
FINAL
FOURTH FIVE-YEAR REVIEW REPORT
OU1, OU2 AND TU-44
LUKE AIR FORCE BASE
GLENDALE, ARIZONA

SEPTEMBER 2017

Prepared for:



Air Force Civil Engineer Center
AFCEC/CZRW
3515 S. General McMullen Dr., Suite 155
Joint Base San Antonio Lackland, Texas 78226-2018
Contract FA8903-16-D-0029-0004

Prepared by:



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Phoenix, Arizona 85020

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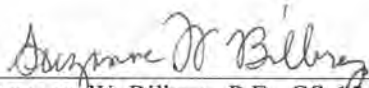
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**FOURTH FIVE-YEAR REVIEW REPORT, OU1, OU2 AND TU-44
LUKE AIR FORCE BASE, GLENDALE AZ
REVIEWED AND APPROVED BY:**



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28 Mar 2018

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LIST OF ACRONYMS AND ABBREVIATIONS

AAC	Arizona Administrative Code
ADEQ	Arizona Department of Environmental Quality
ADHS	Arizona Department of Health Services
ADWR	Arizona Department of Water Resources
AECOM	AECOM Technical Services, Inc.
AFB	Air Force Base
AFCEC	Air Force Civil Engineer Center\
AFFF	aqueous film forming foam
ARAR	Applicable or Relevant and Appropriate Requirements
AST	aboveground storage tank
AWQS	Aquifer Water Quality Standard
BGP	Base General Plan
bgs	below ground surface
BTEX	benzene, ethylbenzene, toluene, and xylene
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CFR	Code of Federal Regulations
COCs	Contaminants of Concern
D&M	Dames & Moore
DPT	Direct Push Technology
ELCR	Excess Lifetime Cancer Risk
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Differences
FFA	Federal Facility Agreement
FPM	FPM Remediations, Inc.
FS	Feasibility Study
FTP	Fire Training Pits
FYR	Five-Year Review
GPS	global positioning system
HDPE	High Density Polyethylene
HI	Hazard Index
ICs	Institutional Controls
ICP	Institutional Control Plan
IDP	Installation Development Plan
IRP	Installation Restoration Program
LOQ	Limit of Quantification
LRL	Laboratory Reporting Limit
LTM	Long Term Monitoring
LUST	Leaking Underground Storage Tank
mg/Kg	milligrams per kilogram
mg/L	milligrams per liter
MNA	Monitored Natural Attenuation
MRLs	Method Reporting Limits

MTBE	Methyl tert butyl ether
NCP	National Contingency Plan
NFA	No Further Action
NFS	National Forest Service
NPL	National Priorities List
NPDES	National Pollutant Discharge Elimination System
O&M	Operation and Maintenance
OU	Operable Unit
OWS	Oil/Water Separator
PAHs	Polynuclear-aromatic Hydrocarbons
PBR	Performance-Based Remediation
PCBs	Polychlorinated Biphenyls
PE	Professional Engineer
PFAS	Perfluoroalkyl Substance
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctane Sulfonate
POC	Point of Compliance
POL	Petroleum, Oils, and Lubricant
ppm	parts per million
PRG	Preliminary Remediation Goal
PSC	Potential Sources of Contamination
RAB	Restoration Advisory Board
RACR	Remedial Action Completion Report
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROD	Record of Decision
ROI	Radius of Influence
R-SRLs	Residential Soil Remediation Levels
SC	Site Closure
SVE	Soil Vapor Extraction
SVOCs	Semi-Volatile Organic Compounds
SWMU	Solid Waste Management Unit
TPE	Two-Phase Extraction
TRPH	Total Recoverable Petroleum Hydrocarbons
UCL	Upper Confidence Limit
URS	URS Group, Inc.
UST	Underground Storage Tank
UTL	Upper Threshold Limits
UU/UE	Unlimited Use and Unrestricted Exposure
VEMUR	Voluntary Environmental Mitigation Use Restriction
VOCs	Volatile Organic Compounds
WRA	Waterdog Recreation Complex
WWTP	Wastewater Treatment Plant

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1.0 INTRODUCTION

The purpose of this Five-Year Review (FYR) is to evaluate the implementation and performance of remedies at Luke Air Force Base (AFB) in order to determine if the remedies are and will continue to be protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in FYR reports such as this one. In addition, FYR reports identify issues found during the review, if any, and document issues and recommendations to address them.

