Fourth Five-Year Review (WPAFB, 2016a); however, USEPA has updated the default exposure factors used in the original risk assessment (USEPA, 2011a and 2014b). The default exposure factors that had changed since the baseline HHRA and previous Five-Year Reviews are summarized in **Table A-2**. The updated factors were evaluated as part of the Fourth Five-Year Review (WPAFB, 2016a). A detailed discussion of these changes is provided in the introduction to this appendix. On the basis of these changes alone (i.e., notwithstanding changes to toxicity values or chemical/physical parameters), most risks and hazard indices based on the 2014 exposure factors were similar or lower than those based on the previous exposure factors. The exceptions were the hazard indices for groundwater exposures by the lifetime resident, which resulted in an increase of the cumulative hazard index by 7 percent. The changes to the default exposure factors for groundwater have little or no impact on the conclusions of the original risk assessment. The conclusions of the original HHRA and previous Five-Year Reviews remain valid. This evaluation remains valid as neither the *Exposure Factors Handbook* (USEPA, 2011a) nor the default exposure factors (USEPA, 2014b) have changed since the last Five-Year Review (WPAFB, 2016a). Therefore, potential exposures to groundwater associated with drinking water or other domestic purposes continue to be prevented due to restrictions on the use of groundwater.

Since the preparation of the GWOU ROD, USEPA, OEPA, DoD, and others have published guidance regarding the evaluation of vapor intrusion (USEPA, 2015; OEPA, 2020; DoD, 2009; ITRC, 2007). The OEPA has updated their VI guidance dated June 2019 but it is still in “draft". Furthermore, since the Fourth Five-Year Review for the GWOU, the USEPA has issued recommendations for assessing protectiveness at sites for vapor intrusion as a supplement to the *Comprehensive Five-Year Review Guidance* (USEPA, 2001, 2012b). This guidance provides protectiveness statement options and describes how possible situations may affect protectiveness determinations.

As part of this Fifth Five-Year Review, the groundwater data from the LTM were compared with recent VISLs based on the migration of VOCs from groundwater-to-indoor air. These values were derived from the VISL Calculator (USEPA, 2019c), which is based on USEPA’s most recent vapor intrusion guidance (USEPA, 2015). As shown in the 2019 data in **Table A-18**, cis-1,2-DCE, trans-1,2-DCE, PCE, TCE, and VC were detected in various monitoring wells throughout the GWOU that exceed residential and/or industrial VISLs. [Note the parameters presented in **Table A-18** are those that exceed a VISL.]

In applying USEPA’s recommended distance for initial evaluation (USEPA, 2015), the locations of monitoring wells with exceedances of industrial/commercial VISLs were mapped with respect to buildings within a 100-ft radius of these locations. The monitoring wells for the GWOU with exceedances are shown on the figures noted in **Table 8-6**. These exceedances were located in the following areas:

- OU5: seven monitoring wells had VISL exceedances. Five of the monitoring wells (CW05-085, CW05-055, OU5/MCD-MW02, OU5/MCD-MW04, and OU5/MCD-MW05) are located within the MCD property, and two of the wells (MW131M and MW132S) are located in wooded areas. There are no buildings within the 100 ft radius of any of these monitoring wells (**Figure 8-3**).

- FAA-B: two monitoring wells (SP-11-MW03 and SP-11-MW07) had VISL exceedances. The buildings within the 100 ft radius of these wells are unoccupied (**Figure 8-13**).

- OU4: two monitoring wells (OU4-MW-02B and OU4-MW-12B) had VISL exceedances; these wells are located on the edge of a golf course. There are no buildings within the 100 ft radius of either monitoring well (**Figure 8-17**).

- OU10: three monitoring wells (OU10-MW-06S, OU10-MW15S, and OU10-MW19D) had VISL exceedances. There are no occupied buildings within the 100 ft radius of any of the wells (**Table 8-6** and **Figure 8-24**), although there are two residences at the 100-ft radius of well OU10-MW19D.

- Former Building 79 Complex: Several wells in the vicinity of former Buildings 79A through 79D show VISL exceedances (**Table 8-6** and **Figure 8-28**). These buildings have been demolished; however, a new Entomology Laboratory (Building 73) has been constructed in the area. A vapor intrusion investigation was performed and a vapor barrier was installed during the construction of this building. Also, an indoor air sample was taken after construction. The results were below the residential RSLs.

- Former Building 59: one monitoring well (B59-MW02) had a VISL exceedance **(Table 8-6** and **Figure 8-31**). Building 143, located adjacent to the Former Building 59 Complex, is an unmanned electrical substation.

Although VOCs are present in groundwater in FAA-A and FAA-B, the areas associated with these plumes are restricted from excavation and construction work. According to the guidelines for protectiveness (USEPA, 2012a,b), the data collected and assessed show that a vapor intrusion exposure pathway does not currently exist. Should it become evident that VOCs are migrating toward on-site buildings or off-site residences, potential vapor intrusion would be evaluated on a site-specific basis. In addition, if a change in use were to be proposed, an amended risk assessment would be performed to evaluate potential exposures to groundwater associated with the GWOU. The vapor intrusion pathway would be included as a potential exposure pathway.

As stated previously, ecological risks were assessed for major surface water bodies within WPAFB (IT, 1999b). The evaluation focused on comparing detected chemical concentrations to surface water and sediment quality criteria. Uses of the surface water bodies and the potential for exposure to surface water and sediment at WPAFB have not changed since the GWOU was issued.

Changes in Toxicity Values

For discussions on site-specific parameters for OU1 (dioxins/furans, pesticides/PCBs, and SVOCs), originally included in the GWOU ROD, please refer to **Section A.1**. The toxicity values were reviewed to determine whether slope factors and reference doses/concentrations that applied at the time of the remedy had changed. Several of the toxicity values that were used in the risk assessments for current and future conditions (IT, 1997d and 1998b) have changed since the GWOU ROD was issued. These changes, however, did not impact the majority of the RGs, because they were based on either MCLs or background concentrations. The background concentrations for the metals no longer apply. As described in the Memo to Site File: GWOU ROD, (Shaw, 2012), monitoring for the metals has been discontinued.

As discussed in the introduction to this appendix, there were no IRIS-verified toxicity values for TCE at the time the RODs, including the GWOU ROD(WPAFB, 1999) were prepared. The final version of the *Toxicological Review of Trichloroethylene* was issued in September 2011 (USEPA, 2011b). The verified oral and inhalation toxicity criteria were also posted in September 2011. This information does not change the conclusions of the original risk assessment for groundwater because TCE concentrations at the GWOU are ultimately compared with the MCL and groundwater is currently restricted as a drinking water source.

According to recent guidance on applying the 2011 TCE IRIS assessment (USEPA, 2019b, 2014c), USEPA "…expects to take early actions at Superfund sites where appropriate to eliminate, reduce, or control the hazards posed by the site. In assessing such cases, USEPA will act with a bias for initiating response actions to ensure protection of human health." These health effects include teratogenic and developmental effects. For noncancer effects, IRIS developed a chronic inhalation RfC for noncancer effects of TCE, which is 2 $\mu g/m^3$. This value is based in part on the developmental toxicity endpoint of increased incidence of fetal cardiac malformations. As stated previously, use of groundwater from the GWOU is restricted.

In response to potential fetal cardiac effects from short-term inhalation exposures during early pregnancy, OEPA DERR has developed imminent hazard indoor air response action levels for TCE. If TCE is detected in indoor air in structures, prompt action is needed depending on the concentration level and the receptors present. The August 2016 OEPA *Guidance Document*

Recommendations Regarding Response Action Levels and Timeframes for Common Contaminants of Concern at Vapor Intrusion Sites in Ohio, (OEPA, 2016) or any subsequent updated versions, discusses action levels and timeframes, and advises prompt responses including temporary relocations of building occupants, ventilation, indoor air treatment, and/or engineering controls depending on the situation. The response action levels are derived for accelerated, urgent, and imminent timeframes, as defined by OEPA. For example, the accelerated response action levels for TCE in indoor air in residential and commercial buildings are 2.1 $\mu g/m^3$ and 8.8 $\mu g/m^3$, respectively. The corresponding response action levels for vapor intrusion from TCE in groundwater underlying residential and commercial buildings (fine-course soil scenario) are 21 μg/L and 89 μg/L, respectively.

Furthermore, Ohio DERR's August 2016 document establishes chronic response action levels for vapor intrusion chemicals of concern, which include TCE, VC, PCE, chloroform, carbon tetrachloride, and naphthalene. Response actions may include additional sampling, mitigation, and/or other activities to reduce exposure to elevated indoor air concentrations of COCs resulting from vapor intrusion.

For inhalation exposure pathways, for example, several toxicity criteria have been revised. In support of the IRIS data base, USEPA has finalized the toxicological reviews for 1,2-DCE, PCE, and TCE and verified inhalation toxicity values (USEPA, 2010b; 2012c; 2011b, respectively). All three of these VOCs have been detected at the GWOU during the monitoring period from 2015 through 2019. Some of the proposed values are more stringent than those used in the baseline HHRA and some are less stringent. In particular, it is noted that the toxicological review for 1,2-DCE concluded that inhalation data for cis-1,2-DCE and trans-1,2-DCE were insufficient to support the derivation of inhalation toxicity values. Therefore, at this time, VISLs cannot not be calculated for these compounds and no values are shown for comparison in **Table A-18**.

Groundwater at the GWOU is not currently being used. Furthermore, the changes in toxicity values would not affect the decisions regarding the future use of groundwater because the compliance levels for the GWOU are based on MCLs. However, these toxicity values could potentially apply to the vapor intrusion pathway if buildings were to be constructed and occupied in the areas overlying VOC-contaminated plumes. In such cases, a site-specific risk assessment would be conducted.

Oral toxicity criteria are adjusted to assess the dermal absorption pathway. The method for modifying oral toxicity criteria involves the determination of absolute oral absorption factors that are applied to the oral toxicity criteria. Also, based on current guidance for dermal risk assessment

(USEPA, 2004), there were changes to some of the factors and assumptions used to calculate dermal toxicity values. The impacts of these changes would be expected to be minimal, especially because VOCs are the primary contributors to risk in the groundwater. The dermal risk assessment guidance (USEPA, 2004) that was applied in the previous Five-Year Reviews (Shaw, 2006, WPAFB 2011, WPAFB 2016a) has not changed. As discussed in the previous reviews, there were changes to some of the factors and assumptions used to calculate dermal toxicity values in the original risk assessment. Of these, the oral absorption factors for some of the metals are more stringent; however, the impacts of these changes are no longer relevant because metals have been eliminated from the LTM Program. In the original risk assessment, exposures to lead in groundwater were evaluated using the IEUBK Model, Version 0.99 (USEPA, 1994a). Because the model is intended to account for exposures to lead from multiple sources, the evaluation for this risk assessment model utilized data from soil and drinking water to total exposure to the population of children for an estimate of a blood lead concentration (IT, 1997d and 1998b). The estimate of lead was then compared to an acceptable blood lead level of 10 μg/dl. Since the Third Five-Year Review, however, metals are no longer included in the LTM sampling program (RPO [Shaw, 2009a] and Memo to Site File: GWOU ROD [Shaw, 2012]). If groundwater were to be used as drinking water source in the future, however, the existing action level for lead in drinking water (15 μg/L) would be protective.

To determine whether changes in toxicity values result in any new COCs in the LTM program, the MDCs of chemicals detected in groundwater samples collected in April 2019 were compared with current MCLs and RSLs. This comparison is shown in **Appendix A, Table A-19**. Two chemicals (bromomethane and cis-1,2-DCE) would be considered new COCs because their MDCs exceeded their MCL and/or RSL. Although cis-1,2-DCE was not specified as a COC in the GWOU ROD, it is now being analyzed as an individual compound along with its related isomer trans-1,2-DCE. It is a common degradation product of chlorinated solvents such as PCE and TCE, which are existing COCs within the GWOU. Bromomethane, also known as methyl bromide, was also detected at an MDC above its RSL. Bromomethane is a solvent, fumigant, and common disinfectant breakdown product associated with chlorination systems. There is no MCL for comparison; however, the MDC only slightly exceeds the current RSL. Although neither of these specific chemicals (cis-1,2-DCE and bromomethane) were existing COCs, both of them are related to compounds or byproducts that are already being monitored as part of the LTM. The remedy is protective as no additional analyses will be necessary to track these recently identified COCs through the LTM.

As described in **Sections 2.6** and **8.5.2.1**, the HAL for PFOS and PFOA was based on a candidate RfD of 2.0E-05 mg/kg/day and a SF of 7.0E-02 $(mg/kg/day)^{-1}$. The RfD and SF have not yet been peer reviewed at the level required to be considered an IRIS value or further evaluated as PPTRVs. Except for the RSL for a related compound (PFBS), there are no RSLs for tap water listed in the RSL table for PFOS, PFOA, or a combination of these compounds (USEPA, 2019a). Given that these values are available in USEPA's on-line RSL calculator, however, screening levels can be calculated (USEPA, 2019d).

The DoD issued guidance on October 15, 2019 to address investigations of sites with per- and polyfluoroalkyl substances within the DoD Cleanup Program (DoD, 2019). As discussed in **Section 2.6.2**, DoD derived conservative screening levels using USEPA's on-line RSL calculator as part of this guidance. For PFOS/PFOA in groundwater, the resulting tap water RSL was 0.040 μg/L. In addition, the guidance recommended the candidate toxicity values for use in site-specific risk assessments in the interim.

Changes in RAOs and Cleanup Goals

The RAOs for the GWOU are stated in **Section 8.2.2**. The RAOs are intended to:

- return useable groundwater to its beneficial use within a reasonable timeframe.
- prevent off-site migration and ingestion of inorganic COC in groundwater that exceed the RG and,
- monitor groundwater areas that exhibit sporadic (spatial or temporal) exceedances of the RG.

As discussed in **Section 8.5.2.1**, the compliance levels for the GWOU are MCLs. These values are summarized in **Table 8-2**. It is noted that *Table 1* from the GWOU also lists COCs that are associated with other RODs (OU1 and OU2). Although these chemicals are sampled and analyzed as part of the overall LTM Program, these constituents are reported separately.

As previously described, an RPO was completed for the GWOU monitoring in 2009 that resulted in the reduction of monitored parameters and of the monitoring well network (Shaw, 2009a). These changes were approved by OEPA and USEPA and presented in the Memo to Site File: GWOU ROD (Shaw, 2012). As a result, metals were eliminated from the LTM Program. Therefore, the compliance levels for inorganic constituents no longer apply.

As discussed in **Section 8.4.4.1**, the majority of wells monitored under the LTM Program exhibit concentrations of VOCs that are either below their respective MCLs or are declining. VOC concentrations for the LTM Program are presented in **Table 8-4**. For organic COCs in groundwater, the RGs for cis-1,2-DCE, trans-1,2-DCE, PCE, TCE, and VC are based on MCLs. It is noted that total 1,2-DCE was originally listed as a COC in the GWOU ROD. As laboratory analysis now differentiates between the individual congeners of 1,2-DCE, results for cis-1,2-DCE and trans-1,2-DCE are being monitored in the LTM Program. The MCLs have not changed since the Fourth Five-Year Review (WPAFB, 2016a). Therefore, the compliance levels for the remaining chemicals in the LTM Program, as amended through the Memo to Site File: GWOU ROD (Shaw, 2012), are still valid.

In addition, as discussed in **Section 8.7**, an SI for Area A was conducted in 2017 to identify any releases of PFCs may have occurred at sites where AFFF containing PFCs may have been used. An RI has been programmed for further investigation.

Table A-1
Comparison of Groundwater Compliance Levels
Source Control Operable Unit
Wright-Patterson AFB, Ohio
Page 1 of 2

Chemical of Concern[1]	ROD Compliance Level[2] (µg/L)	Current Compliance Level [3] (µg/L)	Source of Compliance Level [4] (µg/L)	Reporting Limit [5] (µg/L)
Inorganics				
Arsenic	11.0	10	MCL	10
Beryllium	0.02	4	MCL	4
Cadmium	NA	5	MCL	5
Copper	NA	1,300	MCL	25
Iron	NA	NA	MCL	100
Lead	NA	15	MCL	3
Zinc	NA	NA	MCL	50
Cyanide[6]	NA	200	MCL	10
Ammonia[6]	NA	NA	MCL	200
Volatile Organic Compounds (VOC)				
Benzene	0.62	5	MCL	1
Chloroform	0.26	80[7]	MCL	1
1,2-dichloroethene (total)	0.0677	NA	MCL	0.5
cis-1,2-dichloroethene[8]	NA	70	MCL	0.5
trans-1,2-dichloroethene[8]	NA	100	MCL	1
Ethylbenzene	NA	700	MCL	1
Methylene Chloride	6.22	5	MCL	1
Toluene	NA	1,000	MCL	1
Trichloroethene	3.03	5	MCL	2
Vinyl chloride	0.0283	2	MCL	1
Semivolatile Organic Compounds (SVOC)[6]				
Diethyl phthalate	NA	NA	NA	9.5
4-Methylphenol	NA	NA	NA	9.5
Naphthalene	NA	NA	NA	9.5

Table A-1
Comparison of Groundwater Compliance Levels
Source Control Operable Unit
Wright-Patterson AFB, Ohio
Page 2 of 2

Notes:

1 – Chemicals listed as chemicals of concern in the Source Control Operable Unit (SCOU) ROD.

2 – Groundwater compliance levels as listed in the SCOU ROD (WPAFB, 1993).

3 – Current compliance levels are based on the MCLs as described in the *Explanation of Significant Differences* (ESD) (WPAFB, 2012).

4 – Maximum Contaminant Levels (MCLs). MCLs are promulgated under the Safe Drinking Water Act (USEPA, 2019).

5 – Source: Test America OU1 analytical results from the Long-Term Monitoring (LTM) Program, April 2019.

6 – Ammonia, cyanide, and SVOCs are sampled and analyzed on a five-year cycle (WPAFB, 2012).

7 – Compliance level shown is the MCL for total trihalomethanes.

8 – The congeners for 1,2-DCE were not originally identified as COCs in the SCOU ROD. These individual congeners are currently captured under the LTM Program.

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Abbreviations:

MCL = Maximum Contaminant Level

µg/L = micrograms per liter

NA = Not applicable

ROD = Record of Decision

Table A-2
USEPA Recommended Default Exposure Factors (2014)
Wright-Patterson AFB, Ohio

Definition (Units)	Previous Default Value	Current Recommended Value	Souce of Current Recommendation	Source of Previous Recommendation
Ingestion and Dermal Contact Rates				
Resident Drinking Water Ingestion Rate - Child (L/Day)	1	0.78	US EPA 2011a, Tables 3-15 and 3-33	US EPA 1989 (Exhibit 6-11)
Resident Drinking Water Ingestion Rate - Adult (L/Day)	2	2.5	US EPA 2011a, Table 3-33	US EPA 1989 (Exhibit 6-11)
Resident skin surface area - Child (cm^2)	2,800	2,690	US EPA 2011a, Tables 7-2 and 7-8	US EPA 2002 (Exhibit 1-2)
Resident skin surface area - Adult (cm^2)	5,700	6,032	US EPA 2011a, Tables 7-2 and 7-12	US EPA 2002 (Exhibit 1-2)
Worker skin surface area - Adult (cm^2)	3,300	3,470	US EPA 2011a, Table 7-2	US EPA 2002 (Exhibit 1-2)
Resident water surface area - Child (cm^2)	6,600	6,378	US EPA 2011a, Table 7-10	US EPA 2004 (Exhibit 3-2)
Resident water surface area - Adult (cm^2)	18,000	20,900	US EPA 2011a, Table 7-10	US EPA 2004 (Exhibit 3-2)
Worker soil adherence factor - Adult (mg/cm^2)	0.20	0.12	US EPA 2011a, Table 7-20 and Section 7.2.2	US EPA 2002 (Exhibit 1-2)
Resident Body Weight - Adult (kg)	70	80	US EPA 2011a, Table 8-3	US EPA 1991a (pg. 15)
Worker Body Weight (kg)	70	80	US EPA 2011a, Table 8-3	US EPA 1991a (pg. 15)
Exposure Frequency, Exposure Duration, and Exposure Time Variables				
Resident Exposure Duration (yr)	30	26	EPA 2011a, Table 16-108	US EPA 1991a (pg. 15)
Resident Exposure Duration - Adult (yer)	24	20	Edr (26 years) - Edc (6 years)	US EPA 1991a (pg. 15)
Resident Water Exposure Time - Child (hours/event)	1	0.54	US EPA 2011a, Table 16-28	US EPA 2004
Resident Water Exposure Time - Adult (hours/event)	0.58	0.71	US EPA 2011a, Table 16-20 and 16-31	US EPA 2004

US EPA - U.S. Environmental Protection Agency

References for Cited Sources:

US EPA 1989, Risk Assessment Guidance for Superfund, Volume i: Human Health Evaluation Manual (Part A), Interim Final, Office of Emergency and Remedial Response, EPA/540/1-89/002

US EPA 1991a, Human Health Evaluation Manual, Supplemental Guidance; "Standard Default Exposure Factors", OSWER Directive 9285.6-03

US EPA 2002, Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, OSWER 9355.4-24, December 2002

US EPA 2004, Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Final, OSWER 9285.7-02EP July

US EPA 2011a, Exposure Factors Handbook; 2011 Edition, EPA/600/R-090/052F, September 2011

Table A-3
Compliance Levels for Chemicals of Concern in Soil
Source Control Operable Unit
Wright-Patterson AFB, OH

Chemical of Concern	Soil Compliance Level[a] (µg/kg)	2019 Residential Soil RSL[b] (µg/kg)	2019 Industrial Soil RSL[b] (µg/kg)
2,3,7,8-TCDD	0.00427	0.00480	0.022
Arochlor 1242	83.1	230	950
Arochlor 1248	83.1	230	940
Arochlor 1254	83.1	120	970
Arochlor 1260	83.1	240	990
Benzo(a)pyrene	55.7	110	2,100
Dieldrin	40.0	34.0	140
Beryllium	149	16,000	230,000

Notes:

[a] Values taken from Record of Decision (ROD): Source Control Operable Unit - Landfills 8 and 10 (WPAFB, 1993).

[b] Values derived from USEPA Regional Screening Levels Tables for soil at risk level of $1x10^{-6}$ and a Hazard Quotient of 0.1 (November, 2019).

µg/kg = micrograms per kilogram

Table A-4
Landfill 8 Groundwater Analytical Results Exceeding VISLs
Wright-Patterson AFB, Ohio

Location	Sample Date	VOCs		
		Benzene	TCE	Vinyl Chloride
Units		µg/L	µg/L	µg/L
Residential VISL [a]		**1.6**	**0.52**	**0.15**
Commercial VISL [a]		**6.9**	**2.2**	**2.5**
MCL [b]		**5**	**5**	**2**
LF08-MW10B	19-APR-10	ND	ND	**5.10**
	05-MAY-11	ND	ND	**4.10**
	16-APR-12	ND	ND	**3.70**
	09-APR-13	ND	ND	**4.50**
	07-MAY-14	ND	ND	**3.50**
	21-APR-15	ND	ND	**2.8**
Duplicate	05-MAY-16	ND	ND	**2.6**
	05-MAY-16	ND	ND	**2.6**
Duplicate	26-APR-17	ND	ND	**2.9**
	26-APR-17	ND	ND	**3.2**
	25-APR-18	ND	ND	**3.3**
Duplicate	25-APR-18	ND	ND	**3.2**
	15-APR-19	ND	ND	**3.3**
Duplicate	15-APR-19	ND	ND	**3.4**
LF08-MW10C	19-APR-10	DRY	DRY	DRY
	05-MAY-11	ND	ND	1.0
	16-APR-12	ND	ND	ND
	09-APR-13	ND	ND	ND
	07-MAY-14	ND	ND	0.47 J
	21-APR-15	DRY	DRY	DRY
	05-MAY-16	ND	ND	0.34 J
	26-APR-17	ND	ND	0.49 J
	25-APR-18	ND	ND	0.83 J
	15-APR-19	ND	ND	0.63 J
02-DM-83S-M	28-APR-10	0.4 J	ND	**3.4**
	05-MAY-11	ND D	ND D	2.2 D
	17-APR-12	0.33 J	ND	2.1
	09-APR-13	0.28 J	ND	1.7
	07-MAY-14	0.19 J	ND	1.2
	21-APR-15	ND	ND	1.2
Duplicate	05-MAY-16	0.26 J	ND	1.8 J
	05-MAY-16	0.24 J	ND	1.8 J
Duplicate	26-APR-17	ND	ND	1.3
	26-APR-17	ND	ND	1.4
Duplicate	30-APR-18	ND	ND	1.2
	30-APR-18	ND	ND	1.3
Duplicate	18-APR-19	ND	ND	2.5
	18-APR-19	ND	ND	2.4

Abbreviations:
B = Method blank contamination
COC = Chemical of concern
D = Sample diluted for analysis
J = Estimated value
MCL = Maximum Contaminant Level
µg/L = micrograms per liter
ND = Not detected
TCE = Trichloroethylene

Table A-4
Landfill 8 Groundwater Analytical Results Exceeding VISLs
Wright-Patterson AFB, Ohio

Location	Sample Date	VOCs		
		Benzene	**TCE**	**Vinyl Chloride**
Units		μg/L	μg/L	μg/L
Residential VISL [a]		**1.6**	**0.52**	**0.15**

VISL = Vapor Intrusion Screening Level
VOC = Volatile organic compound

Notes:

[a] VISL obtained from USEPA VISL calculator accessed on-line December, 2019. Value is the target groundwater concentration based on a total cancer risk = 1E-06 and hazard quotient = 0.1.

[b] The MCLs are provided only for comparison with the VISLs.

Concentration exceeds the residential VISL.

Concentration exceeds the residential and commercial VISLs.

Table A-5
Landfill 10 Groundwater Analytical Results Exceeding VISLs
Wright-Patterson AFB, Ohio

Location	Sample Date	VOCs: Benzene	VOCs: Vinyl Chloride
Units		µg/L	µg/L
Residential VISL[a]		**1.6**	**0.15**
Commercial VISL[a]		**6.9**	**2.5**
MCL [b]		**5**	**2**
LF10-MW09B	13-APR-10	DRY	DRY
	26-APR-11	ND	ND
	09-APR-12	ND	ND
	08-APR-13	ND	0.3 J
	01-MAY-14	ND	ND
	14-APR-15	ND	ND
	06-MAY-16	ND	ND
	27-APR-17	ND	ND
	11-APR-18	ND	ND
	15-APR-19	ND	ND

Abbreviations:
B = Method blank contamination
COC = Chemical of concern
J = Estimated value
MCL = Maximum Contaminant Level
µg/L = micrograms per liter
ND = Not detected
VISL = Vapor Intrusion Screening Level
VOC = Volatile organic compound

Notes:
[a] VISL obtained from USEPA VISL calculator accessed on-line, December, 2019. Value is the target groundwater concentration based on a total cancer risk = 1E-06 and hazard quotient = 0.1.
[b] The MCLs are provided only for comparison with the VISLs.

Concentration exceeds the residential VISL.
Concentration exceeds the residential and commercial VISLs.

Table A-6
5 DuPont Way Sub-slab Soil Vapor Sampling
Analytical Results: VOCs
Wright-Patterson AFB, Ohio

Volatile Organic Compounds EPA Method TO15	2015 Residential Sub-Slab Soil Vapor Screening Levels[a] (µg/m³)[b]	2019 Residential Sub-Slab Soil Vapor Screening Levels[c] (µg/m³)[b]	ODH Sub-Slab Soil Gas Screening Levels[d] (µg/m³)	5DW-SV01					5DW-SV02				
				February 2016	November 2016	January 2018	November 2018	October 2019	February 2016	November 2016	January 2018	November 2018	October 2019
Acetone	110,000	107,000	NSL	37	21	16	77	42	77	17	32	8.6	76
Benzene	12	12	10	0.94	0.81	0.57	0.59	0.56	0.8	0.30 J	0.84	0.19 J	0.69
Bromodichloromethane	2.5	2.5	NSL	ND	ND	0.29 J	0.46 J	0.75 J	ND	0.22 J	0.43 J	0.92 J	1.9
1,3-Butadiene	3.1	3.1	NSL	0.22 J	ND	ND	ND	ND	0.17 J	ND	ND	ND	ND
2-Butanone (MEK)	17,000	17,400	50,000	2.1 J	1.9	1.1 J	ND	2.2 J	1.4 J	1.2	3.4	ND	3.1
Carbon disulfide	2,400	2,430	9,000	0.87 J	1.9	ND	ND	ND	0.86 J	0.17 J	0.38 J	ND	ND
Carbon tetrachloride	16	15.6	NSL	0.47 J	ND	0.48 J	ND	0.54 J	0.43 J	ND	0.46 J	ND	0.70 J
Chloroform	4.1	4.1	11	ND	0.27 J	**6.5**	0.96	2.1	ND	0.66	2.8	2.7	**5.5**
Cyclohexane	21,000	20,900	NSL	ND	ND	0.16 J	ND	ND	ND	ND	1.6	ND	ND
Chloromethane	310	313	NSL	1.6 J	1.3	1.2 J	1.4 J	1.4 J	1.7 J	0.69 J	0.30 J	ND	2.8
1,4-Dichlorobenzene	8.5	8.5	NSL	0.34 J	ND	ND	ND	ND	0.21 J	ND	ND	ND	ND
Dibromochloromethane	3.5	NSL	NSL	ND	ND	ND	0.36 J	ND	ND	0.14 J	ND	0.77 J	1.0 J
Dichlorodifluoromethane (Freon 12)	350	348	NSL	2.0	0.53 J	2.1	1.5 J	ND	2.0	0.47 J	1.9	2.0 J	2.2 J
1,2-Dichloroethane (1,2-DCA)	3.6	3.6	NSL	0.11 J	ND	0.11	ND	0.35	0.094 J	ND	0.036 J	0.066J	0.13 J
1,1-Dichloroethene	700	695	NSL	ND	ND	0.025 J	ND	ND	ND	ND	ND	ND	ND
Freon 114	NSL	NSL	NSL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethyl benzene	37	37	3,000	0.51	0.30 J	0.33	0.45	0.45	0.31	0.067 J	2	0.10 J	0.67
Ethanol	NA	NA	NSL	410 E	ND	310 E	810 E	110	590 E	ND	61	13	1,400 E
4-Ethyltoluene	NA	NA	NSL	0.45 J	ND	0.26 J	0.31 J	0.46 J	0.24 J	ND	1.4	ND	0.74 J
Heptane	NA	* 1,390	NSL	0.90	ND	0.69	1.3	ND	0.86	ND	4.3	0.52 J	ND
Hexane	2,400	2,430	NSL	1.1	ND	0.66	0.73	0.69 J	0.72	ND	4.4	0.45 J	0.75 J
2-Hexanone	100	104	NSL	ND	0.26 J	ND	ND	ND	ND	ND	1.4 J	ND	ND
Methylene chloride	2,100	2,090	NSL	0.38 J	0.24 J	0.91 J	0.70 J	ND	0.38 J	0.21 J	0.27 J	0.49 J	ND
4-Methyl-2-pentanone (MIBK)	10,000	10,400	30,000	0.26 J	ND	ND	0.53 J	ND	ND	ND	ND	ND	ND
Propylbenzene	3,500	3,480	NSL	ND	ND	0.14 J	ND	ND	ND	ND	0.78 J	ND	ND
2-Propanol	700	695	NSL	31	ND	17	53	42	38	ND	8.9	5.5	240 E
Styrene	3,500	3,480	NSL	0.57 J	0.28 J	0.56 J	1.2	2.2	0.32 J	ND	ND	ND	3.30 J
Tetrachloroethene (PCE)	140	139	400	0.087 J	0.087 J	0.060 J	0.072 J	0.11 J	0.080 J	ND	0.062 J	0.058 J	0.17 J
Toluene	17,000	17,400	3,000	2.8	2.0	1.4	2.3	2.3	2	0.56	3.4	0.54	2.5
1,1,1-Trichloroethane	17,000	17,400	NSL	0.021 J	ND	ND	0.020 J	ND	0.018 J	ND	0.083 J	ND	ND
Trichloroethene (TCE)	7.0	7.0	20	0.041 J	ND	0.020 J	ND	0.035 J	0.038 J	ND	0.093 J	ND	0.03 J
Trichlorofluoromethane (Freon 11)	2,400	* NSL	NSL	1.1	0.31 J	1.2	1.1	1.4	1.1	0.28 J	1	0.98	1.6
Freon 113	100,000	* 17,400	NSL	0.46 J	ND	0.47 J	0.49 J	0.59 J	0.44 J	ND	0.39 J	0.44 J	ND
1,2,4-Trimethylbenzene	24	* 209	60	0.53 J	0.285 J	0.34 J	0.49 J	0.35 J	0.32 J	ND	2.6	ND	0.76 J
1,3,5-Trimethylbenzene	NA	* 209	60	0.18 J	ND	ND	ND	ND	ND	ND	0.66 J	ND	ND
m,p-Xylene	350	348	2,000	1.5	1.3	0.93	1.2	1.2	0.86	0.17 J	2.8	0.38	1.6
o-Xylene	350	348	2,000	0.54	0.63	0.37	0.47	0.47	0.31	0.066 J	1.4	0.15	0.65
Vinyl Chloride	ND	* 6	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methane (%)				0.00034	NA	0.00034	NA	0.00018	0.00031	NA	0.00042	NA	0.00019

Notes:

[a] VISL obtained from USEPA VISL calculator (Version 3.4, June 2015 RSLs), accessed on-line June 17, 2015. Value is the target sub-slab soil vapor concentration based on a total cancer risk = 1E-06 and Hazard Quotient = 0.1. An attenuation factor of 0.03 is assumed for sub-slab soil vapor. Differences between some of the 2015 and 2019 values are due to differences in rounding of calculator output.

[b] µg/m³ = microgram per cubic meter (gas).

[c] VISL obtained from USEPA VISL calculator (November RSLs), accessed on-line November 20, 2019. Value is the target sub-slab soil vapor concentration based on a total cancer risk = 1E-06 and Hazard Quotient = 0.1. An attenuation factor of 0.03 is assumed for sub-slab soil vapor. Differences between some of the 2015 and 2019 values are due to differences in rounding of calculator output.

[d] Ohio Department of Health (ODH) screening levels (SL) from letter dated April 25, 2012 from Robert Frey (Chief, Health Assessment Section, ODH) to Donna Bohannon (OEPA). SLs derived from USEPA OSWER 2002 Vapor Intrusion Guidance, ATSDR's chronic-duration (more than 1 year) minimal risk levels (MRLs) and cancer risk evaluation guides (CREGs), and USEPA's reference concentrations (RfCs).

* Change in value since previous Five-Year Review.

Bold = Results exceed a calculated screening level.

Abbreviations:

B - analyte detected in blank
E - Result exceeds instrument calibration range
J - result below reporting limit
NSL - No screening level available
ND - Not detected
VISL - Vapor Intrusion Screening Level

Table A-7
Comparison of Maximum Detected Groundwater Concentrations, April 2019, with MCLs and RSLs: SCOU Record of Decision

Chemical	Maximum Groundwater Concentration (a) (µg/L)	Location of Maximum Concentration	Current Compliance Level (b) (µg/L)	Current RSL (c) (µg/L)	Existing Chemical of Concern?	New Chemical of Concern?
Volatile Organic Compounds						
1,1,1-Trichloroethane	52.7	02-DM-81D-M	200	800	NO	NO
1,1-Dichloroethane	29	02-DM-81D-M	---	2.8	YES (d)	NO
1,2-Dichloropropane	2	02-DM-81D-M	5	0.82	NO	NO (e)
Chlorobenzene	0.62 J	02-DM-81D-M	100	7.8	NO	NO
Chloromethane	0.62 J	LF10-MW08A-2	---	19	NO	NO
Vinyl Chloride	3.8	LF10-MW103	2	0.019	YES	NO
cis-1,2-Dichloroethene	2.5	LF10-MW103	70	3.6	NO	NO
trans-1,2-Dichloroethene	0.31 J	LF10-MW103	100	36	NO	NO
Metals						
Aluminum	28,200	LF10-MW103	---	2000	YES	NO
Antimony	4 J	LF10-MW08A-2	6	0.78	YES	NO
Arsenic	70.8	02-DM-84-M	10	0.052	YES	NO
Barium	1,240	LF10-MW08B	2000	380	YES	NO
Beryllium	1.5 J	LF10-MW103	4	2.5	NO	NO
Cadmium	0.3 J	LF10-MW09B	5	0.92	NO	NO
Chromium	66.4	LF10-MW08A-2	100	---	NO	NO
Cobalt	29.7 J	LF10-MW103	---	0.6	YES	NO
Copper	127	LF10-MW103	1300	80	YES	NO
Iron	62,600	LF10-MW103	---	1400	YES (d)	NO
Lead	30.5	LF10-MW103	15	15	YES	NO
Manganese	1,300	LF10-MW103	---	43	YES	NO
Mercury (inorganic)	0.39 J	LF08-MW10B	2	0.57	NO	NO
Nickel	90	LF10-MW103	---	39	YES	NO
Selenium	12	LF10-MW09C	50	10	NO	NO
Vanadium	50	LF10-MW103	---	8.6	YES	NO
Zinc	859	LF10-MW103	---	600	YES	NO

--- - No Value
J - Estimated value
MCL - Maximum Contaminant Level
µg/L - micrograms per liter
RSL - Regional Screening Level
ROD - Record of Decision

Table A-7
Comparison of Maximum Detected Groundwater Concentrations, April 2019, with MCLs and RSLs: SCOU Record of Decision

Chemical	Maximum Groundwater Concentration (a) (µg/L)	Location of Maximum Concentration	Current Compliance Level (b) (µg/L)	Current RSL (c) (µg/L)	Existing Chemical of Concern?	New Chemical of Concern?

(a) Maximum detected concentration based on groundwater samples collected in April 2019 as part of the Long-Term Monitoring Program.

(b) Based on MCLs dated 2019. The MCLs are established as the current compliance levels as described in the *Explanation of Significant Differences* (WPAFB, 2012) for six RODs.

(c) USEPA Regional Screening Levels (RSLs) dated November 2019 at a risk level of 1 x 10^{-6} and Hazard Quotient (HQ) of 0.1. The RSLs are presented for comparison and serve as compliance levels for chemicals without MCLs.

(d) Chemical was identified as a new COC in the Fourth Five-Year Review (WPAFB, 2016) and continues to be tracked through LTM.

(e) Groundwater concentration is above the current RSL, but below the MCL.

Table A-8
Rationale for Further Evaluation of Toxicity Data
21 No Action Sites(1)
Wright-Patterson AFB, Ohio
Page 1 of 6

OU	IRP Site	Type of Risk Assessment	Further Evaluation Required?	Rationale for Further Evaluation of Screening/ Toxicity Values	References
2	B89CSP	Quantitative RA	Yes-Toxicity Values	The site is mostly grass-covered with a paved parking lot.	Final RI Report for Operable Unit 2, ES, 1995.
2	BS1	Quantitative RA	Yes-Toxicity Values	Since the previous Five-Year Review, a new vehicle inspection facility and Gate 26A was constructed on part of BS1. The facility and gate opened in November 2019. Land use remains as commercial/industrial. The site is a grass-covered field with a concrete pad on one part. Land use was assumed to be recreational. Current allowable land use is "open space". The LTCSA and BS1 were evaluated as one exposure unit.	Final RI Report for Operable Unit 2, ES, 1995.
2	CCSA	Quantitative RA	Yes-Toxicity Values	The site is grass-covered; land use is designated as commercial/industrial. The CCSA, TCSP, and Spill Sites 2, 3, and 10 were evaluated as one exposure unit.	Final RI Report for Operable Unit 2, ES, 1995.
2	LTCSA	Quantitative RA	Yes-Toxicity Values	Since the previous Five-Year Review, a new vehicle inspection facility and Gate 26A was constructed on part of LTCSA. The facility and gate opened in November 2019. Land use remains as commercial/industrial. The site is a grassy area within the Laser Test Area; land use is designated as recreational. The LTCSA and BS1 were evaluated as one exposure unit	Final RI Report for Operable Unit 2, ES, 1995.
2	TCSP	Quantitative RA	Yes-Toxicity Values	The site is a grassy area with the southwest portion being paved with asphalt; land use is designated as commercial/industrial. The TCSP, CCSA, and Spill Sites 2, 3, and 10 were evaluated as one exposure unit.	Final RI Report for Operable Unit 2, ES, 1995.

Table A-8
Rationale for Further Evaluation of Toxicity Data
21 No Action Sites[(1)]
Wright-Patterson AFB, Ohio

OU	IRP Site	Type of Risk Assessment	Further Evaluation Required?	Rationale for Further Evaluation of Screening/ Toxicity Values	References
3	EFDZ11	None	No	The site is grass-covered with trees and gravel roads; land use is classified as part open space, including recreational and industrial. No risk assessment was conducted because only VOC and SVOC TICs, and metals were detected at the site. The metals detected were considered to be naturally-occurring.	Site Investigation Report for 16 IRP Sites, SAIC, 1993.
3	EFDZ12	None	No	The area is mostly wooded; land use is classified as part open space, including recreational and industrial. No risk assessment was conducted. No VOCs or SVOCs were detected. One pesticide (endosulfan) was detected at very low concentrations (3.5 µg/kg) and is below its current industrial RSL (7,000 mg/kg or 7,000,000 µg/kg; USEPA, 2015). Metals (i.e., manganese) that were detected are considered to be occurring naturally (concentration was less than background) and/or are below the 2015 industrial and residential RSLs. This site was not carried forward in an RI.	Site Investigation Report for 16 IRP Sites, SAIC, 1993.
3	FTA2	Quantitative RA	Yes-Toxicity Values	FTA2 is mostly grass-covered with paved taxiway located on the southeastern side. FTA2 and FTA5 were evaluated as one exposure unit.	Final RI Report for Operable Unit 3, SAIC, 1995.
3	FTA3	Quantitative RA	Yes-Toxicity Values	FTA3 is gravel-covered; land use is designated as light industrial. FTA 3, FTA 4, and SP1 were evaluated as one exposure unit.	Final RI Report for Operable Unit 3, SAIC, 1995.
3	FTA4	Quantitative RA	Yes-Toxicity Values	FTA4 is gravel-covered; land use is designated as light industrial. FTA3, FTA4, and SP1 were evaluated as one exposure unit	Final RI Report for Operable Unit 3, SAIC, 1995.

Table A-8
Rationale for Further Evaluation of Toxicity Data
21 No Action Sites(1)
Wright-Patterson AFB, Ohio
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OU	IRP Site	Type of Risk Assessment	Further Evaluation Required?	Rationale for Further Evaluation of Screening/ Toxicity Values	References
3	FTA5	Quantitative RA	Yes-Toxicity Values	FTA5 was previously grass-covered, but now is mostly gravel-covered with a small grass-covered area; land use is designated as industrial. FTA2 and FTA5 were evaluated as one exposure unit. (In 1996, USTs were removed from the site and accepted for closure by the State Fire Marshall.	Final RI Report for Operable Unit 3, SAIC, 1995.
3	LF14	Quantitative RA	Yes-Toxicity Values	LF14 is wooded and grass-covered; land use is designated as open space, including recreational.	Final RI Report for Operable Unit 3, SAIC, 1995.
3	SP1	Quantitative RA	Yes-Toxicity Values	SP1 is gravel-covered. The concrete batch plant has been removed	Final RI Report for Operable Unit 3, SAIC, 1995.
5	BS4	Semi-quantitative RA	Yes-RSLs	The area of BS4 is mostly wooded. A paved parking lot has been added for visitors on the northeast end. Site concentrations were originally compared with Region 9 industrial soil PRGs. All concentrations of detected compounds were below the residential PRGs; therefore, WPAFB may consider lifting restrictions on this site.	Decision Document Burial Site 4, SAIC, 1994. Final RI Report for Operable Unit 5, IT Corporation, 1995.
5	FTA1	Semi-quantitative RA	Yes-RSLs	The area of FTA1 is grass-covered with gravel roads and structures; land use is designated as commercial/industrial. Site concentrations were compared with the Region 9 industrial soil PRGs.	Final RI Report for Operable Unit 5, IT Corporation, 1995.

Table A-8
Rationale for Further Evaluation of Toxicity Data
21 No Action Sites[(1)]
Wright-Patterson AFB, Ohio

OU	IRP Site	Type of Risk Assessment	Further Evaluation Required?	Rationale for Further Evaluation of Screening/ Toxicity Values	References
5	GLTS	Semi-quantitative RA	Yes-RSLs	The area of GLTS is mostly brush-covered; land use is designated as recreational. Site concentrations were compared with the Region 9 industrial soil PRGs.	Decision Document Gravel Lake Tank Site, SAIC, 1992. Final RI Report for Operable Unit 5, IT Corporation, 1995.
6	EFDZ1	Quantitative RA	Yes-Toxicity Values	EFDZ1 is a grassy area within the Laser Test Range; land use is designated as part commercial/industrial and open space including recreational. EFDZ1 consists of three areas. PAHs present in EFDZ1C surface soils are likely influenced by the asphalt walking path in the park and the exhaust from the heavily traveled road nearby. Petroleum hydrocarbons found in the surface soil are expected to biodegrade quickly.	IRP, Site Investigation Report for Eight Earthfill Disposal Zones, WPAFB, 1992.
10	CHP-3	Quantitative RA Quantitative RA also at the BBS which is part of CHP-3	Yes-RSLs	Land use at CHP-3 was a light industrial/office complex. At the time that the risk assessment was performed, CHP-3 consisted of three areas: former coal storage area, a former compressor oil sump, and a BBS. Buildings have since been demolished. There is currently a paved parking lot and an open grassy lot. Current exposure to contaminated soil at CHP-3 is considered unlikely because of the partial concrete and asphalt cover.	RI Report. Operable Unit 10, Landfill 13, Central Heating Plant 3 & Associated Battery Burial Site, TCE/PCE Plume & Related Potential Source Areas, Volume 1. WPAFB, 1995.

Table A-8
Rationale for Further Evaluation of Toxicity Data
21 No Action Sites[1]
Wright-Patterson AFB, Ohio

OU	IRP Site	Type of Risk Assessment	Further Evaluation Required?	Rationale for Further Evaluation of Screening/ Toxicity Values	References
10	LF13	None. No soil samples were taken at this site.	No	Land use is light industrial/office complex. The LF13 area is currently used as a paved parking area. The No Action alternative was chosen for LF13 since it is covered and exposure pathways to LF materials are incomplete.	RI Report. Operable Unit 10, Landfill 13, Central Heating Plant 3 & Associated Battery Burial Site, TCE/PCE Plume & Related Potential Source Areas, Volume 1. WPAFB, 1995.
10	TF49A	None	No	In 1993, all USTs at the site were removed. Contaminated soil was also removed from the site, and the excavation was backfilled with clean soil in accordance with BUSTR regulations. The area is a paved parking lot; land use is light industrial/office complex. The risk of exposure to contaminated soil was eliminated when the area was paved.	IRP No Action Proposed Plan for Sites Within or Near OU10, CH2M HILL, 1996.
10	UST 30119	None.	No	In 1989, two USTs at the site were discovered to be leaking and were taken out of service. In 1994, all five USTs at the site were removed. Contaminated soil was removed and the excavation was backfilled with clean soil in accordance with BUSTR regulations. At the time of the risk assessment, the area was mostly paved and was used as the base gas station. The site is now an open grassy lot. The potential for exposure to contaminated soil was eliminated after removal of the leaking USTs. Based on evaluations of the site data, the concurrence with BUSTR, and the current site conditions, UST site 30119 is not expected to pose significant human health risks. The contaminated soil has been removed and disposed.	Technical Document to Support No Further Action Declaration, IRP Site 30119 (USTs 303-306 and UST 57), WPAFB, 1995. IRP No Action Proposed Plan for Sites Within or Near OU10, CH2M HILL, 1996.

Table A-8
Rationale for Further Evaluation of Toxicity Data
21 No Action Sites(1)
Wright-Patterson AFB, Ohio

Notes:

1 – These sites were categorized as No Action sites with the condition that land use remain restricted (Record of Decision for 21 No Action Sites at Wright-Patterson Air Force Base; WPAFB, 1996).

Abbreviations:

B89CSP	= Building 89 Coal Storage Pile
BBS	= Battery Burial Site
BS	= Burial Site
BUSTR	= Bureau of Underground Storage Tank Regulations
CCSA	= Coal and Chemical Storage Area
CHP	= Central Heating Plant
EFDZ	= Earthfill Disposal Zone
ES	= Environmental Science
FTA	= Fire Training Area
GLTS	= Gravel Lake Tank Site
IRP	= Installation Restoration Program
LF	= Landfill
LTCSA	= Long-term Coal Storage Area
mg/kg	= milligram / kilogram
OU	= Operable Unit(s)
PAH	= Polycyclic Aromatic Hydrocarbons
PCE	= Perchloroethylene
PRG	= Preliminary Remediation Goals
RA	= Risk Assessment
RI	= Remedial Investigation
ROD	= Record of Decision
RSL	= Regional Screening Level
SAIC	= Science Applications International Corporation
SP	= Spill Site
SVOC	= Semi-Volatile Organic Compounds
TCE	= Trichloroethylene
TCSP	= Temporary Coal Storage Pile
TIC	= Tentatively Identified Compounds
TF	= Tank Farm
USEPA	= U.S. Environmental Protection Agency
UST	= Underground Storage Tank
VOC	= Volatile Organic Compounds
WPAFB	= Wright-Patterson Air Force Base

Table A-9
Comparison of Screening Levels Used in Semi-Quantitative Risk Assessments
21 No Action Sites
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Chemical of Potential Concern	Screening Levels Used in Original Risk Assessment: PRG - Residential Soil (mg/kg) (1)	PRG - Industrial Soil (mg/kg) (1)	Reference (1)	Current Screening Levels: November 2019 RSL Residential Soil (mg/kg) (2)	November 2019 RSL Industrial Soil (mg/kg) (2)	Maximum Concentration (mg/kg) (3)	COPC in Original Risk Assessment?	Is current screening level more stringent?	New COPC?
OU 5 Fire Training Area (FTA-1)									
Acetone	---	1.30E+03	RI Report 1995	---	6.70E+04	1.80E-02	NO	NO	
Carbon Tetrachloride	---	1.60E-01	RI Report 1995	---	2.90E+00	3.00E-03	NO	NO	
1,2-Dichloroethene	---	3.90E+01	RI Report 1995	---	2.30E+02	3.00E-03	NO	NO	
Methylene Chloride	---	3.90E+00	RI Report 1995	---	3.20E+02	1.40E-02	NO	NO	
Acenaphthene	---	3.60E+01	RI Report 1995	---	4.50E+03	8.40E-01	NO	NO	
Anthracene	---	1.90E+00	RI Report 1995	---	2.30E+04	1.50E+00	NO	NO	
Benzo(a)anthracene	---	3.90E-01	RI Report 1995	---	2.10E+01	7.00E+00	YES	NO	
Benzo(b)fluoranthene	---	3.90E-01	RI Report 1995	---	2.10E+01	5.90E+00	YES	NO	
Benzo(k)fluoranthene	---	3.90E+00	RI Report 1995	---	2.10E+02	7.10E+00	YES	NO	
Benzo(g,h,i)perylene (4)	---	---	RI Report 1995	---	2.30E+03	3.40E+00	NO	YES	
Benzo(a)pyrene	---	3.90E-02	RI Report 1995	---	2.10E+00	6.40E+00	YES	NO	
Bis(2-ethylhexyl)phthalate	---	2.00E+01	RI Report 1995	---	1.60E+02	2.50E+00	NO	NO	
Chrysene	---	3.90E+01	RI Report 1995	---	2.10E+03	7.20E+00	NO	NO	
Dibenz(a,h)anthracene	---	3.90E-02	RI Report 1995	---	2.10E+00	1.70E+00	YES	NO	
1,2-Dichlorobenzene	---	2.30E+02	RI Report 1995	---	9.30E+02	2.60E-01	NO	NO	
Fluoranthene	---	4.10E+03	RI Report 1995	---	3.00E+03	1.30E+01	NO	YES	
Fluorene	---	2.80E+01	RI Report 1995	---	3.00E+03	5.70E-01	NO	NO	
Indeno(1,2,3-cd)pyrene	---	3.90E-01	RI Report 1995	---	2.10E+01	3.70E+00	YES	NO	
2-Methylnaphthalene	---	---	RI Report 1995	---	3.00E+02	9.80E+01	NO	YES	
Naphthalene	---	8.00E+01	RI Report 1995	---	1.70E+01	1.00E+01	NO	YES	NO
Phenanthrene (4)	---	---	RI Report 1995	---	2.30E+03	6.80E+00	NO	YES	
Pyrene	---	3.10E+03	RI Report 1995	---	2.30E+03	1.20E+01	NO	YES	
Aluminum	---	---	RI Report 1995	---	1.10E+05	1.00E+04	NO	YES	
Arsenic	---	1.60E-01	RI Report 1995	---	3.00E+00	6.00E+00	NO	NO	YES
Barium	---	7.20E+03	RI Report 1995	---	2.20E+04	2.60E+02	NO	NO	
Beryllium	---	6.70E-02	RI Report 1995	---	2.30E+02	8.40E-01	YES	NO	
Calcium	---	---	RI Report 1995	---	---	2.50E+05	NO	---	
Chromium VI	---	5.10E+02	RI Report 1995	---	6.30E+00	1.50E+01	NO	YES	YES
Cobalt	---	---	RI Report 1995	---	3.50E+01	8.50E+00	NO	YES	
Copper	---	3.80E+03	RI Report 1995	---	4.70E+03	4.70E+01	NO	NO	
Iron	---	---	RI Report 1995	---	8.20E+04	3.30E+04	NO	YES	
Lead	4.00E+02	---	RI Report 1995	4.00E+02	---	5.70E+01	NO	NO	
Magnesium	---	---	RI Report 1995	---	---	8.30E+04	NO	---	
Manganese	---	5.10E+02	RI Report 1995	---	2.60E+03	7.70E+02	NO	NO	
Mercury	---	3.10E+01	RI Report 1995	---	3.50E+01	9.00E-02	NO	NO	
Nickel	---	2.00E+03	RI Report 1995	---	2.20E+03	1.70E+01	NO	NO	

Table A-9
Comparison of Screening Levels Used in Semi-Quantitative Risk Assessments
21 No Action Sites

Potassium	---	---	RI Report 1995	---	---	1.00E+03	NO	---	
Selenium	---	5.10E+02	RI Report 1995	---	5.80E+02	1.10E+00	NO	NO	
Sodium	---	---	RI Report 1995	---	---	2.50E+02	NO	---	
Thallium	---	8.20E+00	RI Report 1995	---	1.20E+00	3.20E-01	NO	YES	
Vanadium	---	7.20E+02	RI Report 1995	---	5.80E+02	2.70E+01	NO	YES	
Zinc	---	1.00E+05	RI Report 1995	---	3.50E+04	6.80E+01	NO	YES	
OU 5 Burial Site 4									
Acetone	---	1.30E+03	RI Report 1995	6.10E+03	6.70E+04	7.00E-03	NO	NO	
Methylene Chloride	---	3.90E+00	RI Report 1995	3.50E+01	3.20E+02	4.40E-02	NO	NO	
Toluene	---	2.80E+02	RI Report 1995	4.90E+02	4.70E+03	1.90E+00	NO	NO	
1,1,1-Trichloroethane	---	3.00E+02	RI Report 1995	8.10E+02	3.60E+03	5.00E-03	NO	NO	
Pyrene	---	3.10E+03	RI Report 1995	1.80E+02	2.30E+03	1.70E-01	NO	YES	
Lead	4.00E+02	---	RI Report 1995	4.00E+02	---	1.80E+01	NO	NO	
OU 5 Gravel Lake Tank Site									
Toluene	---	2.80E+02	RI Report 1995	---	4.70E+03	6.80E-01	NO	NO	
Lead	4.00E+02	---	RI Report 1995	4.00E+02	---	2.20E+01	NO	NO	
OU10 CHP-3									
Benzo(a)anthracene	---	2.60E+00	RI Report 1995	---	2.10E+01	1.80E-01	NO	NO	
Benzo(b)fluoranthene	---	2.60E+00	RI Report 1995	---	2.10E+01	1.80E-01	NO	NO	
Benzo(k)fluoranthene	---	2.60E+01	RI Report 1995	---	2.10E+02	1.40E-01	NO	NO	
Benzo(a)pyrene	---	2.60E-01	RI Report 1995	---	2.10E+00	1.20E-01	YES	NO	
Chrysene	---	2.40E+01	RI Report 1995	---	2.10E+03	2.40E-01	NO	NO	
Dibenz(a,h)anthracene	---	2.60E-01	RI Report 1995	---	2.10E+00	4.40E-02	NO	NO	
Dibenzofuran	---	2.70E+03	RI Report 1995	---	1.00E+02	2.40E-01	NO	YES	
Fluoranthene	---	2.70E+04	RI Report 1995	---	3.00E+03	3.80E-01	NO	YES	
Fluorene	---	3.00E+02	RI Report 1995	---	3.00E+03	4.60E-02	NO	NO	
Indeno(1,2,3-cd)pyrene	---	2.60E+00	RI Report 1995	---	2.10E+01	9.10E-02	NO	NO	
Naphthalene	---	8.00E+02	RI Report 1995	---	1.70E+01	4.80E-01	NO	YES	
Pyrene	---	2.00E+04	RI Report 1995	---	2.30E+03	2.70E-01	NO	YES	
OU10 Battery Burial Site									
Arsenic	---	2.00E+00	RI Report 1995	---	3.00E+00	3.70E+00	YES	NO	
Beryllium	---	1.10E+00	RI Report 1995	---	2.30E+02	1.40E+00	YES	NO	
Cadmium	---	8.50E+02	RI Report 1995	---	9.80E+01	2.23E+02	NO	YES	YES
Chromium VI	---	2.30E+02	RI Report 1995	---	6.30E+00	1.71E+01	NO	YES	YES
Copper	---	6.30E+03	RI Report 1995	---	4.70E+03	1.90E+03	NO	YES	
Manganese	---	8.30E+03	RI Report 1995	---	2.60E+03	1.38E+04	YES	YES	
Mercury	---	8.50E+03	RI Report 1995	---	3.50E+01	6.37E+01	NO	YES	
Zinc	---	1.00E+05	RI Report 1995	---	3.50E+04	7.59E+04	NO	YES	YES

Table A-9
Comparison of Screening Levels Used in Semi-Quantitative Risk Assessments
21 No Action Sites

--- No value available
PRGs and RSLs based on 10^{-7} cancer risk or a Hazard Index (HI) of 0.1.
COPC - Chemical of Potential Concern.
mg/kg - milligrams/kilogram
OU - Operable Unit
PRG - Preliminary Remediation Goal
RSL - Regional Screening Level
USEPA - U.S. Environmental Protection Agency.

(1) Screening levels were obtained from the original risk assessment and Remedial Investigation (RI) report as referenced.
(2) Screening levels were obtained from USEPA Regional Screening Levels table (dated November 2019).
(3) Maximum concentration of surface and subsurface soil samples taken at site.
(4) Screening values are based on the RSLs for pyrene as a surrogate.

Value has changed since the Fourth Five-Year Review (WPAFB, 2016).

Table A-10
Comparison of Toxicity Values Used in the Quantitative Risk Assessment with Current Toxicity Values for 21 NA Sites
Oral and Dermal Slope Factors
Page 1 of 4

	Toxicity Values Used in Risk Assessment				Current Toxicity Values				
Chemical of Potential Concern	Oral Slope Factor $(mg/kg\text{-}day)^{-1}$ (1)	Gastrointestinal Absorption Factor (1)	Dermal Slope Factor $(mg/kg\text{-}day)^{-1}$ (2)	Reference (1)	Oral Slope Factor $(mg/kg\text{-}day)^{-1}$ (3)	Gastrointestinal Absorption Factor (3)	Dermal Slope Factor $(mg/kg\text{-}day)^{-1}$ (2)	Source (3)	Is current oral toxicity value more stringent?
OU 2									
Aluminum	---	4.00E-02	---	RI Report - 1994	---	1.00E+00	---	---	---
Antimony	---	1.00E-02	---	RI Report - 1994	---	1.50E-01	---	---	---
Arsenic	1.75E+00	8.00E-01	2.19E+00	RI Report - 1994	1.50E+00	1.00E+00	1.50E+00	IRIS	Less
Barium	---	5.00E-02	---	RI Report - 1994	---	7.00E-02	---	---	---
Beryllium	4.30E+00	1.00E-02	4.30E+02	RI Report - 1994	---	7.00E-03	---	---	Less (4)
Cadmium	---	2.00E-02	---	RI Report - 1994	---	2.50E-02	---	---	---
Chromium III	---	2.00E-02	---	RI Report - 1994	---	1.30E-02	---	---	---
Chromium VI	---	2.00E-02	---	RI Report - 1994	5.00E-01	2.50E-02	2.00E+01	CalEPA	More (5)
Cobalt	---	5.00E-02	---	RI Report - 1994	---	1.00E+00	---	---	---
Copper	---	6.00E-01	---	RI Report - 1994	---	1.00E+00	---	---	---
Lead	---	1.50E-01	---	RI Report - 1994	---	1.00E+00	---	---	---
Manganese	---	3.00E-02	---	RI Report - 1994	---	1.00E+00	---	---	---
Mercury	---	1.00E-02	---	RI Report - 1994	---	7.00E-02	---	---	---
Nickel	---	4.00E-02	---	RI Report - 1994	---	4.00E-02	---	---	---
Selenium	---	9.00E-01	---	RI Report - 1994	---	1.00E+00	---	---	---
Silver	---	2.00E-01	---	RI Report - 1994	---	4.00E-02	---	---	---
Thallium	---	1.00E+00	---	RI Report - 1994	---	1.00E+00	---	---	---
Vanadium	---	1.00E-02	---	RI Report - 1994	---	2.60E-02	---	---	---
Zinc	---	2.50E-01	---	RI Report - 1994	---	1.00E+00	---	---	---
Acenaphthene	---	2.00E-01	---	RI Report - 1994	---	1.00E+00	---	---	---
Acenaphthylene	---	2.00E-01	---	RI Report - 1994	---	1.00E+00	---	---	---
Acetone	---	9.00E-01	---	RI Report - 1994	---	1.00E+00	---	---	---
alpha-Chlordane	1.30E+00	5.00E-01	2.60E+00	RI Report - 1994	3.50E-01	1.00E+00	3.50E-01	IRIS	Less
Anthracene	---	2.00E-01	---	RI Report - 1994	---	1.00E+00	---	---	---
Benzene	2.90E-02	9.50E-01	3.05E-02	RI Report - 1994	5.50E-02	1.00E+00	5.50E-02	IRIS	More
Benzo(a)anthracene	7.30E-01	2.00E-01	3.65E+00	RI Report - 1994	1.00E-01	1.00E+00	1.00E-01	RPF	Less
Benzo(a)pyrene	7.30E+00	2.00E-01	3.65E+01	RI Report - 1994	1.00E+00	1.00E+00	1.00E+00	IRIS	Less
Benzo(b)fluoranthene	7.30E-01	2.00E-01	3.65E+00	RI Report - 1994	1.00E-01	1.00E+00	1.00E-01	RPF	Less
Benzo(g,h,i)perylene	---	2.00E-01	---	RI Report - 1994	---	1.00E+00	---	---	---
Benzo(k)fluoranthene	7.30E-02	2.00E-01	3.65E-01	RI Report - 1994	1.00E-02	1.00E+00	1.00E-02	RPF	Less
Bis(2-ethylhexyl)phthalate	1.40E-02	5.00E-01	2.80E-02	RI Report - 1994	1.40E-02	1.00E+00	1.40E-02	IRIS	Same
Carbazole	2.00E-02	2.00E-01	1.00E-01	RI Report - 1994	---	---	---	---	Less (4)
Carbon Disulfide	---	6.30E-01	---	RI Report - 1994	---	1.00E+00	---	---	---
Chrysene	7.30E-03	6.00E-01	1.22E-02	RI Report - 1994	1.00E-03	1.00E+00	1.00E-03	RPF	Less
4,4'-DDD	2.40E-01	2.00E-01	1.20E+00	RI Report - 1994	2.40E-01	1.00E+00	2.40E-01	IRIS	Same
4,4'-DDE	3.40E-01	2.00E-01	1.70E+00	RI Report - 1994	3.40E-01	1.00E+00	3.40E-01	IRIS	Same
4,4'-DDT	3.40E-01	2.00E-01	1.70E+00	RI Report - 1994	3.40E-01	1.00E+00	3.40E-01	IRIS	Same
Dibenz(a,h)anthracene	7.30E+00	2.00E-01	3.65E+01	RI Report - 1994	1.00E+00	1.00E+00	1.00E+00	RPF	Less
Di-n-butyl phthalate	---	9.00E-01	---	RI Report - 1994	---	1.00E+00	---	---	---
Dibenzofuran	---	5.00E-01	---	RI Report - 1994	---	1.00E+00	---	---	---
Dieldrin	1.60E+01	5.00E-01	3.20E+01	RI Report - 1994	1.60E+01	1.00E+00	1.60E+01	IRIS	Same
2,4-Dimethylphenol	---	9.00E-01	---	RI Report - 1994	---	1.00E+00	---	---	---
Endosulfan sulfate	---	8.50E-01	---	RI Report - 1994	---	1.00E+00	---	---	---

Table A-10
Comparison of Toxicity Values Used in the Quantitative Risk Assessment with Current Toxicity Values for 21 NA Sites
Oral and Dermal Slope Factors

Endrin	---	5.00E-01	---	RI Report - 1994	---	1.00E+00	---	---	---
Endrin aldehyde	--	2.00E-01	---	RI Report - 1994	---	1.00E+00	---	---	---
Ethylbenzene	---	8.50E-01	---	RI Report - 1994	1.10E-02	1.00E+00	1.10E-02	CalEPA	---
Fluoranthene	---	2.00E-01	---	RI Report - 1994	---	1.00E+00	---	---	---
Fluorene	---	2.00E-01	---	RI Report - 1994	---	1.00E+00	---	---	---
Heptachlor	4.50E+00	4.00E-01	1.13E+01	RI Report - 1994	4.50E+00	1.00E+00	4.50E+00	IRIS	Same
Heptachlor epoxide	9.10E+00	4.00E-01	2.28E+01	RI Report - 1994	9.10E+00	1.00E+00	9.10E+00	IRIS	Same
Indeno(1,2,3-cd)pyrene	7.30E-01	2.00E-01	3.65E+00	RI Report - 1994	1.00E-01	1.00E+00	1.00E-01	RPF	Less
Methylene Chloride	7.50E-03	9.80E-01	7.65E-03	RI Report - 1994	2.00E-03	1.00E+00	2.00E-03	IRIS	Less
2-Methylnaphthalene	---	2.00E-01	---	RI Report - 1994	---	1.00E+00	---	---	---
4-Methyl-2-pentanone	---	9.00E-01	---	RI Report - 1994	---	1.00E+00	---	---	---
4-Methylphenol	---	7.50E-01	---	RI Report - 1994	---	1.00E+00	---	---	---
Naphthalene	---	2.00E-01	---	RI Report - 1994	---	1.00E+00	---	---	---
Phenanthrene	---	2.00E-01	---	RI Report - 1994	---	1.00E+00	---	---	---
Pyrene	---	2.00E-01	---	RI Report - 1994	---	1.00E+00	---	---	---
Toluene	---	9.00E-01	---	RI Report - 1994	---	1.00E+00	---	---	---
Xylenes	---	9.00E-01	---	RI Report - 1994	---	1.00E+00	---	---	---
OU 3									
Barium	---	9.10E-01	---	RI Report - 1994	---	7.00E-02	---	---	---
Beryllium	4.30E+00	1.00E-02	4.30E+02	RI Report - 1994	---	7.00E-03	---	---	Less (4)
Cadmium (food)	---	2.50E-02	---	RI Report - 1994	---	2.50E-02	---	---	---
Cadmium (water)	---	5.00E-02	---	RI Report - 1994	---	5.00E-02	---	---	---
Chromium III	---	4.50E-01	---	RI Report - 1994	---	1.30E-02	---	---	---
Chromium VI	---	4.50E-01	---	RI Report - 1994	5.00E-01	2.50E-02	2.00E+01	NJDEP	More (5)
Cobalt	---	4.50E-01	---	RI Report - 1994	---	1.00E+00	---	---	---
Copper	---	6.00E-01	---	RI Report - 1994	---	1.00E+00	---	---	---
Lead	---	---	---	RI Report - 1994	---	1.00E+00	---	---	---
Manganese (food)	---	3.00E-02	---	RI Report - 1994	---	1.00E+00	---	---	---
Manganese (water)	---	3.00E-02	---	RI Report - 1994	---	4.00E-02	---	---	---
Mercury	---	1.50E-01	---	RI Report - 1994	---	7.00E-02	---	---	---
Nickel	---	5.00E-02	---	RI Report - 1994	---	4.00E-02	---	---	---
Selenium	---	8.00E-01	---	RI Report - 1994	---	1.00E+00	---	---	---
Silver	---	---	---	RI Report - 1994	---	4.00E-02	---	---	---
Vanadium	---	5.00E-02	---	RI Report - 1994	---	2.60E-02	---	---	---
Zinc	---	2.50E-01	---	RI Report - 1994	---	1.00E+00	---	---	---
Acenaphthene	---	---	---	RI Report - 1994	---	1.00E+00	---	---	---
Acenaphthylene	---	---	---	RI Report - 1994	---	1.00E+00	---	---	---
Acetone	---	8.30E-01	---	RI Report - 1994	---	1.00E+00	---	---	---
Anthracene	---	1.00E+00	---	RI Report - 1994	---	1.00E+00	---	---	---
Aroclor 1260	7.70E+00	7.50E-01	1.03E+01	RI Report - 1994	2.00E+00	1.00E+00	2.00E+01	RSL-S	Less
alpha-Chlordane	---	---	---	RI Report - 1994	3.50E-01	1.00E+00	3.50E-01	IRIS	More (5)
Benzene	2.90E-02	9.00E-01	3.22E-02	RI Report - 1994	5.50E-02	1.00E+00	5.50E-02	IRIS	More
Benzo(a)anthracene	7.30E-01	---	---	RI Report - 1994	1.00E-01	1.00E+00	1.00E-01	RPF	Less
Benzo(a)pyrene	7.30E+00	---	---	RI Report - 1994	1.00E+00	1.00E+00	1.00E+00	IRIS	Less
Benzo(b)fluoranthene	---	---	---	RI Report - 1994	1.00E-01	1.00E+00	1.00E-01	RPF	More (5)
Benzo(g,h,i)perylene	---	---	---	RI Report - 1994	---	1.00E+00	---	---	---
Benzo(k)fluoranthene	7.30E-01	---	---	RI Report - 1994	1.00E-02	1.00E+00	1.00E-02	RPF	Less
Bis(2-ethylhexyl)phthalate	1.40E-02	9.00E-01	1.56E-02	RI Report - 1994	1.40E-02	1.00E+00	1.40E-02	IRIS	Same
2-Butanone	---	9.50E-01	---	RI Report - 1994	---	1.00E+00	---	---	---
Butyl benzyl phthalate	---	---	---	RI Report - 1994	1.90E-03	1.00E+00	1.90E-03	PPRTV	More (5)
Carbazole	2.00E-02	9.00E-01	2.22E-02	RI Report - 1994	---	---	---	---	Less (4)
Chloroform	6.10E-03	1.00E+00	6.10E-03	RI Report - 1994	3.10E-02	1.00E+00	3.10E-02	CalEPA	More
Chrysene	7.30E-03	6.00E-01	1.22E-02	RI Report - 1994	1.00E-03	1.00E+00	1.00E-03	RPF	Less

Table A-10
Comparison of Toxicity Values Used in the Quantitative Risk Assessment with Current Toxicity Values for 21 NA Sites
Oral and Dermal Slope Factors

4,4'-DDD	2.40E-01	9.00E-01	2.67E-01	RI Report - 1994	2.40E-01	1.00E+00	2.40E-01	IRIS	Same
4,4'-DDE	3.40E-01	9.00E-01	3.78E-01	RI Report - 1994	3.40E-01	1.00E+00	3.40E-01	IRIS	Same
4,4'-DDT	3.40E-01	9.00E-01	3.78E-01	RI Report - 1994	3.40E-01	1.00E+00	3.40E-01	IRIS	Same
Dibenz(a,h)anthracene	7.30E+00	---	---	RI Report - 1994	1.00E+00	1.00E+00	1.00E+00	RPF	Less
Di-n-butyl phthalate	---	---	---	RI Report - 1994	---	1.00E+00	---	---	---
Dieldrin	1.60E+01	9.00E-01	1.78E+01	RI Report - 1994	1.60E+01	1.00E+00	1.60E+01	IRIS	Same
Endosulfan	---	9.00E-01	---	RI Report - 1994	---	1.00E+00	---	---	---
Endrin	---	---	---	RI Report - 1994	---	1.00E+00	---	---	---
Endrin Ketone	---	---	---	RI Report - 1994	---	1.00E+00	---	---	---
Ethylbenzene	---	9.20E-01	---	RI Report - 1994	1.10E-02	1.00E+00	1.10E-02	CalEPA	More (5)
Fluoranthene	---	4.30E-01	---	RI Report - 1994	---	1.00E+00	---	---	---
Fluorene	---	---	---	RI Report - 1994	---	1.00E+00	---	---	---
gamma-Chlordane	---	---	---	RI Report - 1994	3.50E-01	1.00E+00	3.50E-01	IRIS	More (5)
Heptachlor	4.50E+00	4.00E-01	1.13E+01	RI Report - 1994	4.50E+00	1.00E+00	4.50E+00	IRIS	Same
Heptachlor epoxide	9.10E+00	9.00E-01	1.01E+01	RI Report - 1994	9.10E+00	1.00E+00	9.10E+00	IRIS	Same
Indeno(1,2,3-cd)pyrene	7.30E-01	---	---	RI Report - 1994	1.00E-01	1.00E+00	1.00E-01	RPF	Less
Isophorone	9.50E-04	---	---	RI Report - 1994	9.50E-04	1.00E+00	9.50E-04	IRIS	Same
2-Methylnaphthalene	---	---	---	RI Report - 1994	---	1.00E+00	---	---	---
Naphthalene	---	---	---	RI Report - 1994	---	1.00E+00	---	---	---
Pentachlorophenol	1.20E-01	1.00E+00	1.20E-01	RI Report - 1994	4.00E-01	1.00E+00	4.00E-01	IRIS	More
Phenanthrene	---	---	---	RI Report - 1994	---	1.00E+00	---	---	---
Pyrene	---	---	---	RI Report - 1994	---	1.00E+00	---	---	---
TCDD-2,3,7,8	1.50E+05	5.00E-01	3.00E+05	RI Report - 1994	1.30E+05	1.00E+00	1.30E+05	CalEPA	Less
Tetrachloroethylene	---	9.00E-01	---	RI Report - 1994	2.10E-03	1.00E+00	2.10E-03	IRIS	More (5)
Toluene	---	1.00E+00	---	RI Report - 1994	---	1.00E+00	---	---	---
Trichloroethylene	---	9.80E-01	---	RI Report - 1994	4.60E-02	1.00E+00	4.60E-02	IRIS	More (5)
Xylenes	---	9.00E-01	---	RI Report - 1994	---	1.00E+00	---	---	---
OU 5									
Beryllium	4.30E+00	---	---	RI Report - 1995	---	7.00E-03	---	---	Less (4)
Benzo(a)anthracene	7.30E-01	---	---	RI Report - 1995	1.00E-01	1.00E+00	1.00E-01	RPF	Less
Benzo(a)pyrene	7.30E+00	---	---	RI Report - 1995	1.00E+00	1.00E+00	1.00E+00	IRIS	Less
Benzo(b)fluoranthene	7.30E-01	---	---	RI Report - 1995	1.00E-01	1.00E+00	1.00E-01	RPF	Less
Benzo(k)fluoranethene	7.30E-02	---	---	RI Report - 1995	1.00E-02	1.00E+00	1.00E-02	RPF	Less
Dibenz(a,h)anthracene	7.30E+00	---	---	RI Report - 1995	1.00E+00	1.00E+00	1.00E+00	RPF	Less
Indeno(1,2,3-cd)pyrene	7.30E-01	---	---	RI Report - 1995	1.00E-01	1.00E+00	1.00E-01	RPF	Less

Table A-10
Comparison of Toxicity Values Used in the Quantitative Risk Assessment with Current Toxicity Values for 21 NA Sites
Oral and Dermal Slope Factors

OU 6										
Aluminum	---	2.00E-01	---	RI Report - 1995	---	1.00E+00	---	---	---
Thallium	---	1.00E-01	---	RI Report - 1995	---	1.00E+00	---	---	---
Benzo(a)pyrene	7.30E+00	6.00E-01	1.22E+01	RI Report - 1995	1.00E+00	1.00E+00	1.00E+00	IRIS	Less
Benzo(b)fluoranthene	7.30E-01	6.00E-01	1.22E+00	RI Report - 1995	1.00E-01	1.00E+00	1.00E-01	RPF	Less
Endrin ketone	--	5.00E-01	---	RI Report - 1995	---	1.00E+00	---	---	---
Total petroleum hydrocarbons	---	---	---	RI Report - 1995	---	1.00E+00	---	---	---

--- No value available.
ATSDR - Agency for Toxic Substance Disease Registry
CalEPA - California Environmental Protection Agency.
COPC - Chemical of Potential Concern.
HHRA - Human Health Risk Assessment.
IRIS - Integrated Risk Information System.
N/A - Not Applicable.
NC - Not identified as a COPC in the baseline HHRA.
NJDEP - New Jersey Department of Environmental Protection
OU - Operable Unit
PPRTV - Provisional Peer Reviewed Toxicity Value
RPF - Relative Potency Factor applied to RSL tables
RSL-S - Specific values from RSL Table User's Guide
USEPA - U.S. Environmental Protection Agency.

(1) Toxicity values and gastrointestinal absorption factors were obtained from the original risk assessment and Remedial Investigation (RI) report as referenced.
(2) Dermal slope factor values are presented for comparison. Values were either presented in the report or calculated from gastrointestinal absorption factors.
(3) Toxicity values were obtained from the USEPA RSL Tables (November 2019), and documented by source (e.g., IRIS, PPRTV, or Tier 3 source).
(4) Impact on cumulative risk is less because there is no current toxicity value available.
(5) Current toxicity value is more stringent because there was no value available for use in the original risk assessment.

Value has changed since the Fourth Five-Year Review (WPAFB, 2016).

Table A-11
Comparison of Toxicity Values Used in the Quantitative Risk Assessment with Current Toxicity Values for 21 NA Sites
Inhalation Unit Risks and Slope Factors

Chemical of Potential Concern	Toxicity Values Used in Risk Assessment			Current Toxicity Values		
	Inhalation Unit Risk (IUR) $(ug/m^3)^{-1}$ (1)	Inhalation Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$ (2)	Reference (1)	Inhalation Unit Risk (IUR) $(ug/m^3)^{-1}$ (3)	Source (3)	Is current inhalation toxicity value more stringent?
OU 2						
Aluminum	---	---	RI Report - 1994	---	---	---
Antimony	---	---	RI Report - 1994	---	---	---
Arsenic	4.30E-03	---	RI Report - 1994	4.30E-03	IRIS	Same
Barium	---	---	RI Report - 1994	---	---	---
Beryllium	2.40E-03	---	RI Report - 1994	2.40E-03	IRIS	Same
Cadmium	1.80E-03	---	RI Report - 1994	1.80E-03	IRIS	Same
Chromium III	---	---	RI Report - 1994	---	---	---
Chromium VI	1.20E-02	---	RI Report - 1994	8.40E-02	RSL-S	More
Cobalt	---	---	RI Report - 1994	9.00E-03	PPRTV	More (4)
Copper	---	---	RI Report - 1994	---	---	---
Lead	---	---	RI Report - 1994	---	---	---
Manganese	---	---	RI Report - 1994	---	---	---
Mercury	---	---	RI Report - 1994	---	---	---
Nickel	---	---	RI Report - 1994	2.60E-04	CalEPA	More (4)
Selenium	---	---	RI Report - 1994	---	---	---
Silver	---	---	RI Report - 1994	---	---	---
Thallium	---	---	RI Report - 1994	---	---	---
Vanadium	---	---	RI Report - 1994	---	---	---
Zinc	---	---	RI Report - 1994	---	---	---
Acenaphthene	---	---	RI Report - 1994	---	---	---
Acenaphthylene	---	---	RI Report - 1994	---	---	---
Acetone	---	---	RI Report - 1994	---	---	---
alpha-Chlordane	3.70E-04	---	RI Report - 1994	1.00E-04	IRIS	Less
Anthracene	---	---	RI Report - 1994	---	---	---
Benzene	8.30E-06	---	RI Report - 1994	7.80E-06	IRIS	Less
Benzo(a)anthracene	---	---	RI Report - 1994	6.00E-05	RPF	More (4)
Benzo(a)pyrene	---	---	RI Report - 1994	6.00E-04	IRIS	More (4)
Benzo(b)fluoranthene	---	---	RI Report - 1994	6.00E-05	RPF	More (4)
Benzo(g,h,i)perylene	---	---	RI Report - 1994	---	---	---
Benzo(k)fluoranethene	---	---	RI Report - 1994	6.00E-06	RPF	More (4)

Table A-11
Comparison of Toxicity Values Used in the Quantitative Risk Assessment with Current Toxicity Values for 21 NA Sites
Inhalation Unit Risks and Slope Factors

Bis(2-ethylhexyl)phthalate	---	---	RI Report - 1994	2.40E-06	CalEPA	More (4)
Carbazole	---	---	RI Report - 1994	---	---	---
Carbon Disulfide	---	---	RI Report - 1994	---	---	---
Chrysene	---	---	RI Report - 1994	6.00E-07	RPF	More (4)
4,4'-DDD	---	---	RI Report - 1994	6.90E-05	CalEPA	More (4)
4,4'-DDE	---	---	RI Report - 1994	9.70E-05	CalEPA	More (4)
4,4'-DDT	9.70E-05	---	RI Report - 1994	9.70E-05	IRIS	Same
Dibenz(a,h)anthracene	---	---	RI Report - 1994	6.00E-04	RPF	More (4)
Di-n-butyl phthalate	---	---	RI Report - 1994	---	---	---
Dibenzofuran	---	---	RI Report - 1994	---	---	---
Dieldrin	4.60E-03	---	RI Report - 1994	4.60E-03	IRIS	Same
2,4-Dimethylphenol	---	---	RI Report - 1994	---	---	---
Endosulfan sulfate	---	---	RI Report - 1994	---	---	---
Endrin	---	---	RI Report - 1994	---	---	---
Endrin aldehyde	---	---	RI Report - 1994	---	---	---
Ethylbenzene	---	---	RI Report - 1994	2.50E-06	CalEPA	More (4)
Fluoranthene	---	---	RI Report - 1994	---	---	---
Fluorene	---	---	RI Report - 1994	---	---	---
Heptachlor	1.30E-03	---	RI Report - 1994	1.30E-03	IRIS	Same
Heptachlor epoxide	2.60E-03	---	RI Report - 1994	2.60E-03	IRIS	Same
Indeno(1,2,3-cd)pyrene	---	---	RI Report - 1994	6.00E-05	RPF	More (4)
Methylene Chloride	4.70E-07	---	RI Report - 1994	1.00E-08	IRIS	Less
2-Methylnaphthalene	---	---	RI Report - 1994	---	---	---
4-Methyl-2-pentanone	---	---	RI Report - 1994	---	---	---
4-Methylphenol	---	---	RI Report - 1994	---	---	---
Naphthalene	---	---	RI Report - 1994	3.40E-05	CalEPA	More (4)
Phenanthrene	---	---	RI Report - 1994	---	---	---
Pyrene	---	---	RI Report - 1994	---	---	---
Toluene	---	---	RI Report - 1994	---	---	---
Xylenes	---	---	RI Report - 1994	---	---	---
OU 3						
Barium	---	---	RI Report - 1994	---	---	---
Beryllium	8.40E+00	2.40E-03	RI Report - 1994	2.40E-03	IRIS	Less
Cadmium (food)	1.80E-03	6.10E+00	RI Report - 1994	1.80E-03	IRIS	Same
Cadmium (water)	1.80E-03	6.10E+00	RI Report - 1994	1.80E-03	IRIS	Same
Chromium III	---	---	RI Report - 1994	---	---	---
Chromium VI	1.20E-02	4.10E+01	RI Report - 1994	8.40E-02	RSL-S	More

Table A-11
Comparison of Toxicity Values Used in the Quantitative Risk Assessment with Current Toxicity Values for 21 NA Sites
Inhalation Unit Risks and Slope Factors

Cobalt	---	---	RI Report - 1994	9.00E-03	PPRTV	More (4)
Copper	---	---	RI Report - 1994	---	---	---
Lead	---	---	RI Report - 1994	---	---	---
Manganese (food)	---	---	RI Report - 1994	---	---	---
Manganese (water)	---	---	RI Report - 1994	---	---	---
Mercury	---	---	RI Report - 1994	---	---	---
Nickel	---	---	RI Report - 1994	2.60E-04	CalEPA	More (4)
Selenium	---	---	RI Report - 1994	---	---	---
Silver	---	---	RI Report - 1994	---	---	---
Vanadium	---	---	RI Report - 1994	---	---	---
Zinc	---	---	RI Report - 1994	---	---	---
Acenaphthene	---	---	RI Report - 1994	---	---	---
Acenaphthylene	---	---	RI Report - 1994	---	---	---
Acetone	---	---	RI Report - 1994	---	---	---
alpha-Chlordane	---	---	RI Report - 1994	1.00E-04	IRIS	More (4)
Anthracene	---	---	RI Report - 1994	---	---	---
Aroclor 1260	---	---	RI Report - 1994	5.70E-04	RSL-S	More (4)
Benzene	8.30E-06	2.90E-02	RI Report - 1994	7.80E-06	IRIS	Less
Benzo(a)anthracene	---	---	RI Report - 1994	6.00E-05	RPF	More (4)
Benzo(a)pyrene	---	---	RI Report - 1994	6.00E-04	IRIS	More (4)
Benzo(b)fluoranthene	---	---	RI Report - 1994	6.00E-05	RPF	More (4)
Benzo(g,h,i)perylene	---	---	RI Report - 1994	---	---	---
Benzo(k)fluoranethene	---	---	RI Report - 1994	6.00E-06	RPF	More (4)
Bis(2-ethylhexyl)phthalate	---	---	RI Report - 1994	2.40E-06	CalEPA	More (4)
2-Butanone	---	---	RI Report - 1994	---	---	---
Butyl benzyl phthalate	---	---	RI Report - 1994	---	---	---
Carbazole	---	---	RI Report - 1994	---	---	---
Chloroform	2.30E-05	8.10E-02	RI Report - 1994	2.30E-05	IRIS	Same
Chrysene	---	---	RI Report - 1994	6.00E-07	RPF	More (4)
4,4'-DDD	---	---	RI Report - 1994	6.90E-05	CalEPA	More (4)
4,4'-DDE	---	---	RI Report - 1994	9.70E-05	CalEPA	More (4)
4,4'-DDT	9.70E-05	3.40E-01	RI Report - 1994	9.70E-05	IRIS	Same
Dibenz(a,h)anthracene	---	---	RI Report - 1994	6.00E-04	RPF	More (4)
Di-n-butyl phthalate	---	---	RI Report - 1994	---	---	---
Dieldrin	4.60E-03	1.60E+01	RI Report - 1994	4.60E-03	IRIS	Same
Endosulfan	---	---	RI Report - 1994	---	---	---
Endrin	---	---	RI Report - 1994	---	---	---

Table A-11
Comparison of Toxicity Values Used in the Quantitative Risk Assessment with Current Toxicity Values for 21 NA Sites
Inhalation Unit Risks and Slope Factors

Endrin Ketone	---	---	RI Report - 1994	---	---	---
Ethylbenzene	---	---	RI Report - 1994	2.50E-06	CalEPA	More (4)
Fluoranthene	---	---	RI Report - 1994	---	---	---
Fluorene	---	---	RI Report - 1994	---	---	---
gamma-Chlordane	---	---	RI Report - 1994	1.00E-04	IRIS	More (4)
Heptachlor	1.30E-03	4.50E+00	RI Report - 1994	1.30E-03	IRIS	Same
Heptachlor epoxide	2.60E-03	9.10E+00	RI Report - 1994	2.60E-03	IRIS	Same
Indeno(1,2,3-cd)pyrene	---	---	RI Report - 1994	6.00E-05	RPF	More (4)
Isophorone	---	---	RI Report - 1994	---	---	---
2-Methylnaphthalene	---	---	RI Report - 1994	---	---	---
Naphthalene	---	---	RI Report - 1994	3.40E-05	CalEPA	More (4)
Pentachlorophenol	---	---	RI Report - 1994	5.10E-06	CalEPA	More (4)
Phenanthrene	---	---	RI Report - 1994	---	---	---
Pyrene	---	---	RI Report - 1994	---	---	---
TCDD-2,3,7,8	3.30E-05	1.50E+05	RI Report - 1994	3.80E+01	CalEPA	More (4)
Tetrachloroethylene	---	---	RI Report - 1994	2.60E-07	IRIS	More (4)
Toluene	---	---	RI Report - 1994	---	---	---
Trichloroethylene	---	---	RI Report - 1994	4.10E-06	IRIS	More (4)
Xylenes	---	---	RI Report - 1994	---	---	---
OU 5						
Beryllium	2.40E-03	8.40E+00	RI Report - 1995	2.40E-03	IRIS	Same
Benzo(a)anthracene	---	---	RI Report - 1995	6.00E-05	RPF	More (4)
Benzo(a)pyrene	1.70E-03	6.10E+00	RI Report - 1995	6.00E-04	IRIS	Less
Benzo(b)fluoranthene	---	---	RI Report - 1995	6.00E-05	RPF	More (4)
Benzo(k)fluoranethene	---	---	RI Report - 1995	6.00E-06	RPF	More (4)
Dibenz(a,h)anthracene	---	---	RI Report - 1995	6.00E-04	RPF	More (4)
Indeno(1,2,3-cd)pyrene	---	---	RI Report - 1995	6.00E-05	RPF	More (4)

Table A-11
Comparison of Toxicity Values Used in the Quantitative Risk Assessment with Current Toxicity Values for 21 NA Sites
Inhalation Unit Risks and Slope Factors

OU 6						
Aluminum	---	---	RI Report - 1995	---	---	---
Thallium	---	---	RI Report - 1995	---	---	---
Benzo(a)pyrene	1.70E-03	6.10E+00	RI Report - 1995	6.00E-04	IRIS	Less
Benzo(b)fluoranthene	1.70E-04	6.10E-01	RI Report - 1995	6.00E-05	RPF	Less
Endrin ketone	---	---	RI Report - 1995	---	---	---
Total petroleum hydrocarbons	---	---	RI Report - 1995	---	---	---

--- No value available.
CalEPA - California Environmental Protection Agency.
COPC - Chemical of Potential Concern.
HHRA - Human Health Risk Assessment.
IRIS - Integrated Risk Information System.
IUR - Inhalation Unit Risk.
N/A - Not Applicable.
NC - Not identified as a COPC in the baseline HHRA
OU - Operable Unit
PPRTV - Provisional Peer-Reviewed Toxicity Value
RPF - Relative Potency Factor applied to RSL tables
RSL-S - Specific value from RSL User's Guide
USEPA - U.S. Environmental Protection Agency.

(1) Toxicity values were obtained from the original risk assessment and Remedial Investigation (RI) report as referenced.
(2) Slope factor values are presented if used in the original report. Equivalent IURs are the recommended values for inhalation risk assessment (USEPA, 2009).
(3) Toxicity values were obtained from the USEPA RSL Tables (November 2019), and documented by source (e.g., IRIS, PPRTV, or Tier 3 sou
(4) Current toxicity value is more stringent because there was no value available for use in the original risk assessment.

Value has changed since the Fourth Five-Year Review (WPAFB, 2016).

Table A-12
Comparison of Toxicity Values Used in the Quantitative Risk Assessment with Current Toxicity Values for 21 NA Sites
Oral and Dermal Reference Doses

Chemical of Potential Concern	Toxicity Values Used in Risk Assessment				Current Toxicity Values				
	Oral Reference Dose (mg/kg-day) (1)	Gastrointestinal Absorption Factor (1)	Dermal Reference Dose (mg/kg-day) (2)	Reference (1)	Oral Reference Dose (mg/kg-day) (3)	Gastrointestinal Absorption Factor (3)	Dermal Reference Dose (mg/kg-day) (2)	Source (3)	Is current oral toxicity value more stringent?
OU 2									
Aluminum	---	4.00E-02	---	RI Report - 1994	1.00E+00	1.00E+00	1.00E+00	PPRTV	More (4)
Antimony	4.00E-04	1.00E-02	4.00E-06	RI Report - 1994	4.00E-04	1.50E-01	6.00E-05	IRIS	Same
Arsenic	3.00E-04	8.00E-01	2.40E-04	RI Report - 1994	3.00E-04	1.00E+00	3.00E-04	IRIS	Same
Barium	7.00E-02	5.00E-02	3.50E-03	RI Report - 1994	2.00E-01	7.00E-02	1.40E-02	IRIS	Less
Beryllium	5.00E-03	1.00E-02	5.00E-05	RI Report - 1994	2.00E-03	7.00E-03	1.40E-05	IRIS	More
Cadmium	5.00E-04	2.00E-02	1.00E-05	RI Report - 1994	1.00E-03	2.50E-02	2.50E-05	IRIS	Less
Chromium III	5.00E-03	2.00E-02	1.00E-04	RI Report - 1994	1.50E+00	1.30E-02	1.95E-02	IRIS	Less (5)
Chromium VI	5.00E-03	2.00E-02	1.00E-04	RI Report - 1994	3.00E-03	2.50E-02	7.50E-05	IRIS	More
Cobalt	---	5.00E-02	---	RI Report - 1994	3.00E-04	1.00E+00	3.00E-04	PPRTV	More (4)
Copper	4.00E-02	6.00E-01	2.40E-02	RI Report - 1994	4.00E-02	1.00E+00	4.00E-02	HEAST	Same
Lead	---	---	---	RI Report - 1994	---	1.00E+00	---	---	---
Manganese	5.00E-03	3.00E-02	1.50E-04	RI Report - 1994	2.40E-02	4.00E-02	9.60E-04	RSL-S	Less
Mercury	3.00E-04	1.00E-02	3.00E-06	RI Report - 1994	3.00E-04	7.00E-02	2.10E-05	IRIS	Same
Nickel	2.00E-02	4.00E-02	8.00E-04	RI Report - 1994	2.00E-02	4.00E-02	8.00E-04	IRIS	Same
Selenium	5.00E-03	9.00E-01	4.50E-03	RI Report - 1994	5.00E-03	1.00E+00	5.00E-03	IRIS	Same
Silver	5.00E-03	2.00E-01	1.00E-03	RI Report - 1994	5.00E-03	4.00E-02	2.00E-04	IRIS	Same
Thallium	---	1.00E+00	---	RI Report - 1994	1.00E-05	1.00E+00	1.00E-05	RSL-X	More (4)
Vanadium	7.00E-03	1.00E-02	7.00E-05	RI Report - 1994	5.00E-03	2.60E-02	1.30E-04	RSL-S	More
Zinc	3.00E-01	2.50E-01	7.50E-02	RI Report - 1994	3.00E-01	1.00E+00	3.00E-01	IRIS	Same
Acenaphthene	6.00E-02	2.00E-01	1.20E-02	RI Report - 1994	6.00E-02	1.00E+00	6.00E-02	IRIS	Same
Acenaphthylene	---	2.00E-01	---	RI Report - 1994	3.00E-02	1.00E+00	3.00E-02	---	More (4,6)
Acetone	1.00E-01	9.00E-01	9.00E-02	RI Report - 1994	9.00E-01	1.00E+00	9.00E-01	IRIS	Less
alpha-Chlordane	6.00E-05	5.00E-01	3.00E-05	RI Report - 1994	5.00E-04	1.00E+00	5.00E-04	IRIS	Less
Anthracene	3.00E-01	2.00E-01	6.00E-02	RI Report - 1994	3.00E-01	1.00E+00	3.00E-01	IRIS	Same
Benzene	---	9.50E-01	---	RI Report - 1994	4.00E-03	1.00E+00	4.00E-03	IRIS	More (4)
Benzo(a)anthracene	---	2.00E-01	---	RI Report - 1994	---	1.00E+00	---	---	---
Benzo(a)pyrene	---	2.00E-01	---	RI Report - 1994	3.00E-04	1.00E+00	3.00E-04	IRIS	More (4)
Benzo(b)fluoranthene	---	2.00E-01	---	RI Report - 1994	---	1.00E+00	---	---	---
Benzo(g,h,i)perylene	---	2.00E-01	---	RI Report - 1994	3.00E-02	1.00E+00	3.00E-02	---	More (4,6)
Benzo(k)fluoranethene	---	2.00E-01	---	RI Report - 1994	---	1.00E+00	---	---	---
Bis(2-ethylhexyl)phthalate	2.00E-02	5.00E-01	1.00E-02	RI Report - 1994	2.00E-02	1.00E+00	2.00E-02	IRIS	Same
Carbazole	---	2.00E-01	---	RI Report - 1994	---	---	---	---	---
Carbon Disulfide	1.00E-01	6.30E-01	6.30E-02	RI Report - 1994	1.00E-01	1.00E+00	1.00E-01	IRIS	Same

Table A-12
Comparison of Toxicity Values Used in the Quantitative Risk Assessment with Current Toxicity Values for 21 NA Sites
Oral and Dermal Reference Doses

Chrysene	---	6.00E-01	---	RI Report - 1994	---	1.00E+00	---	---	---
4,4'-DDD	---	2.00E-01	---	RI Report - 1994	3.00E-05	1.00E+00	3.00E-05	RSL-X	More (4)
4,4'-DDE	---	2.00E-01	---	RI Report - 1994	3.00E-04	1.00E+00	3.00E-04	RSL-X	More (4)
4,4'-DDT	5.00E-04	2.00E-01	1.00E-04	RI Report - 1994	5.00E-04	1.00E+00	5.00E-04	IRIS	Same
Dibenz(a,h)anthracene	---	2.00E-01	---	RI Report - 1994	----	1.00E+00	---	---	---
Di-n-butyl phthalate	1.00E-01	9.00E-01	9.00E-02	RI Report - 1994	1.00E-01	1.00E+00	1.00E-01	IRIS	Same
Dibenzofuran	---	5.00E-01	---	RI Report - 1994	1.00E-03	1.00E+00	1.00E-03	RSL-X	More (4)
Dieldrin	5.00E-05	5.00E-01	2.50E-05	RI Report - 1994	5.00E-05	1.00E+00	5.00E-05	IRIS	Same
2,4-Dimethylphenol	2.00E-02	9.00E-01	1.80E-02	RI Report - 1994	2.00E-02	1.00E+00	2.00E-02	IRIS	Same
Endosulfan sulfate	5.00E-05	8.50E-01	4.25E-05	RI Report - 1994	6.00E-03	1.00E+00	6.00E-03	PPRTV	Less
Endrin	3.00E-04	5.00E-01	1.50E-04	RI Report - 1994	3.00E-04	1.00E+00	3.00E-04	IRIS	Same
Endrin aldehyde	---	2.00E-01	---	RI Report - 1994	3.00E-04	1.00E+00	3.00E-04	IRIS	More (4)
Ethylbenzene	1.00E-01	8.50E-01	8.50E-02	RI Report - 1994	1.00E-01	1.00E+00	1.00E-01	IRIS	Same
Fluoranthene	4.00E-02	2.00E-01	8.00E-03	RI Report - 1994	4.00E-02	1.00E+00	4.00E-02	IRIS	Same
Fluorene	4.00E-02	2.00E-01	8.00E-03	RI Report - 1994	4.00E-02	1.00E+00	4.00E-02	IRIS	Same
Heptachlor	5.00E-04	4.00E-01	2.00E-04	RI Report - 1994	5.00E-04	1.00E+00	5.00E-04	IRIS	Same
Heptachlor epoxide	1.30E-05	4.00E-01	5.20E-06	RI Report - 1994	1.30E-05	1.00E+00	1.30E-05	IRIS	Same
Indeno(1,2,3-cd)pyrene	---	2.00E-01	---	RI Report - 1994	---	1.00E+00	---	---	---
Methylene Chloride	6.00E-02	9.80E-01	5.88E-02	RI Report - 1994	6.00E-03	1.00E+00	6.00E-03	IRIS	More
2-Methylnaphthalene	---	2.00E-01	---	RI Report - 1994	4.00E-03	1.00E+00	4.00E-03	IRIS	More
4-Methyl-2-pentanone	5.00E-02	9.00E-01	4.50E-02	RI Report - 1994	---	1.00E+00	---	---	Less (7)
4-Methylphenol	5.00E-03	7.50E-01	3.75E-03	RI Report - 1994	1.00E-01	1.00E+00	1.00E-01	ATSDR	Less
Naphthalene	4.00E-02	2.00E-01	8.00E-03	RI Report - 1994	2.00E-02	1.00E+00	2.00E-02	IRIS	More
Phenanthrene	---	2.00E-01	---	RI Report - 1994	3.00E-02	1.00E+00	3.00E-02	---	More (4,6)
Pyrene	3.00E-02	2.00E-01	6.00E-03	RI Report - 1994	3.00E-02	1.00E+00	3.00E-02	IRIS	Same
Toluene	2.00E-01	9.00E-01	1.80E-01	RI Report - 1994	8.00E-02	1.00E+00	8.00E-02	IRIS	More
Xylenes	2.00E+00	9.00E-01	1.80E+00	RI Report - 1994	2.00E-01	1.00E+00	2.00E-01	IRIS	More
OU3									
Barium	7.00E-02	9.10E-01	6.37E-02	RI Report - 1994	2.00E-01	7.00E-02	1.40E-02	IRIS	Less
Beryllium	5.00E-03	1.00E-02	5.00E-05	RI Report - 1994	2.00E-03	7.00E-03	1.40E-05	IRIS	More
Cadmium (food)	1.00E-03	2.50E-02	2.50E-05	RI Report - 1994	1.00E-03	2.50E-02	2.50E-05	IRIS	Same
Cadmium (water)	5.00E-04	5.00E-02	2.50E-05	RI Report - 1994	5.00E-04	5.00E-02	2.50E-05	IRIS	Same
Chromium III	1.00E+00	4.50E-01	4.50E-01	RI Report - 1994	1.50E+00	1.30E-02	1.95E-02	IRIS	Less
Chromium VI	5.00E-03	4.50E-01	2.25E-03	RI Report - 1994	3.00E-03	2.50E-02	7.50E-05	IRIS	More
Cobalt	---	4.50E-01	---	RI Report - 1994	3.00E-04	1.00E+00	3.00E-04	PPRTV	More (4)
Copper	3.70E-02	6.00E-01	2.22E-02	RI Report - 1994	4.00E-02	1.00E+00	4.00E-02	HEAST	Same
Lead	---	---	---	RI Report - 1994	---	1.00E+00	---	---	---
Manganese (food)	1.40E-01	3.00E-02	4.20E-03	RI Report - 1994	1.40E-01	1.00E+00	1.40E-01	IRIS	Same
Manganese (water)	5.00E-03	3.00E-02	1.50E-04	RI Report - 1994	2.40E-02	4.00E-02	9.60E-04	RSL-S	Less
Mercury	3.00E-04	1.50E-01	4.50E-05	RI Report - 1994	3.00E-04	7.00E-02	2.10E-05	IRIS	Same

Table A-12
Comparison of Toxicity Values Used in the Quantitative Risk Assessment with Current Toxicity Values for 21 NA Sites
Oral and Dermal Reference Doses

Nickel	2.00E-02	5.00E-02	1.00E-03	RI Report - 1994	2.00E-02	4.00E-02	8.00E-04	IRIS	Same
Selenium	5.00E-03	8.00E-01	4.00E-03	RI Report - 1994	5.00E-03	1.00E+00	5.00E-03	IRIS	Same
Silver	5.00E-03	---	---	RI Report - 1994	5.00E-03	4.00E-02	2.00E-04	IRIS	Same
Vanadium	7.00E-03	5.00E-02	3.50E-04	RI Report - 1994	5.00E-03	2.60E-02	1.30E-04	RSL-S	More
Zinc	3.00E-01	2.50E-01	7.50E-02	RI Report - 1994	3.00E-01	1.00E+00	3.00E-01	IRIS	Same
Acenaphthene	6.00E-02	---	---	RI Report - 1994	6.00E-02	1.00E+00	6.00E-02	IRIS	Same
Acenaphthylene	3.00E-02	---	---	RI Report - 1994	3.00E-02	1.00E+00	3.00E-02	---	More (6)
Acetone	1.00E-01	8.30E-01	8.30E-02	RI Report - 1994	9.00E-01	1.00E+00	9.00E-01	IRIS	Less
alpha-Chlordane	---	---	---	RI Report - 1994	5.00E-04	1.00E+00	5.00E-04	IRIS	More (4)
Anthracene	3.00E-01	1.00E+00	3.00E-01	RI Report - 1994	3.00E-01	1.00E+00	3.00E-01	IRIS	Same
Aroclor 1260	---	---	---	RI Report - 1994	---	1.00E+00	---	---	---
Benzene	4.00E-04	9.00E-01	3.60E-04	RI Report - 1994	4.00E-03	1.00E+00	4.00E-03	IRIS	Less
Benzo(a)anthracene	3.00E-02	---	---	RI Report - 1994	---	1.00E+00	---	---	Less (7)
Benzo(a)pyrene	3.00E-02	---	---	RI Report - 1994	3.00E-04	1.00E+00	3.00E-04	IRIS	Less
Benzo(b)fluoranthene	3.00E-02	---	---	RI Report - 1994	---	1.00E+00	---	---	Less (7)
Benzo(g,h,i)perylene	3.00E-02	---	---	RI Report - 1994	3.00E-02	1.00E+00	3.00E-02	---	Same (6)
Benzo(k)fluoranethene	3.00E-02	---	---	RI Report - 1994	---	1.00E+00	---	---	Less (7)
Bis(2-ethylhexyl)phthalate	2.00E-02	9.00E-01	1.80E-02	RI Report - 1994	2.00E-02	1.00E+00	2.00E-02	IRIS	Same
2-Butanone	6.00E-01	9.50E-01	5.70E-01	RI Report - 1994	6.00E-01	1.00E+00	6.00E-01	IRIS	Same
Butyl benzyl phthalate	2.00E-01	---	---	RI Report - 1994	2.00E-01	1.00E+00	2.00E-01	IRIS	Same
Carbazole	---	9.00E-01	---	RI Report - 1994	---	---	---	---	---
Chloroform	1.00E-02	1.00E+00	1.00E-02	RI Report - 1994	1.00E-02	1.00E+00	1.00E-02	IRIS	Same
Chrysene	3.00E-02	---	---	RI Report - 1994	---	1.00E+00	---	---	Less (7)
4,4'-DDD	---	9.00E-01	---	RI Report - 1994	3.00E-05	1.00E+00	3.00E-05	RSL-X	More (4)
4,4'-DDE	---	9.00E-01	---	RI Report - 1994	3.00E-04	1.00E+00	3.00E-04	RSL-X	More (4)
4,4'-DDT	5.00E-04	9.00E-01	4.50E-04	RI Report - 1994	5.00E-04	1.00E+00	5.00E-04	IRIS	Same
Dibenz(a,h)anthracene	3.00E-02	---	---	RI Report - 1994	----	1.00E+00	---	---	Less (7)
Di-n-butyl phthalate	1.00E-01	---	---	RI Report - 1994	1.00E-01	1.00E+00	1.00E-01	IRIS	Same
Dieldrin	5.00E-05	9.00E-01	4.50E-05	RI Report - 1994	5.00E-05	1.00E+00	5.00E-05	IRIS	Same
Endosulfan	6.00E-03	9.00E-01	5.40E-03	RI Report - 1994	6.00E-03	1.00E+00	6.00E-03	IRIS	Same
Endrin	3.00E-04	---	---	RI Report - 1994	3.00E-04	1.00E+00	3.00E-04	IRIS	Same
Endrin Ketone	---	---	---	RI Report - 1994	3.00E-04	1.00E+00	3.00E-04	---	More (4,8)
Ethylbenzene	1.00E-01	9.20E-01	9.20E-02	RI Report - 1994	1.00E-01	1.00E+00	1.00E-01	IRIS	Same
Fluoranthene	4.00E-02	4.30E-01	1.72E-02	RI Report - 1994	4.00E-02	1.00E+00	4.00E-02	IRIS	Same
Fluorene	4.00E-02	---	---	RI Report - 1994	4.00E-02	1.00E+00	4.00E-02	IRIS	Same
gamma-Chlordane	---	---	---	RI Report - 1994	5.00E-04	1.00E+00	5.00E-04	IRIS	More (4)
Heptachlor	5.00E-04	4.00E-01	2.00E-04	RI Report - 1994	5.00E-04	1.00E+00	5.00E-04	IRIS	Same
Heptachlor epoxide	1.30E-05	9.00E-01	1.17E-05	RI Report - 1994	1.30E-05	1.00E+00	1.30E-05	IRIS	Same
Indeno(1,2,3-cd)pyrene	3.00E-02	---	---	RI Report - 1994	---	1.00E+00	---	---	Less (7)
Isophorone	2.00E-01	---	---	RI Report - 1994	2.00E-01	1.00E+00	2.00E-01	IRIS	Same

Table A-12
Comparison of Toxicity Values Used in the Quantitative Risk Assessment with Current Toxicity Values for 21 NA Sites
Oral and Dermal Reference Doses

2-Methylnaphthalene	3.00E-02	---	---	RI Report - 1994	4.00E-03	1.00E+00	4.00E-03	IRIS	More (4)
Naphthalene	---	---	---	RI Report - 1994	2.00E-02	1.00E+00	2.00E-02	IRIS	More (4)
Pentachlorophenol	3.00E-02	1.00E+00	3.00E-02	RI Report - 1994	5.00E-03	1.00E+00	5.00E-03	IRIS	More
Phenanthrene	3.00E-02	---	---	RI Report - 1994	3.00E-02	1.00E+00	3.00E-02	---	Same (6)
Pyrene	3.00E-02	---	---	RI Report - 1994	3.00E-02	1.00E+00	3.00E-02	IRIS	Same
TCDD-2,3,7,8	---	5.00E-01	---	RI Report - 1994	7.00E-10	1.00E+00	7.00E-10	IRIS	More (4)
Tetrachloroethylene	1.00E-02	9.00E-01	9.00E-03	RI Report - 1994	6.00E-03	1.00E+00	6.00E-03	IRIS	More
Toluene	2.00E-01	1.00E+00	2.00E-01	RI Report - 1994	8.00E-02	1.00E+00	8.00E-02	IRIS	More
Trichloroethylene	---	9.80E-01	---	RI Report - 1994	5.00E-04	1.00E+00	5.00E-04	IRIS	More (4)
Xylenes	2.00E+00	9.00E-01	1.80E+00	RI Report - 1994	2.00E-01	1.00E+00	2.00E-01	IRIS	More
OU 5									
Beryllium	---	---	---	RI Report - 1995	2.00E-03	7.00E-03	1.40E-05	IRIS	More (4)
Benzo(a)anthracene	---	---	---	RI Report - 1995	---	1.00E+00	---	---	---
Benzo(a)pyrene	---	---	---	RI Report - 1995	3.00E-04	1.00E+00	3.00E-04	IRIS	More (4)
Benzo(b)fluoranthene	---	---	---	RI Report - 1995	---	1.00E+00	---	---	---
Benzo(k)fluoranethene	---	---	---	RI Report - 1995	---	1.00E+00	---	---	---
Dibenz(a,h)anthracene	---	---	---	RI Report - 1995	---	1.00E+00	---	---	---
Indeno(1,2,3-cd)pyrene	---	---	---	RI Report - 1995	---	1.00E+00	---	---	---
OU 6									
Aluminum	---	2.00E-01	---	RI Report - 1995	1.00E+00	1.00E+00	1.00E+00	PPRTV	More (4)
Thallium	8.00E-04	1.00E-01	8.00E-05	RI Report - 1995	1.00E-05	1.00E+00	1.00E-05	RSL-X	More
Benzo(a)pyrene	---	6.00E-01	---	RI Report - 1995	3.00E-04	1.00E+00	3.00E-04	IRIS	More (4)
Benzo(b)fluoranthene	---	6.00E-01	---	RI Report - 1995	---	1.00E+00	---	---	---
Endrin ketone	---	5.00E-01	---	RI Report - 1995	3.00E-04	1.00E+00	3.00E-04	---	More (4,8)
Total petroleum hydrocarbons	---	---	---	RI Report - 1995	4.00E-03	1.00E+00	4.00E-03	PPRTV	More (9)

--- No value available.
ATSDR - Agency for Toxic Substances Disease Registry
CalEPA - California Environmental Protection Agency.
COPC - Chemical of Potential Concern.
HEAST - Hazard Effects Assessment Summary Tables
HHRA - Human Health Risk Assessment.
IRIS - Integrated Risk Information System.
N/A - Not Applicable.
NC - Not identified as a COPC in the baseline HHRA.
OU - Operable Unit
PPRTV - Provisional Peer-Reviewed Toxicity Value
RSL-S - Specific values from RSL Table User's Guide
RSL-X - Specific values from PPRTV Screening Level

Table A-12
Comparison of Toxicity Values Used in the Quantitative Risk Assessment with Current Toxicity Values for 21 NA Sites
Oral and Dermal Reference Doses

USEPA - U.S. Environmental Protection Agency.

(1) Toxicity values and gastrointestinal absorption factors were obtained from the original risk assessment and Remedial Investigation (RI) report as referenced.
(2) Dermal reference doses are presented for comparison. Values were either presented in the report or calculated from gastrointestinal absorption factors.
(3) Toxicity values were obtained from the USEPA RSL Tables (November 2019), and documented by source (e.g., IRIS, PPRTV, or Tier 3 source).
(4) Current toxicity value is more stringent because there was no value available for use in the original risk assessment.
(5) Value in original risk assessment was based on total Chromium. Current value is specific to Chromium III.
(6) Value is based on pyrene as a surrogate.
(7) Impact on cumulative hazard index is less because there is no current toxicity value available.
(8) Value is based on endrin as a surrogate.
(9) Value is conservatively based on total petroleum hydrocarbons (aromatic medium).

Value has changed since the Fourth Five-Year Review (WPAFB, 2016).

Table A-13
Comparison of Toxicity Values Used in the Quantitative Risk Assessment with Current Toxicity Values for 21 NA Sites
Inhalation Reference Concentrations and Doses

Chemical of Potential Concern	Toxicity Values Used in Risk Assessment			Current Toxicity Values		
	Inhalation RfC (mg/m^3) (1)	Inhalation RfD (mg/kg-day) (2)	Reference (1)	Inhalation RfC (mg/m^3) (3)	Source (3)	Is current inhalation toxicity value more stringent?
OU 2						
Aluminum	---	---	RI Report - 1994	5.00E-03	PPRTV	More (4)
Antimony	---	---	RI Report - 1994	---	---	---
Arsenic	---	---	RI Report - 1994	1.50E-05	Cal EPA	More (4)
Barium	5.00E-04	---	RI Report - 1994	5.00E-04	HEAST	Same
Beryllium	---	---	RI Report - 1994	2.00E-05	IRIS	More (4)
Cadmium	---	---	RI Report - 1994	1.00E-05	ATSDR	More (4)
Chromium III	---	---	RI Report - 1994	---	---	---
Chromium VI	---	---	RI Report - 1994	1.00E-04	IRIS	More (4)
Cobalt	---	---	RI Report - 1994	6.00E-06	PPRTV	More (4)
Copper	---	---	RI Report - 1994	---	---	---
Lead	---	---	RI Report - 1994	---	---	---
Manganese	5.00E-05	---	RI Report - 1994	5.00E-05	IRIS	Same
Mercury	3.00E-04	---	RI Report - 1994	3.00E-04	RSL-S	Same
Nickel	---	---	RI Report - 1994	9.00E-05	ATSDR	More (4)
Selenium	---	---	RI Report - 1994	2.00E-02	Cal EPA	More (4)
Silver	---	---	RI Report - 1994	---	---	---
Thallium	---	---	RI Report - 1994	---	---	---
Vanadium	---	---	RI Report - 1994	1.00E-04	ATSDR	More (4)
Zinc	---	---	RI Report - 1994	---	---	---
Acenaphthene	---	---	RI Report - 1994	---	---	---
Acenaphthylene	---	---	RI Report - 1994	---	---	---
Acetone	---	---	RI Report - 1994	3.10E+01	ATSDR	More (4)
alpha-Chlordane	---	---	RI Report - 1994	7.00E-04	IRIS	More (4)
Anthracene	---	---	RI Report - 1994	---	---	---
Benzene	---	---	RI Report - 1994	3.00E-02	IRIS	More (4)
Benzo(a)anthracene	---	---	RI Report - 1994	---	---	---
Benzo(a)pyrene	---	---	RI Report - 1994	2.00E-06	IRIS	More (4)
Benzo(b)fluoranthene	---	---	RI Report - 1994	---	---	---
Benzo(g,h,i)perylene	---	---	RI Report - 1994	---	---	---
Benzo(k)fluoranethene	---	---	RI Report - 1994	---	---	---
Bis(2-ethylhexyl)phthalate	---	---	RI Report - 1994	---	---	---
Carbazole	---	---	RI Report - 1994	---	---	---
Carbon Disulfide	1.00E-02	---	RI Report - 1994	7.00E-01	IRIS	Less

Table A-13
Comparison of Toxicity Values Used in the Quantitative Risk Assessment with Current Toxicity Values for 21 NA Sites
Inhalation Reference Concentrations and Doses

Chrysene	---	---	RI Report - 1994	---	---	---
4,4'-DDD	---	---	RI Report - 1994	---	---	---
4,4'-DDE	---	---	RI Report - 1994	---	---	---
4,4'-DDT	---	---	RI Report - 1994	---	---	---
Dibenz(a,h)anthracene	---	---	RI Report - 1994	---	---	---
Di-n-butyl phthalate	---	---	RI Report - 1994	---	---	---
Dibenzofuran	---	---	RI Report - 1994	---	---	---
Dieldrin	---	---	RI Report - 1994	---	---	---
2,4-Dimethylphenol	---	---	RI Report - 1994	---	---	---
Endosulfan sulfate	---	---	RI Report - 1994	---	---	---
Endrin	---	---	RI Report - 1994	---	---	---
Endrin aldehyde	---	---	RI Report - 1994	---	---	---
Ethylbenzene	1.00E+00	---	RI Report - 1994	1.00E+00	IRIS	Same
Fluoranthene	---	---	RI Report - 1994	---	---	---
Fluorene	---	---	RI Report - 1994	---	---	---
Heptachlor	---	---	RI Report - 1994	---	---	---
Heptachlor epoxide	---	---	RI Report - 1994	---	---	---
Indeno(1,2,3-cd)pyrene	---	---	RI Report - 1994	---	---	---
Methylene Chloride	3.00E+00	---	RI Report - 1994	6.00E-01	IRIS	More
2-Methylnaphthalene	---	---	RI Report - 1994	---	---	---
4-Methyl-2-pentanone	8.00E-02	---	RI Report - 1994	3.00E+00	IRIS	Less
4-Methylphenol	---	---	RI Report - 1994	6.00E-01	Cal EPA	More (4)
Naphthalene	---	---	RI Report - 1994	3.00E-03	IRIS	More (4)
Phenanthrene	---	---	RI Report - 1994	---	---	---
Pyrene	---	---	RI Report - 1994	---	---	---
Toluene	4.00E-01	---	RI Report - 1994	5.00E+00	IRIS	Less
Xylenes	---	---	RI Report - 1994	1.00E-01	IRIS	More (4)
OU 3						
Barium	5.00E-04	1.43E-04	RI Report - 1994	5.00E-04	HEAST	Same
Beryllium	---	---	RI Report - 1994	2.00E-05	IRIS	More (4)
Cadmium	---	---	RI Report - 1994	1.00E-05	ATSDR	More (4)
Chromium III	---	---	RI Report - 1994	---	---	---
Chromium VI	---	---	RI Report - 1994	1.00E-04	IRIS	More (4)
Cobalt	---	---	RI Report - 1994	6.00E-06	PPRTV	More (4)
Copper	---	---	RI Report - 1994	---	---	---
Lead	---	---	RI Report - 1994	---	---	---
Manganese (food)	5.00E-05	1.43E-05	RI Report - 1994	5.00E-05	IRIS	Same
Manganese (water)	5.00E-05	1.43E-05	RI Report - 1994	5.00E-05	RSL-S	Same
Mercury	3.00E-04	8.57E-05	RI Report - 1994	3.00E-04	RSL-S	Same
Nickel	---	---	RI Report - 1994	9.00E-05	ATSDR	More (4)

Table A-13
Comparison of Toxicity Values Used in the Quantitative Risk Assessment with Current Toxicity Values for 21 NA Sites
Inhalation Reference Concentrations and Doses

Selenium	---	---	RI Report - 1994	2.00E-02	Cal EPA	More (4)
Silver	---	---	RI Report - 1994	---	---	---
Vanadium	---	---	RI Report - 1994	1.00E-04	ATSDR	More (4)
Zinc	---	---	RI Report - 1994	---	---	---
Acenaphthene	---	---	RI Report - 1994	---	---	---
Acenaphthylene	---	---	RI Report - 1994	---	---	---
Acetone	---	---	RI Report - 1994	3.10E+01	ATSDR	More (4)
alpha-Chlordane	---	---	RI Report - 1994	7.00E-04	IRIS	More (4)
Anthracene	---	---	RI Report - 1994	---	---	---
Aroclor 1260	---	---	RI Report - 1994	---	---	---
Benzene	---	---	RI Report - 1994	3.00E-02	IRIS	More (4)
Benzo(a)anthracene	---	---	RI Report - 1994	---	---	---
Benzo(a)pyrene	---	---	RI Report - 1994	2.00E-06	IRIS	More (4)
Benzo(b)fluoranthene	---	---	RI Report - 1994	---	---	---
Benzo(g,h,i)perylene	---	---	RI Report - 1994	---	---	---
Benzo(k)fluoranethene	---	---	RI Report - 1994	---	---	---
Bis(2-ethylhexyl)phthalate	---	---	RI Report - 1994	---	---	---
2-Butanone	1.00E+00	2.86E-01	RI Report - 1994	5.00E+00	IRIS	Less
Butyl benzyl phthalate	---	---	RI Report - 1994	---	---	---
Carbazole	---	---	RI Report - 1994	---	---	---
Chloroform	---	---	RI Report - 1994	9.80E-02	ATSDR	More (4)
Chrysene	---	---	RI Report - 1994	---	---	---
4,4'-DDD	---	---	RI Report - 1994	---	---	---
4,4'-DDE	---	---	RI Report - 1994	---	---	---
4,4'-DDT	---	---	RI Report - 1994	---	---	---
Dibenz(a,h)anthracene	---	---	RI Report - 1994	---	---	---
Di-n-butyl phthalate	---	---	RI Report - 1994	---	---	---
Dieldrin	---	---	RI Report - 1994	---	---	---
Endosulfan	---	---	RI Report - 1994	---	---	---
Endrin	---	---	RI Report - 1994	---	---	---
Endrin Ketone	---	---	RI Report - 1994	---	---	---
Ethylbenzene	1.00E+00	2.86E-01	RI Report - 1994	1.00E+00	IRIS	Same
Fluoranthene	---	---	RI Report - 1994	---	---	---
Fluorene	---	---	RI Report - 1994	---	---	---
gamma-Chlordane	---	---	RI Report - 1994	7.00E-04	IRIS	More (4)
Heptachlor	---	---	RI Report - 1994	---	---	---
Heptachlor epoxide	---	---	RI Report - 1994	---	---	---
Indeno(1,2,3-cd)pyrene	---	---	RI Report - 1994	---	---	---
Isophorone	---	---	RI Report - 1994	2.00E+00	Cal EPA	More (4)
2-Methylnaphthalene	---	---	RI Report - 1994	---	---	---

Table A-13
Comparison of Toxicity Values Used in the Quantitative Risk Assessment with Current Toxicity Values for 21 NA Sites
Inhalation Reference Concentrations and Doses

Naphthalene	---	---	RI Report - 1994	3.00E-03	IRIS	More (4)
Pentachlorophenol	---	---	RI Report - 1994	---	---	---
Phenanthrene	---	---	RI Report - 1994	---	---	---
Pyrene	---	---	RI Report - 1994	---	---	---
TCDD-2,3,7,8	---	---	RI Report - 1994	4.00E-08	Cal EPA	More (4)
Tetrachloroethylene	---	---	RI Report - 1994	4.00E-02	IRIS	More (4)
Toluene	4.00E-01	1.14E-01	RI Report - 1994	5.00E+00	IRIS	Less
Trichloroethylene	---	---	RI Report - 1994	2.00E-03	IRIS	More (4)
Xylenes	---	---	RI Report - 1994	1.00E-01	IRIS	More (4)
OU 5						
Beryllium	---	---	RI Report - 1995	2.00E-05	IRIS	More (4)
Benzo(a)anthracene	---	---	RI Report - 1995	---	---	---
Benzo(a)pyrene	---	---	RI Report - 1995	2.00E-06	IRIS	More (4)
Benzo(b)fluoranthene	---	---	RI Report - 1995	---	---	---
Benzo(k)fluoranethene	---	---	RI Report - 1995	---	---	---
Dibenz(a,h)anthracene	---	---	RI Report - 1995	---	---	---
Indeno(1,2,3-cd)pyrene	---	---	RI Report - 1995	---	---	---
OU 6						
Aluminum	---	---	RI Report - 1995	5.00E-03	PPRTV	More (4)
Thallium	---	---	RI Report - 1995	---	---	---
Benzo(a)pyrene	---	---	RI Report - 1995	2.00E-06	IRIS	More (4)
Benzo(b)fluoranthene	---	---	RI Report - 1995	---	---	---
Endrin ketone	---	---	RI Report - 1995	---	---	---
Total petroleum hydrocarbons	---	---	RI Report - 1995	3.00E-03	PPRTV	More (4)

--- No value available.
ATSDR - Agency for Toxic Substances Disease Registry
CalEPA - California Environmental Protection Agency.
COPC - Chemical of Potential Concern.
HEAST - Health Effects Assessment Summary Tables
HHRA - Human Health Risk Assessment.
IRIS - Integrated Risk Information System.
IUR - Inhalation Unit Risk.
N/A - Not Applicable.
NC - Not identified as a COPC in the baseline HHRA.
OU - Operable Unit
PPRTV - Provisional Peer-Reviewed Toxicity Values
RSL-S - Specific value from RSL User's Guide
USEPA - U.S. Environmental Protection Agency.

Table A-13
Comparison of Toxicity Values Used in the Quantitative Risk Assessment with Current Toxicity Values for 21 NA Sites
Inhalation Reference Concentrations and Doses

(1) Toxicity values were obtained from the original risk assessment and Remedial Investigation (RI) report as referenced.
(2) RfDs are presented for comparison if used in the original report. Equivalent RfCs are the recommended values for inhalation risk assessment (USEPA, 2009).
(3) Toxicity values were obtained from the USEPA RSL Tables (November 2019), and documented by source (e.g., IRIS, PPRTV, or Tier 3 sou
(4) Current toxicity value is more stringent because there was no value for use in the original risk assessment.

Value has changed since the Fourth Five-Year Review (WPAFB, 2016).

Table A-14
21 No Action Sites Proportional Risk Calculations for Changes in Toxicity Values
Wright-Patterson AFB, OH

Site	Chemical	Changed Values	EPC [a] (mg/kg)	RSL Cancer [b] (mg/kg)	Calculated Risk [c]	Chemical	Changed Values	EPC [a] (mg/kg)	RSL Noncancer [b] (mg/kg)	Calculated Hazard Index [d]
OU2										
Long Term Coal Storage	Chromium VI	SF, IUR	1.72E+01	6.3E+00	2.7E-06	Methylene chloride	RfD, RfC	6.22E-03	3.2E+03	0.000002
Burial Site 1 (BS1)	Nickel	IUR	1.71E+01	6.4E+04	2.7E-10	Aluminum	RfD, RfC	1.22E+04	1.1E+06	0.011
	Benzo(a)anthracene	IUR	3.19E-01	2.1E+01	1.5E-08	Arsenic	RfC	1.27E+01	4.8E+02	0.03
Surface Soil	Benzo(a)pyrene	IUR	2.57E-01	2.1E+00	1.2E-07	Beryllium	RfD, RfC	5.24E-01	2.3E+03	0.0002
Toxicity Values	Benzo(b)fluoranthene	IUR	2.83E-01	2.1E+01	1.3E-08	Cadmium	IUR	6.56E-01	9.8E+02	0.001
	Benzo(k)fluoranthene	IUR	2.42E-01	2.1E+02	1.2E-09	Chromium VI	IUR	1.72E+01	3.5E+03	0.005
	Bis(2-ethylhexyl)phthalate	IUR	2.50E-02	1.6E+02	1.6E-10	Cobalt	RfD, RfC	1.20E+01	3.5E+02	0.03
	Chrysene	IUR	2.80E-01	2.1E+03	1.3E-10	Nickel	RfC	1.71E+01	2.2E+04	0.001
	Dibenz(a,h)anthracene	IUR	1.90E-01	2.1E+00	9.0E-08	Thallium	RfD	4.40E-01	1.2E+01	0.04
	Indeno(1,2,3-cd)pyrene	IUR	2.11E-01	2.1E+01	1.0E-08	Vanadium	RfD, RfC	3.08E+01	5.8E+03	0.005
	Naphthalene	IUR	2.01E-01	1.7E+01	1.2E-08	Acenaphthylene	RfD	1.94E-01	2.3E+04	0.0000084
	4,4'-DDE	IUR	1.16E-03	9.3E+00	1.2E-10	Benzo(g,h,i)perylene	RfD	1.94E-01	2.3E+04	0.0000084
						Dibenzofuran	RfD	2.03E-01	1.0E+03	0.00020
						2-Methylnaphthalene	RfD	2.19E-01	3.0E+03	0.00007
						Naphthalene	RfD, RfC	2.01E-01	5.9E+02	0.00034
						Phenanthrene	RfD	3.72E-01	2.3E+04	0.00002
						Endrin aldehyde	RfD	1.82E-03	2.5E+02	0.000007
						alpha-Chlordane	RfC	6.34E-04	4.5E+02	0.0000014
	Total				**3.0E-06**	**Total**				**0.12**
OU2										
POL Storage Area	Chromium VI	SF, IUR	1.51E+01	6.3E+00	2.4E-06	Acetone	RfC	2.43E-01	6.7E+05	0.00000036
CCSA	Cobalt	IUR	8.96E+00	1.9E+03	4.7E-09	Benzene	RfD, RfC	2.00E-02	4.2E+02	0.000048
TCSP	Nickel	IUR	1.68E+01	6.4E+04	2.6E-10	Toluene	RfD	3.40E-02	4.7E+04	0.00000072
Spill Sites 2 ,3, and 10	Benzo(a)anthracene	IUR	4.91E+00	2.1E+01	2.3E-07	Xylenes	RfC	2.30E-02	2.5E+03	0.0000092
	Benzo(a)pyrene	IUR	3.31E+00	2.1E+00	1.6E-06	Aluminum	RfD, RfC	1.05E+04	1.1E+06	0.0095
Toxicity Values	Benzo(b)fluoranthene	IUR	3.80E+00	2.1E+01	1.8E-07	Arsenic	RfC	7.96E+00	4.8E+02	0.017
	Benzo(k)fluoranthene	IUR	9.77E+00	2.1E+02	4.7E-08	Beryllium	RfD, RfC	4.84E-01	2.3E+03	0.00021
	Bis(2-ethylhexyl)phthalate	IUR	7.82E-01	1.6E+02	4.9E-09	Cadmium	RfC	1.37E+00	9.8E+02	0.0014
	Chrysene	IUR	4.24E+00	2.1E+03	2.0E-09	Chromium VI	RfC	1.51E+01	3.5E+03	0.0043
	Dibenz(a,h)anthracene	IUR	1.07E+00	2.1E+00	5.1E-07	Cobalt	RfD, RfC	8.96E+00	3.5E+02	0.026
	Naphthalene	IUR	3.90E-01	1.7E+01	2.3E-08	Nickel	RfC	1.68E+01	2.2E+04	0.00076
	Benzene	SF	2.00E-02	5.1E+00	3.9E-09	Vanadium	RfD, RfC	2.60E+01	5.8E+03	0.0045
	Ethylbenzene	IUR	6.00E-03	2.5E+01	2.4E-10	Acenaphthylene	RfD	1.20E-01	2.3E+04	0.0000052
						Benzo(g,h,i)perylene	RfD	1.29E+00	2.3E+04	0.000056
						2-Methylnaphthalene	RfD	8.57E-01	3.0E+03	0.00029
						Naphthalene	RfD, RfC	3.90E-01	5.9E+02	0.00066
						Phenanthrene	RfD	3.28E+00	2.3E+04	0.00014
	Total				**5.0E-06**	**Total**				**0.064**

Table A-14
21 No Action Sites Proportional Risk Calculations for Changes in Toxicity Values
Wright-Patterson AFB, OH
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Site	Chemical	Changed Values	EPC [a] (mg/kg)	RSL Cancer [b] (mg/kg)	Calculated Risk [c]	Chemical	Changed Values	EPC [a] (mg/kg)	RSL Noncancer [b] (mg/kg)	Calculated Hazard Index [d]
OU2										
Building 89 Coal Storage	Benzene	SF	4.00E-03	5.1E+00	7.8E-10	Benzene	RfD,RfC	4.00E-03	4.2E+02	0.000010
Pile (B89CSP)	Chromium VI	SF, IUR	1.81E+01	6.3E+00	2.9E-06	Toluene	RfD	1.63E-02	4.7E+04	0.00000035
	Cobalt	IUR	1.06E+01	1.9E+03	5.6E-09	Xylenes	RfC	1.09E-02	2.5E+03	0.0000044
Toxicity Values	Nickel	IUR	1.68E+01	6.4E+04	2.6E-10	Aluminum	RfD, RfC	1.37E+04	1.1E+06	0.012
	Benzo(a)anthracene	IUR	4.77E-01	2.1E+01	2.3E-08	Arsenic	RfC	1.78E+01	4.8E+02	0.037
	Benzo(a)pyrene	IUR	4.19E-01	2.1E+00	2.0E-07	Beryllium	RfD, RfC	9.00E-01	2.3E+03	0.00039
	Benzo(b)fluoranthene	IUR	6.34E-01	2.1E+01	3.0E-08	Cadmium	RfC	1.10E+00	9.8E+02	0.0011
	Benzo(k)fluoranthene	IUR	5.52E-01	2.1E+02	2.6E-09	Chromium VI	RfC	1.81E+01	3.5E+03	0.0052
	Bis(2-ethylhexyl)phthalate	IUR	5.60E-02	1.6E+02	3.5E-10	Cobalt	RfD, RfC	1.06E+01	3.5E+02	0.030
	Chrysene	IUR	6.38E-01	2.1E+03	3.0E-10	Nickel	RfC	1.68E+01	2.2E+04	0.00076
	Naphthalene	IUR	1.03E+00	1.7E+01	6.1E-08	Selenium		4.07E+00	5.8E+03	0.00070
						Vanadium	RfD, RfC	3.29E+01	5.8E+03	0.0057
						Acenaphthylene	RfD	5.70E-02	2.3E+04	0.0000025
						Benzo(g,h,i)perylene	RfD	2.80E-01	2.3E+04	0.000012
						Dibenzofuran	RfD	4.70E-01	1.0E+03	0.00047
						2-Methylnaphthalene	RfD	1.30E+00	3.0E+03	0.00043
						4-Methylphenol	RfC	9.00E-02	8.2E+04	0.0000011
						Naphthalene	RfD, RfC	1.03E+00	5.9E+02	0.0017
						Phenanthrene	RfD	1.35E+00	2.3E+04	0.000059
	Total				**3.2E-06**	**Total**				**0.096**
OU3										
Fire Training Area 3/4	Benzene	SF	6.82E-03	5.1E+00	1.3E-09	Acetone	RfC	4.61E-02	6.7E+05	0.000000069
Spill Site 1	Ethylbenzene	SF, IUR	1.53E-02	2.5E+01	6.1E-10	Benzene	RfC	6.82E-03	4.2E+02	0.000016
	Cobalt	IUR	5.45E+00	1.9E+03	2.9E-09	Toluene	RfD	2.00E-03	4.7E+04	0.000000043
Toxicity Values	Nickel	IUR	1.02E+01	6.4E+04	1.6E-10	Xylenes	RfD	2.12E-02	2.5E+03	0.0000085
	Benzo(a)anthracene	IUR	3.21E-01	2.1E+01	1.5E-08	Beryllium	RfD, RfC	7.78E-01	2.3E+03	0.00034
	Benzo(a)pyrene	IUR	3.32E-01	2.1E+00	1.6E-07	Cadmium	RfC	1.83E+00	9.8E+02	0.0019
	Benzo(b)fluoranthene	IUR	5.85E-01	2.1E+01	2.8E-08	Cobalt	RfD, RfC	5.45E+00	3.5E+02	0.016
	Benzo(k)fluoranthene	IUR	3.29E-01	2.1E+02	1.6E-09	Nickel	RfC	1.02E+01	2.2E+04	0.00046
	Bis(2-ethylhexyl)phthalate	IUR	1.30E-01	1.6E+02	8.1E-10	Selenium	RfC	3.41E-01	5.8E+03	0.000059
	Butyl benzyl phthalate	SF	2.65E-01	1.2E+03	2.2E-10	Vanadium	RfD, RfC	2.49E+01	5.8E+03	0.0043
	Chrysene	IUR	3.42E-01	2.1E+03	1.6E-10	Acenaphthylene	RfD	1.00E-01	2.3E+04	0.0000043
	Dibenz(a,h)anthracene	IUR	2.10E-01	2.1E+00	1.0E-07	Benzo(g,h,i)perylene	RfD	3.19E-01	2.3E+04	0.000014
	Indeno(1,2,3-cd)pyrene	IUR	3.42E-01	2.1E+01	1.6E-08	2-Methylnaphthalene	RfD	4.57E-01	3.0E+03	0.00015
	Naphthalene	IUR	6.76E-01	1.7E+01	4.0E-08	Naphthalene	RfD, RfC	6.76E-01	5.9E+02	0.0011
	gamma-Chlordane	SF, IUR	1.50E-02	7.7E+00	1.9E-09	Phenanthrene	RfD	9.21E-01	2.3E+04	0.000040
	4,4'-DDD	IUR	1.70E-02	9.6E+00	1.8E-09	Endrin Ketone	RfD	1.50E-03	2.5E+02	0.0000060
						gamma-Chlordane	RfD, RfC	1.50E-02	4.5E+02	0.000033
	Total				**3.7E-07**	**Total**				**0.024**

Table A-14
21 No Action Sites Proportional Risk Calculations for Changes in Toxicity Values
Wright-Patterson AFB, OH
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Site	Chemical	Changed Values	EPC [a] (mg/kg)	RSL Cancer [b] (mg/kg)	Calculated Risk [c]	Chemical	Changed Values	EPC [a] (mg/kg)	RSL Noncancer [b] (mg/kg)	Calculated Hazard Index [d]
OU3										
Fire Training Area 2/5	Benzene	SF	1.00E-03	5.1E+00	2.0E-10	Acetone	RfC	1.37E-02	6.7E+05	0.000000020
	Chloroform	SF	3.00E-03	1.4E+00	2.1E-09	Benzene	RfC	1.00E-03	4.2E+02	0.0000024
Toxicity Values	Ethylbenzene	SF, IUR	1.00E-03	2.5E+01	4.0E-11	Chloroform	RfC	3.00E-03	1.0E+03	0.0000030
	Tetrachloroethylene	SF, IUR	2.00E-03	1.0E+02	2.0E-11	Tetrachloroethylene	RfD, RfC	2.00E-03	3.9E+02	0.0000051
	Trichloroethylene	SF, IUR	2.00E-03	6.0E+00	3.3E-10	Toluene	RfD	4.00E-03	4.7E+04	0.000000085
	Cobalt	IUR	5.70E+00	1.9E+03	3.0E-09	Trichloroethylene	RfD, RfC	2.00E-03	1.9E+01	0.00011
	Nickel	IUR	1.16E+01	6.4E+04	1.8E-10	Xylenes	RfD, RfC	6.47E-03	2.5E+03	0.0000026
	Benzo(a)anthracene	IUR	1.51E-01	2.1E+01	7.2E-09	Cadmium	RfC	1.12E+00	9.8E+02	0.0011
	Benzo(a)pyrene	IUR	1.80E-01	2.1E+00	8.6E-08	Cobalt	RfD, RfC	5.70E+00	3.5E+02	0.016
	Benzo(b)fluoranthene	IUR	2.29E-01	2.1E+01	1.1E-08	Nickel	RfC	1.16E+01	2.2E+04	0.00053
	Benzo(k)fluoranthene	IUR	1.86E-01	2.1E+02	8.9E-10	Selenium	RfC	4.97E-01	5.8E+03	0.000086
	Bis(2-ethylhexyl)phthalate	IUR	1.90E-01	1.6E+02	1.2E-09	Vanadium	RfD, RfC	2.23E+01	5.8E+03	0.0038
	Butyl benzyl phthalate	SF	2.23E-01	1.2E+03	1.9E-10	Acenaphthylene	RfD	3.70E-02	2.3E+04	0.0000016
	Chrysene	IUR	1.40E-01	2.1E+03	6.7E-11	Benzo(g,h,i)perylene	RfD	2.13E-01	2.3E+04	0.0000093
	Dibenz(a,h)anthracene	IUR	2.10E-01	2.1E+00	1.0E-07	Isophorone	RfC	3.70E-02	1.6E+05	0.00000023
	Indeno(1,2,3-cd)pyrene	IUR	2.12E-01	2.1E+01	1.0E-08	Pentachlorophenol	RfD	1.60E-01	2.8E+03	0.000057
	Pentachlorophenol	SF, IUR	1.60E-01	4.0E+00	4.0E-08	Phenanthrene	RfD	1.55E-01	2.3E+04	0.0000067
	4,4'-DDD	IUR	9.30E-04	9.6E+00	9.7E-11					
	Total				**2.6E-07**	**Total**				**0.022**
OU3										
Landfill 14	Chromium VI	SF, IUR	3.41E+01	6.3E+00	5.4E-06	Cadmium	RfC	1.50E+00	9.8E+02	0.0015
	Benzo(a)anthracene	IUR	3.50E-01	2.1E+01	1.7E-08	Chromium VI	RfC	3.41E+01	3.5E+03	0.0097
Toxicity Values	Benzo(a)pyrene	IUR	6.70E-01	2.1E+00	3.2E-07	Acenaphthylene	RfD	2.90E-02	2.3E+04	0.0000013
	Benzo(b)fluoranthene	IUR	9.30E-01	2.1E+01	4.4E-08	Benzo(g,h,i)perylene	RfD	5.80E-01	2.3E+04	0.000025
	Benzo(k)fluoranthene	IUR	5.40E-01	2.1E+02	2.6E-09	Phenanthrene	RfD	4.20E-01	2.3E+04	0.000018
	Bis(2-ethylhexyl)phthalate (Cal)	IUR	1.10E-01	1.6E+02	6.9E-10	Endrin Ketone	RfD	1.80E-03	2.5E+02	0.0000072
	Chrysene	IUR	2.70E-01	2.1E+03	1.3E-10	TCDD - Toxicity Equivalent	RfD,RfC	3.57E-06	7.2E-04	0.0050
	Dibenz(a,h)anthracene	IUR	2.10E-01	2.1E+00	1.0E-07					
	Indeno(1,2,3-cd)pyrene	IUR	6.80E-01	2.1E+01	3.2E-08					
	alpha-Chlordane	SF, IUR	1.20E-03	7.7E+00	1.6E-10					
	Aroclor 1260	IUR	7.20E-02	9.9E-01	7.3E-08					
	TCDD - Toxicity Equivalent	IUR	3.57E-06	2.20E-05	1.6E-07					
	Total				**6.2E-06**	**Total**				**0.016**

Table A-14
21 No Action Sites Proportional Risk Calculations for Changes in Toxicity Values
Wright-Patterson AFB, OH

Site	Chemical	Changed Values	EPC [a] (mg/kg)	RSL Cancer [b] (mg/kg)	Calculated Risk [c]	Chemical	Changed Values	EPC [a] (mg/kg)	RSL Noncancer [b] (mg/kg)	Calculated Hazard Index [d]
OU5 FTA-1 RSL Comparisons	Arsenic	RSL	6.00E+00	3.0E+00	2.0E-06	Arsenic	RSL	6.00E+00	4.8E+02	0.0013
	Chromium VI	RSL	1.30E+01	6.3E+00	2.1E-06	Chromium VI	RSL	1.30E+01	3.5E+03	0.00037
	Naphthalene	RSL	1.00E+01	1.7E+01	5.9E-07	Naphthalene	RSL	1.00E+01	5.9E+02	0.0017
	Total				**4.7E-06**	**Total**				**0.0033**
OU6 EFDZ1 Toxicity Values	Benzo(a)pyrene	IUR	1.60E-01	2.1E+00	7.6E-08	Endrin Ketone	RfD	1.20.E-03	2.5E+02	0.00000048
	Benzo(b)fluoranthene	IUR	3.70E-01	2.1E+01	1.8E-08	Total petroleum hydrocarbons	RfD,RfC	9.60.E+01	4.2E+02	0.023
	Total				**9.4E-08**	**Total**				**0.023**
OU10 CHP-3 RSL Comparisons	Dibenz(a,h)anthracene	RSL	4.40E-02	2.1E+00	2.1E-08	None				
	Total				**2.1E-08**					
OU10 Battery Burial Site RSL Comparisons	Cadmium	RSL	2.23E+02	9.3E+03	2.4E-08	Cadmium	RSL	2.23E+02	9.8E+02	0.023
	Chromium VI	RSL	1.71E+01	6.3E+00	2.7E-06	Chromium VI	RSL	1.71E+01	3.5E+03	0.00049
						Zinc	RSL	7.59.E+04	3.5E+05	0.022
	Total				**2.7E-06**	**Total**				**0.045**

ELCR = Excess Lifetime Cancer Risk
EPC = Exposure Point Concentration
IUR = Inhalation Unit Risk
RfC = Reference Concentration
RfD = Reference Dose
RSL = Regional Screening Level
SF = Slope Factor

a) Exposure point concentration was the Reasonable Maximum Exposure (RME) concentration based on either the 95 percent upper confidence limit (UCL) of the arithmetic mean or the maximum detected concentration, whichever was lower. Values obtained from the original risk assessments.

b) Values obtained from the USEPA's RSL table for the Composite Worker Soil and based on a cancer risk of 1 x 10^{-6} and a noncancer hazard index (HI) of 1.

c) The risk associated with the EPC is calculated:

Risk = [(EPC) x (1 x 10^{-6})] / RSL cancer

d) The hazard index (HI) associated with the EPC is calculated:

HI = EPC / RSL noncancer

Table A-15
Rationale for Further Evaluation of Toxicity Values
41 No Action Sites[1]
Wright-Patterson AFB, Ohio
Page 1 of 13

OU	IRP Site	Type of Risk Assessment	Further Evaluation Required?	Rationale for Further Evaluation of Screening/ Toxicity Values	References
3	LF11	Quantitative RA	No	Under a base-wide landfill capping program, LF11 was capped. The presumptive remedy also included removing debris from the landfill surface. Because the area has been capped, there is no current exposure to soil. No further evaluation required.	Final RI Report for Operable Unit 3, SAIC, 1995.
3	LF12	Quantitative RA	No	Under a non-time critical removal action, LF12 was excavated and waste was removed and disposed in 1997. Because the contents of the landfill have been excavated and the landfill backfilled and reseeded, there is no exposure to soil. No further evaluation required.	Final Remedial Investigation Report for Operable Unit 3, SAIC, 1995. Independent Engineer's Report for Landfill 12 Removal Action, IT, 1998.
4	CHP2	Semi-Quantitative RA	No	The storm sewer pipe that exits the heating plant was capped, and the floor drain lines were cleaned and abandoned. Former storage area was paved and is currently used as a parking lot. The site is now occupied by Building 271.	IRP Stage 2 Report, Roy F. Weston, Inc., 1989. Decision Document Central Heating Plant 2, WPAFB, 1991. RI/FS Addendum for Operable Unit 4, CH2M HILL, 1998.
4	LF3	Quantitative RA	No	The area has been capped; therefore, there is no current exposure to soil. Limited access and land use restrictions that prevent intrusive activities will continue to be implemented at LF3 per the 41 No Action Sites ROD. Current allowable use is outdoor recreation. It was concluded that no action was necessary beyond the landfill cap (a presumptive remedy).	IRP, Proposed Plan for 41 Sites, Wright-Patterson Air Force Base, June 1998.

Table A-15
Rationale for Further Evaluation of Toxicity Values
41 No Action Sites(1)
Wright-Patterson AFB, Ohio
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OU	IRP Site	Type of Risk Assessment	Further Evaluation Required?	Rationale for Further Evaluation of Screening/ Toxicity Values	References
4	LF4	Quantitative RA	No	Limited access and land use restrictions that prevent intrusive activities will continue to be implemented at LF4 per the 41 No Action Sites ROD. Because the area has been capped, there is no current exposure to soil. No current exposure receptors.	IRP, Proposed Plan for 41 Sites, Wright-Patterson Air Force Base, June 1998.
4	LF6	Quantitative RA	No	It was concluded that no action was necessary beyond the landfill cap (a presumptive remedy). Limited access and land use restrictions that prevent intrusive activities will continue to be implemented at LF6 per the 41 No Action Sites ROD. The protective soil cover over the clay landfill cap will continue to be maintained as required to prevent erosion and ponding.	IRP, Proposed Plan for 41 Sites, Wright-Patterson Air Force Base, June 1998.
4	LF7	Quantitative RA	No	It was concluded that no action was necessary beyond the landfill cap (a presumptive remedy). Limited access and land use restrictions that prevent intrusive activities will continue to be implemented at LF7 per the 41 No Action Sites ROD. The barn was razed and engineered cover was placed over the landfill. The protective soil cover over the clay landfill cap will continue to be maintained as required to prevent erosion and ponding. Also included in this area are the Drum Staging and Disposal Area. This area is wooded with mature trees and shrubs. No landfilling was known to have occurred in this area and no cover soil is believed to have been placed over the native soils. No evidence of drums in the drum staging area was encountered during RI activities.	ROD for 41 No Action Sites at Wright-Patterson Air Force Base, WPAFB, 1998.

Table A-15
Rationale for Further Evaluation of Toxicity Values
41 No Action Sites[1]
Wright-Patterson AFB, Ohio
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OU	IRP Site	Type of Risk Assessment	Further Evaluation Required?	Rationale for Further Evaluation of Screening/ Toxicity Values	References
5	LF5	Semi-quantitative RA	No	It was concluded that no action was necessary beyond the landfill cap (a presumptive remedy). Under a base-wide landfill capping program, LF5 was capped in 1996. Maintenance of the landfill cap will continue to be conducted as described in the Operation and Maintenance Plan.	Site-Specific Removal Action Plan for Landfill Capping, Site Specific Document for Landfill 5, IT Corporation, 1994. Final RI Report for Operable Unit 5, IT Corporation, 1995. Independent Engineer's Certification Report for Landfill 5 Capping System, IT Corporation and EEC, 1996.
6	LF1	Quantitative RA	No	Landfill capping was selected as the presumptive remedy. The area has been capped; therefore, there is no current exposure to soil. Maintenance of the landfill cap will continue to be conducted as described in the Operation and Maintenance Plan specific to the landfill. Most of LF1 now appears to be covered by Perimeter Road on base and extends as far west as the northbound exit ramp from Harshman Road to Springfield Pike. Current allowable land use is open space.	RI/FS Site Specific Work Plan, OU6 LF1, LF2 and EFDZ1, WPAFB, 1993. SSRAP, Operable Unit 6, Landfill Nos. 1 and 2, WPAFB, 1996.
6	LF2	Quantitative RA	No	Landfill capping was selected as the presumptive remedy. This control limits the exposure of human and ecological receptors to landfill refuse. Land use and excavation activities have been restricted. Maintenance of the landfill cap will continue to be conducted as described in the Operation and Maintenance Plan specific to the landfill.	SSRAP, Operable Unit 6, Landfill Nos. 1 and 2, WPAFB, 1996.

Table A-15
Rationale for Further Evaluation of Toxicity Values
41 No Action Sites[1]
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OU	IRP Site	Type of Risk Assessment	Further Evaluation Required?	Rationale for Further Evaluation of Screening/ Toxicity Values	References
7	LF9	Semi-quantitative RA	No	Under a base-wide landfill capping program, LF9 was capped. Monitoring requirements for landfill cover are followed. The site is an undeveloped, open area surrounded by woods and is occasionally used for recreational hunting. It is located in a runway flyover zone and neither industrial use nor residential development is viable. In June 1998, construction of a native soil and vegetative cover was completed as part of a presumptive remedy action.	Final Field Investigation Report, Wright-Patterson Air Force Base, Operable Unit 7, WPAFB, 1996. Final Removal Action Report, Operable Unit 7 (LF9), Kelchner, 1998.
8	SP11	Semi-Quantitative RA and Quantitative RA	Yes - RSLs	TPH in subsurface soil exceeded BUSTR action levels. A non-time critical removal action was implemented consisting of the installation of a downgradient french drain to collect groundwater and surface water. The collected water is pumped to an existing oil/water separator for treatment. At the time of the risk assessment, land use at SP11 was designated as industrial. The site is currently used as the Aircraft Survivability Research Facility; allowable land use is for research and development. This site is being further addressed.	Final RI Report for Operable Unit 8, CH2M HILL, 1997.
8	SP5 OU8 41 sites	Semi-quantitative RA	No	TPH in subsurface soil west of SP5 exceeded BUSTR action levels. As part of a non-time critical removal action, a bioslurper was installed to remove floating product from groundwater, in addition to organic soil vapors from the vadose soils. The site cover includes grass, asphalt, and gravel. No surface soil sampling was performed. Risks and hazards were not calculated for subsurface soil because concentrations were several orders of magnitude below the Region 9 PRGs.	Final RI Report for Operable Unit 8, CH2M HILL, 1997.

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OU	IRP Site	Type of Risk Assessment	Further Evaluation Required?	Rationale for Further Evaluation of Screening/ Toxicity Values	References
8	SP6	None	No	Site concentrations of PCBs were found to exceed the cleanup levels under TSCA. In 1986, the transformer and pad located at this site were removed and soil excavations were conducted in 1986, 1987, and 1992. Verification samples collected after the last excavation effort showed that PCB contamination was below 10 ppm for all but one sample at 11.7 ppm. These concentration levels were below the TSCA cleanup criteria for electrical substations (50 ppm). The TSCA clean-up criteria have not changed.	Final Report Wright-Patterson AFB, Spill Sites 6 & 8, USACOE, 1991.
8	SP7	Semi-quantitative RA	No	When SP7 was incorporated into the IRP, it was placed under the oversight authority of BUSTR. Closure of 14 USTs at the site was conducted in late 1991. The site was “over-excavated” to the top of bedrock exposure or building foundation was encountered. The tanks were then replaced. Soil sample concentrations were compared to Region 3 RBCs and were found to be below the risk-based levels for an industrial/commercial scenario.	Decision Document for Spill Site 7, WPAFB, 1993.
8	SP9	Semi-quantitative RA	No	When SP9 was incorporated into the IRP, it was placed under the oversight authority of BUSTR. Closure of the USTs at the site was conducted in 1992. The site was “over-excavated” to the top of bedrock exposure. Soil sample concentrations were compared to Region 3 RBCs and were found to be below the risk-based levels for an industrial/commercial scenario.	Decision Document for Spill Site 9, WPAFB, 1993.
8	UST 71A	Semi-quantitative RA	No	The site cover includes a gravel parking lot, a paved road, a lawn, and a landscaped median. No surface soil samples were collected. Region 9 industrial soil PRGs were used to screen soil samples. Risks and hazards were not calculated for subsurface soil because concentrations were several orders of magnitude below the Region 9 PRGs	Final RI Report for Operable Unit 8, CH2M HILL, 1997.

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OU	IRP Site	Type of Risk Assessment	Further Evaluation Required?	Rationale for Further Evaluation of Screening/ Toxicity Values	References
9	BS3	Qualitative RA	No	This site is grassy and wooded area; land use at BS3 is designated as open space. A qualitative risk assessment was conducted (i.e., inorganics were compared to background). Lead concentrations exceeded background values slightly but are thought to be within the naturally occurring range. Lead was compared with the residential lead exposure criteria of 400 mg/kg. Site concentrations of lead are below this level. This criterion has not changed. Toluene and SVOC TICs were the only other detected contaminants. Toluene was not considered to be site related.	Final Site Investigation Report for 16 IRP Sites, SAIC, 1993.
9	BS5	Semi-quantitative RA	Yes-RSLs	BS5 is grass covered; land use is designated as open space. Region 9 residential and industrial soil PRGs were used to screen soil samples.	Final Site Investigation Report for Burial Sites 5 and 6, ICI, 1998.
9	BS6	Semi-quantitative RA	Yes-RSLs	BS6 is grass covered; land use is designated as open space. Region 9 residential and industrial soil PRGs were used to screen soil samples.	Final Site Investigation Report for Burial Sites 5 and 6, ICI, 1998.
9	EFDZ10	None		EFDZ10 is partially wooded; land use is designated as open space. Metals and low levels of VOCs and SVOC TICs were detected in soil. Since the SI, additional background data have been obtained. Based on these data, the metals concentrations are likely naturally-occurring.	Final Site Investigation Report for 16 IRP Sites, SAIC, 1993.
9	EFDZ2	Semi-quantitative RA	No	EFDZ2 is grass covered; land use at is designated as industrial. Soil samples were collected at 20-22 ft. Metals and low levels of VOCs and SVOC TICs were detected in soil. Region 9 residential soil PRGs were used to screen soil samples in the SI. The maximum concentrations of all COCs were lower than the residential PRGs for most constituents by at least two orders of magnitude. This site was not carried forward to an RI.	Site Investigation Report for Eight Earthfill Disposal Zones, ES, 1992.
9	EFDZ3	Semi-	No	EFDZ3 is grass covered; land use is designated as industrial. Soil samples were	Site Investigation Report for

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OU	IRP Site	Type of Risk Assessment	Further Evaluation Required?	Rationale for Further Evaluation of Screening/ Toxicity Values	References
		quantitative RA		collected at 14-16 ft. Metals and low levels of VOCs and SVOC TICs were detected in soil. Region 9 residential soil PRGs were used to screen soil samples. The maximum concentrations of all COCs were lower than the residential PRGs for most constituents by at least two orders of magnitude. This site was not carried forward to an RI.	Eight Earthfill Disposal Zones, ES, 1992.
9	EFDZ4	Semi-quantitative RA	Yes - RSLs	EFDZ4 is grass covered; land use is designated as industrial. Metals and low levels of VOCs and SVOC TICs were detected in soil. Region 9 industrial soil PRGs were used to screen soil samples. This site was carried forward to an RI.	Site Investigation Report for Eight Earthfill Disposal Zones, ES, 1992. Final RI Report Operable Unit 9, IT, 1997.
9	EFDZ5	Semi-quantitative RA	No	EFDZ5 is grass covered; land use is designated as open space. Soil samples were collected from 10-12 ft. Metals were detected in soil. Region 9 residential soil PRGs were used to screen soil samples. The maximum concentrations of all COCs were lower than the residential PRG with the exception of beryllium; beryllium did not appear to be site related. This site was not carried forward to an RI.	Site Investigation Report for Eight Earthfill Disposal Zones, ES, 1992.
9	EFDZ6	Semi-quantitative RA	No	EFDZ6 was mostly grass covered. Soil samples were collected at 15 -17 ft. A parking lot for Building 837 now occupies the site. Region 9 residential soil PRGs were used to screen soil samples. The maximum concentrations of all COCs were lower than the residential PRG with the exception of beryllium; beryllium did not appear to be site related. This site was not carried forward to an RI.	Site Investigation Report for Eight Earthfill Disposal Zones, ES, 1992.
9	EFDZ7	Semi-quantitative RA	No	EFDZ3 is grass covered; land use is designated as open space. Soil samples were collected at 9-11 ft. Region 9 residential soil PRGs were used to screen soil samples. The maximum concentration of all COCs was lower than the residential PRG. This site was not carried forward to an RI.	Site Investigation Report for Eight Earthfill Disposal Zones, ES, 1992.
9	EFDZ8	Semi-quantitative RA	No	EFDZ8 is mostly grass covered except for a portion covered by an asphalt parking lot. Soil samples were collected at 2 - 4 ft. Region 9 residential soil PRGs were used to	Site Investigation Report for Eight Earthfill Disposal Zones,

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OU	IRP Site	Type of Risk Assessment	Further Evaluation Required?	Rationale for Further Evaluation of Screening/ Toxicity Values	References
				screen soil samples. The maximum concentrations of all COCs were lower than the residential PRG with the exception of beryllium; beryllium did not appear to be site related. This site was not carried forward in an RI.	ES, 1992.
9	EFDZ9	Semi-quantitative RA	Yes - RSLs	EFDZ9 was previously grass covered, but is now a wooded lot. Region 9 industrial soil PRGs were used to screen soil samples. This site was carried forward in an RI.	Site Investigation Report for Eight Earthfill Disposal Zones, ES, 1992. Final RI Report Operable Unit 9, IT, 1997.
9	HP5	Semi-quantitative RA	Yes-RSLs	PAHs were found to exceed Region 9PRGs in the coal storage area. As a result, portions of the railroad tracks were removed and surface areas were graded and paved or resurfaced with clean gravel. A heating plant continues to operate at this site. Region 9 industrial PRGs were used originally to screen soil samples. WPAFB upgraded the coal storage area to mitigate potential threats to human health and the environment.	Final Remedial Investigation Report Operable Unit 9, IT, 1997.

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OU	IRP Site	Type of Risk Assessment	Further Evaluation Required?	Rationale for Further Evaluation of Screening/ Toxicity Values	References
	DRMO	Semi-quantitative RA and Quantitative RA	Yes-RSLs	An EE/CA was conducted to evaluate a non-time critical removal action for the site because PAHs were found to exceed PRGs. The removal action, completed in October 1998, consisted of excavation and off-site disposal of surface soil and backfilling and placing clean gravel over the affected areas. The DRMO is mostly gravel and asphalt covered; land use at this site is designated as industrial. When maximum concentrations from the supplemental investigation (post-removal action) were screened against the most current industrial RSLs (2015), PAHs (except anthracene, benzo(k)fluoranthene and chrysene) still exceeded the new RSL values. Though not analyzed in the supplemental investigation, the arsenic concentration from the initial sampling exceeded its RSL value. This area is currently covered with gravel and asphalt.	Final RI Report Operable Unit 9, IT, 1997. Engineering Evaluation/Cost Analysis at Defense Reutilization Marketing Office Storage Yard Removal Action, IT, 1998. DRMO Final Action Removal Report, IT, 1998. Soil Removal Project, OU 9 – DRMO, Kelchner Environmental, Inc., 1999.
10	East Ramp UST (ERTR)	Semi-Quantitative RA	No	The 12,000 gal UST was removed in 1988 and closed in accordance with BUSTR and USEPA regulations. Based on evaluations of the site data, the concurrence with BUSTR, and the current site conditions, this area is not expected to pose significant human health risks. No additional action is necessary because the contaminated soil has been removed and disposed. Concentrations are below the most current Action Levels set by BUSTR (2017).	Technical Document to Support No Further Response Action Planned, IRP East Ramp UST, WPAFB 1991.
10	SP4	A qualitative analysis of health risk associated with the site indicated that VOCs and TPH	No	SP4 is a leaded gasoline UST spill area discovered in 1988. Visibly contaminated soil was removed and the excavation was backfilled with uncontaminated material and closed in accordance with BUSTR and USEPA regulations. Concentrations are below the most current Action Levels set by BUSTR (2017). Therefore, this does not affect the conclusions of the risk assessment.	Technical Document to Support No Further Response Action Planned IRP Spill Site 4, WPAFB 1991.

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OU	IRP Site	Type of Risk Assessment	Further Evaluation Required?	Rationale for Further Evaluation of Screening/ Toxicity Values	References
11	BS2	Semi-quantitative RA	Yes-RSLs	BS2 is grass covered; land use is designated as open space. Region 9 industrial and residential soil PRGs were used originally to screen soil samples. The ROD concluded that the uniformity of chemical patterns throughout the base surface water systems and the lack of correlation of these patterns with the activities historically conducted within the OUs, seem to imply sources present in the environment due to human activity, such as automobile or airplane exhaust, or pesticides used for agricultural purposes rather than an OU-related source.	Final Field Investigation Report Operable Unit 11, Metcalf & Eddy, Inc., 1997.
11	CDA	Semi-quantitative RA.	Yes-RSLs	The CDA is mostly grass covered or paved. Region 9 industrial and residential soil PRGs were used originally to screen soil samples. The maximum concentration of all COCs was lower than the residential and industrial soil PRGs at the $1x10^{-6}$ level except arsenic. Arsenic, however, was below background. When screened against the most current residential and industrial RSLs (2015), the maximum COC concentrations are still below these values, with the exception of arsenic, benzo(a)pyrene and dibenzo(a,h)anthracene which exceeded the residential RSLs. The ROD concluded that the uniformity of chemical patterns throughout the base surface water systems and the lack of correlation of these patterns with the activities historically conducted within the OUs, seem to imply sources present in the environment due to human activity, such as automobile or airplane exhaust, or pesticides used for agricultural purposes rather than an OU-related source.	Final Field Investigation Report Operable Unit 11, Metcalf & Eddy, Inc., 1997.
11	UST 4020	None	No	The UST was removed in 1986. The site is mostly grass covered or paved. The concentration of contaminants detected did not exceed BUSTR cleanup criteria with the exception of one sample taken at a depth of 13 to 15 ft. BUSTR levels for closure and corrective action were revised in 2005 but did not change when BUSTR was updated in 2017.	Installation Restoration Program Stage 2 Report, Roy F. Weston, Inc., 1989.

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OU	IRP Site	Type of Risk Assessment	Further Evaluation Required?	Rationale for Further Evaluation of Screening/ Toxicity Values	References
	EOD	Quantitative RA (before and after removal actions)	No	The site is regulated under State of Ohio RCRA regulations. Closure activities, completed in early 1998, consisted of removing ash and debris from the Open Burning (OB) unit, removing and recycling the OB unit, removing and disposing of approximately 10 cubic yards of non-hazardous contaminated soil from beneath the OB unit, and regarding the site. The site is mostly grass-covered or paved and is fenced and locked. Both risk assessments indicated that risk and hazard estimates were below industrial targets of $1x10^{-5}$ and 1, respectively. The ICs are based on the condition that land use remains industrial.	Closure Certification Explosive Ordnance Disposal Range, IT Corporation, 1999.
	HP1	None	No	The site is mostly covered by an asphalt parking lot. No soil samples were collected (bedrock was encountered at 3.5 ft bgs). The ICs in place are based on the condition that land use remains industrial.	IRP Stage 2 Report, Roy F. Weston, Inc., 1989.
	HP4	None	No	The site is mostly covered by an asphalt parking lot. As a result of the Stage 2 investigation, a stormwater runoff collection system was implemented. Stormwater is combined with other aqueous waste effluent streams from HP4 and are neutralized before being discharged to the storm sewer system. No soil samples were collected. The ICs in place are based on the condition that land use remains industrial.	IRP Stage 2 Report, Roy F. Weston, Inc., 1989.
	NUC	None	No	The NUC is classified as a Site 91B under the AEA of 1954, thus exempted from NRC oversight. Applicable inspection, maintenance and monitoring activities are performed to ensure compliance with the Air Force Nuclear Reactor Program (AFI 91-109), the USAF Special Nuclear Reactor Study 97-1, and the protection of personnel and environment from unnecessary exposure to radiation. Land use is designated as industrial. The reactor was decommissioned in 1970.	IRP Stage 2 Report, Roy F. Weston, Inc., 1989.

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OU	IRP Site	Type of Risk Assessment	Further Evaluation Required?	Rationale for Further Evaluation of Screening/ Toxicity Values	References
	RADB	None	No	None listed in the ROD. In 1990, the concrete slab at the site was removed and the soils were excavated to bedrock (approximately 9 ft). The excavation was then filled and graded.	IRP Stage 2 Report, Roy F. Weston, Inc., 1989. Decision Document Radioactive Waste Burial Site, WPAFB, 1992.
	SP8	None	No	Soil samples collected in 1988 after two transformers were found to be leaking showed PCB contamination at the site with concentrations ranging up to 42 ppm. After the transformers were removed, contaminated soil was excavated. Site is primarily a grassy lot. After excavation of contaminated soil, confirmatory samples were collected The PCB concentrations on site were less than the regulatory criterion of 10 ppm for a residential scenario.	Final Report Wright-Patterson AFB, Spill Sites 6 & 8, USACOE, 1991.

Notes:

1 – These sites were categorized as NA sites with the condition that land use remain restricted.

(Record of Decision for 41 No Action Sites at Wright-Patterson Air Force Base, WPAFB; 1998).

Abbreviations:

AEA = Atomic Energy Act
BGS = Below ground surface
BS = Burial Site
BUSTR = Bureau of Underground Storage Tank Regulations
CDA = Chemical Disposal Area
CHP = Central Heating Plant
COCs = Chemicals of Concern
DRMO = Defense Reutilization Management Office
EE/CA = Engineering Evaluation/Cost Analysis
EFDZ = Earthfill Disposal Zone
EOD = Explosive Ordnance Disposal
HP = Heating Plant
ICs = Institutional Controls
IRP = Installation Restoration Program
LF = Landfill
mg/kg = milligram(s) per kilogram
NRC = Nuclear Regulatory Commission
NUC = Deactivated Nuclear Reactor
OU = Operable Unit(s)
PAH = Polycyclic Aromatic Hydrocarbons
PCB = Polychlorinated Biphenyl
ppm = parts per million
PRGs = Preliminary Remediation Goals

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RBC = Risk-Based Concentrations
RCRA = Resource Conservation and Recovery Act
RI = Remedial Investigation
ROD = Record of Decision
RSL = Regional Screening Level
SP = Spill Site
SSRAP = Site Specific Remedial Action Plan
SVOC = Semi-volatile Organic Compound
TIC = Tentatively Identified Compounds
TPH = Total Petroleum Hydrocarbons
TSCA = Toxic Substances Control Act
USAF = U.S. Air Force
USEPA = U.S. Environmental Protection Agency
UST = Underground Storage Tank
VOC = Volatile Organic Compound
WPAFB = Wright-Patterson Air Force Base

Table A-16
Comparison of Screening Levels Used in the Risk Assessment with Current Screening Levels
41 No Action Sites

Chemical of Potential Concern	Screening Levels Used in Original Risk Assessment			Current Screening Levels					
	PRG - Residential Soil (mg/kg) (1)	PRG - Industrial Soil (mg/kg) (1)	Reference (1)	November 2019 RSL Residential Soil (mg/kg) (2)	November 2019 RSL Industrial Soil (mg/kg) (2)	Maximum Soil Concentration (mg/kg) (3)	COPC in Original Risk Assessment?	Is current screening level more stringent?	New COPC?
OU 8 Spill Site 11									
Acetone	---	8.40E+03	RI Report 1997	---	6.70E+04	1.80E-02	NO	NO	
Benzo(a)anthracene	---	2.60E+00	RI Report 1997	---	2.10E+01	2.70E-01	NO	NO	
Benzo(a)pyrene	---	2.60E-01	RI Report 1997	---	2.10E+00	3.10E-01	YES	NO	
Benzo(b)fluoranthene	---	2.60E+00	RI Report 1997	---	2.10E+01	3.90E-01	NO	NO	
Benzo(k)fluoranthene	---	2.60E+01	RI Report 1997	---	2.10E+02	4.10E-01	NO	NO	
Bis(2-ethylhexyl)phthalate	---	1.40E+02	RI Report 1997	---	1.60E+02	1.10E-01	NO	NO	
Chrysene	---	2.40E+01	RI Report 1997	---	2.10E+03	4.30E-01	NO	NO	
Dibenz(a,h)anthracene	---	2.60E-01	RI Report 1997	---	2.10E+00	9.00E-02	NO	NO	
Fluoranthene	---	2.70E+04	RI Report 1997	---	3.00E+03	6.30E-01	NO	YES	
Indeno(1,2,3-cd)pyrene	---	2.60E+00	RI Report 1997	---	2.10E+01	2.70E-01	NO	NO	
Lead	4.00E+02	---	RI Report 1997	4.00E+02	---	1.28E+01	NO	NO	
Methyl Ethyl Ketone	---	3.40E+04	RI Report 1997	---	1.90E+04	3.00E-03	NO	YES	
Phenanthrene (4)	---	---	RI Report 1997	---	2.30E+03	1.80E-01	---	YES	
Pyrene	---	2.00E+04	RI Report 1997	---	2.30E+03	7.00E-01	NO	YES	
1,2-Dichloroethene	---	2.70E+02	RI Report 1997	---	2.30E+02	4.00E-03	NO	YES	
Trichloroethene	---	1.70E+01	RI Report 1997	---	1.90E+00	1.00E-03	NO	YES	

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Comparison of Screening Levels Used in the Risk Assessment with Current Screening Levels
41 No Action Sites

OU 8 UST 71A									
2-Methylnaphthalene	---	8.00E+02	RI Report 1997	---	3.00E+02	1.10E-01	NO	YES	
Acetone	---	8.40E+03	RI Report 1997	---	6.70E+04	5.00E-02	NO	NO	
Benzo(a)anthracene	---	2.60E+00	RI Report 1997	---	2.10E+01	1.00E-01	NO	NO	
Benzo(a)pyrene	---	2.60E-01	RI Report 1997	---	2.10E+00	7.10E-02	NO	NO	
Benzo(b)fluoranthene	---	2.60E+00	RI Report 1997	---	2.10E+01	8.20E-02	NO	NO	
Benzo(k)fluoranthene	---	2.60E+01	RI Report 1997	---	2.10E+02	7.80E-02	NO	NO	
Bis(2-ethylhexyl)phthalate	---	1.40E+02	RI Report 1997	---	1.60E+02	3.50E+00	NO	NO	
Chrysene	---	2.40E+01	RI Report 1997	---	2.10E+03	1.30E-01	NO	NO	
Fluoranthene	---	2.70E+04	RI Report 1997	---	3.00E+03	1.90E-01	NO	YES	
Fluorene	---	3.00E+02	RI Report 1997	---	3.00E+03	4.70E-02	NO	NO	
Lead	4.00E+02	---	RI Report 1997	4.00E+02	---	4.81E+01	NO	NO	
Methylene Chloride	---	2.50E+01	RI Report 1997	---	3.20E+02	3.00E-03	NO	NO	
Naphthalene	---	8.00E+02	RI Report 1997	---	1.70E+01	9.00E-02	NO	YES	
Phenanthrene (4)	---	---	RI Report 1997	---	2.30E+03	1.80E-01	NO	YES	
Pyrene	---	2.00E+04	RI Report 1997	---	2.30E+03	2.10E-01	NO	YES	
Toluene	---	2.70E+04	RI Report 1997	---	4.70E+03	1.50E-03	NO	YES	
Iron	---	---	RI Report 1997	---	8.20E+04	6.66E+03	NO	YES	

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Comparison of Screening Levels Used in the Risk Assessment with Current Screening Levels
41 No Action Sites

OU 9 Burial Site 5 (BS5)									
Ethylbenzene	2.30E+02	2.30E+02	SI Report 1998	5.80E+00	2.50E+01	3.00E-03	NO	YES	
Methylene Chloride	7.80E+00	1.80E+01	SI Report 1998	3.50E+01	3.20E+02	1.40E-01	NO	NO	
Tetrachloroethene	5.40E+00	1.70E+01	SI Report 1998	8.10E+00	3.90E+01	2.00E-02	NO	NO	
Toluene	7.90E+02	8.80E+02	SI Report 1998	4.90E+02	4.70E+03	7.00E-03	NO	YES	
m,p-Xylene	3.20E+02	3.20E+02	SI Report 1998	5.50E+01	2.40E+02	4.00E-03	NO	YES	
Bis(2-ethylhexyl)phthalate	3.20E+01	1.40E+02	SI Report 1998	3.90E+01	1.60E+02	9.00E-02	NO	NO	
Aluminum	7.70E+04	1.00E+05	SI Report 1998	7.70E+03	1.10E+05	6.27E+03	NO	YES	
Barium	5.30E+03	1.00E+05	SI Report 1998	1.50E+03	2.20E+04	8.10E+01	NO	YES	
Chromium III	2.10E+02	4.50E+02	SI Report 1998	1.20E+04	1.80E+05	3.28E+01	NO	NO	
Cobalt	4.60E+03	9.70E+04	SI Report 1998	2.30E+00	3.50E+01	5.90E+00	NO	YES	Yes (5)
Copper	2.80E+03	6.30E+04	SI Report 1998	3.10E+02	4.70E+03	1.08E+01	NO	YES	
Lead	4.00E+02	1.00E+03	SI Report 1998	4.00E+02	8.00E+02	8.40E+00	NO	YES	
Manganese	1.84E+03	4.10E+04	SI Report 1998	1.80E+02	2.60E+03	3.12E+02	NO	YES	Yes (5)
Nickel	1.50E+03	3.40E+04	SI Report 1998	1.50E+02	2.20E+03	8.34E+01	NO	YES	
Vanadium	5.40E+02	1.20E+04	SI Report 1998	3.90E+01	5.80E+02	1.34E+01	NO	YES	
Zinc	2.30E+04	1.00E+05	SI Report 1998	2.30E+03	3.50E+04	6.48E+01	NO	YES	

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Comparison of Screening Levels Used in the Risk Assessment with Current Screening Levels
41 No Action Sites

OU 9 Burial Site 6 (BS6)										
Aluminum	7.70E+04	1.00E+05	SI Report 1998	7.70E+03	1.10E+05	1.09E+04	NO	YES	Yes (5)
Barium	5.30E+03	1.00E+05	SI Report 1998	1.50E+03	2.20E+04	1.48E+02	NO	YES	
Chromium III	2.10E+02	4.50E+02	SI Report 1998	1.20E+04	1.80E+05	1.50E+01	NO	NO	
Cobalt	4.60E+03	9.70E+04	SI Report 1998	2.30E+00	3.50E+01	6.20E+00	NO	YES	Yes (5)
Copper	2.80E+03	6.30E+04	SI Report 1998	3.10E+02	4.70E+03	1.47E+01	NO	YES	
Lead	4.00E+02	1.00E+03	SI Report 1998	4.00E+02	8.00E+02	2.05E+01	NO	YES	
Manganese	1.84E+03	4.10E+04	SI Report 1998	1.80E+02	2.60E+03	5.72E+02	NO	YES	Yes (5)
Mercury	2.30E+01	5.10E+02	SI Report 1998	2.30E+00	3.50E+01	1.30E-01	NO	YES	
Nickel	1.50E+03	3.40E+04	SI Report 1998	1.50E+02	2.20E+03	2.10E+01	NO	YES	
Vanadium	5.40E+02	1.20E+04	SI Report 1998	3.90E+01	5.80E+02	2.29E+01	NO	YES	
Zinc	2.30E+04	1.00E+05	SI Report 1998	2.30E+03	3.50E+04	8.88E+01	NO	YES	
Aroclor 1260	6.60E-02	3.40E-01	SI Report 1998	2.40E-01	9.90E-01	4.86E-02	NO	NO	
OU 9 Earth Fill Disposal Zone (EFDZ) 4									
Benzo(a)pyrene	---	2.60E-01	RI Report 1997	---	2.10E+00	2.40E-01	NO	NO	
Dibenz(a,h)anthracene	---	2.60E-01	RI Report 1997	---	2.10E+00	7.10E-02	NO	NO	
Arsenic	---	2.40E+00	RI Report 1997	---	3.00E+00	8.20E+00	YES	NO	
OU 9 Earth Fill Disposal Zone (EFDZ) 9									
Benzo(a)pyrene	---	2.60E-01	RI Report 1997	---	2.10E+00	1.70E-01	NO	NO	
Dibenz(a,h)anthracene	---	2.60E-01	RI Report 1997	---	2.10E+00	5.60E-02	NO	NO	
Arsenic	---	2.40E+00	RI Report 1997	---	3.00E+00	9.30E+00	YES	NO	

Table A-16
Comparison of Screening Levels Used in the Risk Assessment with Current Screening Levels
41 No Action Sites

OU 9 HP5/DRMO									
Anthracene	---	1.90E+01	RI Report 1997	---	2.30E+04	6.60E+01	YES	NO	
Benzo(a)anthracene	---	2.60E+00	RI Report 1997	---	2.10E+01	1.80E+02	YES	NO	
Benzo(a)pyrene	---	2.60E-01	RI Report 1997	---	2.10E+00	2.00E+02	YES	NO	
Benzo(b)fluoranthene	---	2.60E+00	RI Report 1997	---	2.10E+01	2.90E+02	YES	NO	
Benzo(k)fluoranthene	---	2.60E+01	RI Report 1997	---	2.10E+02	1.90E+02	YES	NO	
Chrysene	---	2.40E+01	RI Report 1997	---	2.10E+03	1.80E+02	YES	NO	
Dibenz(a,h)anthracene	---	2.60E-01	RI Report 1997	---	2.10E+00	4.90E+01	YES	NO	
Indeno(1,2,3-cd)pyrene	---	2.60E+00	RI Report 1997	---	2.10E+01	1.50E+02	YES	NO	
Arsenic	---	2.40E+00	RI Report 1997	---	3.00E+00	8.60E+00	YES	NO	
Beryllium	---	1.10E+00	RI Report 1997	---	2.30E+02	9.80E-01	NO	NO	
Cadmium	---	8.50E+02	RI Report 1997	---	9.80E+01	1.30E+02	NO	YES	YES
Chromium III	---	4.50E+02	RI Report 1997	---	1.80E+05	3.80E+01	NO	NO	
Lead	---	1.00E+03	RI Report 1997	---	8.00E+02	1.30E+02	NO	YES	
4,4'-DDT	---	5.60E+00	RI Report 1997	---	8.50E+00	1.50E+00	NO	NO	
alpha-Chlordane	---	1.50E+00	RI Report 1997	---	7.70E+00	2.00E-01	NO	NO	
Aroclor 1242	---	3.40E-01	RI Report 1997	---	9.50E-01	4.20E-01	YES	NO	
Aroclor 1254	---	1.90E+01	RI Report 1997	---	9.70E-01	4.80E+00	NO	YES	YES
Dieldrin	---	1.20E-01	RI Report 1997	---	1.40E-01	4.50E-02	NO	NO	
OU 9 DRMO Supplemental Investigation									
Anthracene	---	1.90E+01	Removal Report 1998	---	2.30E+04	5.00E+00	NO	NO	
Benzo(a)anthracene	---	2.60E+00	Removal Report 1998	---	2.10E+01	2.40E+01	YES	NO	
Benzo(a)pyrene	---	2.60E-01	Removal Report 1998	---	2.10E+00	2.20E+01	YES	NO	
Benzo(b)fluoranthene	---	2.60E+00	Removal Report 1998	---	2.10E+01	3.80E+01	YES	NO	
Benzo(k)fluoranthene	---	2.60E+01	Removal Report 1998	---	2.10E+02	1.50E+01	NO	NO	
Chrysene	---	2.40E+01	Removal Report 1998	---	2.10E+03	2.60E+01	YES	NO	
Dibenz(a,h)anthracene	---	2.60E-01	Removal Report 1998	---	2.10E+00	3.90E+00	YES	NO	
Indeno(1,2,3-cd)pyrene	---	2.60E+00	Removal Report 1998	---	2.10E+01	1.30E+01	YES	NO	

Table A-16
Comparison of Screening Levels Used in the Risk Assessment with Current Screening Levels
41 No Action Sites

OU 11 Burial Site 2										
Toluene	1.90E+03	2.80E+03	RI Report 1997	4.90E+02	4.70E+03	8.00E-03	NO	YES	
Anthracene	1.90E+01	1.90E+01	RI Report 1997	1.80E+03	2.30E+04	5.00E-03	NO	NO	
Benzo(a)anthracene	6.10E-01	2.60E+00	RI Report 1997	1.10E+00	2.10E+01	5.40E-02	NO	NO	
Benzo(a)pyrene	6.10E-02	2.60E-01	RI Report 1997	1.10E-01	2.10E+00	5.90E-02	NO	NO	
Benzo(b)fluoranthene	6.10E-01	2.60E+00	RI Report 1997	1.10E+00	2.10E+01	9.80E-02	NO	NO	
Benzo(g,h,i)perylene (4)	2.00E+03	2.00E+04	RI Report 1997	1.80E+02	2.30E+03	5.00E-02	NO	YES	
Benzo(k)fluoranthene	6.10E+00	2.60E+01	RI Report 1997	1.10E+01	2.10E+02	3.40E-02	NO	NO	
Bis(2-ethylhexyl)phthalate	3.20E+01	1.40E+02	RI Report 1997	3.90E+01	1.60E+02	3.10E-02	NO	NO	
Butylbenzyl phthalate	1.30E+04	1.00E+05	RI Report 1997	2.90E+02	1.20E+03	3.90E-02	NO	YES	
Chrysene	2.40E+01	2.40E+01	RI Report 1997	1.10E+02	2.10E+03	5.50E-02	NO	NO	
Fluoranthene	2.60E+03	2.70E+04	RI Report 1997	2.40E+02	3.00E+03	8.80E-02	NO	YES	
Indeno(1,2,3-cd)pyrene	6.10E-01	2.60E+00	RI Report 1997	1.10E+00	2.10E+01	5.50E-02	NO	NO	
Phenanthrene (4)	2.00E+03	2.00E+04	RI Report 1997	1.80E+02	2.30E+03	3.30E-01	NO	YES	
Phenol	3.90E+04	1.00E+05	RI Report 1997	1.90E+03	2.50E+04	1.50E-02	NO	YES	
Pyrene	2.00E+03	2.00E+04	RI Report 1997	1.80E+02	2.30E+03	7.90E-02	NO	YES	
Aluminum	7.70E+04	1.00E+05	RI Report 1997	7.70E+03	1.10E+05	1.75E+04	NO	YES	YES (5)
Arsenic	3.80E-01	2.40E+00	RI Report 1997	6.80E-01	3.00E+00	1.78E+01	YES	NO	
Barium	5.30E+03	1.00E+05	RI Report 1997	1.50E+03	2.20E+04	2.50E+02	NO	YES	
Beryllium	1.40E-01	1.10E+00	RI Report 1997	1.60E+01	2.30E+02	9.05E-01	NO	NO	
Cadmium	3.80E+01	8.50E+02	RI Report 1997	7.10E+00	9.80E+01	6.90E-01	NO	YES	
Chromium III	3.00E+01	6.40E+01	RI Report 1997	1.20E+04	1.80E+05	1.95E+01	NO	NO	
Lead	4.00E+02	1.00E+03	RI Report 1997	4.00E+02	8.00E+02	2.40E+01	NO	YES	
Manganese	3.20E+03	4.30E+04	RI Report 1997	1.80E+02	2.60E+03	7.10E+02	NO	YES	YES (5)
Nickel	1.50E+03	3.40E+04	RI Report 1997	1.50E+02	2.20E+03	2.00E+01	NO	YES	
Selenium	3.80E+02	8.50E+03	RI Report 1997	3.90E+01	5.80E+02	1.70E+00	NO	YES	
Silver	3.80E+02	8.50E+03	RI Report 1997	3.90E+01	5.80E+02	6.83E-01	NO	YES	
Thallium	1.00E-01	1.40E+02	RI Report 1997	7.80E-02	1.20E+00	2.00E+00	NO	YES	YES
Vanadium	5.40E+02	1.20E+04	RI Report 1997	3.90E+01	5.80E+02	3.70E+01	NO	YES	
Zinc	2.30E+04	1.00E+05	RI Report 1997	2.30E+03	3.50E+04	7.15E+01	NO	YES	

Table A-16
Comparison of Screening Levels Used in the Risk Assessment with Current Screening Levels
41 No Action Sites

OU 11 Chemical Disposal Area (CDA)									
Acenaphthalene (4)	3.60E+02	3.60E+02	RI Report 1997	1.80E+02	2.30E+03	3.90E-01	NO	YES	
Anthracene	1.90E+01	1.90E+01	RI Report 1997	1.80E+03	2.30E+04	1.00E-02	NO	NO	
Benzo(a)anthracene	6.10E-01	2.60E+00	RI Report 1997	1.10E+00	2.10E+01	3.80E-02	NO	NO	
Benzo(a)pyrene	6.10E-02	2.60E-01	RI Report 1997	1.10E-01	2.10E+00	5.40E-02	NO	NO	
Benzo(b)fluoranthene	6.10E-01	2.60E+00	RI Report 1997	1.10E+00	2.10E+01	1.50E-01	NO	NO	
Benzo(g,h,i)perylene (4)	2.00E+03	2.00E+04	RI Report 1997	1.80E+02	2.30E+03	1.00E-01	NO	YES	
Benzo(k)fluoranthene	6.10E+00	2.60E+01	RI Report 1997	1.10E+01	2.10E+02	3.70E-02	NO	NO	
Bis(2-ethylhexyl)phthalate	3.20E+01	1.40E+02	RI Report 1997	3.90E+01	1.60E+02	2.90E-02	NO	NO	
Butylbenzyl phthalate	1.30E+04	1.00E+05	RI Report 1997	2.90E+02	1.20E+03	9.60E-02	NO	YES	
Carbazole	2.20E+01	9.50E+01	RI Report 1997	---	---	1.40E-02	NO	NO	
Chrysene	2.40E+01	2.40E+01	RI Report 1997	1.10E+02	2.10E+03	9.00E-02	NO	NO	
Dibenz(a,h)anthracene	6.10E-02	2.60E-01	RI Report 1997	1.10E-01	2.10E+00	1.90E-02	NO	NO	
Fluoranthene	2.60E+03	2.70E+04	RI Report 1997	2.40E+02	3.00E+03	1.60E-01	NO	YES	
Indeno(1,2,3-cd)pyrene	6.10E-01	2.60E+00	RI Report 1997	1.10E+00	2.10E+01	9.90E-02	NO	NO	
Phenanthrene (4)	2.00E+03	2.00E+04	RI Report 1997	1.80E+02	2.30E+03	6.30E-02	NO	YES	
Pyrene	2.00E+03	2.00E+04	RI Report 1997	1.80E+02	2.30E+03	1.30E-01	NO	YES	
Aluminum	7.70E+04	1.00E+05	RI Report 1997	7.70E+03	1.10E+05	1.10E+04	NO	YES	YES (5)
Arsenic	3.80E-01	2.40E+00	RI Report 1997	6.80E-01	3.00E+00	6.70E+00	YES	NO	
Barium	5.30E+03	1.00E+05	RI Report 1997	1.50E+03	2.20E+04	1.30E+02	NO	YES	
Beryllium	1.40E-01	1.10E+00	RI Report 1997	1.60E+01	2.30E+02	5.90E-01	YES	NO	
Cadmium	3.80E+01	8.50E+02	RI Report 1997	7.10E+00	9.80E+01	2.30E+00	NO	YES	
Chromium III	3.00E+01	6.40E+01	RI Report 1997	1.20E+04	1.80E+05	3.90E+01	NO	NO	
Cobalt	4.60E+03	9.70E+04	RI Report 1997	2.30E+00	3.50E+01	8.70E+00	NO	YES	YES (5)
Lead	4.00E+02	1.00E+03	RI Report 1997	4.00E+02	8.00E+02	6.40E+01	NO	YES	
Manganese	3.20E+03	4.30E+04	RI Report 1997	1.80E+02	2.60E+03	5.30E+02	NO	YES	YES (5)
Nickel	1.50E+03	3.40E+04	RI Report 1997	1.50E+02	2.20E+03	1.90E+01	NO	YES	
Selenium	3.80E+02	8.50E+03	RI Report 1997	3.90E+01	5.80E+02	7.30E-01	NO	YES	
Vanadium	5.40E+02	1.20E+04	RI Report 1997	3.90E+01	5.80E+02	2.70E+01	NO	YES	
Zinc	2.30E+04	1.00E+05	RI Report 1997	2.30E+03	3.50E+04	3.80E+02	NO	YES	

Table A-16
Comparison of Screening Levels Used in the Risk Assessment with Current Screening Levels
41 No Action Sites

--- - No value available.
COPC - Chemical of Potential Concern.
OU - Operable Unit
PRG - Preliminary Remediation Goal
RSL - Regional Screening Level
USEPA - U.S. Environmental Protection Agency.

(1) Screening levels were obtained from the original risk assessment and Remedial Investigation (RI) report as referenced.
(2) Screening levels were obtained from USEPA Regional Screening Levels (RSLs) table (dated November 2019) based on a cancer risk of $1x10^{-6}$ and a hazard quotient of 0.1.
(3) Maximum concentration of surface soil samples taken at site.
(4) RSL for pyrene is used as a surrogate.
(5) Maximum detected concentration in soil is above the residential soil RSL, but below the industrial soil RSL.

Table A-17
41 No Action Sites Proportional Risk Calculations for Changes in Toxicity Values
Wright-Patterson AFB, OH

Site	Chemical	Changed Values	EPC [a] (mg/kg)	RSL Cancer [b] (mg/kg)	Calculated Risk [c]	Chemical	Changed Values	EPC [a] (mg/kg)	RSL Noncancer [b] (mg/kg)	Calculated Hazard Index [d]
OU9 HP5/DRMO Surface Soil RSL Comparison	Aroclor 1254	RSL	4.80E+00	9.7E-01	4.9E-06	Cadmium	RSL	1.30E+02	9.8E+02	0.13
						Aroclor 1254	RSL	4.80E+00	1.5E+01	0.32
	Total				**4.9E-06**	**Total**				**0.45**
OU11 Burial Site 2 Surface Soil RSL Comparison	None					Thallium	RSL	2.00E+00	1.2E+01	0.17
	Total				**0.0E+00**	**Total**				**0.17**

ELCR = Excess Lifetime Cancer Risk
EPC = Exposure Point Concentration
RSL = Regional Screening Level

a) Exposure point concentration was the Reasonable Maximum Exposure (RME) concentration based on either the 95 percent upper confidence limit (UCL) of the arithmetic mean or the maximum detected concentration, whichever was lower. Values obtained from the original risk assessments.

b) Values obtained from the USEPA's RSL table for the Composite Worker Soil and based on a cancer risk of 1×10^{-6} and a noncancer hazard index (HI) of 1 (November 2019).

c) The risk associated with the EPC is calculated:

$$\text{Risk} = [(\text{EPC}) \times (1 \times 10^{-6})] / \text{RSL cancer}$$

d) The hazard index (HI) associated with the EPC is calculated:

$$\text{HI} = \text{EPC} / \text{RSL noncancer}$$

Table A-18
LTM Program Groundwater Sampling Results Exceeding VISLs
Groundwater Operable Unit
Wright-Patterson AFB, Ohio

Sample Location	Management Area	Sample Date	cis-1,2-DCE μg/L		trans-1,2-DCE μg/L		PCE μg/L		TCE μg/L		Vinyl Chloride μg/L	
Units												
Residential VISL [a]			NA		NA		5.8		0.52		0.15	
Commercial VISL [a]			NA		NA		24		2.2		2.5	
MCL [b]			70		100		5		5		2	
			Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
NEA-MW27-3I	**OU2**	20-Apr-10		ND		ND	3			ND		ND
(Semiannual)		11-Oct-10		ND		ND	2.5			ND		ND
		29-Apr-11		ND		ND	2.9			ND		ND
		19-Oct-11		ND		ND	1.9			ND		ND
		17-Apr-12		ND		ND	2.6			ND		ND
		10-Oct-12		ND		ND	2.6			ND		ND
		02-Apr-13		ND		ND	2.8			ND		ND
		08-Oct-13		ND		ND	3			ND		ND
		02-May-14		ND		ND	3.1			ND		ND
		21-Oct-14		ND		ND	1.9			ND		ND
		17-Apr-15		ND		ND	2.1			ND		ND
		20-Oct-15		ND		ND	1.4			ND		ND
		28-Apr-16		ND		ND	1.6			ND		ND
		25-Oct-16		ND		ND	1.3			ND		ND
		03-May-17		ND		ND	1.5			ND		ND
		19-Oct-17		ND		ND	1.5			ND		ND
		16-Apr-18		ND		ND	1.3			ND		ND
		17-Oct-18		ND		ND	1.1			ND		ND
		17-Apr-19		ND		ND	1.1			ND		ND
GR-214	**OU3**	15-Apr-10		ND		ND		ND		ND		ND
(05-DM-123S-M)	Duplicate	14-Oct-10	0.24	J		ND		ND		ND		ND
(Semiannual)		14-Oct-10	0.25	J		ND		ND		ND		ND
		26-Apr-11		ND		ND		ND		ND		ND
	Duplicate	17-Oct-11		ND		ND		ND		ND		ND
		17-Oct-11		ND		ND		ND	0.24	J		ND
		18-Apr-12		ND		ND		ND	0.23	J		ND
	Duplicate	09-Oct-12	0.31	J		ND		ND	0.24	J		ND
		09-Oct-12	0.34	J		ND		ND	0.24	J		ND
		05-Apr-13		ND		ND		ND	0.24	J		ND
	Duplicate	07-Oct-13		ND		ND		ND	0.23	J		ND
		07-Oct-13		ND		ND		ND	0.20	J		ND
		09-May-14		ND		ND		ND		ND		ND
	Duplicate	23-Oct-14	0.23	J		ND		ND		ND		ND
		23-Oct-14	0.23	J		ND		ND		ND		ND
		21-Apr-15		ND		ND		ND		ND		ND
	Duplicate	22-Oct-15		ND		ND		ND		ND		ND
		22-Oct-15		ND		ND		ND		ND		ND
		28-Apr-16	0.26	J		ND		ND		ND		ND
	Duplicate	26-Oct-16	0.29	J		ND		ND		ND		ND
		26-Oct-16	0.27	J		ND		ND		ND		ND
		15-May-17		ND		ND		ND		ND		ND
		01-Nov-17		ND		ND		ND		ND		ND
		19-Apr-18		ND		ND		ND		ND		ND
		17-Oct-18		ND		ND		ND		ND		ND
		Spring 2019	Not Sampled per 2017 Annual LTM Report									
GR-215	**OU3**	22-Apr-10	0.38	J		ND		ND	1.8	J		ND
(05-DM-123I-M)		14-Oct-10	0.31	J		ND		ND	1.3	J		ND
(Semiannual)		26-Apr-11	0.24	J		ND		ND	1.2	J		ND
		17-Oct-11		ND		ND		ND	1.4	J		ND
		18-Apr-12		ND		ND		ND	1.4	J		ND
		09-Oct-12	0.17	J		ND		ND	1.5	J		ND
GR-215	**OU3**	05-Apr-13		ND		ND		ND	1.2	J		ND
(continued)		07-Oct-13		ND		ND		ND	1.1	J		ND
		09-May-14		ND		ND		ND	0.92	J		ND
		23-Oct-14		ND		ND		ND	0.92	J		ND
		21-Apr-15		ND		ND		ND	0.5	J		ND
		22-Oct-15		ND		ND		ND	0.63	J		ND
		28-Apr-16		ND		ND		ND	0.36	J		ND
		26-Oct-16	0.23	J		ND		ND	0.32	J		ND
		15-May-17		ND		ND		ND		ND		ND
		01-Nov-17		ND		ND		ND	0.41	J		ND
		19-Apr-18		ND		ND		ND		ND		ND
		17-Oct-18	0.31	J		ND		ND		ND		ND
		24-Apr-19		ND		ND		ND		ND		ND

Table A-18
LTM Program Groundwater Sampling Results Exceeding VISLs
Groundwater Operable Unit
Wright-Patterson AFB, Ohio
Page 2 of 16

Sample Location	Management Area	Sample Date	cis-1,2-DCE		trans-1,2-DCE		PCE		TCE		Vinyl Chloride	
Units			µg/L		µg/L		µg/L		µg/L		µg/L	
Residential VISL [a]			NA		NA		5.8		0.52		0.15	
Commercial VISL [a]			NA		NA		24		2.2		2.5	
MCL [b]			70		100		5		5		2	
			Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
BMP-OU4-01B-60	**OU4**	20-Apr-10	1.4			ND		ND	0.77	J	0.4	J
(Annual)		13-Oct-10	1.2			ND		ND	0.74	J	0.28	J
		28-Apr-11	1.3			ND		ND	0.65	J	0.24	J
		13-Apr-12	1.3			ND		ND	0.87	J	0.22	J
		03-Apr-13	1.3			ND		ND	0.66	J	0.30	J
		09-May-14	1.2			ND		ND	0.56	J		ND
		14-Apr-15	0.99			ND		ND	0.42	J		ND
		28-Apr-16	0.86	J		ND		ND	0.42	J		ND
		02-May-17	0.76	J		ND		ND	0.57	J		ND
		26-Apr-18	0.68	J		ND		ND	0.41	J		ND
		23-Apr-19	0.5	J		ND		ND	0.48	J		ND
OU4-MW-02B	**OU4**	23-Apr-10	0.28	J		ND		ND	**5.8**			ND
(Annual)		14-Oct-10	0.33	J		ND		ND	**4.4**			ND
		13-May-11	0.31	J		ND		ND	**4.7**			ND
		24-Apr-12		ND		ND	0.38	J	**4.7**			ND
		05-Apr-13	0.30	J		ND	0.32	J	**4.4**			ND
		09-May-14	0.28	J		ND	0.47	J	**4.3**			ND
		20-Apr-15		ND		ND	0.54	J	**3.6**			ND
		28-Apr-16		ND		ND	0.66	J	**3**			ND
		02-May-17		ND		ND	1.3		**2.9**			ND
		26-Apr-18		ND		ND		ND	**2.3**			ND
		23-Apr-19		ND		ND	0.25	J	**2.6**			ND
OU4-MW-03B	**OU4**	19-Apr-10	0.51			ND		ND	**2.8**			ND
(Annual)		13-Oct-10		ND		ND		ND	2			ND
		28-Apr-11	0.37	J		ND		ND	**2.4**			ND
		17-Apr-12	0.50			ND		ND	2.2			ND
		04-Apr-13	0.70			ND	0.66	J	1.9	J		ND
		09-May-14	0.51			ND		ND	2.1			ND
		14-Apr-15	0.36	J		ND		ND	1.5	J		ND
		29-Apr-16	0.37	J		ND		ND	1.2			ND
		02-May-17		ND		ND		ND	1.8			ND
		17-Apr-18		ND		ND	0.24	J	1.5			ND
		23-Apr-19		ND		ND	0.24	J	1.3			ND
OU4-MW-03C	**OU4**	13-Apr-10	0.8			ND	0.71	J	**3**			ND
(Annual)	Duplicate	13-Apr-10	0.75			ND	0.68	J	**2.8**			ND
		13-Oct-10	0.84			ND	0.63	J	**2.3**			ND
	Duplicate	28-Apr-11	0.58			ND	0.61	J	**2.3**			ND
		28-Apr-11	0.67			ND	0.61	J	**2.5**			ND
	Duplicate	17-Apr-12	0.88			ND	0.77	J	**2.5**			ND
		17-Apr-12	0.94			ND	0.76	J	**2.6**			ND
	Duplicate	04-Apr-13	0.76			ND	0.72	J	2.1			ND
		04-Apr-13	0.17	J		ND		ND	2.2			ND
	Duplicate	12-May-14	0.80			ND	0.80	J	**2.9**			ND
		12-May-14	0.67			ND	0.85	J	**2.8**			ND
	Duplicate	14-Apr-15	0.60			ND	0.75	J	1.8	J		ND
		14-Apr-15	0.55			ND	0.72	J	1.8	J		ND
		29-Apr-16	0.68	J		ND	0.72	J	1.5			ND
		02-May-17		ND		ND	0.85	J	2			ND
		17-Apr-18	0.64	J		ND	0.77	J	1.6			ND
		23-Apr-19	0.6	J		ND	0.72	J	1.3			ND
OU4-MW-12B	**OU4**	22-Apr-10	0.31	J		ND	13		**3.4**			ND
(Semiannual)		13-Oct-10	0.34	J		ND	10		**2.5**			ND
		13-May-11	0.22	J		ND	11		**2.7**			ND
		24-Apr-12		ND		ND	13		**2.3**			ND
		05-Apr-13	0.17	J		ND	13		**2.3**			ND
		09-May-14		ND		ND	12		2.1			ND
		20-Apr-15		ND		ND	15		1.8	J		ND
		28-Apr-16		ND		ND	14		1.4			ND
		02-May-17		ND		ND	16.6		1.5			ND
		19-Oct-17		ND		ND	18.3		1.4			ND
		26-Apr-18		ND		ND	16.6		1.3			ND
		16-Oct-18	0.35	J		ND	17.1		1.5			ND
		23-Apr-19		ND		ND	17.8		1.3			ND

Table A-18
LTM Program Groundwater Sampling Results Exceeding VISLs
Groundwater Operable Unit
Wright-Patterson AFB, Ohio
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Sample Location	Management Area	Sample Date	cis-1,2-DCE µg/L		trans-1,2-DCE µg/L		PCE µg/L		TCE µg/L		Vinyl Chloride µg/L	
Units												
Residential VISL [a]			NA		NA		5.8		0.52		0.15	
Commercial VISL [a]			NA		NA		24		2.2		2.5	
MCL [b]			70		100		5		5		2	
			Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
11-536-M	**OU4**	03-May-17	0.71	J		ND	1.4			ND		ND
(Annual)		26-Apr-18	0.68	J		ND	1.3			ND		ND
		23-Apr-19	0.92	J		ND	1.0			ND		ND
11-538-M	**OU4**	03-May-17		ND		ND	**16**		0.74	J		ND
(Semiannual)	Duplicate	19-Oct-17		ND		ND	**17.3**		0.63	J		ND
		19-Oct-17		ND		ND	**16.7**		0.69	J		ND
		26-Apr-18		ND		ND	**16.3**		0.43	J		ND
		16-Oct-18		ND		ND	**16.2**		0.51	J		ND
	Duplicate	16-Oct-18		ND		ND	**15.7**		0.51	J		ND
		23-Apr-19		ND		ND	**15.4**		0.43	J		ND
CW04-060	**OU5**	19-Apr-10		ND		ND		ND		ND		ND
(Semiannual)		13-Oct-10	0.36	J		ND		ND		ND		ND
		28-Apr-11		ND		ND		ND		ND		ND
		17-Oct-11		ND		ND		ND		ND		ND
		18-Apr-12		ND		ND		ND		ND		ND
		09-Oct-12	0.29	J		ND		ND		ND		ND
		04-Apr-13	0.2	J		ND		ND		ND		ND
		07-Oct-13		ND		ND		ND		ND		ND
		12-May-14		ND		ND		ND		ND		ND
		23-Oct-14	0.27	J		ND		ND		ND		ND
		22-Apr-15	0.29	J		ND		ND		ND		ND
		20-Oct-15	0.33	J		ND		ND		ND		ND
		28-Apr-16	0.25	J		ND		ND		ND		ND
		26-Oct-16	0.20	J		ND		ND		ND		ND
		16-May-17		ND		ND		ND		ND		ND
		01-Nov-17		ND		ND		ND		ND		ND
		19-Apr-18		ND		ND		ND		ND		ND
		23-Oct-18	0.30	J		ND		ND		ND		ND
		29-Apr-19		ND		ND		ND		ND		ND
CW05-055	**OU5**	15-Apr-10	0.32	J		ND		ND		ND		ND
(Semiannual)	Duplicate	15-Apr-10	0.34	J		ND		ND		ND		ND
		13-Oct-10	0.48	J		ND		ND		ND		ND
		28-Apr-11	0.75			ND		ND		ND		ND
	Duplicate	28-Apr-11	0.67			ND		ND		ND		ND
		17-Oct-11		ND		ND		ND		ND		ND
		18-Apr-12	0.29	J		ND		ND		ND		ND
		09-Oct-12		ND		ND		ND		ND		ND
		04-Apr-13	0.18	J		ND		ND		ND		ND
		07-Oct-13		ND		ND		ND		ND		ND
		12-May-14		ND		ND		ND		ND		ND
		23-Oct-14	0.21	J		ND		ND		ND		ND
		22-Apr-15	0.43	J		ND		ND		ND		ND
		20-Oct-15		ND		ND		ND		ND		ND
		28-Apr-16	0.29	J		ND		ND		ND		ND
		28-Oct-16	Damaged Wellhead, Not Sampled									
CW05-085	**OU5**	19-Apr-10	12		0.35	J		ND	**17**		0.51	J
(Semiannual)		13-Oct-10	7.6		0.22	J		ND	**18**		0.44	J
	Duplicate	13-Oct-10	8		0.26	J		ND	**19**		0.44	J
		28-Apr-11	11		0.42	J		ND	**18**		0.51	J
	Duplicate	17-Oct-11	9.4		0.31	J		ND	**15**		0.52	J
		17-Oct-11	9.8		0.34	J		ND	**16**		0.6	J
	Duplicate	18-Apr-12	7.5		0.37	J		ND	**20**		0.61	J
		18-Apr-12	7.2		0.25	J		ND	**19**		0.56	J
	Duplicate	09-Oct-12	9.1		0.31	J		ND	**17**		0.57	J
		09-Oct-12	9.5		0.31	J		ND	**17**		0.5	J
	Duplicate	04-Apr-13	12		0.48	J		ND	**19**		0.57	J
		04-Apr-13	12		0.45	J		ND	**18**		0.54	J
	Duplicate	07-Oct-13	18		0.73			ND	**19**		0.66	J
		07-Oct-13	19		0.67			ND	**20**		0.74	J
	Duplicate	12-May-14	14		0.62			ND	**18**		0.68	J
		12-May-14	17		0.68			ND	**21**		0.87	J
	Duplicate	23-Oct-14	8.3		0.28	J		ND	**15**		0.41	J
		23-Oct-14	8.1		0.26	J		ND	**15**		0.47	J

Table A-18
LTM Program Groundwater Sampling Results Exceeding VISLs
Groundwater Operable Unit
Wright-Patterson AFB, Ohio

Sample Location	Management Area	Sample Date	cis-1,2-DCE µg/L		trans-1,2-DCE µg/L		PCE µg/L		TCE µg/L		Vinyl Chloride µg/L	
Units												
Residential VISL [a]			NA		NA		5.8		0.52		0.15	
Commercial VISL [a]			NA		NA		24		2.2		2.5	
MCL [b]			70		100		5		5		2	
			Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
CW05-085	Duplicate	22-Apr-15	6.5			ND		ND	**13**			ND
(continued)		22-Apr-15	6.9			ND		ND	**13**		0.31	J
	Duplicate	20-Oct-15	5.9			ND		ND	**14**		0.47	J
		20-Oct-15	6			ND		ND	**14**		0.45	J
	Duplicate	28-Apr-16	13		0.47	J		ND	**11**		0.43	J
		28-Apr-16	13		0.54	J		ND	**11**		0.44	J
	Duplicate	26-Oct-16	6.4			ND		ND	**10**			ND
		26-Oct-16	6.5			ND		ND	**10**			ND
	Duplicate	16-May-17	13.3		0.59	J		ND	**13.5**			ND
		16-May-17	9.6			ND		ND	**13.3**		0.54	J
	Duplicate	25-Oct-17	5.9		0.23	J		ND	**12.3**			ND
		25-Oct-17	6		0.24	J		ND	**12.3**			ND
		19-Apr-18	22.0		0.72	J	1.2		**12.6**		0.58	J
	Duplicate	19-Apr-18	17.9		0.52	J	1.1		**12.5**		0.66	J
		23-Oct-18	25.3		0.74	J		ND	**9.8**		0.75	J
		29-Apr-19	11.5			ND		ND	**8.8**		ND	
	Duplicate	29-Apr-19	12.2			ND		ND	**8.6**		0.45	J
CW10-055	**OU5**	15-Apr-10	4.8			ND		ND	**12**			ND
(Semiannual)		12-Oct-10	4.5			ND		ND	**15**			ND
		05-May-11	4.1			ND		ND	**14**			ND
		17-Oct-11	5.2			ND		ND	**12**			ND
		11-Apr-12	4.7			ND		ND	**14**			ND
		10-Oct-12	5.2			ND		ND	**14**			ND
		04-Apr-13	5.1			ND		ND	**14**			ND
		09-Oct-13	4.4			ND	0.38	J	**15**			ND
		08-May-14	6.6			ND		ND	**8.7**			ND
		23-Oct-14	3.4			ND	0.29	J	**12**			ND
		22-Apr-15	4.5			ND	0.34	J	**13**			ND
		22-Oct-15	4.5			ND		ND	**11**			ND
		27-Apr-16	4.2			ND	0.37	J	**9.6**			ND
		24-Oct-16	3.8			ND	0.36	J	**11**			ND
		10-May-17	4.8			ND	0.32	J	**13.6**			ND
		02-Nov-17	3.7			ND	0.28	J	**16.5**			ND
		23-Apr-18	5.2		0.23	J		ND	**10**			ND
		23-Oct-18	6.5		0.30	J	0.33	J	**13.7**			ND
		01-May-19	6.2			ND	0.42	J	**11.8**			ND
OU5/MCD-MW02	**OU5**	09-Oct-13	4.5	D		ND D	1.1	J D	**43**	D		ND D
(Semiannual)		08-May-14	3.4			ND	1.7		**37**			ND
		23-Oct-14	5.3			ND	1.3		**34**			ND
		22-Apr-15	6.1			ND	1.3		**36**			ND
		29-Oct-15	3.3			ND	1.3		**27**			ND
	Duplicate	27-Apr-16	2.1			ND	1.4		**17**			ND
		27-Apr-16	2.3			ND	1.4		**18**			ND
		24-Oct-16	4.1			ND	1.0		**19**			ND
	Duplicate	10-May-17	5			ND	1.0		**26.9**			ND
		10-May-17	4.9			ND	0.8	J	**23.8**			ND
	Duplicate	24-Oct-17	3.9			ND	1.1		**23.6**			ND
		24-Oct-17	3.9			ND	1.2		**23.3**			ND
		23-Apr-18	3.1			ND	1.4		**16.5**			ND
	Duplicate	23-Apr-18	3.1			ND	1.5		**16.5**			ND
		18-Oct-18	4.2			ND	1.3		**17.4**			ND
	Duplicate	18-Oct-18	4.2			ND	1.3		**17**			ND
		01-May-19	2.8			ND	1.3		**12.8**			ND
	Duplicate	01-May-19	2.8			ND	1.4		**12.9**			ND
OU5/MCD-MW04	**OU5**	25-Oct-16	11		0.19	J	0.34	J	**21**			ND
(Semiannual)		10-May-17	10.1		0.57	J		ND	**26.9**			ND
		02-Nov-17	12.7			ND	0.24	J	**29.2**			ND
		23-Apr-18	13.1		0.39	J		ND	**22.4**			ND
		22-Oct-18	21.2		0.58	J		ND	**14.5**			ND
		01-May-19	22			ND		ND	**10**			ND

Table A-18
LTM Program Groundwater Sampling Results Exceeding VISLs
Groundwater Operable Unit
Wright-Patterson AFB, Ohio
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Sample Location	Management Area	Sample Date	cis-1,2-DCE		trans-1,2-DCE		PCE		TCE		Vinyl Chloride	
Units			µg/L		µg/L		µg/L		µg/L		µg/L	
Residential VISL [a]			NA		NA		5.8		0.52		0.15	
Commercial VISL [a]			NA		NA		24		2.2		2.5	
MCL [b]			70		100		5		5		2	
			Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
OU5/MCD-MW05	**OU5**	25-Oct-16	7.3		0.18	J		ND	**18**			ND
(Semiannual)		10-May-17	6.4		0.34	J		ND	**18.7**			ND
		24-Oct-17	9.3		0.40	J		ND	**23.8**			ND
		19-Apr-18	9.5		0.29	J		ND	**19.4**			ND
		22-Oct-18	21.2		0.49	J		ND	**10.2**			ND
		02-May-19	22.3		0.23	J		ND	0.73	J		ND
HD-11[a]	**OU5**	20-Apr-10	17		0.75			ND	**5.4**		0.5	J
(Semiannual)		12-Oct-10	13		0.49	J		ND	**7**		0.31	J
		11-May-11	15		0.65			ND	2		0.53	J
		18-Oct-11	13		0.44	J		ND	**2.8**			ND
		11-Apr-12	12		0.48	J		ND	2.2		0.29	J
		10-Oct-12	11		0.42	J		ND	**3.8**		0.24	J
		10-Apr-13	9.3		0.39	J		ND	2			ND
		09-Oct-13	10		0.35	J		ND	**4.3**			ND
		08-May-14	6		0.26	J		ND	1.3	J		ND
		22-Oct-14	6.7			ND		ND	1.2	J		ND
		15-Apr-15	5.7			ND		ND	1.8	J	0.29	J
		22-Oct-15	5.2			ND		ND	0.87	J	0.37	J
		27-Apr-16	5.2		0.21	J		ND	0.47	J	0.25	J
		24-Oct-16	5.5			ND		ND	0.48	JQ		ND
		09-May-17	6		0.23	J		ND	0.52	J		ND
		23-Oct-17	6.7		0.28	J		ND	0.65	J		ND
		18-Apr-18	4.8			ND	1.2			ND		ND
		18-Oct-18	5.2		0.28	J		ND		ND		ND
		02-May-19	3.0			ND	0.41	J		ND		ND
HD-12M[a]	**OU5**	20-Apr-10		ND		ND		ND		ND		ND
(Semiannual)		12-Oct-10		ND		ND		ND		ND		ND
		11-May-11		ND		ND		ND		ND		ND
		18-Oct-11		ND		ND		ND		ND		ND
		11-Apr-12		ND		ND		ND		ND		ND
		10-Oct-12		ND		ND		ND		ND		ND
		10-Apr-13		ND		ND		ND		ND		ND
		09-Oct-13		ND		ND		ND		ND		ND
		08-May-14		ND		ND		ND		ND		ND
		22-Oct-14		ND		ND		ND		ND		ND
		15-Apr-15		ND		ND		ND		ND		ND
		22-Oct-15		ND		ND		ND		ND		ND
		27-Apr-16		ND		ND		ND		ND		ND
		24-Oct-16		ND		ND		ND		ND		ND
		09-May-17		ND		ND		ND		ND		ND
		23-Oct-17		ND		ND		ND		ND		ND
		18-Apr-18		ND		ND	1.5			ND		ND
		18-Oct-18		ND		ND		ND		ND		ND
		02-May-19		ND		ND		ND		ND		ND
HD-12S[a]	**OU5**	20-Apr-10		ND		ND	0.44	J		ND		ND
(Semiannual)		12-Oct-10		ND		ND	0.38	J		ND		ND
		11-May-11		ND		ND	0.34	J		ND		ND
		18-Oct-11		ND		ND	0.29	J		ND		ND
		11-Apr-12		ND		ND	0.3	J		ND		ND
		10-Oct-12		ND		ND	0.33	J		ND		ND
		10-Apr-13		ND		ND		ND		ND		ND
		09-Oct-13		ND		ND	0.31	J		ND		ND
		08-May-14		ND		ND		ND		ND		ND
		22-Oct-14		ND		ND	0.28	J		ND		ND
		15-Apr-15		ND		ND		ND		ND		ND
		22-Oct-15		ND		ND		ND		ND		ND
		27-Apr-16		ND		ND	0.35	J		ND		ND
		24-Oct-16		ND		ND		ND		ND		ND
		09-May-17		ND		ND		ND		ND		ND
		23-Oct-17		ND		ND		ND		ND		ND
		18-Apr-18		ND		ND	2.4			ND		ND
		18-Oct-18		ND		ND		ND		ND		ND
		02-May-19		ND		ND		ND		ND		ND

Table A-18
LTM Program Groundwater Sampling Results Exceeding VISLs
Groundwater Operable Unit
Wright-Patterson AFB, Ohio

Sample Location	Management Area	Sample Date	cis-1,2-DCE µg/L		trans-1,2-DCE µg/L		PCE µg/L		TCE µg/L		Vinyl Chloride µg/L	
Units												
Residential VISL [a]			NA		NA		5.8		0.52		0.15	
Commercial VISL [a]			NA		NA		24		2.2		2.5	
MCL [b]			70		100		5		5		2	
			Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
HD-13D[a] (Semiannual)	OU5	20-Apr-10	13		0.65			ND		ND	0.4	J
		12-Oct-10	12		0.58			ND		ND	0.29	J
		11-May-11	12		0.62			ND		ND	0.36	J
		18-Oct-11	10		0.49	J		ND		ND		ND
		11-Apr-12	11		0.53			ND		ND	0.24	J
		10-Oct-12	13		0.64			ND		ND	0.41	J
		10-Apr-13	10		0.56			ND		ND	0.37	J
		09-Oct-13	12		0.59			ND		ND		ND
		08-May-14	11		0.58			ND		ND		ND
		22-Oct-14	11		0.52			ND		ND		ND
		15-Apr-15	11		0.44	J		ND		ND	0.34	J
		22-Oct-15	11		0.47	J		ND		ND		ND
		27-Apr-16	9.1		0.46	J		ND		ND		ND
		24-Oct-16	9.4		0.39	J		ND		ND		ND
		09-May-17	1.2			ND		ND		ND		ND
		23-Oct-17	10.3		0.54	J		ND		ND		ND
		18-Apr-18	10		0.53	J		ND		ND		ND
		18-Oct-18	7.2		0.25	J		ND		ND	0.63	J
		02-May-19	6.2		0.26	J		ND		ND	0.61	J
HD-13S[a] (Semiannual)	OU5	20-Apr-10	5.5			ND		ND		ND	1.7	
		12-Oct-10	5.1			ND		ND		ND	2.3	
		11-May-11	0.53			ND		ND		ND		ND
		18-Oct-11	1.5			ND		ND		ND		ND
		11-Apr-12	1.9			ND		ND		ND	0.39	J
		10-Oct-12	4.2			ND		ND		ND	0.94	J
		10-Apr-13	2.8			ND		ND		ND	1.3	
		09-Oct-13	3.1			ND		ND		ND	0.87	J
		08-May-14	1.7			ND		ND		ND		ND
		22-Oct-14	2			ND		ND		ND		ND
		15-Apr-15	1.4			ND		ND		ND		ND
		22-Oct-15	3.1			ND		ND		ND		ND
		27-Apr-16	2.5			ND		ND		ND		ND
		24-Oct-16	1.5			ND		ND		ND		ND
		09-May-17	9		0.55	J		ND		ND		ND
		23-Oct-17		ND		ND		ND		ND		ND
		18-Apr-18		ND		ND		ND		ND		ND
		18-Oct-18		ND		ND		ND		ND		ND
		02-May-19		ND		ND		ND		ND		ND
MW125S[a] (Semiannual)	OU5	19-Apr-10	0.45	J		ND		ND		ND		ND
		11-Oct-10	0.42	J		ND		ND		ND		ND
		11-May-11		ND		ND		ND		ND		ND
		17-Oct-11		ND		ND		ND		ND		ND
		11-JUL-12		ND		ND		ND	0.33	J		ND
		11-Oct-12	0.22	J		ND		ND	0.44	J		ND
		04-Apr-13	0.18	J		ND		ND	0.26	J		ND
		09-Oct-13	Well not sampled during this sampling round. City of Dayton unable to assist.									
		08-May-14	Well not sampled during this sampling round. City of Dayton unable to assist.									
		22-Oct-14	Well not sampled during this sampling round. City of Dayton unable to assist.									
		16-Apr-15	0.26	J		ND		ND	0.34	J		ND
		22-Oct-15	Well not sampled during this sampling round. City of Dayton unable to assist.									
		27-Apr-16	Well not sampled during this sampling round. City of Dayton unable to assist.									
		24-Oct-16	Well not sampled during this sampling round. City of Dayton unable to assist.									
		09-May-17		ND		ND		ND		ND		ND
		24-Oct-17		ND		ND		ND	0.43	J		ND
		19-Apr-18		ND		ND		ND		ND		ND
		22-Oct-18		ND		ND		ND		ND		ND
		02-May-19		ND		ND		ND		ND		ND
MW131M[a] (Semiannual)	OU5	20-Apr-10	0.48	J		ND		ND		ND	1.4	
		12-Oct-10	1.2			ND		ND		ND	**5.1**	
		11-May-11		ND		ND		ND		ND		ND
		18-Oct-11		ND		ND		ND		ND		ND
		11-Apr-12	0.63			ND		ND	0.71	J		ND

Table A-18
LTM Program Groundwater Sampling Results Exceeding VISLs
Groundwater Operable Unit
Wright-Patterson AFB, Ohio

Sample Location	Management Area	Sample Date	cis-1,2-DCE µg/L		trans-1,2-DCE µg/L		PCE µg/L		TCE µg/L		Vinyl Chloride µg/L	
Units												
Residential VISL [a]			NA		NA		5.8		0.52		0.15	
Commercial VISL [a]			NA		NA		24		2.2		2.5	
MCL [b]			70		100		5		5		2	
			Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
MW131M[a] (continued)		10-Oct-12	2.7		0.23	J		ND	0.82	J	**2.2**	
		10-Apr-13	2.2			ND		ND	0.39	J	**4.2**	
		09-Oct-13	1.9			ND		ND		ND	**2.8**	
		08-May-14	0.35	J		ND		ND	0.35	J		ND
		22-Oct-14	0.5			ND		ND		ND	0.45	J
		15-Apr-15		ND		ND		ND		ND		ND
		22-Oct-15	1.1			ND		ND	1.9	J		ND
		27-Apr-16	1.1			ND		ND	1.1			ND
		24-Oct-16	2.2			ND		ND	2.2		0.46	J
		09-May-17	2			ND		ND	**3.4**		1.3	
		23-Oct-17	2.6			ND		ND	0.80	J		ND
		18-Apr-18		ND		ND		ND		ND		ND
		18-Oct-18	1.1			ND		ND		ND		ND
		02-May-19		ND		ND		ND		ND		ND
MW131S[a] (Semiannual)	**OU5**	20-Apr-10		ND		ND		ND		ND		ND
		12-Oct-10		ND		ND		ND		ND		ND
		11-May-11		ND		ND		ND		ND		ND
		18-Oct-11		ND		ND		ND		ND		ND
		11-Apr-12		ND		ND		ND		ND		ND
		10-Oct-12		ND		ND	0.36	J		ND		ND
		10-Apr-13		ND		ND		ND		ND		ND
		09-Oct-13		ND		ND	0.33	J		ND		ND
		08-May-14		ND		ND		ND		ND		ND
		22-Oct-14		ND		ND	0.27	J		ND		ND
		15-Apr-15		ND		ND		ND		ND		ND
		22-Oct-15		ND		ND		ND		ND		ND
		27-Apr-16		ND		ND		ND		ND		ND
		24-Oct-16		ND		ND		ND		ND		ND
		09-May-17		ND		ND		ND		ND		ND
		23-Oct-17		ND		ND		ND		ND		ND
		18-Apr-18		ND		ND		ND		ND		ND
		18-Oct-18		ND		ND		ND		ND		ND
		02-May-19		ND		ND		ND		ND		ND
MW132S[a] (Semiannual)	**OU5**	20-Apr-10	7.8			ND	1.2		**13**			ND
		12-Oct-10	3.8			ND	1.2		**15**			ND
		11-May-11	1			ND	0.78	J	**11**			ND
		18-Oct-11	7.7			ND	0.87	J	**8.6**			ND
		11-Apr-12	6.4			ND	0.83	J	**14**			ND
		10-Oct-12	6.7			ND	0.8	J	**12**			ND
		10-Apr-13	5.7			ND	0.73	J	**11**			ND
		09-Oct-13	5.1			ND	0.83	J	**11**			ND
		08-May-14	6.5			ND	0.31	J	**4**			ND
		22-Oct-14	7.5			ND	0.40	J	**4.5**		0.53	J
		15-Apr-15	8.8			ND	0.32	J	**3.9**		0.73	J
		22-Oct-15	7.5			ND	0.39	J	**4.2**		0.75	J
		27-Apr-16	7.0		0.18	J	0.32	J	**3.1**		0.92	J
		24-Oct-16	6.2			ND	0.30	J	**3.8**		0.74	J
		09-May-17	3.4			ND	0.67	J	**8.6**			ND
		23-Oct-17	3.3			ND	0.76	J	**11.1**			ND
		18-Apr-18	4.5			ND		ND	**7.7**			ND
		18-Oct-18	4.2			ND	0.61	J	**10.6**			ND
		02-May-19	7.8			ND	0.53	J	**2.6**			ND
CW03-077 (MT-230) (Semiannual)	**OU8**	19-Apr-10		ND		ND	0.68	J	0.49	J		ND
		12-Oct-10		ND		ND	0.52	J	0.34	J		ND
		27-Apr-11		ND		ND	0.59	J	0.5	J		ND
		19-Oct-11		ND		ND	0.54	J	0.35	J		ND
		11-Apr-12		ND		ND	0.65	J	0.48	J		ND
		11-Oct-12		ND		ND	0.49	J	0.35	J		ND
		04-Apr-13		ND		ND	0.55	J	0.55	J		ND
		07-Oct-13		ND		ND	0.65	J	0.41	J		ND
		30-Apr-14		ND		ND	0.63	J	0.50	J		ND
		20-Oct-14		ND		ND	0.67	J	0.56	J		ND
		14-Apr-15		ND		ND	0.56	J	0.64	J		ND
		19-Oct-15		ND		ND	0.67	J	0.56	J		ND

Table A-18
LTM Program Groundwater Sampling Results Exceeding VISLs
Groundwater Operable Unit
Wright-Patterson AFB, Ohio
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Sample Location	Management Area	Sample Date	cis-1,2-DCE µg/L		trans-1,2-DCE µg/L		PCE µg/L		TCE µg/L		Vinyl Chloride µg/L	
Units												
Residential VISL [a]			NA		NA		5.8		0.52		0.15	
Commercial VISL [a]			NA		NA		24		2.2		2.5	
MCL [b]			70		100		5		5		2	
			Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
CW03-077		25-Apr-16		ND		ND	0.49	J	0.45	J		ND
(continued)		21-Oct-16		ND		ND	0.31	J		ND		ND
		08-May-17		ND		ND	0.54	J		ND		ND
		19-Oct-17		ND		ND	0.59	J	0.53	J		ND
		18-Apr-18		ND		ND	0.57	J	0.44	J		ND
		15-Oct-18		ND		ND	0.57	J	0.56	J		ND
		22-Apr-19		ND		ND	0.52	J	0.63	J		ND
EFD04-MW06	**OU9**	12-May-09		ND		ND		ND		ND		ND
(Annual)		14-Apr-10		ND		ND		ND		ND		ND
		04-May-11		ND		ND		ND		ND		ND
		11-Apr-12		ND		ND		ND		ND		ND
		03-Apr-13		ND		ND		ND		ND		ND
		08-May-14		ND		ND		ND		ND		ND
		15-Apr-15		ND		ND		ND		ND		ND
		25-Apr-16		ND		ND		ND		ND		ND
		08-May-17		ND		ND		ND		ND		ND
		23-Apr-18		ND		ND		ND		ND		ND
		Spring 2019	Not Sampled per 2017 Annual LTM Report									
EFD09-M575	**OU9** Duplicate	14-Apr-10		ND		ND		ND		ND		ND
(Annual)		14-Apr-10		ND		ND		ND		ND		ND
	Duplicate	13-May-11		ND		ND		ND		ND		ND
		13-May-11		ND		ND		ND		ND		ND
	Duplicate	20-Apr-12		ND		ND		ND		ND		ND
		20-Apr-12		ND		ND		ND		ND		ND
	Duplicate	04-Apr-13		ND		ND		ND	0.17	J		ND
		04-Apr-13	0.2	J		ND		ND		ND		ND
	Duplicate	13-May-14		ND		ND		ND		ND		ND
		13-May-14		ND		ND		ND		ND		ND
	Duplicate	23-Apr-15		ND		ND		ND		ND		ND
		23-Apr-15		ND		ND		ND		ND		ND
		25-Apr-16		ND		ND		ND		ND		ND
		08-May-17		ND		ND		ND		ND		ND
		23-Apr-18		ND		ND		ND		ND		ND
		Spring 2019	Not Sampled per 2017 Annual LTM Report									
GR-333	**OU10**	28-Apr-10		ND		ND	0.7	J	0.36	J		ND
(Annual)		18-Oct-10		ND		ND	0.83	J	0.39	J		ND
		16-May-11		ND		ND	0.89	J	0.4	J		ND
		23-Apr-12		ND		ND	0.9	J	0.33	J		ND
		04-Apr-13		ND		ND	0.73	J	0.31	J		ND
		12-May-14		ND		ND	0.86	J	0.28	J		ND
		20-Apr-15		ND		ND	0.78	J		ND		ND
		02-May-16		ND		ND	0.83	J		ND		ND
		17-May-17		ND		ND	0.75	J		ND		ND
		19-Apr-18		ND		ND	0.81	J		ND		ND
		29-Apr-19		ND		ND	0.72	J		ND		ND
OU10-MW-01I	**OU10**	02-May-17		ND		ND		ND		ND		ND
(Semiannual)		17-Oct-17		ND		ND		ND		ND		ND
OU10-MW-02S		26-Oct-16		ND		ND	5.0			ND		ND
(Semiannual)		02-May-17		ND		ND	7.6			ND		ND
		19-Oct-17		ND		ND	8.7			ND		ND
		16-Apr-18		ND		ND	7.5			ND		ND
		17-Oct-18		ND		ND	8.6			ND		ND
		24-Apr-19		ND		ND	8.4			ND		ND
OU10-MW-03S	**OU10**	21-Apr-10		ND		ND	4.3			ND		ND
(Annual)		11-Oct-10		ND		ND	6			ND		ND
		29-Apr-11		ND		ND	3			ND		ND
		19-Oct-11		ND		ND	4.2			ND		ND
		13-Apr-12		ND		ND	4.3			ND		ND
		03-Apr-13	1			ND	4.3		0.64	J		ND
		30-Apr-14	1.2			ND	4.5		**3.4**			ND
		20-Apr-15	0.32	J		ND	3.7		1.2	J		ND
		02-May-16		ND		ND	4.8		1.4			ND

Table A-18
LTM Program Groundwater Sampling Results Exceeding VISLs
Groundwater Operable Unit
Wright-Patterson AFB, Ohio

Sample Location	Management Area	Sample Date	cis-1,2-DCE µg/L		trans-1,2-DCE µg/L		PCE µg/L		TCE µg/L		Vinyl Chloride µg/L	
Units												
Residential VISL [a]			NA		NA		5.8		0.52		0.15	
Commercial VISL [a]			NA		NA		24		2.2		2.5	
MCL [b]			70		100		5		5		2	
			Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
OU10-MW-03S		02-May-17		ND		ND	6.6		1.7			ND
(continued)		16-Apr-18		ND		ND	6.0		1.8			ND
		24-Apr-19		ND		ND	5.0		1.0			ND
OU10-MW-04S	OU10	22-Apr-15		ND		ND	1.8			ND		ND
(Semiannual)		20-Oct-15		ND		ND	2.0			ND		ND
	Duplicate	29-Apr-16		ND		ND	1.9			ND		ND
		29-Apr-16		ND		ND	1.9			ND		ND
		25-Oct-16		ND		ND	2.0			ND		ND
	Duplicate	03-May-17		ND		ND	2.2			ND		ND
		03-May-17		ND		ND	2.0			ND		ND
		17-Oct-17		ND		ND	2.3			ND		ND
		17-Apr-18		ND		ND	1.8			ND		ND
	Duplicate	17-Apr-18		ND		ND	2.0			ND		ND
		17-Oct-18		ND		ND	2.3			ND		ND
		24-Apr-19		ND		ND	1.8			ND		ND
OU10-MW-06D	OU10	13-Apr-10		ND		ND		ND		ND		ND
(Annual)		11-Oct-10		ND		ND	2			ND		ND
		25-Apr-11		ND		ND	1.7			ND		ND
		13-Apr-12		ND		ND		ND		ND		ND
		02-Apr-13		ND		ND		ND		ND		ND
		30-Apr-14		ND		ND		ND		ND		ND
		17-Apr-15		ND		ND	0.90	J		ND		ND
		29-Apr-16		ND		ND		ND		ND		ND
		02-May-17		ND		ND		ND		ND		ND
		16-Apr-18		ND		ND		ND		ND		ND
		24-Apr-19		ND		ND		ND		ND		ND
OU10-MW-06S	OU10	26-Apr-10		ND		ND	1.7		**9**			ND
(Annual)	Duplicate	26-Apr-10		ND		ND	1.7		**9**			ND
		11-Oct-10		ND		ND	3.4		**8.6**			ND
	Duplicate	25-Apr-11		ND		ND	3.1		**9.1**			ND
		25-Apr-11		ND		ND	3.1		**8.8**			ND
	Duplicate	13-Apr-12		ND		ND	1.8		**11**			ND
		13-Apr-12		ND		ND	1.8		**11**			ND
	Duplicate	02-Apr-13		ND		ND	1		**10**			ND
		02-Apr-13		ND		ND	1.2		**10**			ND
	Duplicate	30-Apr-14		ND		ND	1.1		**9.1**			ND
		30-Apr-14		ND		ND	1.2		**8.9**			ND
	Duplicate	17-Apr-15		ND		ND	6.4		**6.5**			ND
		17-Apr-15		ND		ND	6.8		**6.6**			ND
	Duplicate	29-Apr-16		ND		ND	9.3		**5.1**			ND
		29-Apr-16		ND		ND	8.6		**5**			ND
	Duplicate	02-May-17		ND		ND	5.6		**7.1**			ND
		02-May-17		ND		ND	5.9		**7.5**			ND
		16-Apr-18		ND		ND	7.6		**5.9**			ND
	Duplicate	16-Apr-18		ND		ND	8.1		**6.3**			ND
		24-Apr-19		ND		ND	8.1		**6.1**			ND
	Duplicate	24-Apr-19		ND		ND	8.6		**6.0**			ND
OU10-MW-11D	OU10	13-Apr-10		ND		ND	6.2		**2.8**			ND
(Annual)		11-Oct-10		ND		ND	6.6		**2.8**			ND
		28-Apr-11		ND		ND	5		**2.5**			ND
		13-Apr-12		ND		ND	7.5		2			ND
		02-Apr-13		ND		ND	5.8		1.5	J		ND
		05-May-14		ND		ND	6.3		1.2	J		ND
		14-Apr-15		ND		ND	6.4		0.74	J		ND
		02-May-16		ND		ND	7.8		0.52	J		ND
		02-May-17		ND		ND	8.9		0.54	J		ND
		17-Apr-18		ND		ND	9.5		0.43	J		ND
		23-Apr-19		ND		ND	7.9		0.45	J		ND
OU10-MW-11S	OU10	20-Apr-10		ND		ND	13			ND		ND
(Annual)		11-Oct-10		ND		ND	14			ND		ND
		28-Apr-11		ND		ND	11			ND		ND
		13-Apr-12		ND		ND	13			ND		ND
		02-Apr-13		ND		ND	10			ND		ND

Table A-18
LTM Program Groundwater Sampling Results Exceeding VISLs
Groundwater Operable Unit
Wright-Patterson AFB, Ohio

Sample Location	Management Area	Sample Date	cis-1,2-DCE µg/L		trans-1,2-DCE µg/L		PCE µg/L		TCE µg/L		Vinyl Chloride µg/L	
Units												
Residential VISL [a]			NA		NA		5.8		0.52		0.15	
Commercial VISL [a]			NA		NA		24		2.2		2.5	
MCL [b]			70		100		5		5		2	
			Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
OU10-MW-11S		05-May-14		ND		ND	11		0.21	J		ND
(continued)		14-Apr-15		ND		ND	12			ND		ND
		02-May-16		ND		ND	12			ND		ND
		02-May-17		ND		ND	1.2			ND		ND
		17-Apr-18		ND		ND	10.5			ND		ND
		23-Apr-19		ND		ND	11			ND		ND
OU10-MW15S	**OU10**	22-Apr-15		ND		ND		ND	**4.8**			ND
(Semiannual)		20-Oct-15		ND		ND		ND	**7.0**			ND
		02-May-16		ND		ND		ND	**7.3**			ND
		26-Oct-16		ND		ND		ND	**5.1**			ND
		03-May-17		ND		ND		ND	**7.9**			ND
		25-Oct-17		ND		ND		ND	**7.0**			ND
		17-Apr-18		ND		ND		ND	**7.9**			ND
		22-Oct-18		ND		ND		ND	**11.4**			ND
		23-Apr-19		ND		ND		ND	**11.1**			ND
OU10-MW-19D	**OU10**	27-Apr-10		ND		ND		ND	1.9	J		ND
(Semiannual)		11-Oct-10		ND		ND		ND	2.1			ND
		05-May-11		ND		ND		ND	1.9	J		ND
		17-Oct-11		ND		ND		ND	1.5	J		ND
		17-Apr-12		ND		ND		ND	1.7	J		ND
		11-Oct-12		ND		ND		ND	1.9	J		ND
		03-Apr-13		ND		ND		ND	1.5	J		ND
		08-Oct-13		ND		ND		ND	1.4	J		ND
		09-May-14		ND		ND		ND	1.5	J		ND
		20-Oct-14		ND		ND	0.20	J	1.4	J		ND
		20-Apr-15		ND		ND		ND	1.3	J		ND
		20-Oct-15		ND		ND		ND	1.3	J		ND
		02-May-16		ND		ND		ND	1.1			ND
		25-Oct-16		ND		ND		ND	0.90	J		ND
		17-May-17		ND		ND		ND	1.4			ND
		02-Nov-17		ND		ND		ND	1.1			ND
		24-Apr-18		ND		ND		ND	1.1			ND
		23-Oct-18		ND		ND		ND	0.96	J		ND
		24-Apr-19		ND		ND		ND	0.93	J		ND
OU10-MW-21S	**OU10**	22-Apr-10		ND		ND		ND	**3.3**			ND
(Semiannual)		21-Oct-10		ND		ND		ND	**3.4**			ND
		10-May-11		ND		ND		ND	**2.5**			ND
		19-Oct-11		ND		ND		ND	**2.8**			ND
		19-Apr-12		ND		ND		ND	**2.6**			ND
		12-Oct-12		ND		ND		ND	**2.8**			ND
		18-Apr-13		ND		ND		ND	**2.3**			ND
		08-Oct-13		ND		ND		ND	2			ND
		12-May-14		ND		ND		ND	2.2			ND
		21-Oct-14		ND		ND		ND	1.9	J		ND
		21-Apr-15		ND		ND		ND	1.6	J		ND
		21-Oct-15		ND		ND		ND	1.7	J		ND
		02-May-16		ND		ND		ND	1.4			ND
		27-Oct-16		ND		ND		ND	1.3			ND
		17-May-17		ND		ND		ND	1.4			ND
		31-Oct-17		ND		ND		ND	1.5			ND
		17-Apr-18		ND		ND		ND	1.0			ND
		18-Oct-18		ND		ND		ND	1.1			ND
		24-Apr-19		ND		ND		ND	1.0			ND
OU10-MW-25S	**OU10**	20-Apr-10		ND		ND	4			ND		ND
(Semiannual)	Duplicate	11-Oct-10		ND		ND	4.1			ND		ND
		11-Oct-10		ND		ND	4.1			ND		ND
		25-Apr-11		ND		ND	3.7			ND		ND
	Duplicate	19-Oct-11		ND		ND	4			ND		ND
		19-Oct-11		ND		ND	4			ND		ND
		17-Apr-12		ND		ND	5.3			ND		ND
	Duplicate	10-Oct-12		ND		ND	5.4			ND		ND
		10-Oct-12		ND		ND	5.1			ND		ND
		02-Apr-13		ND		ND	4.6			ND		ND
		08-Oct-13		ND		ND	4.6			ND		ND

Table A-18
LTM Program Groundwater Sampling Results Exceeding VISLs
Groundwater Operable Unit
Wright-Patterson AFB, Ohio

Sample Location	Management Area	Sample Date	cis-1,2-DCE		trans-1,2-DCE		PCE		TCE		Vinyl Chloride	
Units			µg/L		µg/L		µg/L		µg/L		µg/L	
Residential VISL [a]			NA		NA		5.8		0.52		0.15	
Commercial VISL [a]			NA		NA		24		2.2		2.5	
MCL [b]			70		100		5		5		2	
			Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
OU10-MW-25S		09-May-14		ND		ND	5.9			ND		ND
(continued)	Duplicate	21-Oct-14		ND		ND	6.1			ND		ND
		21-Oct-14		ND		ND	5.9			ND		ND
		20-Apr-15		ND		ND	**5**			ND		ND
	Duplicate	20-Oct-15		ND		ND	6.3			ND		ND
		20-Oct-15		ND		ND	6.4			ND		ND
		29-Apr-16		ND		ND	5.8			ND		ND
	Duplicate	26-Oct-16		ND		ND	4.4			ND		ND
		26-Oct-16		ND		ND	4.4			ND		ND
		03-May-17		ND		ND	4.8			ND		ND
		19-Oct-17		ND		ND	6.4			ND		ND
		16-Apr-18		ND		ND	5.0			ND		ND
		22-Oct-18		ND		ND	6.4			ND		ND
	Duplicate	22-Oct-18		ND		ND	6.4			ND		ND
		22-Apr-19		ND		ND	6.2			ND		ND
LF512-MW-14	**OU10**	26-Oct-16		ND		ND	6.8			ND		ND
(Semiannual)		03-May-17		ND		ND	8.8			ND		ND
		19-Oct-17		ND		ND	9.8			ND		ND
		19-Oct-17		ND		ND	9.8			ND		ND
		16-Apr-18		ND		ND	9.2			ND		ND
		22-Oct-18		ND		ND	9.6			ND		ND
		24-Apr-19		ND		ND	8.7			ND		ND
23-578-M	**OU10 (CHP4)**	15-Oct-08		ND		ND	2.1		1.3	J		ND
(Semiannual)		11-May-09		ND		ND	1.9		1.3	J		ND
		05-Oct-09		ND		ND	2		1.6	J		ND
		26-Apr-10		ND		ND	1.7		2.1			ND
		11-Oct-10		ND		ND	2.1		2.2			ND
		25-Apr-11		ND		ND	1.9		1.8	J		ND
		19-Oct-11		ND		ND	1.6		1.1	J		ND
		13-Apr-12		ND		ND	1.5		1.2	J		ND
		09-Oct-12		ND		ND	1.7		1	J		ND
		03-Apr-13		ND		ND	1.1		1	J		ND
		08-Oct-13		ND		ND	1.2		1.1	J		ND
		30-Apr-14		ND		ND	1.1		1.6	J		ND
		20-Oct-14		ND		ND	1.1		1.4	J		ND
		20-Apr-15		ND		ND	1.1		0.90	J		ND
		19-Oct-15		ND		ND	1.1		1.0	J		ND
		02-May-16		ND		ND	1.2		1.1			ND
		21-Oct-16		ND		ND	0.54	J	0.50	J		ND
		03-May-17		ND		ND	1.1		1.1			ND
		17-Oct-17		ND		ND	0.74	J	0.82	J		ND
		16-Apr-18		ND		ND	1.0		1.4			ND
		16-Oct-18		ND		ND	1.1		1.2			ND
		24-Apr-19		ND		ND	1.1		1.8			ND
CHP4-MW01	**OU10 (CHP4)**	26-Apr-10		ND		ND	0.6	J		ND		ND
(Annual)		11-Oct-10		ND		ND	0.78	J		ND		ND
		25-Apr-11		ND		ND	0.54	J		ND		ND
		11-Apr-12	Not sampled due to construction in the vicinity of the well location.									
		03-Apr-13		ND		ND	0.66	J		ND		ND
		09-May-14	Not sampled, well buried during area construction.									
		20-Apr-15	Not sampled, well buried during area construction.									
		02-May-16	Not sampled, well buried during area construction.									
		03-May-17		ND		ND	0.55	J		ND		ND
		17-Oct-17		ND		ND	0.43	J		ND		ND
		16-Apr-18		ND		ND		ND		ND		ND
		16-Oct-18		ND		ND	0.32	J		ND		ND
		Spring 2019	Not Sampled per 2017 Annual LTM Report									
GR-330	**OU10 (CHP4)**	27-Apr-10		ND		ND	7.2			ND		ND
(Semiannual)		11-Oct-10		ND		ND	1.6			ND		ND
		28-Apr-11		ND		ND	0.65	J		ND		ND
		19-Oct-11		ND		ND	1.2			ND		ND
		19-Apr-12		ND		ND	0.82	J		ND		ND
		09-Oct-12		ND		ND	1.1			ND		ND
		04-Apr-13		ND		ND	0.63	J		ND		ND

Table A-18
LTM Program Groundwater Sampling Results Exceeding VISLs
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Sample Location	Management Area	Sample Date	cis-1,2-DCE µg/L		trans-1,2-DCE µg/L		PCE µg/L		TCE µg/L		Vinyl Chloride µg/L	
Units												
Residential VISL [a]			NA		NA		5.8		0.52		0.15	
Commercial VISL [a]			NA		NA		24		2.2		2.5	
MCL [b]			70		100		5		5		2	
			Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
GR-330		08-Oct-13		ND		ND	0.4	J		ND		ND
(continued)		09-May-14		ND		ND	1.1			ND		ND
		23-Oct-14		ND		ND	0.77	J		ND		ND
		20-Apr-15		ND		ND	1.8			ND		ND
		19-Oct-15		ND		ND	0.78	J		ND		ND
		02-May-16		ND		ND	1.0			ND		ND
		25-Oct-16		ND		ND	0.80	J		ND		ND
		03-May-17		ND		ND	1.9			ND		ND
		17-Oct-17		ND		ND	0.86	J		ND		ND
		17-Apr-18		ND		ND	0.42	J		ND		ND
		16-Oct-18		ND		ND	0.86	J		ND		ND
		24-Apr-19		ND		ND		ND		ND		ND
B59-MW02	**Building 59**	12-Apr-05	**3,100**		13			ND	**4,000**		**50**	
(Semiannual)		08-Jun-05	Oxidant Injection Pilot Test Conducted in Well B59-MW02									
		23-Apr-07	Oxidant present in well - not sampled									
		19-Apr-12	Oxidant present in well - not sampled									
		10-May-17	**3,150**		68.7			ND	**625**		**319**	
		24-Oct-18	**2,550**		35.2			ND	**249**		**55.2**	
		22-Apr-19	**2,310**		79.2			ND	**466**		**297**	
B59-MW03	**Building 59**	12-Apr-05	**160**	D	7.1			ND	**46**	D	**41**	D
(Semiannual)		23-Apr-07	**160**	D	10			ND	**130**	D	**33**	
	Duplicate	23-Apr-07	**170**	D	11			ND	**130**	D	**35**	
		19-Apr-12	**150**	D	5.8			ND	**4.6**		**15**	
		08-May-17	**359**		20.6			ND	**15.5**		**16.1**	
		24-Oct-18	**283**		13.4			ND	**17.4**		**22.1**	
		22-Apr-19	**393**		19.1			ND	**98.2**		**12.3**	
B79C/D-MW01	**Building 79**	13-Apr-10	12	D	1.5	D		ND D	**41**	D	0.31	J D
(Semiannual)		21-Oct-10	12		1.6			ND	**50**		0.4	J
		11-May-11	11	D	1.7	D		ND D	**52**	D	0.39	J D
		18-Apr-12	13		2.2			ND	**58**		0.37	J
		02-Apr-13	15	H	2.3	H		ND	**65**	D	0.51	J H
		19-Nov-13	13	D	1.9	D		ND D	**58**	D		ND D
		06-May-14	17		2.2			ND	**45**	D	0.28	J
		20-Oct-14	17		2.3			ND	**50**			ND
Injection pilot test conducted Nov. 2014.												
		13-Apr-15	61		2.9			ND	1.3	J	0.65	J
		19-Oct-15	62		1.5			ND		ND	**3.4**	
	Duplicate	25-Apr-16	15		0.40	J		ND		ND	**21**	
		25-Apr-16	16		0.41	J		ND		ND	**19**	
		19-Oct-16	5.1		0.39	J		ND		ND	2.3	
	Duplicate	03-May-17	2.7		0.24	J		ND		ND	**2.8**	
		03-May-17	2.6			ND		ND		ND	**2.9**	
	Duplicate	18-Oct-17	2.9			ND		ND		ND	**3.4**	
		18-Oct-17	3.4		0.35	J		ND		ND	**3.4**	
		20-Apr-18	1.7			ND		ND		ND	2.3	
	Duplicate	20-Apr-18	1.6			ND		ND		ND	2.1	
		23-Oct-18	7.4		0.53	J		ND		ND	**7.3**	
	Duplicate	23-Oct-18	7.3		0.59	J		ND		ND	**7.4**	
		18-Apr-19	2.5		0.31	J		ND		ND	**3.8**	
	Duplicate	18-Apr-19	2.4		0.35	J		ND		ND	**4.0**	
B79C/D-MW02	**Building 79**	19-Apr-10		ND		ND		ND	**33**			ND
(Annual)		14-Oct-10		ND		ND		ND	**28**			ND
		11-May-11		ND		ND		ND	**32**			ND
		18-Apr-12		ND		ND		ND	**26**			ND
		02-Apr-13		ND		ND		ND	**27**			ND
		19-Nov-13		ND		ND		ND	**25**			ND
		06-May-14		ND		ND		ND	**25**			ND
		13-Apr-15		ND		ND		ND	**27**			ND
		25-Apr-16		ND		ND		ND	**20**			ND
		03-May-17		ND		ND		ND	**28.8**			ND
		20-Apr-18		ND		ND		ND	**22.8**			ND
		18-Apr-19		ND		ND		ND	**23.8**			ND

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Sample Location	Management Area	Sample Date	cis-1,2-DCE µg/L		trans-1,2-DCE µg/L		PCE µg/L		TCE µg/L		Vinyl Chloride µg/L	
Units												
Residential VISL [a]			NA		NA		5.8		0.52		0.15	
Commercial VISL [a]			NA		NA		24		2.2		2.5	
MCL [b]			70		100		5		5		2	
			Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
B79C/D-MW03	**Building 79**	13-Apr-10		ND		ND		ND	**4.6**			ND
(Annual)	Duplicate	14-Oct-10		ND		ND		ND	**10**			ND
		14-Oct-10		ND		ND		ND	**9.6**			ND
		13-May-11	0.24	J		ND		ND	**12**			ND
		18-Apr-12		ND		ND		ND	**7.5**			ND
		02-Apr-13		ND		ND		ND	**6**			ND
		19-Nov-13		ND		ND		ND	**4.6**			ND
		06-May-14		ND		ND		ND	**3.6**			ND
		13-Apr-15	0.27	J		ND		ND	**11**			ND
		25-Apr-16		ND		ND		ND	1.6			ND
		03-May-17		ND		ND		ND	**2.6**			ND
		20-Apr-18		ND		ND		ND	**3.8**			ND
		18-Apr-19		ND		ND		ND	**8.1**			ND
B79C/D-MW04	**Building 79**	13-Apr-10	0.75			ND		ND	**24**			ND
(Annual)		14-Oct-10	1.1		0.41	J		ND	**40**			ND
		11-May-11	0.22	J		ND		ND	1.4	J		ND
		18-Apr-12	0.71		0.2	J		ND	**14**			ND
		02-Apr-13	1.4		0.33	J		ND	**17**			ND
	Duplicate	19-Nov-13	0.91		0.31	J		ND	**14**			ND
		19-Nov-13	0.91		0.26	J		ND	**14**			ND
		06-May-14	1.7		0.35	J		ND	**28**			ND
		13-Apr-15	0.28	J		ND		ND	**7.1**			ND
		25-Apr-16	0.98	J	0.17	J		ND	**14**			ND
		03-May-17		ND		ND		ND	**4.4**			ND
		20-Apr-18		ND		ND		ND	**10.5**			ND
		18-Apr-19		ND		ND		ND	**9.6**			ND
B79C/D-MW05	**Building 79**	19-Apr-10		ND		ND		ND		ND		ND
(Annual)		14-Oct-10		ND		ND		ND		ND		ND
		06-May-11		ND		ND		ND		ND		ND
		18-Apr-12		ND		ND		ND		ND		ND
		03-Apr-13		ND		ND		ND		ND		ND
		06-May-14		ND		ND		ND		ND		ND
		13-Apr-15		ND		ND		ND		ND		ND
		25-Apr-16		ND		ND		ND		ND		ND
		08-May-17		ND		ND		ND		ND		ND
		13-Apr-18		ND		ND		ND		ND		ND
		Spring 2019	Not Sampled per 2017 Annual LTM Report									
B79C/D-MW06	**Building 79**	20-Nov-13	3.1		0.39	J		ND	**11**			ND
(Semiannual)		06-May-14	3.1		0.41	J		ND	**10**			ND
		20-Oct-14	3.1		0.36	J		ND	**13**			ND
		15-Apr-15	3		0.40	J		ND	**12**			ND
		19-Oct-15	3.5		0.51			ND	**16**			ND
		02-May-16	2.9		0.43	J		ND	**11**			ND
		19-Oct-16	3.1		0.43	J		ND	**12**			ND
		08-May-17	2.9		0.54	J		ND	**12.9**			ND
		19-Oct-17	3.8		0.56	J		ND	**19.6**			ND
		13-Apr-18	3.0		0.44	J		ND	**15**			ND
		15-Oct-18	3.2		0.47	J		ND	**15.4**			ND
		18-Apr-19	2.7		0.62	J		ND	**14.9**			ND
B79C/D-MW07	**Building 79**	20-Nov-13		ND		ND		ND		ND		ND
(Semiannual)	Duplicate	07-May-14		ND		ND		ND		ND		ND
		07-May-14		ND		ND		ND		ND		ND
		20-Oct-14		ND		ND		ND		ND		ND
	Duplicate	15-Apr-15		ND		ND		ND		ND		ND
		15-Apr-15		ND		ND		ND		ND		ND
		19-Oct-15		ND		ND		ND		ND		ND
		02-May-16		ND		ND		ND		ND		ND
		19-Oct-16		ND		ND		ND		ND		ND
		08-May-17		ND		ND		ND		ND		ND
		19-Oct-17		ND		ND		ND		ND		ND
		13-Apr-18		ND		ND		ND		ND		ND
		15-Oct-18		ND		ND		ND		ND		ND

Table A-18
LTM Program Groundwater Sampling Results Exceeding VISLs
Groundwater Operable Unit
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Sample Location	Management Area	Sample Date	cis-1,2-DCE µg/L		trans-1,2-DCE µg/L		PCE µg/L		TCE µg/L		Vinyl Chloride µg/L	
Units												
Residential VISL [a]			NA		NA		5.8		0.52		0.15	
Commercial VISL [a]			NA		NA		24		2.2		2.5	
MCL [b]			70		100		5		5		2	
			Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
BS5 P-1	**Burial Site 5**	21-Apr-10		ND		ND	3.8			ND		ND
(Annual)		15-Oct-10		ND		ND	4.5			ND		ND
		12-May-11		ND		ND	1.7			ND		ND
		23-Apr-12		ND		ND	1.6			ND		ND
		05-Apr-13		ND		ND	5.5			ND		ND
		07-May-14		ND		ND	4.2			ND		ND
		17-Apr-15		ND		ND	5.2			ND		ND
		26-Apr-16		ND		ND	2.3			ND		ND
		15-May-17		ND		ND	4.7			ND		ND
		25-Apr-18		ND		ND	2.2			ND		ND
		25-Apr-19		ND		ND	3.3			ND		ND
BS5 P-3	**Burial Site 5**	21-Apr-10		ND		ND	14			ND		ND
(Annual)		15-Oct-10		ND		ND	14			ND		ND
		12-May-11		ND		ND	13			ND		ND
		23-Apr-12		ND		ND	13			ND		ND
		05-Apr-13		ND		ND	12			ND		ND
		07-May-14		ND		ND	10			ND		ND
		17-Apr-15		ND		ND	10			ND		ND
		26-Apr-16		ND		ND	10			ND		ND
		15-May-17		ND		ND	9.8			ND		ND
		25-Apr-18		ND		ND	10.8			ND		ND
		25-Apr-19		ND		ND	8.6			ND		ND
BS5 P-4	**Burial Site 5**	21-Apr-10		ND		ND	18			ND		ND
(Annual)	Duplicate	21-Apr-10		ND		ND	16			ND		ND
		15-Oct-10		ND		ND	18			ND		ND
	Duplicate	12-May-11		ND		ND	12			ND		ND
		12-May-11		ND		ND	13			ND		ND
	Duplicate	23-Apr-12		ND		ND	15			ND		ND
		23-Apr-12		ND		ND	14			ND		ND
	Duplicate	05-Apr-13	1.2			ND	8.3		0.77	J		ND
		05-Apr-13	1.4			ND	7.3		0.93	J		ND
	Duplicate	07-May-14		ND		ND	11			ND		ND
		07-May-14		ND		ND	10			ND		ND
	Duplicate	17-Apr-15		ND		ND	10			ND		ND
		17-Apr-15		ND		ND	11			ND		ND
		26-Apr-16		ND		ND	11		0.34	J		ND
	Duplicate	15-May-17		ND		ND	8.9			ND		ND
		15-May-17		ND		ND	8.9			ND		ND
		25-Apr-18		ND		ND	10.2			ND		ND
	Duplicate	25-Apr-18		ND		ND	9.5			ND		ND
		25-Apr-19		ND		ND	8.7			ND		ND
	Duplicate	25-Apr-19		ND		ND	8.9			ND		ND
SP11-MW01	**FAA-B**	14-Apr-10	0.6		0.44	J		ND		ND	**3**	
(Annual)	Duplicate	14-Apr-10	0.55		0.49	J		ND		ND	**2.7**	
	Duplicate	27-Apr-11	0.74		0.49	J		ND		ND	2	
		27-Apr-11	0.7		0.48	J		ND		ND	2.1	
	Duplicate	11-Apr-12		ND	0.33	J		ND		ND	1.1	
		11-Apr-12		ND	0.36	J		ND		ND	1.2	
	Duplicate	03-Apr-13	0.29	J	0.24	J		ND		ND	1.1	
		03-Apr-13	0.33	J	0.25	J		ND		ND	0.99	J
	Duplicate	07-May-14	0.30	J	0.29	J		ND		ND	0.74	J
		07-May-14	0.32	J	0.31	J		ND		ND	0.85	J
	Duplicate	20-Apr-15		ND		ND		ND		ND	0.32	J
		20-Apr-15		ND		ND		ND		ND	0.37	J
	Duplicate	26-Apr-16		ND		ND		ND		ND		ND
		26-Apr-16		ND	0.17	J		ND		ND		ND
	Duplicate	08-May-17		ND		ND		ND		ND		ND
		08-May-17		ND		ND		ND		ND		ND
		24-Apr-18		ND		ND		ND		ND		ND
	Duplicate	24-Apr-18		ND		ND		ND		ND		ND
		Spring 2019	Not sampled per 2017 Annual LTM Report									

Table A-18
LTM Program Groundwater Sampling Results Exceeding VISLs
Groundwater Operable Unit
Wright-Patterson AFB, Ohio

Sample Location	Management Area	Sample Date	cis-1,2-DCE µg/L		trans-1,2-DCE µg/L		PCE µg/L		TCE µg/L		Vinyl Chloride µg/L	
Units												
Residential VISL [a]			NA		NA		5.8		0.52		0.15	
Commercial VISL [a]			NA		NA		24		2.2		2.5	
MCL [b]			70		100		5		5		2	
			Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
SP11-MW02	**FAA-B**	23-Apr-10	9.7		0.32	J		ND		ND		ND
(Annual)		05-May-11	10		0.35	J		ND		ND		ND
		23-Apr-12	10		0.32	J		ND		ND	0.22	J
		05-Apr-13	6.9		0.24	J		ND		ND	0.23	J
		12-May-14	5.7		0.28	J		ND		ND		ND
		23-Apr-15	3.8			ND		ND		ND		ND
		26-Apr-16	3.1		0.17	J		ND		ND		ND
		08-May-17	2.5			ND		ND		ND		ND
		26-Apr-18	2.1			ND		ND		ND		ND
		Spring 2019	Not sampled per 2017 Annual LTM Report									
SP11-MW03	**FAA-B**	19-Apr-10	3.8	D		ND D		ND D	1	J D	**61**	D
(Annual)		27-Apr-11	14		0.61			ND	6		**32**	
		17-Apr-12	2.5			ND		ND	1	J	**33**	D
		03-Apr-13	1.7		0.2	J		ND	0.31	J	**36**	
		07-May-14	2.7		0.23	J		ND	0.38	J	**39**	
		23-Apr-15	1.3			ND		ND	0.54	J	**18**	
		26-Apr-16	1.5		0.18	J		ND		ND	**17**	
		08-May-17		ND		ND		ND		ND		ND
		24-Apr-18	1.1			ND		ND		ND	**26.2**	
		22-Apr-19	2.2			ND		ND	0.74	J	**19.7**	
SP11-MW05	**FAA-B**	25-Apr-18		ND		ND		ND		ND	**2.9**	
SP11-MW07	**FAA-B**	23-Apr-10	2.3		0.26	J		ND		ND	**14**	
(Annual)		10-May-11	1.1		0.29	J		ND		ND	**6.2**	
		20-Apr-12	1			ND		ND		ND	**8.3**	
		03-Apr-13	1.6			ND		ND		ND	**11**	
		12-May-14	0.91			ND		ND	0.32	J	0.95	J
		20-Apr-15	Well not sampled area flooded.+-									
		26-Apr-16		ND		ND		ND		ND	**3.3**	
		05-May-17	0.89	J		ND		ND		ND	1.7	
		24-Apr-18	1.2			ND		ND		ND	**3.3**	
		22-Apr-19	0.84	J		ND		ND		ND	1.3	
SP11-MW08	**FAA-B**	19-Apr-10	3.2		1.7			ND		ND	**2.6**	
(Annual)		27-Apr-11	2.5		1.5			ND		ND	1.5	
		17-Apr-12	1.8		1.4			ND		ND	1.4	
		03-Apr-13	1.6		1.9			ND		ND	1.4	
		12-May-14	1.7		2			ND		ND	1.4	
		20-Apr-15	0.99		1.6			ND		ND	0.87	J
		25-Apr-16	0.88	J	1.4			ND		ND	0.58	J
		08-May-17	0.86	J	1.3			ND		ND	1.3	
		24-Apr-18	1.0		0.84	J		ND		ND	1.3	
		22-Apr-19	0.96	J		ND		ND		ND	0.96	J
SP11-MW09	**FAA-B**	23-Apr-10	37	D	1.7	D		ND D	**2.8**	J D	**11**	D
(Annual)		05-May-11	10		0.21	J		ND	**3.5**		0.82	J
		23-Apr-12	31		1.7			ND	1.7	J	**16**	
		05-Apr-13	5.9		0.28	J		ND	**3.9**		1.9	
		13-May-14	8.6		0.55			ND	1.8	J	**7.2**	
		23-Apr-15	2.5			ND		ND	1.8	J	0.5	J
		26-Apr-16	3.4		0.30	J		ND	1.3		**7.0**	
		08-May-17	1.2			ND		ND	1.4		1.5	
		26-Apr-18	1.0			ND		ND	1.2		0.86	J
		3-May-19	1.0	J		ND		ND	0.58	J	1.3	

Table A-18
LTM Program Groundwater Sampling Results Exceeding VISLs
Groundwater Operable Unit
Wright-Patterson AFB, Ohio

Sample Location	Management Area	Sample Date	cis-1,2-DCE		trans-1,2-DCE		PCE		TCE		Vinyl Chloride	
Units			µg/L		µg/L		µg/L		µg/L		µg/L	
Residential VISL [a]			NA		NA		5.8		0.52		0.15	
Commercial VISL [a]			NA		NA		24		2.2		2.5	
MCL [b]			70		100		5		5		2	
			Result	Qual	Result	Qual	Result	Qual	Result	Qual	Result	Qual
Ambient Blanks												
HD-13S[a]	Ambient Blanks	10-Apr-13		ND		ND		ND		ND		ND
		09-Oct-13		ND		ND		ND		ND		ND
		08-May-14		ND		ND		ND		ND		ND
		22-Oct-14		ND		ND		ND		ND		ND
		15-Apr-15		ND		ND		ND		ND		ND
		22-Oct-15		ND		ND		ND		ND		ND
		27-Apr-16		ND		ND		ND		ND		ND
		24-Oct-16		ND		ND		ND		ND		ND
		09-May-17		ND		ND		ND		ND		ND
		23-Oct-17		ND		ND		ND		ND		ND
		18-Apr-18		ND		ND		ND		ND		ND
		18-Oct-18		ND		ND		ND		ND		ND
		2-May-19		ND		ND		ND		ND		ND
Monitoring Wells Proposed for Abandonment												
SP11-MW04	FAA-B	25-Apr-18		ND		ND		ND		ND		ND
CW14-016	OU5	24-Oct-18		Dry								
CW19-017	OU5	24-Oct-18		ND		ND		ND		ND		ND
CW20-019	OU5	24-Oct-18		ND		ND		ND		ND		ND

1,2-DCA - 1,2-Dichloroethane
B - Method Blank Detection
cis-1,2-DCE - cis-1,2-Dichloroethene
CHP4 - Central Heating Plant 4
D - Result obtained from the analysis of a dilution
DB - Diffusion Bag
GWOU - Groundwater Operable Unit
J - estimated

ND - Not detected
OU - Operable Unit
ug/L - Micrograms per liter
PCE - Tetrachloroethylene
TCE - Trichloroethylene
trans-1,2-DCE - trans-1,2-Dichloroethene
VISL - Vapor Intrusion Screening Level

[a] = City of Dayton well
1 = Upper portion of screened interval.
2 = Lower portion of screened interval.

Notes:

[a] VISL obtained from USEPA VISL calculator accessed on-line, December, 2019. Value is the target groundwater concentration based on a total cancer risk = 1E-06 and hazard quotient = 0.1.

[b] The MCLs are provided only for comparison with the VISLs.

Concentration exceeds the residential VISL.

"Bolded" concentration exceeds the residential and commercial VISLs.

Table A-19
Comparison of Maximum Detected Groundwater Concentrations, April 2019, with MCLs and RSLs
Basewide LTM and Annual VOC Analytical Data

Chemical	Maximum Groundwater Concentration (a) (µg/L)	Location of Maximum Concentration	Current MCL (b) (µg/L)	Current RSL (c) (µg/L)	Existing Chemical of Concern? (d)	Chemical of Concern Identified in 2015? (e)	New Chemical of Concern in 2019?
Volatile Organic Compounds							
1,1,1-Trichloroethane	0.51 J	OU4-MW-02B	200	800	NO	NO	NO
1,1-Dichloroethene	6.5	B59-MW02	7	28	NO	NO	NO
1,4-Dioxane	ND	NA	---	0.46	NO	YES	NO
Benzene	3.4 J	B59-MW03	5	0.46	YES	NO	NO (f)
Bromomethane	0.97 J	HD11	---	0.75	NO	NO	YES
Carbon Tetrachloride	0.4 J	OU10-MW-21S	5	0.45	NO	NO	NO (f)
Chloroform	5.8	OU10-MW-02S	80	0.22	NO	NO	NO (f)
cis-1,2-Dichloroethene	2,310	B59-MW02	70	3.6	NO (g)	NO	YES
Tetrachloroethene	17.8	OU4-MW-12B	5	4.1	YES	NO	NO
trans-1,2-Dichloroethene	79.2	B59-MW02	100	36	NO (g)	NO	NO (f)
Trichloroethene	466	B59-MW02	5	0.28	YES	NO	NO
Vinyl Chloride	297	B59-MW02	2	0.019	YES	NO	NO

--- - No Value
µg/L - micrograms per liter
J - Estimated value
LTM - Long-Term Monitoring
MCL - Maximum Contaminant Level
NA - Not Applicable
ND - Not Detected
RSL - Regional Screening Level
USEPA - U.S. Environmental Protection Agency

(a) Maximum detected concentration based on groundwater samples collected in April 2019 as part of the Long-Term Monitoring Program.
(b) Based on the most current MCLs as obtained from "2018 Edition of the Drinking Water Standards and Health Advisories" (USEPA, 2018).
(c) USEPA Regional Screening Levels (RSLs) dated November 2019.
(d) Listed as a Chemical of Concern in the GWOU ROD.
(e) Identified as a new Chemical of Concern in the Fourth Five-Year Review.
(f) Groundwater concentration is above the current RSL, but below the MCL.
(g) Total 1,2-dichloroethene was listed as a Chemical of Concern in the GWOU ROD. Individual isomers of 1,2-dichloroethene are now being analyzed.

Appendix B
Inspection Records, Interview Records, and Photographs

Appendix B Contents

<u>Interview Records:</u>

Justin Hall, Site Supervisor, CAM Management and Services, September 18, 2019
Harold Honeycutt, Supervisor, 88 CES/CEOHP, September 19, 2019
David Blair, Operations Manager, 88 FSS, September 19, 2019

In addition to the three interviews conducted, a request to complete an interview questionnaire and schedule site visits, if necessary, was emailed to the OEPA on September 18, 2019 for the purpose of preparing responses and to set up a meeting to review the status and any concerns of sites included during this Five-Year Review. No response was received from the OEPA. In addition, the USEPA RPM was not contacted to complete an interview questionnaire due to her continuous involvement in project status calls throughout the duration of the FYR.

<u>Inspection Checklists:</u>

LF5, October 10, 2019
LFs 8 & 10, October 10, 2019
Spill Site 11, October 10, 2019

Per the *Five-Year Review Site Inspection Checklist* (OSWER No. 9355.7-03B-P) user guidelines, the checklist focuses on the two most common types of remedies that are subject to five-year reviews: landfill covers and groundwater pump and treat remedies. Therefore, only those sites with an active groundwater pump and treat system (the groundwater pump and treat system near LF5, and the leachate extraction system near LFs 8 and 10) and Spill Site 11 (passive French Drain and oil/water separator) had individual inspection checklists completed. For the other landfills with only landfill covers and signage, a comprehensive interview form was completed based on site inspections and a review of the findings in the Quarterly Landfills 1-7, 9 and 11 and Spill Site11 Recovery System Performance Report #27, July – September 2019 (CAM, 2019) with the landfill maintenance contractor. The remaining three LFs – LF12 (all fill material has been removed), LF13 (paved parking lot and lawn area), and LF14 (grass and wooded area, determined not to be a landfill in the OU3 RI Report) – do not have landfill covers and are not maintained by the landfill maintenance contractor. Photographs of all the IRP sites are provided.

<u>Quarterly Landfills 1-7, 9 and 11 and Spill Site11 Recovery System Performance Report #27, July – September 2019 (CAM, 2019)</u>:

This quarterly systems performance report is included in this Appendix for a more detailed description of current landfill conditions.

<u>Photographs</u>

Photographs are presented for:

- Source Control Operable Unit - Photos 1-7
- 21 No Action Sites - Photos 8-42
- 41 No Action Sites - Photos 43-125
- Groundwater Operable Unit - Photos 126-132

Landfill Contractor Five-Year Review Interviews

Information gathered from interviews during the site inspection may be key to understanding site status. Interviews should be conducted with various individuals or groups, including the operation and maintenance (O&M) site manager, O&M staff, local regulatory authorities and response agencies, community action groups or associations, site neighbors, and other stakeholders. Written documentation of the interview should briefly summarize the discussion, address any problems or successes with the implementation of the remedy, and provide suggestions for future reference. Forms to use during interviews are provided at the end of this appendix.

Interview	Information Sought
O&M Manager/Operating Contractor	– O&M status of the remedy, compliance with permit and reporting requirements, and complaints filed – effectiveness of the O&M Plan – information about any potential causes for concern about the remedy progress and performance of the remedy
O&M Staff	– effectiveness of the O&M Manual – information about any potential causes for concern about the remedy Recommendations for adjusting the mode of operation or optimizing the operations protocol
Remedial Design/Remedial Action Consultant	– original concepts behind the O&M of the remedy – questions about remedial design parameters, expected performance and cost, and changes that have occurred during implementation

INTERVIEW DOCUMENTATION FORM

The following is a list of individual interviewed for this five-year review. See the attached contact record(s) for a detailed summary of the interviews.

Justin Hall	Site Supervisor	CAM Management and Services	9/18/2019
Name	Title/Position	Organization	Date
Name	Title/Position	Organization	Date
Name	Title/Position	Organization	Date
Name	Title/Position	Organization	Date

INTERVIEW RECORD

Site Name: Wright-Patterson AFB, Ohio	**EPA ID No.:** OH7571724312	
Subject: 5th Five-Year Record of Decision Review	**Time: 11:00**	**Date: 9/18/2019**
Type: __ Telephone _X_ Visit __ Other **Location of Visit:** WPAFB, 13th St. contractor's lot	__ Incoming __ Outgoing	

Contact Made By:

Name: Greg Plamondon	**Title:** Project Geologist	**Organization:** APTIM

Individual Contacted:

Name: Justin Hall	**Title:** Site Supervisor	**Organization:** CAM Management

Telephone No:__(937) 475-4652______ **Fax No:** **E-Mail Address:** **justin@cammanagementandservices.com**	**Street Address:_** 13th St. contractor's lot, Area B **City, State, Zip:_**WPAFB, OH, 45433**____________**

Summary Of Conversation

Landfill 5 GWTS

1. What is your overall impression of the project? (general sentiment)

The remedy appears to be functioning as designed.

2. Is the remedy functioning as expected? How well is the remedy performing?

The system is performing well with minimal down time.

3. What does the monitoring data show? Are there any trends that show contaminant levels are decreasing?

Yes, levels are slowly decreasing.

4. Is there a continuous on-site O&M presence? If so, please describe staff and activities. If there is not a continuous on-site presence, describe staff and frequency of site inspections and activities.

Yes, Contractor onsite during each workday as well as any emergency responses. The system is inspected daily for proper operation and to check flow rates. In addition, the regular and corrective maintenance are performed as scheduled and required.

5. Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines since start-up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe changes and impacts.

No, there have not been any significant changes.

6. Have there been unexpected O&M difficulties or costs at the site since start-up or in the last five years? If so, please give details.

No additional O&M difficulties or costs have been noticed. The contractor has managed the site for multiple contracts and is very familiar with the system and required activities and associated costs.

7. Have there been opportunities to optimize O&M, or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency.

Please see attached document containing the O&M optimization.

8. Do you have any comments, suggestions, or recommendations regarding the project?

None at this time.

9. Do you have any comments, suggestions, or recommendations regarding the project (i.e., design, construction documents, constructability, management, regulatory agencies, etc.)?

None at this time.

(continuation)

2.10 Evaluation of GWTS Performance

The objectives for the replacement GWTS are provided in Section 1.2 (Objectives) of this report. Compliance with each of the objectives is discussed in the following subsections. The GWTS is operating properly and successfully.

2.10.1 Energy Efficiency

Power usage was measured for the original GWTS using Square D PowerLogic® PM800 power meter prior to deconstruction. The meter measures, records, and displays power usage in units of KW hours. The same meter was installed to measure energy usage for the replacement GWTS. The power usage for the replacement GWTS is 53 kW hours less than the original GWTS. This equates to an annual cost savings of approximately $42,000.

2.10.2 Treat Groundwater at Rates up to 800 gpm

The GWTS continuously treats groundwater pumped from EW-1 at flow rates up to 800 gpm. The effluent flow rate from the air stripper is equal to the influent flow rate from EW-1. The current flow rate being delivered to the air stripper from EW-1 is approximately 500 gpm.

2.10.3 Operation and Maintenance

The replacement GWTS is less complex to operate and maintain than the original GWTS. The original GWTS required use of CARUS™ K-5 anti-scaling chemical to control scale buildup at a cost of $8,000 per month. The replacement GWTS has eliminated the need for use of anti-scaling chemicals. This equates to an annual cost savings of $96,000. In addition, the need to maintain the metering pump, injection quill, storage tank, and materials handling and O&M associated with use of CARUS™ K-5 were also eliminated.

The replacement GWTS is comprised of less equipment is therefore less complex to operate and maintain than the original GWTS. For example, only one blower is required in place of six aeration blowers for the original GWTS. Two stages (levels) of perforated trays are used in place of 132 dome diffusers (located in two x 20,000-gallon aeration tanks) for the original GWTS system. A spare set of perforated trays was provided with the replacement GWTS to minimize downtime when cleaning is required.

The replacement GWTS is housed in a treatment building to protect the equipment (i.e., air stripper, blower, transfer pump, electrical panel, and controls from the elements) and provide a protected environment to facilitate maintenance by O&M personnel.

A programmable logic controller (PLC) monitors process sensors for control of the air stripper system, to record (i.e., datalog) operating data, and report alarm conditions via email and text messages to O&M personnel. The PLC continuously monitors the operating status of the GWTS and informs O&M personnel if an operating parameter is out of range and maintenance is required. The PLC provides remote viewing of the operating status of the GWTS and the ability to remotely control (e.g., start up and shut down) the system. The information that is datalogged is used to prepare monthly reports for AFCED and OEPA and to track operating parameters (e.g., differential pressure across the air stripper trays) to determine when O&M is required.

2.10.4 Maintain Compliance with NPDES Permit

Groundwater is being pumped from extraction well EW-1, continuously treated by the GWTS, and discharged to West Twin Lakes in compliance with the final effluent limitations and monitoring requirements listed in Part I, A of NPDES Permit 1IN00156*FD (OEPA, 2014). The requirements include measurement and reporting (on a monthly basis) for the following parameters for the effluent:

- pH
- Total dissolved residue (mg/L)
- Total phosphorus (mg/L) (sampled quarterly)
- Total organic carbon (mg/L)
- Benzene (µg/L)
- Tetrachloroethylene (µg/L)
- 1,1-Dichloroethylene (µg/L)
- 1,1,1-Trichloroethane (µg/L)
- 1,2-Dichloroethane (µg/L)
- 1,2-trans-Dichloroethylene (µg/L)
- Vinyl chloride (µg/L)
- Trichloroethene (µg/L)
- Chlorobenzene (µg/L)
- Flow rate – million gallons per day (MGD) (recorded daily)
- Sum of halomethanes (µg/L)

The results are documented in the Monthly Operating Reports (MORs) for the Landfill 5 Groundwater Treatment System prepared and submitted to AFCEC and OEPA. The GWTS is in compliance with all discharge limitations specified in the NPDES Permit.

The influent and effluent sampling results for the GWTS from December 2015 (at the time the GWTS was placed in service) through November 2016 are shown on Table 2-1. Influent and effluent samples are analyzed for VOCs on a monthly basis using EPA Method 624. Influent sample collected over the past year indicate that Trichloroethene (TCE) and cis-1,2-Dichloroethene (cis-1,2-DCE) are the only VOCs detected in the groundwater being pumped from EW-1. The GWTS is effectively treating 100% of the VOCs in the influent groundwater to levels that are below detection limit (BDL).

Table 2-1 Monthly Influent and Effluent Sampling Results December 2015 through November 2016

	Influent		Effluent	
Date	cis-1,2-DCE (µg/L)	TCE (µg/L)	cis-1,2-DCE (µg/L)	TCE (µg/L)
December 2015	10.1	5.02	BDL	BDL
January 2016	9.41	4.76	BDL	BDL
February 2016	11.5	5.12	BDL	BDL
March 2016	10.1	5.33	BDL	BDL
April 2016	10.3	5.48	BDL	BDL
May 2016	9.61	4.72	BDL	BDL
June 2016	10.3	5.28	BDL	BDL

July 2016	10.3	4.25	BDL	BDL
August 2016	7.22	3.54	BDL	BDL
September 2016	6.73	3.04	BDL	BDL
October 2016	7.54	3.64	BDL	BDL
November 2016	7.22	2.95	BDL	BDL

BDL = below detection limit

2.10.5 Prevent Off-Site Migration of Contaminated Groundwater

The most recent hydraulic containment monitoring for OU5 was performed in October 2016 as part of the Long Term Monitoring program at WPAFB. Water level monitoring was conducted for the monitoring wells at OU5 and used to develop the water level contours and particle tracks shown on Figure 2-7. These particle tracks illustrate the flow paths of simulated groundwater contaminant particles that are being released from the upgradient highpoint of LF5. Figure 2-7 shows that the released particles are being captured by EW-1 providing hydraulic containment for the LF5 contaminated groundwater at the WPAFB/MCD boundary.

Landfills 8 & 10

1. What is your overall impression of the project? (general sentiment)

The remedy appears to be functioning as designed.

2. Is the remedy functioning as expected? How well is the remedy performing?

The system is performing well with minimal down time.

3. What does the monitoring data show? Are there any trends that show contaminant levels are decreasing?

N/A

4. Is there a continuous on-site O&M presence? If so, please describe staff and activities. If there is not a continuous on-site presence, describe staff and frequency of site inspections and activities.

Yes, Contractor onsite during each workday as well as any emergency responses. The system is inspected daily for proper operation and to check flow rates. In addition, the regular and corrective maintenance are performed as scheduled and required.

5. Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines since start-up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe changes and impacts.

No, there have not been any significant changes.

6. Have there been unexpected O&M difficulties or costs at the site since start-up or in the last five years? If so, please give details.

No additional O&M difficulties or costs have been noticed. The contractor has managed the site for multiple contracts and is very familiar with the system and required activities and associated costs.

7. Have there been opportunities to optimize O&M, or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency.

The frequency of operation for the flare was reduced from twice to once per week. Prior to optimization, the flare was operated twice per week (Monday and Thursday). The landfills do not, however, generate sufficient methane following operation of the flare on Monday to operate the flare again on Thursday. USEPA and OEPA approved a reduction in the frequency of flare operation to once per week, on Mondays.

8. Do you have any comments, suggestions, or recommendations regarding the project?

None at this time.

9. Do you have any comments, suggestions, or recommendations regarding the project (i.e., design, construction documents, constructability, management, regulatory agencies, etc.)?

None at this time.

(continuation)

Multiple Landfills

1. What is your overall impression of the project? (general sentiment)

The remedy appears to be functioning as designed.

2. Is the remedy functioning as expected? How well is the remedy performing?

The remedy is functioning as inspected.

3. What does the monitoring data show? Are there any trends that show contaminant levels are decreasing?

N/A

4. Is there a continuous on-site O&M presence? If so, please describe staff and activities. If there is not a continuous on-site presence, describe staff and frequency of site inspections and activities.

No, each landfill is visited quarterly to inspect and perform scheduled and required maintenance.

5. Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines since start-up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe changes and impacts.

No, there have not been any significant changes.

6. Have there been unexpected O&M difficulties or costs at the site since start-up or in the last five years? If so, please give details.

No additional O&M difficulties or costs have been noticed. The contractor has managed the site for multiple contracts and is very familiar with the system and required activities and associated costs.

7. Have there been opportunities to optimize O&M, or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency.

Please see attached document containing the O&M optimization.

8. Do you have any comments, suggestions, or recommendations regarding the project?

None at this time.

9. Do you have any comments, suggestions, or recommendations regarding the project (i.e., design, construction documents, constructability, management, regulatory agencies, etc.)?

None at this time.

(continuation)

Multiple Landfills O&M Optimization

1. Wright-Patterson AFB is requesting reduction in the frequency of inspections and reporting for Landfills 001 through 007, 009, and 011 based on historic inspection results documented in the System Performance Reports. Inspections performed since the landfill caps were installed indicate that the conditions at the landfills are stable (do not change appreciably during a six-month interval compared to a three-month interval) and reducing the inspection/reporting frequency will be as protective as the current inspection/reporting frequency.

2. The proposed optimized schedule for the inspections and reporting is shown on the table below. For Landfills 1, 2, 5, 6, 7, 9, and 11 the inspections would be performed semi-annually, and the results would be reported annually in the System Performance Reports. Landfills 3 underlies the tenth green of the Military Golf Course and is maintained by WPAFB. Landfill 4 is a paved and fenced area used for storage of equipment and is maintained by WPAFB. For Landfills 3 and 4 the inspections would be performed annually, and the results reported annually in the System Performance Reports. There are no actual inspection or maintenance requirements specified in the O&M Manual for Landfills 3 and 4.

3. The current and proposed optimized inspection and reporting schedule for each Landfill is shown below:

Landfill	Current Schedule		Proposed Optimized Schedule	
	Inspections	Reporting	Inspections[1]	Reporting
Landfill 001 (cap installed 1998)	Quarterly	Quarterly	Semi-annual	Annual
Landfill 002 (cap installed 1998)	Quarterly	Quarterly	Semi-annual	Annual
Landfill 003 (cap installed 1994)	Quarterly	Quarterly	Annual	Annual
Landfill 004 (cap installed 1998)	Quarterly	Quarterly	Annual	Annual
Landfill 005 (cap installed 1995)	Quarterly	Quarterly	Semi-annual	Annual
Landfill 006 (cap installed 1998)	Quarterly	Quarterly	Semi-annual	Annual
Landfill 007 (cap installed 1998)	Quarterly	Quarterly	Semi-annual	Annual
Landfill 009 (cap installed 1998)	Quarterly	Quarterly	Semi-annual	Annual
Landfill 011 (cap installed 1997)	Quarterly	Quarterly	Semi-annual	Annual

Note:

[1] Semi-annual inspections will be performed in spring and fall, and annual inspections will be performed in the spring.

Spill Site 11

1. What is your overall impression of the project? (general sentiment)

The remedy appears to be functioning as designed.

2. Is the remedy functioning as expected? How well is the remedy performing?

The system is performing well with minimal down time.

3. What does the monitoring data show? Are there any trends that show contaminant levels are decreasing?

N/A

4. Is there a continuous on-site O&M presence? If so, please describe staff and activities. If there is not a continuous on-site presence, describe staff and frequency of site inspections and activities.

The site is visited quarterly to inspect and perform scheduled and required maintenance to the system to ensure proper operation.

5. Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines since start-up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe changes and impacts.

No, there have not been any significant changes.

6. Have there been unexpected O&M difficulties or costs at the site since start-up or in the last five years? If so, please give details.

No additional O&M difficulties or costs have been noticed. The contractor has managed the site for multiple contracts and is very familiar with the system and required activities and associated costs.

7. Have there been opportunities to optimize O&M, or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency.

An autodialer was installed in July 2017 to monitor the water level in the interceptor trench and send alarm notifications to O&M personnel if the system fails (e.g., if the sump pump fails resulting in high water level in the sump and interceptor trench).

8. Do you have any comments, suggestions, or recommendations regarding the project?

None at this time.

9. Do you have any comments, suggestions, or recommendations regarding the project (i.e., design, construction documents, constructability, management, regulatory agencies, etc.)?

None at this time.

(continuation)

CE Grounds (LF4) Five-Year Review Interview(s)

Information gathered from interviews during the site inspection may be key to understanding site status. Interviews should be conducted with various individuals or groups, including the operation and maintenance (O&M) site manager, O&M staff, local regulatory authorities and response agencies, community action groups or associations, site neighbors, and other stakeholders. Written documentation of the interview should briefly summarize the discussion, address any problems or successes with the implementation of the remedy, and provide suggestions for future reference. Forms to use during interviews are provided at the end of this appendix.

Building 10879 and associated storage yard which overlies LF4 is used by CE Grounds and Roads for equipment and materials storage and equipment maintenance.

INTERVIEW DOCUMENTATION FORM

The following is a list of individual(s) interviewed for this five-year review. See the attached contact record(s) for a detailed summary of the interviews.

Name	Title/Position	Organization	Date
1 Harold Honeycutt	Supervisor PE6	88CES/CEOHP	19 Sep 19
2 David Blair	Operations Manager	88FSS	09-19-2019

INTERVIEW RECORD

Site Name: Wright-Patterson AFB, Ohio		**EPA ID No.:** OH7571724312
Subject: 5th Five-Year Record of Decision Review	**Time:**	**Date:**
Type: __ Telephone _X_ Visit __ Other **Location of Visit:** Bldg. 10879		__ Incoming __ Outgoing

Contact Made By:

Name: Greg Plamondon	**Title:** Project Geologist	**Organization:** APTIM

Individual Contacted:

Name: Mr. Harold Honeycutt	**Title:** 1000	**Organization:** CE Grounds Maintenance
Telephone No: (937) 257-2473 **Fax No:** **E-Mail Address:**	**Street Address:** **City, State, Zip:**	

Summary Of Conversation

1. Have there been any spills or leaks at the site?

(1) None
(2) None

2. Have there been any excavations or other intrusive work done at the site?

(1) None
(2) None

3. Are you aware that all excavations and other boring within the landfill must first be approved by WPAFB Environmental Restoration [Ms. Treva Bashore – (937) 257-6391]?

(1) Yes
(2) Yes

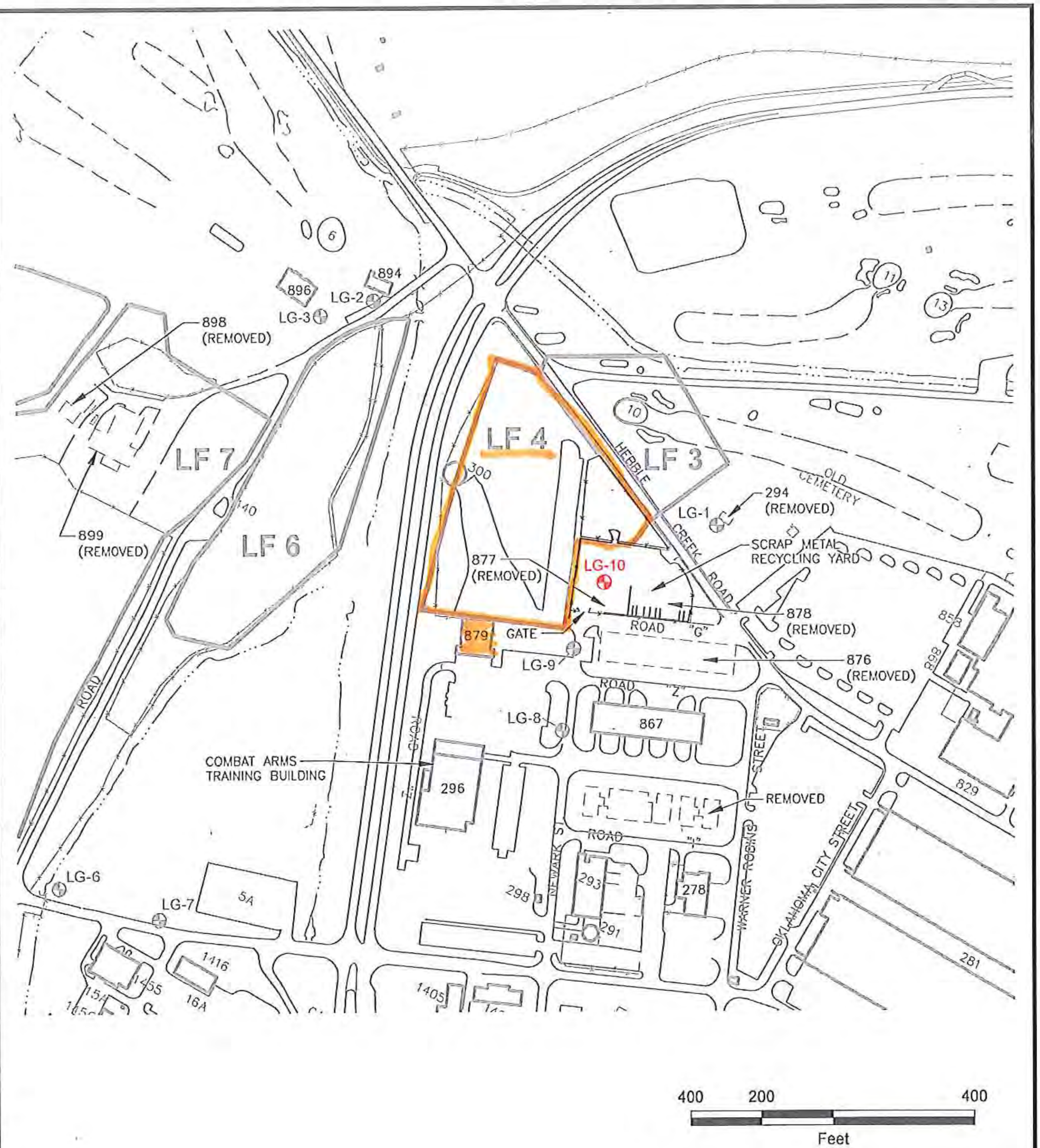
4. Has there been any noticeable vapors or seeps at the site?

(1) None - 879 (2) Recycle - Yes by gate - bubbles in puddle

5. Do you have any comments, suggestions, or recommendations regarding the site's management or operation?

(1) None

(2) None



Legend

LG-10 Landfill Gas Monitoring Location

LG-1 Landfill Gas Monitoring Locations abandoned

IRP Sites (locations approximate)

OU Operable Unit

Note:
For IRP Site acronyms, please refer to Figures 1-1 and 1-2

N

WRIGHT-PATTERSON
AIR FORCE BASE,
OHIO

2018 INTERIM LTM REPORT

FIGURE NUMBER 6-1

OU4 LANDFILL GAS MONITORING LOCATIONS

APTIM

APTIM
5050 Section Avenue
Cincinnati, Ohio 45212

M. Najar - G:\WPAFB\GIS_Documents\Project_Maps\147383.EK018140\DWGs\WPAFB_2018_INT_LTM_06-1_OU4_LF_Gas_Mon_Locs.dwg - Wed, 8/15/2018 - 4:25 PM

Insurance, Taxes and Licenses - This includes items such as liability and sudden and accidental insurance, real estate taxes on purchased land or right-of-way, licensing fees for certain technologies, and permit renewal and reporting costs.

Other Costs - This includes all other items which do not fit into any of the above categories.

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Please note that "O&M" is referred to throughout this checklist. At sites where Long-Term Response Actions are in progress, O&M activities may be referred to as "system operations" since these sites are not considered to be in the O&M phase while being remediated under the Superfund program.

Five-Year Review Site Inspection Checklist ~~(Template)~~

(Working document for site inspection. Information may be completed by hand and attached to the Five-Year Review report as supporting documentation of site status. "N/A" refers to "not applicable.")

I. SITE INFORMATION	
Site name: LFs 8 & 10	**Date of inspection:** 10 Oct, 2019
Location and Region: WPAFB, OH	**EPA ID:** OH 7571724312
Agency, office, or company leading the five-year review: Army Corp. of Engineers	**Weather/temperature:** Clear - partly cloudy, mid-70's °F
Remedy Includes: (Check all that apply) ☒ Landfill cover/containment ☒ Access controls ☒ Institutional controls ☒ Groundwater pump and treatment ☐ Surface water collection and treatment ☒ Other Landfill gas collection system	☐ Monitored natural attenuation ☒ Groundwater containment ☐ Vertical barrier walls
Attachments: ☐ Inspection team roster attached	☒ Site map attached See report.
II. INTERVIEWS (Check all that apply)	
1. **O&M site manager** Justin Hall (Name) Site Supervisor (Title) 18 Sept, 2019 (Date) Interviewed ☐ at site ☐ at office ☒ by phone Phone no. (937) 475-4652 Problems, suggestions; ☒ Report attached w/ interview form	

2. **O&M staff** Same as #1 ______ ______
Name Title Date
Interviewed ☐ at site ☐ at office ☐ by phone Phone no. ______
Problems, suggestions; ☐ Report attached ______

______

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency Ohio EPA
Contact Dwayne Tolson ______ ______ ______
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached ______

______

Agency ______
Contact ______ ______ ______ ______
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached ______

______

Agency ______
Contact ______ ______ ______ ______
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached ______

______

Agency ______
Contact ______ ______ ______ ______
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached ______

______

4. **Other interviews** (optional) ☒ Report attached.

See interview questions & answers.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**
☐ O&M manual ☐ Readily available ☐ Up to date ☐ N/A
☐ As-built drawings ☐ Readily available ☐ Up to date ☐ N/A
☒ Maintenance logs ☒ Readily available ☒ Up to date ☐ N/A
Remarks Maint. logs are presented in Monthly Operating Reports (MORs)

2. **Site-Specific Health and Safety Plan** ☐ Readily available ☐ Up to date ☒ N/A
☐ Contingency plan/emergency response plan ☐ Readily available ☐ Up to date ☒ N/A
Remarks

3. **O&M and OSHA Training Records** ☐ Readily available ☐ Up to date ☒ N/A
Remarks

4. **Permits and Service Agreements**
☐ Air discharge permit ☐ Readily available ☐ Up to date ☐ N/A
☒ Effluent discharge ☒ Readily available ☒ Up to date ☐ N/A
☒ Waste disposal, POTW ☐ Readily available ☐ Up to date ☐ N/A
☐ Other permits ☐ Readily available ☐ Up to date ☐ N/A
Remarks Effluent discharge to City of Fairborn publicly owned treatment works, no treatment at LFs 8&10

5. **Gas Generation Records** ☒ Readily available ☒ Up to date ☐ N/A
Remarks

6. **Settlement Monument Records** ☒ Readily available ☐ Up to date ☐ N/A
Remarks

7. **Groundwater Monitoring Records** ☒ Readily available ☒ Up to date ☐ N/A
Remarks

8. **Leachate Extraction Records** ☒ Readily available ☒ Up to date ☐ N/A
Remarks

9. **Discharge Compliance Records**
☐ Air ☐ Readily available ☐ Up to date ☒ N/A
☐ Water (effluent) ☐ Readily available ☐ Up to date ☒ N/A
Remarks

10. **Daily Access/Security Logs** ☐ Readily available ☐ Up to date ☒ N/A
Remarks

IV. O&M COSTS

1. **O&M Organization**
☐ State in-house ☐ Contractor for State
☐ PRP in-house ☐ Contractor for PRP
☒ Federal Facility in-house ☒ Contractor for Federal Facility
☐ Other ______

2. **O&M Cost Records**
☐ Readily available ☐ Up to date
☐ Funding mechanism/agreement in place
Original O&M cost estimate ______ ☐ Breakdown attached

Total annual cost by year for review period if available

From ______ Date	To ______ Date	______ Total cost	☐ Breakdown attached
From ______ Date	To ______ Date	______ Total cost	☐ Breakdown attached
From ______ Date	To ______ Date	______ Total cost	☐ Breakdown attached
From ______ Date	To ______ Date	______ Total cost	☐ Breakdown attached
From ______ Date	To ______ Date	______ Total cost	☐ Breakdown attached

3. **Unanticipated or Unusually High O&M Costs During Review Period**
Describe costs and reasons:
None for this period.

V. ACCESS AND INSTITUTIONAL CONTROLS ☐ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☒ Location shown on site map ☒ Gates secured ☐ N/A
Remarks P/s refer to report map Figure 3-1

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A
Remarks See photo log for Source Control Operable Unit

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented	☐ Yes	☒ No	☐ N/A
Site conditions imply ICs not being fully enforced	☐ Yes	☒ No	☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) ____________

Frequency Daily

Responsible party/agency OEPA

Contact Justin Hall / CAM ____________ ____________ ____________

Name Title Date Phone no.

Reporting is up-to-date	☒ Yes	☐ No	☐ N/A
Reports are verified by the lead agency	☒ Yes	☐ No	☐ N/A
Specific requirements in deed or decision documents have been met	☐ Yes	☐ No	☒ N/A
Violations have been reported	☐ Yes	☐ No	☒ N/A

Other problems or suggestions: ☐ Report attached

2. **Adequacy** ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A

Remarks ____________

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☒ No vandalism evident

Remarks ____________

2. **Land use changes on site** ☒ N/A

Remarks ____________

3. **Land use changes off site** ☒ N/A

Remarks ____________

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ☒ Roads adequate ☐ N/A

Remarks ____________

B. Other Site Conditions

Remarks Fencing + gates are in good condition and locked

VII. LANDFILL COVERS ☒Applicable ☐N/A

A. Landfill Surface

1. **Settlement** (Low spots) ☐ Location shown on site map ☐ Settlement not evident
   Areal extent______ Depth______
   Remarks Settling monuments are surveyed periodically

2. **Cracks** ☐ Location shown on site map ☒Cracking not evident
   Lengths______ Widths______ Depths______
   Remarks______

3. **Erosion** ☐ Location shown on site map ☒Erosion not evident
   Areal extent______ Depth______
   Remarks______

4. **Holes** ☐ Location shown on site map ☒Holes not evident
   Areal extent______ Depth______
   Remarks______

5. **Vegetative Cover** ☒Grass ☒Cover properly established ☒No signs of stress
   ☐ Trees/Shrubs (indicate size and locations on a diagram)
   Remarks______

6. **Alternative Cover (armored rock, concrete, etc.)** ☒N/A
   Remarks______

7. **Bulges** ☐ Location shown on site map ☒Bulges not evident
   Areal extent______ Height______
   Remarks______

8.	**Wet Areas/Water Damage** ☐ Wet areas ☐ Ponding ☐ Seeps ☐ Soft subgrade Remarks______	☒ Wet areas/water damage not evident ☐ Location shown on site map ☐ Location shown on site map ☐ Location shown on site map ☐ Location shown on site map	 Areal extent______ Areal extent______ Areal extent______ Areal extent______
9.	**Slope Instability** ☐ Slides Areal extent______ Remarks______	☐ Location shown on site map	☒ No evidence of slope instability
B. Benches	☐ Applicable ☒ N/A (Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)		
1.	**Flows Bypass Bench** Remarks______	☐ Location shown on site map	☒ N/A or okay
2.	**Bench Breached** Remarks______	☐ Location shown on site map	☒ N/A or okay
3.	**Bench Overtopped** Remarks______	☐ Location shown on site map	☒ N/A or okay
C. Letdown Channels	☒ Applicable ☐ N/A (Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)		
1.	**Settlement** Areal extent______ Remarks______	☐ Location shown on site map Depth______	☒ No evidence of settlement
2.	**Material Degradation** Material type______ Remarks______	☐ Location shown on site map Areal extent______	☒ No evidence of degradation
3.	**Erosion** Areal extent______ Remarks______	☐ Location shown on site map Depth______	☒ No evidence of erosion

4.	**Undercutting** ☐ Location shown on site map ☒ No evidence of undercutting Areal extent______________ Depth____________ Remarks______________________________	
5.	**Obstructions** Type____________________ ☒ No obstructions ☐ Location shown on site map Areal extent______________ Size____________ Remarks______________________________	
6.	**Excessive Vegetative Growth** Type____________________ ☒ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow ☐ Location shown on site map Areal extent______________ Remarks______________________________	
D. Cover Penetrations ☒ Applicable ☐ N/A		
1.	**Gas Vents** ☐ Active ☐ Passive ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A Remarks______________________________	
2.	**Gas Monitoring Probes** ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A Remarks______________________________	
3.	**Monitoring Wells** (within surface area of landfill) ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A Remarks______________________________	
4.	**Leachate Extraction Wells** ☒ Properly secured/locked ☒ Functioning ☐ Routinely sampled ☒ Good condition ☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A Remarks______________________________	
5.	**Settlement Monuments** ☐ Located ☒ Routinely surveyed ☐ N/A Remarks______________________________	

E. Gas Collection and Treatment ☒ Applicable ☐ N/A
1. **Gas Treatment Facilities** ☒ Flaring ☐ Thermal destruction ☐ Collection for reuse ☒ Good condition ☐ Needs Maintenance Remarks System ran twice/Week
2. **Gas Collection Wells, Manifolds and Piping** ☒ Good condition ☐ Needs Maintenance Remarks
3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings) ☒ Good condition ☐ Needs Maintenance ☐ N/A Remarks New monitors (April 2019) in-place
F. Cover Drainage Layer ☒ Applicable ☐ N/A
1. **Outlet Pipes Inspected** ☒ Functioning ☐ N/A Remarks
2. **Outlet Rock Inspected** ☒ Functioning ☐ N/A Remarks
G. Detention/Sedimentation Ponds ☐ Applicable ☒ N/A
1. **Siltation** Areal extent ____ Depth ____ ☐ N/A ☐ Siltation not evident Remarks
2. **Erosion** Areal extent ____ Depth ____ ☐ Erosion not evident Remarks
3. **Outlet Works** ☐ Functioning ☐ N/A Remarks
4. **Dam** ☐ Functioning ☐ N/A Remarks

H. Retaining Walls ☐ Applicable ☒ N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement________ Vertical displacement________
Rotational displacement________
Remarks________

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident
Remarks________

I. Perimeter Ditches/Off-Site Discharge ☒ Applicable ☐ N/A

1. **Siltation** ☐ Location shown on site map ☒ Siltation not evident
Areal extent________ Depth________
Remarks________

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A
☒ Vegetation does not impede flow
Areal extent________ Type________
Remarks________

3. **Erosion** ☐ Location shown on site map ☒ Erosion not evident
Areal extent________ Depth________
Remarks________

4. **Discharge Structure** ☐ Functioning ☒ N/A
Remarks________

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. **Settlement** ☐ Location shown on site map ☐ Settlement not evident
Areal extent________ Depth________
Remarks________

2. **Performance Monitoring** Type of monitoring________
☐ Performance not monitored
Frequency________ ☐ Evidence of breaching
Head differential________
Remarks________

IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ Applicable ☐ N/A
A. Groundwater Extraction Wells, Pumps, and Pipelines ☒ Applicable ☐ N/A
1. **Pumps, Wellhead Plumbing, and Electrical** ☒ Good condition ☒ All required wells properly operating ☐ Needs Maintenance ☐ N/A Remarks
2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances** ☒ Good condition ☐ Needs Maintenance Remarks
3. **Spare Parts and Equipment** ☒ Readily available ☒ Good condition ☐ Requires upgrade ☐ Needs to be provided Remarks
B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A
1. **Collection Structures, Pumps, and Electrical** ☐ Good condition ☐ Needs Maintenance Remarks
2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances** ☐ Good condition ☐ Needs Maintenance Remarks
3. **Spare Parts and Equipment** ☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided Remarks

C. Treatment System ☒ Applicable ☐ N/A	
1.	**Treatment Train** (Check components that apply) ☐ Metals removal ☐ Oil/water separation ☐ Bioremediation ☐ Air stripping ☐ Carbon adsorbers ☐ Filters____ ☐ Additive (*e.g.*, chelation agent, flocculent)____ ☐ Others____ ☐ Good condition ☐ Needs Maintenance ☒ Sampling ports properly marked and functional ☐ Sampling/maintenance log displayed and up to date ☒ Equipment properly identified ☐ Quantity of groundwater treated annually____ ☐ Quantity of surface water treated annually____ Remarks Groundwater/leachate collection only, no treatment on-site
2.	**Electrical Enclosures and Panels** (properly rated and functional) ☐ N/A ☒ Good condition ☐ Needs Maintenance Remarks____
3.	**Tanks, Vaults, Storage Vessels** ☐ N/A ☒ Good condition ☐ Proper secondary containment ☐ Needs Maintenance Remarks____
4.	**Discharge Structure and Appurtenances** ☐ N/A ☒ Good condition ☐ Needs Maintenance Remarks____
5.	**Treatment Building(s)** ☒ N/A ☐ Good condition (esp. roof and doorways) ☐ Needs repair ☐ Chemicals and equipment properly stored Remarks____
6.	**Monitoring Wells** (pump and treatment remedy) ☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition ☒ All required wells located ☐ Needs Maintenance ☐ N/A Remarks____
D. Monitoring Data	
1.	Monitoring Data ☒ Is routinely submitted on time ☒ Is of acceptable quality
2.	Monitoring data suggests: ☒ Groundwater plume is effectively contained ☒ Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ All required wells located ☐ Needs Maintenance ☒ N/A
Remarks

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

Landfill caps and extraction wells are in good condition and functioning as designed.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

Sites are inspected daily. Water levels to verify extraction well operation is conducted monthly.

C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future. None observed.
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. Landfill gas monitoring could be reduced from semi-annually to annually at most of the network locations.

Insurance, Taxes and Licenses - This includes items such as liability and sudden and accidental insurance, real estate taxes on purchased land or right-of-way, licensing fees for certain technologies, and permit renewal and reporting costs.

Other Costs - This includes all other items which do not fit into any of the above categories.

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Please note that "O&M" is referred to throughout this checklist. At sites where Long-Term Response Actions are in progress, O&M activities may be referred to as "system operations" since these sites are not considered to be in the O&M phase while being remediated under the Superfund program.

Five-Year Review Site Inspection Checklist ~~(Template)~~

(Working document for site inspection. Information may be completed by hand and attached to the Five-Year Review report as supporting documentation of site status. "N/A" refers to "not applicable.")

I. SITE INFORMATION	
Site name: LF5	Date of inspection: 10 Oct 2019
Location and Region: WPAFB, OH	EPA ID: OH7571724312
Agency, office, or company leading the five-year review: Army Corp of Engineers	Weather/temperature: Partly cloudy, mild, mid-70's °F
Remedy Includes: (Check all that apply) ☒ Landfill cover/containment ☒ Access controls ☒ Institutional controls ☒ Groundwater pump and treatment ☐ Surface water collection and treatment ☐ Other ______	☒ Monitored natural attenuation ☒ Groundwater containment ☐ Vertical barrier walls
Attachments: ☐ Inspection team roster attached	☒ Site map attached See report
II. INTERVIEWS (Check all that apply)	
1. O&M site manager Justin Hall (Name) Site Supervisor (Title) 10 Oct. 2019 (Date) Interviewed ☐ at site ☐ at office ☒ by phone Phone no. (937) 475-4652 Problems, suggestions; ☒ Report attached w/ interview form	

2. **O&M staff** Same as #1 ______ ______
Name Title Date
Interviewed ☐ at site ☐ at office ☐ by phone Phone no. ______
Problems, suggestions; ☐ Report attached ______

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency Ohio EPA
Contact Dwayne Tolson ______ ______ ______
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached ______

Agency ______
Contact ______ ______ ______ ______
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached ______

Agency ______
Contact ______ ______ ______ ______
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached ______

Agency ______
Contact ______ ______ ______ ______
Name Title Date Phone no.
Problems; suggestions; ☐ Report attached ______

4. **Other interviews** (optional) ☒ Report attached.

See interview record

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)				
1. **O&M Documents**				
	☐ O&M manual	☐ Readily available	☐ Up to date	☐ N/A
	☐ As-built drawings	☐ Readily available	☐ Up to date	☐ N/A
	☒ Maintenance logs	☒ Readily available	☒ Up to date	☐ N/A
	Remarks Maint. logs are presented in monthly operating reports (MOR's)			
2. **Site-Specific Health and Safety Plan**		☐ Readily available	☐ Up to date	☒ N/A
	☐ Contingency plan/emergency response plan	☐ Readily available	☐ Up to date	☒ N/A
	Remarks			
3. **O&M and OSHA Training Records**		☐ Readily available	☐ Up to date	☒ N/A
	Remarks			
4. **Permits and Service Agreements**				
	☐ Air discharge permit	☐ Readily available	☐ Up to date	☐ N/A
	☒ Effluent discharge	☒ Readily available	☐ Up to date	☐ N/A
	☐ Waste disposal, POTW	☐ Readily available	☐ Up to date	☐ N/A
	☐ Other permits	☐ Readily available	☐ Up to date	☐ N/A
	Remarks Effluent discharged to Lowe Twin Lake, NPDES Sampling results available			
5. **Gas Generation Records**		☐ Readily available	☐ Up to date	☒ N/A
	Remarks Passive venting			
6. **Settlement Monument Records**		☐ Readily available	☐ Up to date	☒ N/A
	Remarks Not reviewed			
7. **Groundwater Monitoring Records**		☒ Readily available	☐ Up to date	☐ N/A
	Remarks LTM Program annual reports			
8. **Leachate Extraction Records**		☒ Readily available	☒ Up to date	☐ N/A
	Remarks Analyzed monthly			
9. **Discharge Compliance Records**				
	☐ Air	☐ Readily available	☐ Up to date	☐ N/A
	☒ Water (effluent)	☒ Readily available	☒ Up to date	☐ N/A
	Remarks			
10. **Daily Access/Security Logs**		☒ Readily available	☒ Up to date	☐ N/A
	Remarks			

IV. O&M COSTS

1. **O&M Organization**
☐ State in-house ☐ Contractor for State
☐ PRP in-house ☐ Contractor for PRP
☒ Federal Facility in-house ☒ Contractor for Federal Facility
☐ Other CAM

2. **O&M Cost Records**
☐ Readily available ☐ Up to date
☐ Funding mechanism/agreement in place
Original O&M cost estimate__________ ☐ Breakdown attached

Total annual cost by year for review period if available

From_______ (Date) To_______ (Date) _______ (Total cost) ☐ Breakdown attached
From_______ (Date) To_______ (Date) _______ (Total cost) ☐ Breakdown attached
From_______ (Date) To_______ (Date) _______ (Total cost) ☐ Breakdown attached
From_______ (Date) To_______ (Date) _______ (Total cost) ☐ Breakdown attached
From_______ (Date) To_______ (Date) _______ (Total cost) ☐ Breakdown attached

3. **Unanticipated or Unusually High O&M Costs During Review Period**
Describe costs and reasons: Sand in the well casing, grinding of pump impellers.

V. ACCESS AND INSTITUTIONAL CONTROLS ☐ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☒ Location shown on site map ☒ Gates secured ☐ N/A
Remarks See report figure for fencing

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A
Remarks In place on gates + fencing, photo log

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented	☐ Yes	☒ No	☐ N/A
Site conditions imply ICs not being fully enforced	☐ Yes	☒ No	☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) __________
Frequency Daily
Responsible party/agency OEPA
Contact Justin Hall / CAM __________ __________ __________
Name Title Date Phone no.

Reporting is up-to-date	☒ Yes	☐ No	☐ N/A
Reports are verified by the lead agency	☒ Yes	☐ No	☐ N/A
Specific requirements in deed or decision documents have been met	☐ Yes	☐ No	☒ N/A
Violations have been reported	☐ Yes	☐ No	☒ N/A

Other problems or suggestions: ☐ Report attached

2. **Adequacy** ☒ ICs are adequate ☐ ICs are inadequate ☐ N/A
Remarks

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ☒ No vandalism evident
Remarks

2. **Land use changes on site** ☒ N/A
Remarks

3. **Land use changes off site** ☒ N/A
Remarks

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. **Roads damaged** ☐ Location shown on site map ☒ Roads adequate ☐ N/A
Remarks

B. Other Site Conditions

Remarks
Fencing and gates are in good condition + locked.
LF5 has recently been mowed.

VII. LANDFILL COVERS ☒ Applicable ☐ N/A

A. Landfill Surface

1. **Settlement** (Low spots) ☐ Location shown on site map ☒ Settlement not evident
Areal extent______ Depth______
Remarks Photo log of LF top.

2. **Cracks** ☐ Location shown on site map ☒ Cracking not evident
Lengths______ Widths______ Depths______
Remarks______

3. **Erosion** ☐ Location shown on site map ☒ Erosion not evident
Areal extent______ Depth______
Remarks______

4. **Holes** ☐ Location shown on site map ☒ Holes not evident
Areal extent______ Depth______
Remarks______

5. **Vegetative Cover** ☒ Grass ☒ Cover properly established ☒ No signs of stress
☐ Trees/Shrubs (indicate size and locations on a diagram)
Remarks______

6. **Alternative Cover (armored rock, concrete, etc.)** ☒ N/A
Remarks______

7. **Bulges** ☐ Location shown on site map ☒ Bulges not evident
Areal extent______ Height______
Remarks______

8.	**Wet Areas/Water Damage**	☒ Wet areas/water damage not evident
	☐ Wet areas	☐ Location shown on site map Areal extent_____
	☐ Ponding	☐ Location shown on site map Areal extent_____
	☐ Seeps	☐ Location shown on site map Areal extent_____
	☐ Soft subgrade	☐ Location shown on site map Areal extent_____
	Remarks_____	
9.	**Slope Instability** ☐ Slides	☐ Location shown on site map ☒ No evidence of slope instability
	Areal extent_____	
	Remarks_____	

B. Benches ☐ Applicable ☒ N/A

(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1.	**Flows Bypass Bench**	☐ Location shown on site map ☒ N/A or okay
	Remarks_____	
2.	**Bench Breached**	☐ Location shown on site map ☒ N/A or okay
	Remarks_____	
3.	**Bench Overtopped**	☐ Location shown on site map ☒ N/A or okay
	Remarks_____	

C. Letdown Channels ☐ Applicable ☒ N/A

(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1.	**Settlement**	☐ Location shown on site map ☒ No evidence of settlement
	Areal extent_____	Depth_____
	Remarks_____	
2.	**Material Degradation**	☐ Location shown on site map ☒ No evidence of degradation
	Material type_____	Areal extent_____
	Remarks_____	
3.	**Erosion**	☐ Location shown on site map ☒ No evidence of erosion
	Areal extent_____	Depth_____
	Remarks_____	

4.	**Undercutting** ☐ Location shown on site map ☒ No evidence of undercutting Areal extent______ Depth______ Remarks______
5.	**Obstructions** Type______ ☒ No obstructions ☐ Location shown on site map Areal extent______ Size______ Remarks______
6.	**Excessive Vegetative Growth** Type______ ☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow ☐ Location shown on site map Areal extent______ Remarks______
D.	**Cover Penetrations** ☐ Applicable ☐ N/A
1.	**Gas Vents** ☐ Active ☒ Passive ☒ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☒ Good condition ☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A Remarks______
2.	**Gas Monitoring Probes** ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ Evidence of leakage at penetration ☐ Needs Maintenance ☒ N/A Remarks______
3.	**Monitoring Wells** (within surface area of landfill) ☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition ☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A Remarks______
4.	**Leachate Extraction Wells** ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ Evidence of leakage at penetration ☐ Needs Maintenance ☒ N/A Remarks______
5.	**Settlement Monuments** ☐ Located ☐ Routinely surveyed ☐ N/A Remarks Not observed

E. Gas Collection and Treatment	☐ Applicable ☒ N/A
1. **Gas Treatment Facilities** ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse ☐ Good condition ☐ Needs Maintenance Remarks______	
2. **Gas Collection Wells, Manifolds and Piping** ☐ Good condition ☐ Needs Maintenance Remarks______	
3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings) ☐ Good condition ☐ Needs Maintenance ☐ N/A Remarks______	
F. Cover Drainage Layer	☐ Applicable ☐ N/A
1. **Outlet Pipes Inspected** ☒ Functioning ☐ N/A Remarks______	
2. **Outlet Rock Inspected** ☒ Functioning ☐ N/A Remarks______	
G. Detention/Sedimentation Ponds	☐ Applicable ☐ N/A
1. **Siltation** Areal extent______ Depth______ ☒ N/A ☐ Siltation not evident Remarks______	
2. **Erosion** Areal extent______ Depth______ ☐ Erosion not evident Remarks______	
3. **Outlet Works** ☐ Functioning ☐ N/A Remarks______	
4. **Dam** ☐ Functioning ☐ N/A Remarks______	

H. Retaining Walls ☐ Applicable ☒ N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident
Horizontal displacement__________ Vertical displacement__________
Rotational displacement__________
Remarks__________

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident
Remarks__________

I. Perimeter Ditches/Off-Site Discharge ☒ Applicable ☐ N/A

1. **Siltation** ☐ Location shown on site map ☒ Siltation not evident
Areal extent__________ Depth__________
Remarks__________

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A
☒ Vegetation does not impede flow
Areal extent__________ Type__________
Remarks__________

3. **Erosion** ☐ Location shown on site map ☒ Erosion not evident
Areal extent__________ Depth__________
Remarks__________

4. **Discharge Structure** ☐ Functioning ☒ N/A
Remarks__________

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

1. **Settlement** ☐ Location shown on site map ☐ Settlement not evident
Areal extent__________ Depth__________
Remarks__________

2. **Performance Monitoring** Type of monitoring__________
☐ Performance not monitored
Frequency__________ ☐ Evidence of breaching
Head differential__________
Remarks__________

IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ Applicable ☐ N/A
A. Groundwater Extraction Wells, Pumps, and Pipelines ☒ Applicable ☐ N/A
1. **Pumps, Wellhead Plumbing, and Electrical** ☒ Good condition ☒ All required wells properly operating ☐ Needs Maintenance ☐ N/A Remarks EW-1 operating as disigned
2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances** ☒ Good condition ☐ Needs Maintenance Remarks
3. **Spare Parts and Equipment** ☒ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided Remarks
B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ☒ N/A
1. **Collection Structures, Pumps, and Electrical** ☐ Good condition ☐ Needs Maintenance Remarks
2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances** ☐ Good condition ☐ Needs Maintenance Remarks
3. **Spare Parts and Equipment** ☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided Remarks

C. Treatment System ☒ Applicable ☐ N/A	
1.	**Treatment Train** (Check components that apply) ☐ Metals removal ☐ Oil/water separation ☐ Bioremediation ☒ Air stripping ☐ Carbon adsorbers ☐ Filters____ ☐ Additive (*e.g.*, chelation agent, flocculent)____ ☐ Others____ ☒ Good condition ☐ Needs Maintenance ☒ Sampling ports properly marked and functional ☐ Sampling/maintenance log displayed and up to date ☐ Equipment properly identified ☒ Quantity of groundwater treated annually____ ☐ Quantity of surface water treated annually____ Remarks GWTS new Dec. 2015
2.	**Electrical Enclosures and Panels** (properly rated and functional) ☐ N/A ☒ Good condition ☐ Needs Maintenance Remarks____
3.	**Tanks, Vaults, Storage Vessels** ☒ N/A ☐ Good condition ☐ Proper secondary containment ☐ Needs Maintenance Remarks____
4.	**Discharge Structure and Appurtenances** ☐ N/A ☒ Good condition ☐ Needs Maintenance Remarks____
5.	**Treatment Building(s)** ☐ N/A ☒ Good condition (esp. roof and doorways) ☐ Needs repair ☐ Chemicals and equipment properly stored Remarks____
6.	**Monitoring Wells** (pump and treatment remedy) ☒ Properly secured/locked ☐ Functioning ☒ Routinely sampled ☐ Good condition ☒ All required wells located ☐ Needs Maintenance ☐ N/A Remarks____
D. Monitoring Data	
1.	Monitoring Data ☒ Is routinely submitted on time ☒ Is of acceptable quality
2.	Monitoring data suggests: ☒ Groundwater plume is effectively contained ☒ Contaminant concentrations are declining

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)
   ☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition
   ☒ All required wells located ☐ Needs Maintenance ☐ N/A
   Remarks For FAA-A only

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

The new GWTS (Dec. 2015) is a much more efficient and cost effective treatment system than the old system. The LF is well maintained

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

Based on quarterly water level monitoring, extraction well EW-1 is being nearly continuously kept in operation and maintains hydraulic containment across the LF5 western boundary.

C.	Early Indicators of Potential Remedy Problems
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future.
	None reported

D.	Opportunities for Optimization
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.
	None observed.

CAM Management and Services
Remediation & Construction Services
Dayton Project Office
13th & G Streets, Area B
Wright-Patterson AFB, OH 45433

Quarterly Landfills 1-7, 9 and 11 and Spill Site 11 Recovery System Performance Report # 27
July - September 2019

Contract No. FA8903-09-D-8588

Prepared for
Wright-Patterson Air Force Base
Air Force Civil Engineer Center (AFCEC/CZO)
Environmental Restoration Program
Wright-Patterson Air Force Base, Ohio 45322

Prepared by
CAM Management and Services

October 29, 2019

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APPENDIX

1.0 INTRODUCTION

Versar Inc. has retained CAM Management and Services (CAM) under Contract No. FA8903-09-D-8588 to provide Operations and Maintenance (O&M) of Spill Site 11 and Landfills 1, 2, 3, 4, 5, 6, 7, 9 and 11. This Quarterly System Performance Report documents O&M activities performed during the reporting period of 01 April 2019 through 30 June 2019, and incorporates the inspection notes generated during multiple visits to each landfill and Spill Site 11 during the reporting period. The quarterly inspections were performed from 17 September 2019 thru 30 September 2019. The landfill inspection forms are included in Appendix A. Photographic documentation is provided for each of the landfills and for Spill Site 11 at the end of their respective sections. Figures 1 and 2 provide aerial maps showing the locations and site boundaries for Landfills 1, 2, 3, 4, 5, 6, 7, 9, 11, and Spill Site 11.

The monitoring requirements for each of the landfills and Spill Site 11 (including preventive and corrective maintenance requirements) are provided in the Operation and Maintenance Manual for Landfills 1,2,5,6,7,9, 11, and Spill Site 11 at Wright-Patterson Air Force Base (Tetra Tech, Inc., 2008). Landfills 3 and 4 are also included in the report based on the requirements in the Final Optimized Exit Strategy Performance Plan, OU3 Landfill 11, OU4 Landfills 3, 4, 6 and 7, OU5 Landfill 5, OU6 Landfills 1 and 2, OU7 Landfill 9, Wright-Patterson AFB, Ohio (Versar, 2013). Conformance with the O&M requirements is discussed within each site-specific section of this report. The requirements include inspection, maintenance, and repair of landfill cover systems including soil erosion or exposure of cover system, drainage features, eradication of burrowing animals, and mowing of the vegetative cover. Minor corrective maintenance is performed on an as-needed basis.

During the inspections, the following observations were made regarding the signs:

Landfills 2, 3, 4, 5, 6, 7, 9, and 11 have signs posted on perimeter fences and gates (or pole mounted) and the information on the signs is accurate. These signs are visible, secured to proper locations, and in good repair. Currently, Landfill 1, does not have a posted sign. Landfills 1, 3, and 4 have no requirements for signage.

2.0 LANDFILL 1

Landfill 1 is located inside the WPAFB fence, east of the off-ramp from Harshman Road to Springfield Pike, approximately 500 feet south of the Harshman Road/Springfield Pike interchange. The landfill measures approximately four acres and straddles an asphalt road (the perimeter road) at the west edge of an open, grass-covered field. The field surrounds Landfill 1 to the northeast, east, and southeast. To the north is Springfield Pike, beyond which are commercial and residential properties. To the east is the Air Force Museum. To the south is Harshman Road, which is a divided highway at this location. CAM visited Landfill 1 for the quarterly inspection on 17 September 2019. The purpose of this visit was to determine if:

- The landfill covers are subsiding;
- Improvements are required to address erosion from stormwater runoff;
- Turf growth is inhibiting drainage;
- The integrity of the covers or slopes is being affected by burrowing animals; or
- The vegetative layer requires fertilizing or liming.

This visit consisted of an inspection of the vegetation layer for subsidence, side slopes, drainage features, and the perimeter fence. Multiple photographs were taken to document this task. There was no evidence of burrowing animals during this quarter.

2.1 VEGETATION LAYER

The quarterly inspection showed no animal borrows on the landfill cap. No erosion or bare spots were noticed. The landfill cover was in good condition. The Air Force mows Landfill 1 regularly.

2.2 SIDE SLOPES

The quarterly inspection showed no signs of erosion or stressed areas.

2.3 DRAINAGE SYSTEMS

The quarterly inspections showed no signs of ponding on the landfill or surrounding areas. The drainage systems are working properly and as designed.

2.4 PERIMETER FENCE

The perimeter fence was in good condition. No signs of damage were noted.

2.5 CORRECTIVE MAINTENANCE

No corrective maintenance was required this quarter.

2.6 CONCLUSIONS AND RECOMMENDATIONS

The landfill is in good condition. No repairs are necessary.

LANDFILL 1 PHOTOGRAPHS

Landfill 1 Quarterly Inspection

Photograph # 1 Landfill Vegetation

Landfill 1 Quarterly Inspection

Photograph # 2 Landfill Perimeter Fence and Access Road

Landfill 1 Quarterly Inspection

Photograph # 3 Landfill Vegetation

3.0 LANDFILL 2

Landfill 2 is located approximately one mile southwest of Landfill 1, on the west side of Harshman Road, across from the National Guard Facility. It is an irregularly shaped, 23-acre parcel. It is bounded to the north by an apartment complex, to the east by Harshman Road, beyond which are commercial properties, to the south by Lily Creek, beyond which is an open, grass-covered field, and to the west by wooded land, beyond which are residential properties. CAM visited Landfill 2 for the quarterly inspection on 17 September 2019. The purpose of this visit was to determine if:

- The landfill covers are subsiding;
- Improvements are required to address erosion from stormwater runoff;
- Turf growth is inhibiting drainage; or
- The integrity of the covers or slopes is being affected by burrowing animals; or
- The vegetative layer requires fertilizing or liming.

This visit consisted of an inspection of the vegetation layer, side slopes, drainage features, and the perimeter fence. Multiple photographs were taken to document this task. There was no evidence of burrowing animals during this quarter.

3.1 VEGETATION LAYER

The vegetation was in good condition with minor bare areas. No ponding was observed on the landfill.

3.2 SIDE SLOPES

No erosion or bare spots were observed on the side slopes.

3.3 DRAINAGE SYSTEMS

The landfill was diverting water to swales and away from the landfill adequately. The drainage systems are working properly and as designed.

3.4 PERIMETER FENCE

The perimeter fence was in good condition. The locks and gates were functioning properly.

3.5 CORRECTIVE MAINTENANCE

Vegetation layer mowed. Performed weed eating on perimeter fence line.

3.6 CONCLUSIONS AND RECOMMENDATIONS

The landfill is in good condition. No repairs are necessary.

LANDFILL 2 PHOTOGRAPHS

Landfill 2 Quarterly Inspection

Photograph # 1 Landfill Access Fence and Sign

Landfill 2 Quarterly Inspection

Photograph # 2 Landfill Perimeter Fence

4.0 LANDFILL 3

Landfill 3 is northeast of the intersection of Novick and Hebble Creek Roads and covers 2.9 acres. The landfill operated as a surface dump and burn operation and it was reported to have accepted general refuse from Areas A and B. The landfill underlies the tenth green of the Military Golf Course and supports the growth of grass and small trees. Hebble Creek flows along a portion of the northern boundary of the site. CAM visited Landfill 3 for the quarterly inspection on 17 September 2019. The landfill was inspected for soil erosion or exposure of cover system, drainage features, presence of burrowing animals, and condition of the vegetative cover (e.g., to determine if vegetative layer requires fertilizing or liming and for subsidence). WPAFB Golf Course performs the maintenance and mowing for Landfill 3. The purpose of this visit was to determine if:

- The landfill covers are subsiding;
- Condition of vegetation layer, side slopes, and drainage features;
- Ponding or erosion is present;
- The integrity of the covers or slopes is being affected by burrowing animals;

4.1 CORRECTIVE MAINTENANCE

No corrective maintenance was required this quarter. The Air Force mows Landfill 3 regularly.

4.2 CONCLUSIONS AND RECOMMENDATIONS

The landfill is in good condition. The drainage systems are working properly and as designed.

LANDFILL 3 PHOTOGRAPHS

Landfill 3 Quarterly Inspection

Photograph # 1 Landfill Sign

Landfill 3 Quarterly Inspection

Photograph # 2 Landfill 3

Landfill 3 Quarterly Inspection

Photograph # 3 Landfill 3

5.0 LANDFILL 4

Landfill 4 is a paved and fenced area covering 6.4 acres that WPAFB Civil Engineering uses as an equipment storage area. There is a salt storage dome (Building 300) located on the western edge of the landfill. Historical aerial photographs (1946) show that part of Landfill 4 was a water-filled gravel pit, approximately an acre in size. Hebble Creek is north of the landfill, and an unnamed tributary to Hebble Creek parallels the southwest boundary of the landfill on the opposite side of Skeel Avenue. CAM visited Landfill 4 for the quarterly inspection on 17 September 2019. The landfill was inspected for soil erosion or exposure of cover system, drainage features, presence of burrowing animals, and condition of the vegetative cover (e.g., to determine if vegetative layer requires fertilizing or liming and for subsidence). WPAFB performs the maintenance for Landfill 4. The purpose of this visit was to determine if:

- The landfill covers are subsiding;
- Ponding or erosion is present;
- The integrity of the covers or slopes is being affected by burrowing animals;
- Condition of perimeter access road and fence.

5.1 CORRECTIVE MAINTENANCE

No corrective maintenance was required this quarter. The drainage systems are working properly and as designed. Mowing is not required because Landfill 4 is covered with gravel.

5.2 CONCLUSIONS AND RECOMMENDATIONS

The landfill is in good condition. No repairs are necessary.

LANDFILL 4 PHOTOGRAPHS

Landfill 4 Quarterly Inspection

Photograph # 1 Landfill Sign

Landfill 4 Quarterly Inspection

Photograph # 2 Landfill Fence Line

Landfill 4 Quarterly Inspection

Photograph # 3 Landfill Staging Area

6.0 LANDFILL 5

Landfill 5 is a 23-acre site located in Area A, about 2,000 feet to the southwest of the main runway. It is situated parallel to Hebble Creek Road, east of the road. It is located north of the Twin Lakes and is bordered by Prairie Road to the south. CAM visited Landfill 5 for the quarterly inspection on 18 September 2019. The purpose of this visit was to determine if:

- The landfill covers are subsiding;
- Improvements are required to address erosion from stormwater runoff;
- Turf growth is inhibiting drainage;
- The integrity of the covers or slopes is being affected by burrowing animals;
- Rock check dams are in place and functioning properly;
- The gas venting system is operational;
- Fences, gates, signs and locks are in place and/or operational;
- Monitoring wells have been disturbed; or
- The vegetative layer requires fertilizing or liming.

This visit consisted of an inspection of the vegetation layer for subsidence, side slopes, drainage systems, gas venting systems, perimeter fence, gates, locks, signs, rock check dams, access roads, and monitoring wells. Multiple photographs were taken to document this task.

6.1 VEGETATION LAYER

The quarterly inspection showed that the vegetation cover was in good condition. No bare areas were observed on the landfill.

6.2 SIDE SLOPES

The quarterly inspection showed no sign of erosion. The side slopes were in good condition with no stressed or bare areas.

6.3 DRAINAGE SYSTEMS

The quarterly inspection showed no signs of ponding along the landfill. The down drains on the landfill are clean and clear of all obstructions. The drainage systems are working properly and as designed.

6.4 GAS VENTING SYSTEM

The quarterly inspection showed no damage to the gas vents. No bird nests were observed.

6.5 PERIMETER FENCE, GATES, LOCKS AND SIGNS

The quarterly inspection showed the fence was in good condition. The gates and locks are operational and show no signs of damage.

6.6 EROSION ROCK CHECK DAMS

The erosion rock check dams are intact and functioning as designed.

6.7 PERIMETER ACCESS ROADS

The perimeter access road is in good condition.

6.8 MONITORING WELLS

The monitoring wells around Landfill 5 appear to be in good condition. No signs of vehicle collision or physical instability were observed. All monitoring wells on the landfill are clear of vegetative growth and accessible.

6.9 CORRECTIVE MAINTENANCE

The vegetation layer was mowed and weed eating was performed around the vent stacks, rock dams, down drains and perimeter fence line during the week of 23 September 2019.

6.10 CONCLUSIONS AND RECOMMENDATIONS

The landfill is in good condition. No repairs are necessary.

LANDFILL 5 PHOTOGRAPHS

Landfill 5 Quarterly Inspection

Photograph # 1 Landfill Gate and Signs

Landfill 5 Quarterly Inspection

Photograph # 2 Landfill Backside Entrance

Landfill 5 Quarterly Inspection

Photograph # 3 Landfill Vegetation

7.0 LANDFILL 6

Landfill 6 is on the east side of Battle Creek Road and measures approximately 14.5 acres. It is bounded to the northwest by woodland, to the southwest by the Twin Base Golf Course, to the southeast by an open field, and to the northeast by an unnamed tributary to Hebble Creek. Landfill 6 is a grass-covered field that was used by WPAFB Riding Club as a horse pasture. CAM visited Landfill 6 for the quarterly inspection on 18 September 2019. The purpose of this visit was to determine if:

- The landfill covers are subsiding;
- Improvements are required to address erosion from stormwater runoff;
- Turf growth is inhibiting drainage;
- The integrity of the covers or slopes is being affected by burrowing animals; or
- The vegetative layer requires fertilizing or liming.

This visit consisted of an inspection of the vegetation layer for subsidence, side slopes, and drainage features. Multiple photographs were taken to document this task.

7.1 VEGETATION LAYER

The quarterly inspection showed that the vegetation cover was in good condition. The Air Force mows Landfill 6 regularly.

7.2 SIDE SLOPES

The quarterly inspection showed no signs of erosion. The side slopes were in good condition with no stressed or bare areas.

7.3 DRAINAGE SYSTEMS

The quarterly inspection showed no signs of ponding along the landfill. The drainage systems are working properly and as designed.

7.4 CORRECTIVE MAINTENANCE

No corrective maintenance was required this quarter.

7.5 CONCLUSIONS AND RECOMMENDATIONS

The landfill is in good condition. No repairs are necessary.

LANDFILL 6 PHOTOGRAPHS

Landfill 6 Quarterly Inspection

Photograph # 1 Landfill Sign

Landfill 6 Quarterly Inspection

Photograph # 2 Landfill Fence Line

Landfill 6 Quarterly Inspection

Photograph # 3 Landfill Vegetation

8.0 LANDFILL 7

Landfill 7 is on the west side of Battle Creek Road and measures approximately 18 acres. Landfill 7 is bounded to the northwest by woodland, to the southwest by the Twin Base Golf Course, to the southeast by an open field, and to the northeast by an unnamed tributary to Hebble Creek. CAM visited Landfill 7 for the quarterly inspection on 18 September 2019. The purpose of this visit was to determine if:

- The landfill covers are subsiding;
- Improvements are required to address erosion from stormwater runoff;
- Turf growth is inhibiting drainage;
- The integrity of the covers or slopes is being affected by burrowing animals; or
- The vegetative layer requires fertilizing or liming.

This visit consisted of a thorough inspection of the vegetation layer for subsidence, and side slopes. Multiple photographs were taken to document this task.

8.1 VEGETATION LAYER

The quarterly inspection showed that the vegetation cover was in good condition. No bare areas were observed on the landfill.

8.2 SIDE SLOPES

The quarterly inspection showed no sign of erosion. The side slopes were in good condition with no stressed or bare areas.

8.3 DRAINAGE SYSTEMS

The landfill was diverting the water to the designed swales and away from the landfill adequately. The drainage pipe showed no signs of damage and had no obstructions.

8.4 CORRECTIVE MAINTENANCE

The vegetation layer was mowed and weed eating was performed around the drainage pipe during the week of 16 September 2019.

8.5 CONCLUSIONS AND RECOMMENDATIONS

The landfill is in good condition. No repairs are necessary.

LANDFILL 7 PHOTOGRAPHS

Landfill 7 Quarterly Inspection

Photograph # 1 Landfill Drainage Swale

Landfill 7 Quarterly Inspection

Photograph # 2 Landfill Vegetation

Landfill 7 Quarterly Inspection

Photograph # 3 Landfill Sign

9.0 LANDFILL 9

Landfill 9 is located along the northeast boundary of WPAFB, Area A, southeast of the extended runway, and north of State Route 235 between Haddix Road and Sandhill Road. The landfill is accessed via a gate on the east side of Haddix Road. An approximately 1,000-foot-long access road leads from the gate to the landfill. Landfill 9 measures approximately 14.5 acres and is abutted to the west by farmland and to the north, east, and south by vacant, wooded land. A Dayton Power and Light utility easement roughly parallels the east boundary of the landfill. CAM visited Landfill 9 for the quarterly inspection 20 September 2019. The purpose of this visit was to determine if:

- The landfill covers are subsiding;
- Improvements are required to address erosion from stormwater runoff;
- Repair or improvement of the pond/rip rap channel or haul road are required;
- Turf growth is inhibiting drainage;
- Mowing is necessary;
- Fertilizing or liming is necessary; or
- The integrity of the covers or slopes is being affected by burrowing animals.

The pond/rip rap channel is inspected routinely to assess whether drainage is being impaired by the build-up of silt or debris. The quarterly inspection consisted of an inspection of the vegetation layer for subsidence, side slopes, drainage features, haul road, and survey monuments. Multiple photographs were taken to document this task.

9.1 VEGETATION LAYER

The quarterly inspection showed that the vegetation cover was in good condition. Moderate subsidence is present at Landfill 9. The observed subsidence is cosmetic in nature and does not pose a risk to the landfill cap and does not result in erosion that adversely affects surrounding property. The vegetation layer was mowed this quarter.

9.2 SIDE SLOPES

The quarterly inspection showed no sign of erosion. The side slopes were in good condition with no stressed or bare areas.

9.3 DRAINAGE SYSTEMS

The landfill was diverting the water to the designed swales and away from the landfill adequately. The drainage systems are working properly and as designed.

9.4 PERIMETER ACCESS ROADS

The perimeter access road is in good condition. The haul road showed no signs of erosion or ruts.

9.5 CORRECTIVE MAINTENANCE

The vegetation layer was mowed and weed eating was performed on the rip rap during this quarter.

9.6 CONCLUSIONS AND RECOMMENDATIONS

The landfill is in good condition. No repairs are necessary.

LANDFILL 9 PHOTOGRAPHS

Landfill 9 Quarterly Inspection

Photograph # 1 Landfill Sign

Landfill 9 Quarterly Inspection

Photograph # 2 Landfill Rip-Rap

Landfill 9 Quarterly Inspection

Photograph # 3 Landfill Vegetation

10.0 LANDFILL 11

Landfill 11 is in Area A of WPAFB, between the Mad River and Riverview Road, near the main runway, and measures approximately 16 acres. CAM visited Landfill 11 for the quarterly inspection on 22 September 2019. The purpose of the visit was to determine if:

- The landfill covers are subsiding;
- Improvements are required to address erosion from stormwater runoff;
- Turf growth is inhibiting drainage;
- The integrity of the covers or slopes is being affected by burrowing animals;
- Rock check dams are in place and still functioning properly;
- Fences, gates, signs and locks are in place and/ or operational; or
- The vegetative layer requires fertilizing or liming.

This visit consisted of an inspection of the vegetation layer for subsidence, side slopes, drainage features, and the perimeter fence. Multiple photographs were taken to document this task. Mild to moderate subsidence is present at Landfill 11.

10.1 VEGETATION LAYER

The quarterly inspection showed that the vegetation cover was in good condition.

10.2 SIDE SLOPES

The quarterly inspection showed no sign of erosion. The side slopes were in good condition with no stressed or bare areas.

10.3 DRAINAGE SYSTEMS

The quarterly inspection showed no signs of obstruction or damage on any pipes or wing walls. The landfill and surrounding areas appear to be diverting water to their designed location. The drainage systems are working properly and as designed.

10.4 PERIMETER FENCE

The quarterly inspection showed no damage to the perimeter fence.

10.5 ROCK CHECK DAMS

The quarterly inspection showed the rock check dams are intact and functioning as designed.

10.6 PERIMETER ACCESS ROADS

The quarterly inspection showed the access roads are in good condition.

10.7 RIP RAP

The quarterly inspection showed that the rip rap is in good condition and functioning as designed.

10.8 CORRECTIVE MAINTENANCE

Vegetation layer was mowed during week of 23 September 2019. Performed weed eating and clearing on rip rap.

10.9 CONCLUSIONS AND RECOMMENDATIONS

The landfill is in good condition. No repairs are necessary.

LANDFILL 11 PHOTOGRAPHS

Landfill 11 Quarterly Inspection

Photograph # 1 Landfill Sign

Landfill 11 Quarterly Inspection

Photograph # 2 Landfill Vegetation

Landfill 11 Quarterly Inspection

Photograph # 3 Landfill Rip Rap

11.0 SPILL SITE 11

Spill Site 11 is located on the 46th Test Wing Survivability Flight Test Ranges 2 and 3, Building 94 at 2710 D Street. CAM visited Spill Site 11 for the quarterly inspection on 30 September 2019. Spill Site 11 has a French drain connected to the below ground oil-water separator. The French drain collects groundwater and surface runoff downgradient of former areas of contamination. Groundwater and surface water flows into a trench that drains to a central manhole. A sump pump located in the manhole delivers the water to a below ground oil-water separator to remove free-phase oil. The recovered oil in the below ground oil-water separator and is pumped out periodically (typically once per year). The water from the below ground separator discharges to the stormwater system.

This visit consisted of an inspection of the catch basins, manhole and grating drain concrete, inlet sump, drain line and oil-water separator pit water level, pump and floats, discharge valves and all electrical components. Multiple photographs were taken to document this task.

11.1 CATCH BASINS

The catch basins showed no signs of clogging or obstruction and are in good repair.

11.2 MANHOLE, GRATING AND CONCRETE DRAIN

The manhole, grating and concrete drain are in good condition. Minimal signs of sediment build up were visible in the grating. No signs of clogging or damage were observed. The drainage systems are working properly and as designed.

11.3 INLET SUMP, DRAIN LINE AND SEPARATOR PIT WATER LEVEL

The inlet sump, drain line and separator pit water levels are in good condition. The gravity drain line shows no signs of clogging and is connected to the separator. The water in the observation well is at the proper level.

11.4 PUMP, FLOAT SWITCHES, DISCHARGE VALVE, AND ELECTRICAL COMPONENTS

The pump, float switches, discharge valve and electrical components are in good operating condition. The system was tested and is functioning as designed.

11.5 EXTREME WEATHER CHECK

No extreme weather checks were required this quarter.

11.6 CORRECTIVE MAINTENANCE

No corrective maintenance was required during this quarter.

11.7 CONCLUSIONS AND RECOMMENDATIONS

Spill Site 11 and its components are in good condition. No repairs are necessary. Versar/CAM will install a sign at Spill Site 11 if provided by CE. It is recommended that CE obtain approval from Facility Manager prior to installation of sign at Spill Site 11.

SPILL SITE 11 PHOTOGRAPHS

Spill Site 11 Quarterly Inspection

Photograph # 1 Inlet Sump Pump Grating

Spill Site 11 Quarterly Inspection

Photograph # 2 Gravity Drain Line

Spill Site 11 Quarterly Inspection

Photograph # 3 Inlet Sump

12.0 REFERENCES

Tetra Tech, Inc. 2008. *Operation and Maintenance Manual for Landfills 1, 2, 5, 6, 7, 9, 11, and Spill Site 11 at Wright-Patterson Air Force Base*. February, 22 2008.

Versar. 2013. *Final Optimized Exit Strategy Performance Plan, OU3 Landfill 11, OU4 Landfills 3, 4, 6 and 7, OU5 Landfill 5, OU6 Landfills 1 and 2, OU7 Landfill 9*, Wright-Patterson AFB, Ohio. December 30, 2013.

FIGURES

Figure 1. Aerial Map Showing Location and Site Boundaries for Landfills 3, 4, 5, 6, 7, 9 and 11

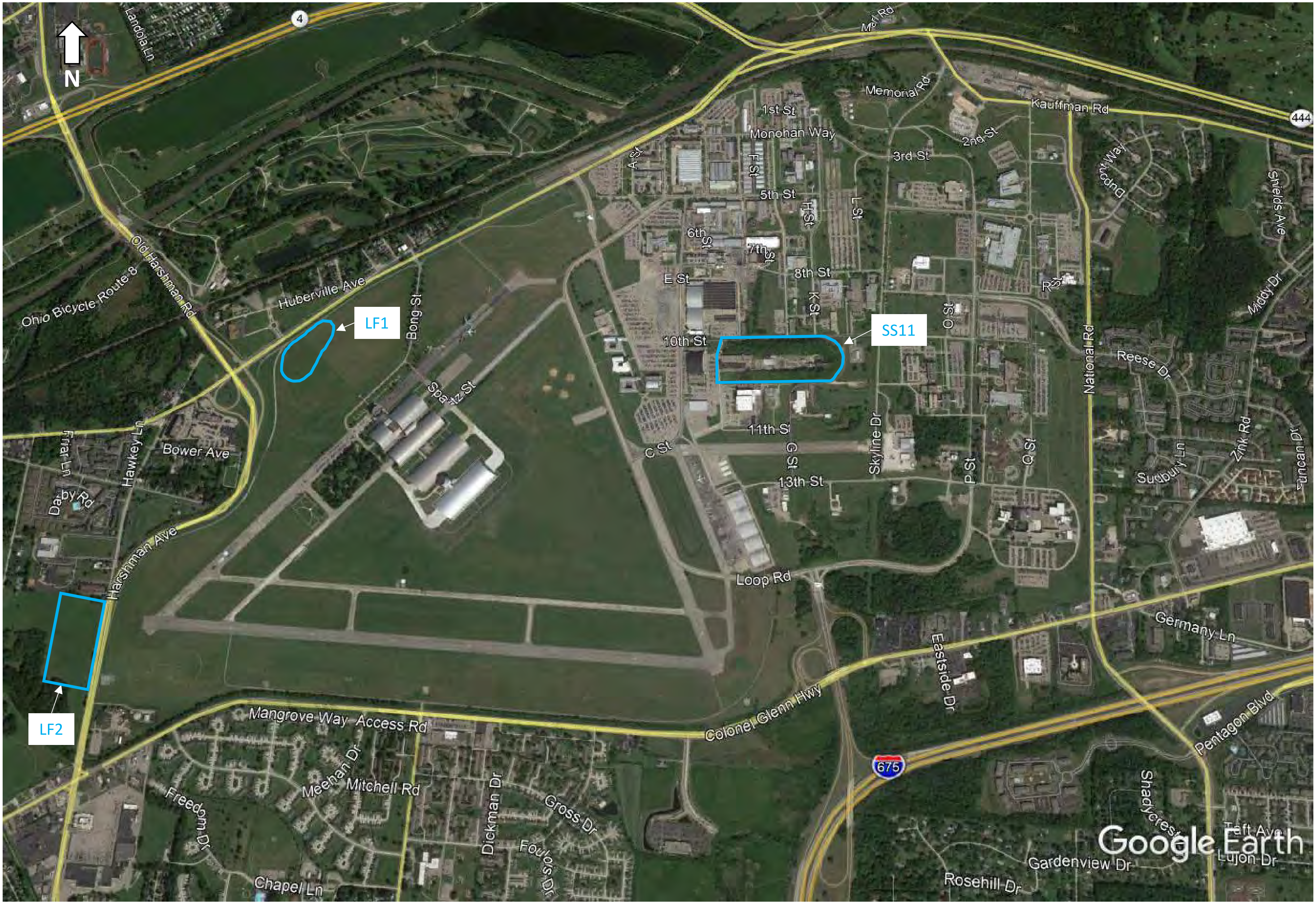

Figure 2. Aerial Map Showing Location and Site Boundaries for Landfills 1, 2 and Spill Site 11

APPENDIX A

Landfill Inspection Forms

Operation and Maintenance of Landfill
Contract # FA8903-09-D-8588

LANDFILL INSPECTION FORM

Facility Name: WPAFB	Date of Inspection: 17 September 2019
Facility Location: Area B	Time of Inspection:
Site Identification: Landfill 1 [LF001]	Name of Inspector (1): J.Hall
	Name of Inspector (2):

Inspection Items

1.	**Vegetation Layer Inspected** *(check for distressed vegetation, vector damage, subsidence, ponding, need for fertilizer and/or lime, shrub/deep-rooted plant growth, etc.)*
	Observations: Vegetation layer in good condition.
2.	**Side Slopes Inspected** *(check for gullies, cracks, erosion, subsidence, etc.)*
	Observations: Side slopes in good condition.
3.	**Drainage Features Inspected** *(check drainage swales, piping, french drain, etc.)*
	Observations: Drainage features in good condition.
4.	**Perimeter Fence** *(as applicable, check for condition, missing parts, etc.)*
	Observations: Perimeter fence in good condition.

Maintenance

5.	**Maintenance Performed During Quarter** *(describe and append all appropriate documentation)*
	None

Additional Comments

LANDFILL INSPECTION FORM

Facility Name: WPAFB	Date of Inspection: 17 September 2019
Facility Location: Area B	Time of Inspection:
Site Identification: Landfill 2 [LF002]	Name of Inspector (1): J. Hall
	Name of Inspector (2):

Inspection Items

1. Vegetation Layer Inspected
(check for distressed vegetation, vector damage, subsidence, ponding, need for fertilizer and/or lime, shrub/deep-rooted plant growth, etc.)

Observations: Vegetation layer in good condition.

2. Side Slopes Inspected
(check for gullies, cracks, erosion, subsidence, etc.)

Observations: Side slopes in good condition.

3. Drainage Features Inspected
(check drainage swales, piping, french drain, etc.)

Observations: Drainage features in good condition.

4. Perimeter Fence, Gates, Locks, and Descriptive Signs Inspected
(as applicable, check for condition, missing parts, etc.)

Observations: Perimeter fence, gates, locks, and descriptive signs in good condition.

Maintenance

5. Maintenance Performed During Quarter
(describe and append all appropriate documentation)

Vegetation layer mowed. Performed weed eating on perimeter fence line.

Additional Comments

CAM Management & Services

Operation and Maintenance of Landfill
Contract # FA8903-09-D-8588

LANDFILL INSPECTION FORM

Facility Name: WPAFB	Date of Inspection: 17 September 2019
Facility Location: Area A	Time of Inspection:
Site Identification: Landfill 3 [LF003]	Name of Inspector (1): J. Hall
	Name of Inspector (2):

Inspection Items

1.	**Vegetation Layer Inspected** *(check for distressed vegetation, vector damage, subsidence, ponding, need for fertilizer and/or lime, shrub/deep-rooted plant growth, etc.)*
	Observations: Vegetation layer in good condition.
2.	**Side Slopes Inspected** *(check for gullies, cracks, erosion, subsidence, etc.)*
	Observations: Side slopes in good condition.
3.	**Drainage Features Inspected** *(check erosion rock dams, drainage swales, channels, piping, lining, turf inhibiting drainage, silt accumulation, etc.)*
	Observations: Drainage features in good condition.

Maintenance

4.	**Maintenance Performed During Quarter** *(describe and append all appropriate documentation)*
	None

Additional Comments

Operation and Maintenance of Landfill
Contract # FA8903-09-D-8588

LANDFILL INSPECTION FORM

Facility Name: WPAFB	Date of Inspection: 17 September 2019
Facility Location: Area A	Time of Inspection:
Site Identification: Landfill 4 [LF004]	Name of Inspector (1): J. Hall
	Name of Inspector (2):

Inspection Items	
1.	**Cover Layer Inspected** *(check for vector damage, subsidence, ponding, erosion, etc.)*
	Observations: Cover layer in good condition.
2.	**Perimeter Access Road and Fence Inspected** *(as applicable, check for condition, missing parts, etc.)*
	Observations: Perimeter access road and fence in good condition.
Maintenance	
3.	**Maintenance Performed During Quarter** *(describe and append all appropriate documentation)*
	None
Additional Comments	

CAM Management & Services

Operation and Maintenance of Landfill
Contract # FA8903-09-D-8588

LANDFILL INSPECTION FORM

Facility Name: WPAFB	Date of Inspection: 18 September 2019
Facility Location: Area A	Time of Inspection:
Site Identification: Landfill 5 [LF005]	Name of Inspector (1): J. Hall
	Name of Inspector (2):

Inspection Items

1. Vegetation Layer Inspected
(check for distressed vegetation, vector damage, subsidence, ponding, need for fertilizer and/or lime, shrub/deep-rooted plant growth, etc.)

Observations: Vegetation layer in good condition.

2. Side Slopes Inspected
(check for gullies, cracks, erosion, subsidence, etc.)

Observations: Side slopes in good condition.

3. Drainage Features Inspected
(check erosion rock dams, drainage swales, channels, piping, lining, turf inhibiting drainage, silt accumulation, etc.)

Observations: Drainage features in good condition.

4. Gas Venting System and Monitoring Wells Inspected
(check for settling, erosion, condition, function, disturbance, damage, etc.)

Observations: Gas venting system and monitoring wells in good condition.

5. Perimeter Access Road, Fence, Gates, Locks, Descriptive Signs and Survey Monuments Inspected
(as applicable, check for condition, missing parts, etc.)

Observations: Perimeter fence, gates, locks,descriptive signs and survey monuments in good condition.

Maintenance

6. Maintenance Performed During Quarter
(describe and append all appropriate documentation)

Vegetation layer mowed. Performed weed eating around vent stacks, rock dams, down drains, monitoring wells and perimeter fence line.

Additional Comments

Operation and Maintenance of Landfill
Contract # FA8903-09-D-8588

LANDFILL INSPECTION FORM

Facility Name: WPAFB	Date of Inspection: 18 September 2019
Facility Location: Area A	Time of Inspection:
Site Identification: Landfill 6 [LF006]	Name of Inspector (1): J. Hall
	Name of Inspector (2):

Inspection Items

1.	**Vegetation Layer Inspected** *(check for distressed vegetation, vector damage, subsidence, ponding, need for fertilizer and/or lime, shrub/deep-rooted plant growth, etc.)*
	Observations: Vegetation layer in good condition.
2.	**Side Slopes Inspected** *(check for gullies, cracks, erosion, subsidence, etc.)*
	Observations: Side slopes in good condition.
3.	**Drainage Features Inspected** *(check erosion rock dams, drainage swales, channels, piping, lining, turf inhibiting drainage, silt accumulation, etc.)*
	Observations: Drainage features in good condition.
4.	**Fence and Descriptive Signs Inspected** *(as applicable, check for condition, missing parts, etc.)*
	Observations: Fence and descriptive signs in good condition.

Maintenance

5.	**Maintenance Performed During Quarter** *(describe and append all appropriate documentation)*
	None

Additional Comments

LANDFILL INSPECTION FORM

Facility Name: WPAFB	Date of Inspection: 18 September 2019
Facility Location: Area A	Time of Inspection:
Site Identification: Landfill 7 [LF007]	Name of Inspector (1): J. Hall
	Name of Inspector (2):

Inspection Items

1. Vegetation Layer Inspected
(check for distressed vegetation, vector damage, subsidence, ponding, need for fertilizer and/or lime, shrub/deep-rooted plant growth, etc.)

Observations: Vegetation layer in good condition.

2. Side Slopes and Drum Staging/Disposal Area (DSDA) Slope Inspected
(check for gullies, cracks, erosion, subsidence, exposure of metal debris or drums, etc.)

Observations: Side slopes and DSDA slope in good condition.

3. Drainage Features Inspected
(check erosion rock dams, drainage swales, channels, piping, lining, turf inhibiting drainage, silt accumulation, etc.)

Observations: Drainage features in good condition.

4. Descriptive Signs Inspected
(as applicable, check for condition, missing parts, etc.)

Observations: Descriptive sign in good condition.

Maintenance

5. Maintenance Performed During Quarter
(describe and append all appropriate documentation)

Vegetation layer mowed. Performed weed eating around drainage pipe.

Additional Comments

Operation and Maintenance of Landfill
Contract # FA8903-09-D-8588

LANDFILL INSPECTION FORM

Facility Name: WPAFB	Date of Inspection: 20 September 2019
Facility Location: Area A	Time of Inspection:
Site Identification: Landfill 9 [LF009]	Name of Inspector (1): J. Hall
	Name of Inspector (2):

Inspection Items

1. **Vegetation Layer Inspected**
(check for distressed vegetation, vector damage, subsidence, ponding, need for fertilizer and/or lime, shrub/deep-rooted plant growth, etc.)
Observations: Vegetation layer in good condition.

2. **Side Slopes Inspected**
(check for gullies, cracks, erosion, subsidence, etc.)
Observations: Side slopes in good condition.

3. **Drainage Features Inspected**
(check erosion rock dams, drainage swales, channels, piping, lining, turf inhibiting drainage, silt accumulation, etc.)
Observations: Drainage features in good condition.

4. **Perimeter Access Road, Fence, Gates, Locks, Descriptive Signs and Survey Monuments Inspected**
(as applicable, check for condition, missing parts, etc.)
Observations: Perimeter fence, gates, locks,descriptive signs and survey monuments in good condition.

Maintenance

5. **Maintenance Performed During Quarter**
(describe and append all appropriate documentation)
Vegetation layer mowed. Performed weed eating on rip-rap.

Additional Comments

Operation and Maintenance of Landfill
Contract # FA8903-09-D-8588

LANDFILL INSPECTION FORM

Facility Name: WPAFB	Date of Inspection: 22 September 2019
Facility Location: Area A	Time of Inspection:
Site Identification: Landfill 11 [LF0011]	Name of Inspector (1): J. Hall
	Name of Inspector (2):

Inspection Items

1. Vegetation Layer Inspected
(check for distressed vegetation, vector damage, subsidence, ponding, need for fertilizer and/or lime, shrub/deep-rooted plant growth, etc.)

Observations: Vegetation layer in good condition.

2. Side Slopes Inspected
(check for gullies, cracks, erosion, subsidence, etc.)

Observations: Side slopes in good condition.

3. Drainage Features Inspected
(check erosion rock dams, drainage swales, channels, piping, lining, turf inhibiting drainage, silt accumulation, etc.)

Observations: Drainage features in good condition.

4. Monitoring Wells Inspected
(check for settling, erosion, condition, function, disturbance, damage, etc.)

Observations: Monitoring wells in good condition.

5. Perimeter Access Road, Fence, Gates, Locks, Descriptive Signs and Survey Monuments Inspected
(as applicable, check for condition, missing parts, etc.)

Observations: Perimeter fence, gates, locks,descriptive signs and survey monuments in good condition.

Maintenance

6. Maintenance Performed During Quarter
(describe and append all appropriate documentation)

Vegetation layer mowed. Performed weed eating on rip-rap, rock dam and around drainage wing wall.

Additional Comments

Operation and Maintenance of Landfill
Contract # FA8903-09-D-8588

SPILL SITE INSPECTION FORM

Facility Name: WPAFB	Date of Inspection: 30 September 2019
Facility Location: Area B	Time of Inspection:
Site Identification: Spill Site 11 [SS065]	Name of Inspector (1): J. Hall
	Name of Inspector (2):

Inspection Items

1. **Manhole, Grating, and Concrete Drain Inspected**
(check for clogging, water build-up, drain footer, etc.)
Observations: Manhole, Grating, and Concrete Drain in good condition.

2. **Inlet Sump, Drain Line, and Separator Pit Water Level Inspected**
(check flow, water level in observation well, gravity drain line, etc.)
Observations: Inlet sump, drain line, and separator pit water level in good condition.

3. **Pump, Float Switches, Discharge Valve, and Electrical Components Inspected**
(check for condition, function, damage, cycling properly, etc.)
Observations: Pump, float switches, discharge valve and electrical components in good condition.

Maintenance

4. **Maintenance Performed During Quarter**
(describe and append all appropriate documentation)
None

Additional Comments

Photographs

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Table of Photos

Presented here in the order that photos were taken with site name, location description.

Source Control Operable Unit

21 No Action Sites

41 No Action Sites

Groundwater Operable Unit

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Source Control
Operable Unit


1. LF8 Abandoned Ordnance & Skeet Range – McClellan Drive (north) and National Road (west) , Area B

2. LF8 Abandoned Ordnance & Skeet Range - LF8, National Rd. at McClellan Dr., Area B


3. LFs 8 & 10 – Gate to leachate collection facility, end of Longstreet Lane, Area B

4. LF8 – Inner locked gate with sign and barbwire fencing, LF8 eastern boundary, Area B

5. LF10 Locked gate off SSW Kauffman Road & Shields Ave, Area B

6. LF10 - Sign on gate off SSW Kauffman Road & Shields Ave, Area B

7. LF10 – LF10N looking south to LF10S, Area B

21 No Action Sites

8. BS1 –New commercial truck inspection facility, Gate 26A, Loop Road (north), Area A

9. BS1/LTCSP area in foreground off Loop Road (north), Area A

10. BS1 – Gravelly and grassy area off Loop Road (north), Area A

11. LTCSA – Grassy area along the curve of Skeel Ave. off Loop Road (north), Area A

12. LTCSA – Grassy area along curve of Skeel Ave. off Loop Road (north), Area A

13. TCSP – Grassy area inside fence faces NNE at Loop Road (north), Area A

14. B89 CSP – Grassy area and parking lot near Skeel Avenue and Xenia Drive, Area A

15. B89 CSP – Grassy area near Skeel Avenue and Xenia Drive, Area A

16. CCSA – Grassy area along curve of Skeel Ave. faces NNE, Area A

17. CCSA – Grassy area along curve of Skeel Ave., faces east, Area A

18. EFDZ11 - Grassy area near Boy Scout Amphitheatre faces NNW at Riverview Road, Area A

19. EFDZ12 – Grassy field area near Riverview Road, Area A

20. EFDZ12 – Grassy field area of EFDZ12 near Riverview Road, Area A

21. SP1 – Grassy and gravelly area inside Landfill 11 Riverview Road, Area A

22. FTA2 - Grassy outside along fenced site faces SSW at Riverview Road, Area A

23. FTA3 – Gravel lot outside Landfill 11 faces NNW at Riverview Road, Area A

24. FTA4 – Gravel lot outside Landfill 11 at Riverview Road, Area A

25. FTA5 – Discrete fencing to Fire Training Area at Riverview Road, Area A

26. FTA5 – Building 4091 in FTA5 faces NW at Riverview Road, Area A


27. LF 14 – Grassy area off road faces NNW at Riverview Road, Area A


28. FTA1 – Gate to FTA1 off Hebble Creek Road, Area A


29. BS4 – Overgrown area between road and fence off NNW Marl Road, Area A

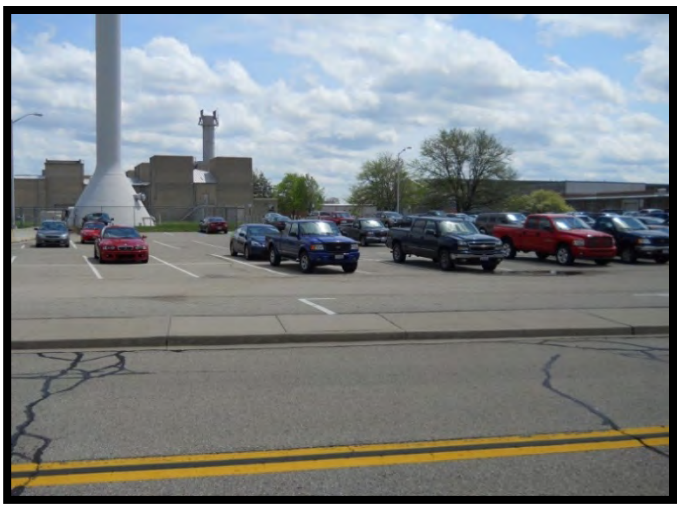

30. BS4 – Overgrown area between the road and fence faces ENE at Marl Road, Area A

31. GLTS (Aerial) – Located due east of Gravel Lake, access from Marl Road, Area A


32. UST119 – Grassy area near Building 30119 at ESE Pearson Road and Allbrook Drive, Area A

33. EFDZ1 – Open grassy area faces NE at Perimeter Road and Maverick Drive

34. EFDZ1 – Open grassy area faces NNW at Harshman Road



35. TF49A – Paved parking lot at SE Pearson Road and Van Patton Drive, Area A

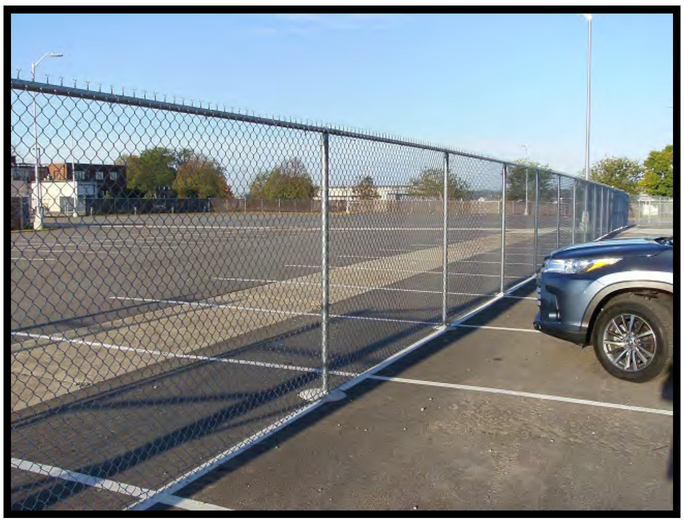
36. LF13 – Paved area off SSE on Southern side of Sundorph Drive and Pearson Road, Area A

37. LF13 – Paved area faces NE on eastern side of Sundorph Drive and Pearson Road, Area A

38. LF13 – Paved area faces SSE on northern side of Sundorph Drive and Pearson Road, Area A

39. LF13 – Paved area down center of lot at NE Sundorph Drive and Pearson Road, Area A

40. LF13 – Paved area down center of lot at SW Sundorph Drive and Pearson Road, Area A



41. CHP3 and UST 119 – Paved parking lot looking west toward Pearson Rd., Area A

42. CHP3 - Paved parking lot near Building 170 at ESE Harness Road and Access Avenue, Area A

41 No Action Sites

43. LF11 – Locked north gate and sign at Landfill 11 faces NW at Riverview Road, Area A

44. LF11 - Sign on gate of Landfill at Riverview Road, Area A

45. LF11 – South gate along Riverview Road, Area A

46. LF12 (Excavated) – No cap, all trenches of landfill deposits have been removed. Grassy area with gravel adjacent to Riverview Road.

47. LF12 (Excavated) – Grassy area inside Landfill 12 from Riverview Road

48. LF3 – Golf course at East Skeel Ave, Area A

49. LF4 – Signage on gate to Landfill 4 Skeel Ave, Area A

50. LF4 (West side) – Civil Engineering-Grounds, material storage yard on LF4. Skeel Ave (west) and Hebble Creek Road (north), Area A

51. LF4 (East side) – Civil Engineering-Grounds, material storage yard on LF4. Skeel Ave (west) and Hebble Creek Road (north), Area A

52. LF6 – Sign at Landfill 6 on Battle Creek Road, Area A

53. LF6 – Grassy area looking NE with perimeter fence in background, Battle Creek Road, Area A

54. LF7 – Landfill 7 sign at SSW Battle Creek Road, Area A

55. LF7 – Grassy landfill area at SW Battle Creek Road, looking NW, Area A

56. LF7 – Locked chain gate across LF7 access road off Battle Creek Road, looking SW, Area A

57. CHP2 – Near Building 271 faces ESE Road "M" and "T" Road, Area A

58. LF5 – Groundwater treatment system (GWTS) at LF5, Riverview Road at Prairie Road. Activated December 2015, Area A

59. LF5 – Sign on gate near treatment system at GWTS, Area A

60. LF5 – Looking NW from LF5 toward Riverview Road, EW-1 (left) and TAS (right), Area A

61. LF5 - Top of LF5 looking north, Area A

62. LF5 – Monitoring wells at LF5 along Riverview Road, Area A

63. LF1 – Grassy area/open field in front of Air Force Museum, Area B

64. LF1 – Fence line along road NNW of LF1 Perimeter Road. Area B

65. LF2 – Sign on locked, barbed fence gate along Harshman Road

66. LF9 – Locked, barbed fence gate to LF9 off Sandhill Road, Area A

67. LF9 – Sign in grassy area inside discrete fencing faces ENE at Access Ave. off Sandhill Road, Area A

68. SP5 – Grassy area near Building 70 faces East "C" and 7th Streets

69. SP5 – Looking down at UST marker, "C" and 7th Streets, Area B

70. SP5 – Grassy area near Building 70 at "C" and 7th Streets, Area B

71. SP6 – Grassy area near Building 14 at B and 4th Streets, Area B

72. SP7 – Grassy area faces NNE 9th Street, Area B

73. SP7 – Roadway next to grassy area faces E. 9th Street, Area B

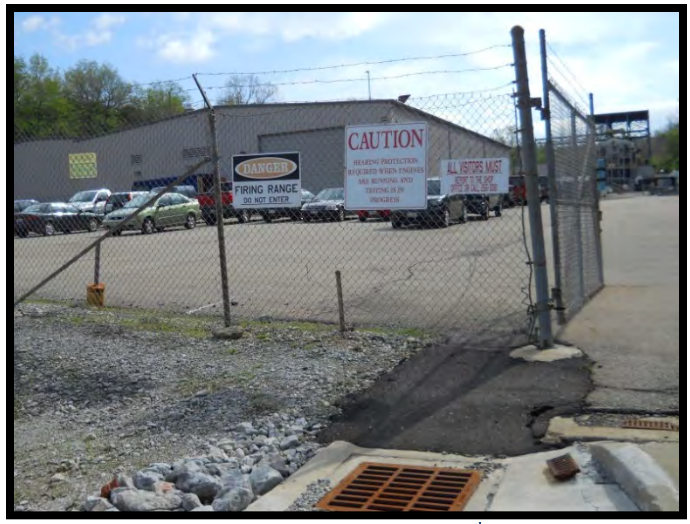
74. SP9 – Outside discrete fence faces NNE with signage at 9th Street, Area B

75. SP9 – Outside discrete fence faces NNE with signage at 9th Street, Area B

76. SP11 – Gravelly area inside discrete fence at ESE 11th Street, Area B

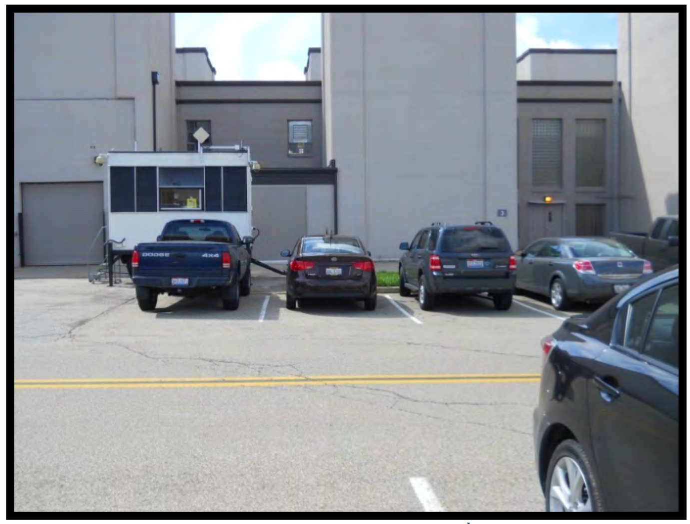
77. SP11 – Outside discrete fence that faces WSW with signage at 11th Street, Area B

78. SP11 – Outside discrete fence with signage at 11th Street, Area B



79. SP11 – Outside discrete fence with signage at 11th Street, Area B

80. UST71A – Street and parking lot looking north at 7th Street, Building 70 (west) and Building 435 (north), Area B



81. UST71A – Street and parking looking south, 7th Street and Building 71, Area B

82. EFDZ2 – Grassy area faces W at 11th Street, Area B

83. EFDZ2 - Grassy area looking west (Building 79 & lot), 11th Street (north), Area B

84. EFDZs 3 & 4 – Looking east, EFDZ3 (left) and EFDZ4 (right), Area B

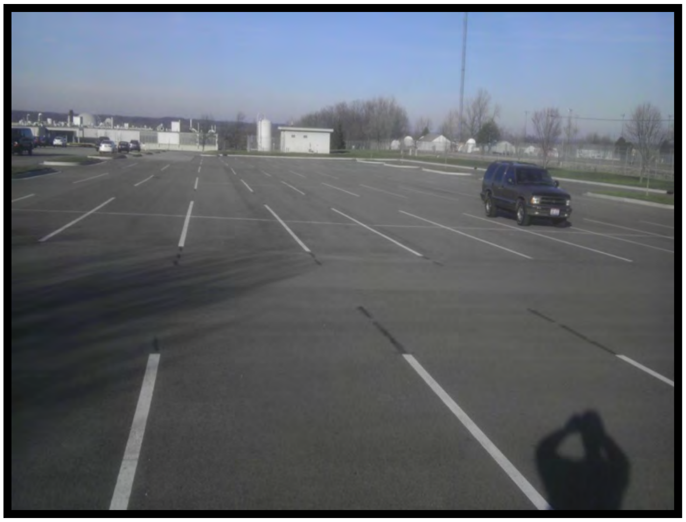
85. EFDZ3 - Grassy area N of accelerated runway faces W at Skyline Dr., Area B

86. EFDZ4 – Grassy area faces S at Skyline Drive and 13th Street, Area B

87. EFDZ5 – Looking NE from 13th Street, fencing along National Road, Area B

88. EFDZ5 – Grassy area with walking paths and outer fence, seen from National Road, Area B

89. EFDZ6 – Looking SW from 5th Street, Area B



90. EFDZ6 – Parking lot area behind Building 453, Area B

91. EFDZ7 – Grassy area faces SSW at 13th Street, Area B

92. EFDZ4 – Earthfill disposal zone signage along Skyline Drive, Area B

93. EFDZ8 – Grassy area with recreational vehicles along 13th Street faces NNE at 13th Street, Area B

94. EFDZ9 – Wooded area behind Building 471 faces SSE at Loop Road West, Area B

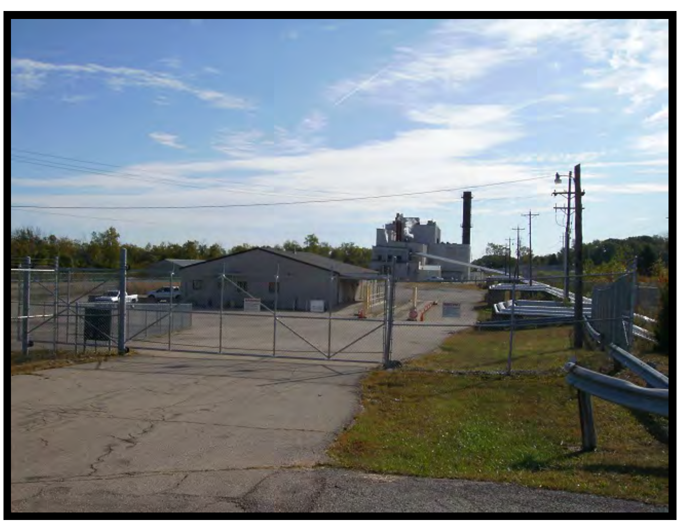
95. EFDZ9 – Wooded area behind Building 471 faces SW at Loop Road West, Area B


96. EFDZ10 – Looking SE from parking lot for Building 620, Area B


97. EFDZ10 - Grassy area faces parking lot and SE Loop Road West, Area B


98. BS3 – Barbed, gated, locked fence, faces ENE at Loop Road near Gate 22B, Area B

99. BS3 – Signage near fence faces W at Loop Road near Gate 22B, Area B

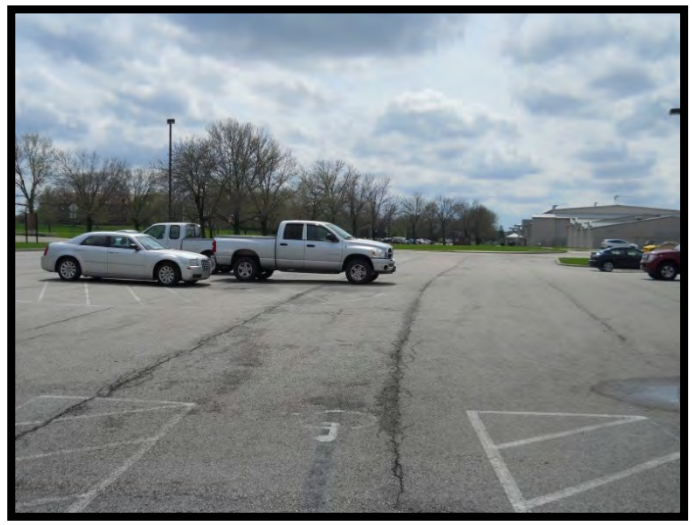

100. CHP5 – CHP5 (background) and DRMO (foreground), locked and gated entry at Kauffman Ave, Area B


101. CHP5 – Gated entry with barbed fencing along Kauffman Avenue at National Road, Area B

102. SS4 – SS4/OU2 Groundwater treatment facility along Pearson Road, Area A

103. SS4 – Sign on discrete barb wired, locked, fence to SS4 area faces SW at Skeel Road, Area A

104. ERUST – Paved/grass area at ESE Skeel Avenue and Allbrook Drive, Area A



105. ERUST – Paved/grass area at SW Skeel Avenue and Allbrook Drive, Area A

106. BS2 – Grassy area along curve faces WSW at Riverview Road, Area A

107. BS2 – Grassy area showing perimeter fence at Riverview Road, Area A

108. UST 4020 – Paved area near Building 4020 Republic Road and Vincent Avenue, Area A

109. UST 4020 – Paved grassy area near Building 4020 Republic Road and Vincent Avenue, Area A

110. CDA – Grassy area at SE Vincent and Lightning Avenues, Area A

111. CDA – Grassy area faces SSW at Vincent and Lightning Avenues, Area A

112. SS8 – Grassy area near Building 2 faces ENE Springer Road, Area A

113. SS8 – Grassy area near Perimeter fence and Building 2 faces SSE Springer Road, Area A


114. CHP1 – Parking lot location of former CHP1 faces ENE at Monohan Way


115. CHP4 – CHP4 looking north toward State Route 444 and Oak Street, Area A


116. CHP4 – Grassy area behind parking lot faces SE and Perimeter fence State Route 444 and Oak Street, Area A


117. NR – Building 470 (deactivated nuclear reactor) on 13th Street, Area B


118. RWBS – Grassy area south of 12th Street, west of Building 625, Area B


119. RWBS – Grassy area south of 12th Street and West of Building 625, Area B

120. EOD – Back fence of EOD Range showing signage, Riverview Road, Area A

121. EOD – Locked, barbed fence gate to EOD Range at Riverview Road, Area A

122. BS5 and BS6 – Access gate to the Laser Test Range, BS5, and BS6. Looking north toward Loop Road, Area B

123. BS5 – Grassy area showing Perimeter fence faces S at Perimeter Road and Maverick Drive, Area B

124. BS5 – Looking west from near Gate 15B, BS5 located south-central portion of photo, Area B

125. BS6 – Grassy area showing fence faces NNW at Loop Road near Gate 22B, Area B

Groundwater
Operable Unit

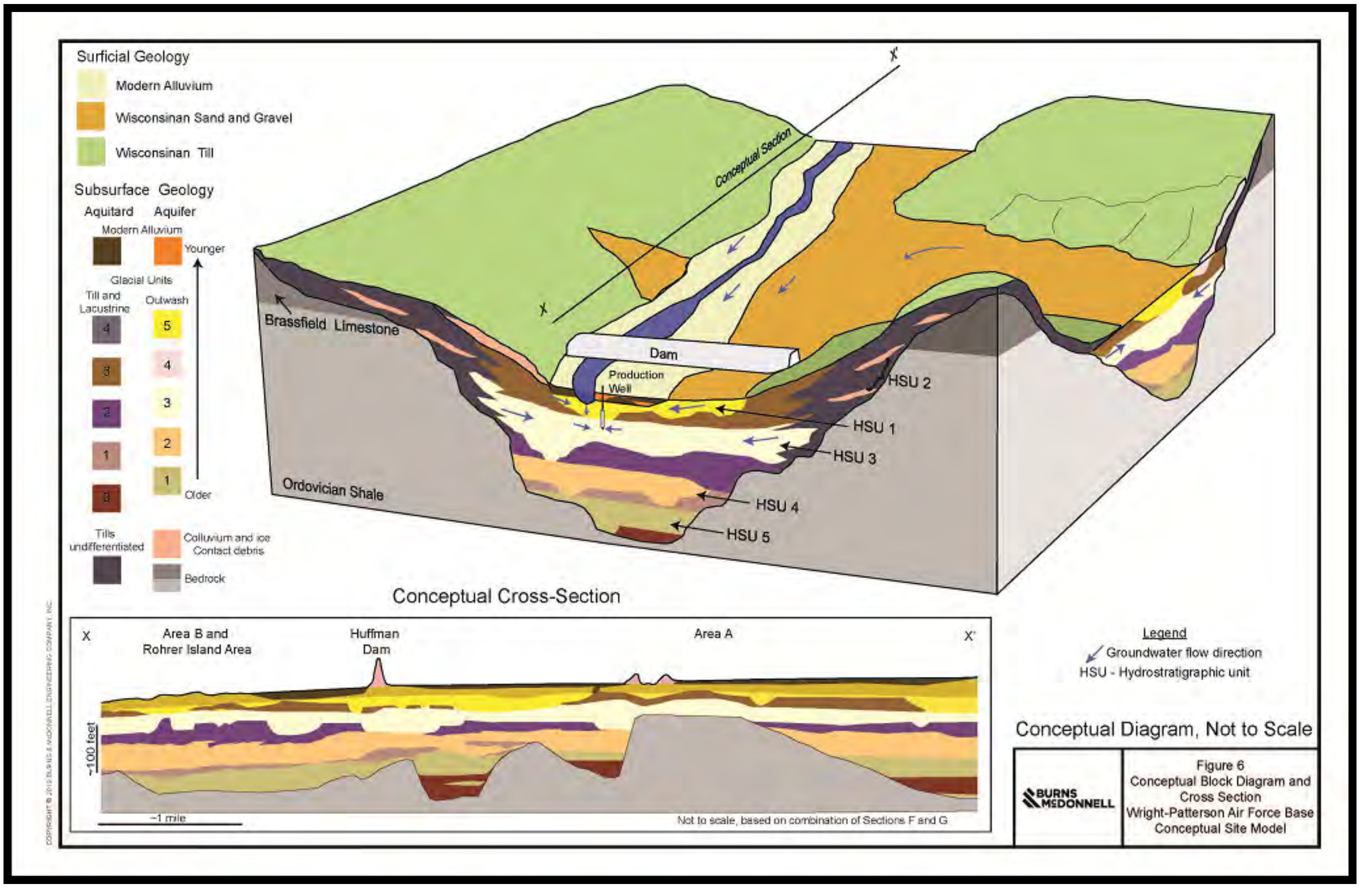
126. Former Bldg 59 Complex – Parking lot, Building 23 (north) on 6th Street, Area B

127. Former Bldg 59 Complex – Parking lot, Building 18 (west), on 8th Street, Area B

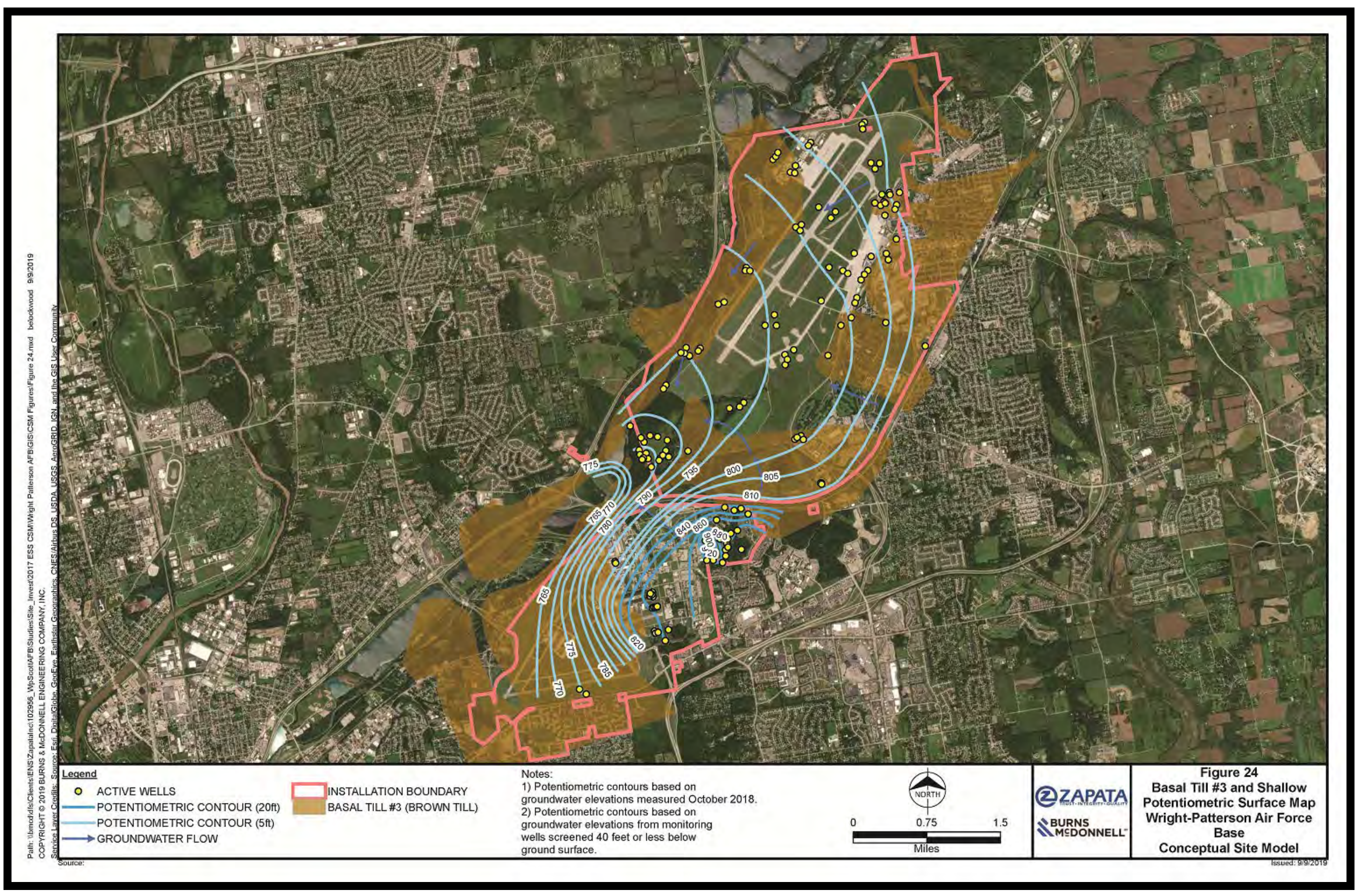
128. Former Bldg. 79/95 Complex– Building 73 (constructed summer 2010) at west end of site near "G" Street, Area B

129. Former Bldg. 79/95 Complex– Looking SE from near Building 73, Area B

130. FAA-B – Looking north, drum storage Facility 92 on 10th Street in background, Area B



131. GWOU Conceptual Block Diagram and Cross Section, Conceptual Site Model, Areas A and B



132. GWOU Basil Till and Shallow Potentiometric Surface Map, Conceptual Site Model, Areas A and B

Appendix C
City of Dayton Groundwater Monitoring Program Data

Table C-1
City of Dayton Groundwater Monitoring Program Data

Sample Year - 2015					
Sample	Address	Analyte	Method	Result	Unit
3/23/2015	Mad 71	1,2-Dichloroethane	EPA 524.2	0.475	ug/l
3/23/2015	Mad 71	Tetrachloroethene	EPA 524.2	0.49	ug/l
3/23/2015	Mad 71	Trichloroethene	EPA 524.2	0.59	ug/l
4/15/2015	Mad Mon. HD 11	cis-1,2-Dichloroethene	EPA 524.2	4.881	ug/l
4/15/2015	Mad Mon. HD 11	Trichloroethene	EPA 524.2	1.556	ug/l
4/15/2015	Mad Mon. HD 13S	cis-1,2-Dichloroethene	EPA 524.2	1.002	ug/l
4/15/2015	Mad Mon. 127D	cis-1,2-Dichloroethene	EPA 524.2	9.506	ug/l
4/15/2015	Mad Mon. 127D	trans-1,2-Dichloroethene	EPA 524.2	0.504	ug/l
4/15/2015	Mad Mon. 127D	Vinyl chloride	EPA 524.2	0.462	ug/l
4/15/2015	Mad Mon. 132S	cis-1,2-Dichloroethene	EPA 524.2	7.565	
4/15/2015	Mad Mon. 132S	Trichloroethene	EPA 524.2	3.987	
4/15/2015	Mad Mon. 132S	Vinyl chloride	EPA 524.2	0.86	
10/22/2015	Mad Mon. HD 13S	cis-1,2-Dichloroethene	EPA 524.2	3.369	ug/l
10/22/2015	Mad Mon. 127D	cis-1,2-Dichloroethene	EPA 524.2	10.253	ug/l
10/22/2015	Mad Mon. 127D	trans-1,2-Dichloroethene	EPA 524.2	0.512	ug/l
10/22/2015	Mad Mon. 131M	cis-1,2-Dichloroethene	EPA 524.2	1.244	ug/l
10/22/2015	Mad Mon. 131M	Trichloroethene	EPA 524.2	2.318	ug/l
10/22/2015	Mad Mon. 132S	cis-1,2-Dichloroethene	EPA 524.2	7.115	ug/l
10/22/2015	Mad Mon. 132S	Trichloroethene	EPA 524.2	4.101	ug/l
10/22/2015	Mad Mon. 132S	Vinyl chloride	EPA 524.2	0.984	ug/l
12/8/2015	Mad Mon. 147S	Tetrachloroethene	EPA 524.2	0.524	ug/l

Table C-1
City of Dayton Groundwater Monitoring Program Data

Sample	Address	Analyte	Method	Result	Unit
Sample Year - 2016					
4/26/2016	Mad Mon. 131D	cis-1,2-Dichloroethene	EPA 524.2	2.859	ug/l
4/26/2016	Mad Mon. 131D	Trichloroethene	EPA 524.2	1.533	ug/l
4/26/2016	Mad Mon. 131D	Vinyl chloride	EPA 524.2	0.466	ug/l
4/27/2016	Mad Mon. HD 11	cis-1,2-Dichloroethene	EPA 524.2	5.044	ug/l
4/27/2016	Mad Mon. HD 11	Trichloroethene	EPA 524.2	0.584	ug/l
4/27/2016	Mad Mon. HD 11	Vinyl chloride	EPA 524.2	0.582	ug/l
4/27/2016	Mad Mon. HD 13S	cis-1,2-Dichloroethene	EPA 524.2	2.968	ug/l
4/27/2016	Mad Mon. 127D	cis-1,2-Dichloroethene	EPA 524.2	9.52	ug/l
4/27/2016	Mad Mon. 127D	trans-1,2-Dichloroethene	EPA 524.2	0.499	ug/l
4/27/2016	Mad Mon. 131M	cis-1,2-Dichloroethene	EPA 524.2	1.389	ug/l
4/27/2016	Mad Mon. 131M	Trichloroethene	EPA 524.2	1.73	ug/l
4/27/2016	Mad Mon. 132S	cis-1,2-Dichloroethene	EPA 524.2	7.363	ug/l
4/27/2016	Mad Mon. 132S	Trichloroethene	EPA 524.2	4.477	ug/l
4/27/2016	Mad Mon. 132S	Vinyl chloride	EPA 524.2	1.393	ug/l
6/14/2016	Mad 71	1,2-Dichloroethane	EPA 524.2	0.334	ug/l
6/14/2016	Mad 71	Tetrachloroethene	EPA 524.2	0.357	ug/l
6/14/2016	Mad 71	Trichloroethene	EPA 524.2	0.307	ug/l
10/24/2016	Mad Mon. HD 11	cis-1,2-Dichloroethene	EPA 524.2	5.986	ug/l
10/24/2016	Mad Mon. HD 11	Trichloroethene	EPA 524.2	0.525	ug/l
10/24/2016	Mad Mon. HD 13	cis-1,2-Dichloroethene	EPA 524.2	1.608	ug/l
10/24/2016	Mad Mon. 127D	cis-1,2-Dichloroethene	EPA 524.2	9.919	ug/l
10/24/2016	Mad Mon. 127D	trans-1,2-Dichloroethene	EPA 524.2	0.449	ug/l
10/24/2016	Mad Mon. 131M	cis-1,2-Dichloroethene	EPA 524.2	2.129	ug/l
10/24/2016	Mad Mon. 131M	Trichloroethene	EPA 524.2	2.583	ug/l
10/24/2016	Mad Mon. 131M	Vinyl chloride	EPA 524.2	0.575	ug/l
10/24/2016	Mad Mon. 132S	cis-1,2-Dichloroethene	EPA 524.2	5.759	ug/l
10/24/2016	Mad Mon. 132S	Trichloroethene	EPA 524.2	3.84	ug/l
10/24/2016	Mad Mon. 132S	Vinyl chloride	EPA 524.2	0.922	ug/l
11/14/2016	Mad Mon. 147S	Tetrachloroethene	EPA 524.2	0.512	ug/l

Table C-1
City of Dayton Groundwater Monitoring Program Data

Sample Year - 2017					
Sample	**Address**	**Analyte**	**Method**	**Result**	**Unit**
3/20/2017	Mad 71	Tetrachloroethene	EPA 524.2	0.508	ug/l
5/9/2017	Mad Mon. HD 11	cis-1,2-Dichloroethene	EPA 524.2	6.194	ug/l
5/9/2017	Mad Mon. HD 11	Trichloroethene	EPA 524.2	0.458	ug/l
5/9/2017	Mad Mon. HD 13S	cis-1,2-Dichloroethene	EPA 524.2	1.413	ug/l
5/9/2017	Mad Mon. 127D	cis-1,2-Dichloroethene	EPA 524.2	9.023	ug/l
5/9/2017	Mad Mon. 131M	cis-1,2-Dichloroethene	EPA 524.2	2.609	ug/l
5/9/2017	Mad Mon. 131M	Trichloroethene	EPA 524.2	3.715	ug/l
5/9/2017	Mad Mon. 131M	Vinyl chloride	EPA 524.2	1.088	ug/l
5/9/2017	Mad Mon. 132S	cis-1,2-Dichloroethene	EPA 524.2	3.898	ug/l
5/9/2017	Mad Mon. 132S	Tetrachloroethene	EPA 524.2	0.688	ug/l
5/9/2017	Mad Mon. 132S	Trichloroethene	EPA 524.2	8.445	ug/l
6/5/2017	Mad Mon. HD 11	cis-1,2-Dichloroethene	EPA 524.2	5.307	ug/l
6/5/2017	Mad Mon. 131M	cis-1,2-Dichloroethene	EPA 524.2	1.378	ug/l
6/5/2017	Mad Mon. 131M	Vinyl chloride	EPA 524.2	0.828	ug/l
6/5/2017	Mad Mon. 132S	cis-1,2-Dichloroethene	EPA 524.2	3.575	ug/l
6/5/2017	Mad Mon. 132S	Tetrachloroethene	EPA 524.2	0.462	ug/l
6/5/2017	Mad Mon. 132S	Trichloroethene	EPA 524.2	6.554	ug/l
9/6/2017	Mad Mon. 132S	cis-1,2-Dichloroethene	EPA 524.2	3.837	ug/l
9/6/2017	Mad Mon. 132S	Tetrachloroethene	EPA 524.2	0.515	ug/l
9/6/2017	Mad Mon. 132S	Trichloroethene	EPA 524.2	10.123	ug/l
9/7/2017	Mad Mon. 131M	cis-1,2-Dichloroethene	EPA 524.2	1.959	ug/l
9/7/2017	Mad Mon. 131M	Trichloroethene	EPA 524.2	0.449	ug/l
10/23/2017	Mad Mon. HD 11	cis-1,2-Dichloroethene	EPA 524.2	5.371	ug/l
10/23/2017	Mad Mon. 127D	cis-1,2-Dichloroethene	EPA 524.2	9.138	ug/l
10/23/2017	Mad Mon. 131M	cis-1,2-Dichloroethene	EPA 524.2	2.461	ug/l
10/23/2017	Mad Mon. 131M	Trichloroethene	EPA 524.2	0.568	ug/l
10/23/2017	Mad Mon. 132S	cis-1,2-Dichloroethene	EPA 524.2	2.77	ug/l
10/23/2017	Mad Mon. 132S	Tetrachloroethene	EPA 524.2	0.787	ug/l
10/23/2017	Mad Mon. 132S	Trichloroethene	EPA 524.2	10.199	ug/l
12/4/2017	Mad Mon. 131M	cis-1,2-Dichloroethene	EPA 524.2	0.614	ug/l
12/4/2017	Mad Mon. 132S	cis-1,2-Dichloroethene	EPA 524.2	4.152	ug/l
12/4/2017	Mad Mon. 132S	Trichloroethene	EPA 524.2	7.547	ug/l

Table C-1
City of Dayton Groundwater Monitoring Program Data

Sample Year - 2018					
Sample	**Address**	**Analyte**	**Method**	**Result**	**Unit**
3/13/2018	Mad Mon. 132S	cis-1,2-Dichloroethene	EPA 524.2	3.24	ug/l
3/13/2018	Mad Mon. 132S	Tetrachloroethene	EPA 524.2	0.508	ug/l
3/13/2018	Mad Mon. 132S	Trichloroethene	EPA 524.2	8.019	ug/l
4/18/2018	Mad Mon. HD 11	cis-1,2-Dichloroethene	EPA 524.2	5.545	ug/l
4/18/2018	Mad Mon. HD 11	Tetrachloroethene	EPA 524.2	1.75	ug/l
4/18/2018	Mad Mon. HD 12M	Tetrachloroethene	EPA 524.2	1.368	ug/l
4/18/2018	Mad Mon. 126S	Tetrachloroethene	EPA 524.2	1.555	ug/l
4/18/2018	Mad Mon. 127D	cis-1,2-Dichloroethene	EPA 524.2	12.107	ug/l
4/18/2018	Mad Mon. 127D	trans-1,2-Dichloroethene	EPA 524.2	0.61	ug/l
4/18/2018	Mad Mon. 127D	Vinyl chloride	EPA 524.2	0.455	ug/l
4/18/2018	Mad Mon. 132S	cis-1,2-Dichloroethene	EPA 524.2	4.488	ug/l
4/18/2018	Mad Mon. 132S	Tetrachloroethene	EPA 524.2	0.722	ug/l
4/18/2018	Mad Mon. 132S	Trichloroethene	EPA 524.2	7.973	ug/l
6/13/2018	Mad Mon. 132S	cis-1,2-Dichloroethene	EPA 524.2	8.775	ug/l
6/13/2018	Mad Mon. 132S	Tetrachloroethene	EPA 524.2	0.523	ug/l
6/13/2018	Mad Mon. 132S	Trichloroethene	EPA 524.2	7.058	ug/l
9/6/2018	Mad Mon. 132S	cis-1,2-Dichloroethene	EPA 524.2	7.015	ug/l
9/6/2018	Mad Mon. 132S	Trichloroethene	EPA 524.2	6.52	ug/l
9/19/2018	Mad Mon. 109S	Tetrachloroethene	EPA 524.2	0.629	ug/l
10/16/2018	Mad Mon. 131D	cis-1,2-Dichloroethene	EPA 524.2	3.655	ug/l
10/16/2018	Mad Mon. 131D	Trichloroethene	EPA 524.2	1.63	ug/l
10/18/2018	Mad Mon. HD 11	cis-1,2-Dichloroethene	EPA 524.2	4.345	ug/l
10/18/2018	Mad Mon. 127D	cis-1,2-Dichloroethene	EPA 524.2	6.315	ug/l
10/18/2018	Mad Mon. 127D	Vinyl chloride	EPA 524.2	0.668	ug/l
10/18/2018	Mad Mon. 131M	cis-1,2-Dichloroethene	EPA 524.2	1.421	ug/l
10/18/2018	Mad Mon. 132S	cis-1,2-Dichloroethene	EPA 524.2	3.58	ug/l
10/18/2018	Mad Mon. 132S	Tetrachloroethene	EPA 524.2	0.669	ug/l
10/18/2018	Mad Mon. 132S	Trichloroethene	EPA 524.2	9.209	ug/l
12/5/2018	Mad Mon. 132S	cis-1,2-Dichloroethene	EPA 524.2	3.785	ug/l
12/5/2018	Mad Mon. 132S	Tetrachloroethene	EPA 524.2	0.594	ug/l
12/5/2018	Mad Mon. 132S	Trichloroethene	EPA 524.2	8.946	ug/l

Table C-1
City of Dayton Groundwater Monitoring Program Data

Sample Year - 2019					
Sample	**Address**	**Analyte**	**Method**	**Result**	**Unit**
5/2/2019	Mad Mon. HD 11	cis-1,2-Dichloroethene	EPA 524.2	3.333	ug/l
5/2/2019	Mad Mon. 127D	cis-1,2-Dichloroethene	EPA 524.2	7.371	ug/l
5/2/2019	Mad Mon. 127D	Vinyl chloride	EPA 524.2	1.216	ug/l
6/17/2019	Mad Mon. 109S	Tetrachloroethene	EPA 524.2	0.652	ug/l

Legend

- Phase 1 Monitoring Well Location
- Extraction Well
- Monitoring Well
- Piezometer
- City of Dayton Potable Water Wells
- Installation Boundary

N

600 300 0 600

Feet

WRIGHT-PATTERSON
AIR FORCE BASE,
OHIO

FIFTH FIVE-YEAR ROD REVIEW

FIGURE NUMBER

C-1

CITY OF DAYTON
HUFFMAN DAM WELLS

APTIM

APTIM
5050 Section Avenue
Cincinnati, Ohio 45212

G:\WPAFB\GIS_Documents\Project_Maps\501363.03000000\WPAFB_5yrROD_0C-1_OU5_HuffmanDamWells.mxd; Analyst: Mike.Najar; Date: 11/8/2019 9:17:18 AM

Attachment 1
Decision Documents

Attachment 2
Land Use Control Plan