AECOM Technical Services, Inc (AECOM), formerly URS Group, Inc. (URS), has prepared this FYR report pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121, consistent with the National Contingency Plan (NCP)(40 Code of Federal Regulations [CFR] Section 300.430(f)(4)(ii)), and considering United States Environmental Protection Agency (EPA) policy.

This is the fourth FYR for the Luke AFB. The triggering action for this statutory review is the completion of the third FYR in July 2012. Therefore, the time period covered by the report is from July 2012 to July 2017. The FYR has been prepared due to the fact that hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure (UU/UE).

There are two operable units (OUs) (OU-1 and OU-2), which are both addressed in this FYR consisting of 12 sites. The OU-2 sites were the first to be investigated and addressed areas where petroleum-related wastes could have impacted soil. The OU-1 sites were not limited to petroleum-related wastes and addressed air, groundwater, soil, and surface water. In addition, one additional site, TU-044 is included in this fourth FYR. Site TU-044 is located off-base at Apache Lake in Fish Creek, Arizona (AZ). It is regulated under the State of Arizona underground storage tank (UST) program and thus, was never part of the Luke AFB National Priorities List (NPL) investigations. The environmental work at TU-044 is funded with restoration dollars rather than compliance funds and is included per Air Force Civil Engineer Center (AFCEC) policy to perform FYRs at all restoration-funded sites for documentation purposes.

The Luke AFB Superfund Site FYR was led by Charles “Jeff” Rothrock, Environmental Chief, Luke AFB. The FYR team members listed below assisted with the review:

- Ms. Joyce Clark, Councilmember, City of Glendale, Yucca District
- Laura Fischer, Federal Projects Unit, Project Manager, Arizona Department of Environmental Quality (ADEQ)
- Stephanie McCary, AFCEC Remedial Project Manager
- Don Ficklen, AFCEC Program Manager
- Daniel Kiefer, U.S. Air Force Legal
- Darren Berg, Engineer-in-Training, Task Manager, AECOM
- Jeff Rackow, Professional Engineer (PE), AECOM
- John Kim, Project Manager, AECOM

The review began on August 18, 2016.

1.1 Site Background

The location of Luke AFB in relation to the Phoenix metropolitan area is depicted on Figure 1. The AFB covers approximately 4,000 acres west of Glendale, Arizona. Construction of the facility began on March 29, 1941. Although only a few essential buildings had been completed, training of the first class of pilots began on June 6, 1941. Luke AFB is an active-duty F-16 Fighting Falcon and F-35 Lightning II training base. The host command at Luke is the 56th Fighter Wing, under the Air Education and Training Command's 19th Air Force.

The EPA placed Luke AFB on the NPL in 1990. On September 27, 1990, the EPA, ADEQ, Arizona Department of Water Resources (ADWR), and Air Force signed the Federal Facility Agreement (FFA) to establish the procedural framework for conducting the required environmental investigations at Luke AFB. The FFA identified 33 potential sources of contamination (PSC) at Luke AFB, which were divided into two operable units, OU-1 and OU-2. OU-2 included soil investigation at 8 PSCs, while OU-1 included soil investigation of 25 PSCs and a base wide investigation of air, surface water, and groundwater. Of the 8 sites investigated at OU-2, only 2 sites warranted remedial action. The OU-2 Record of Decision (ROD) was signed in 1994. Remedial actions identified in the OU-2 ROD are listed in Table 1-1:

Table 1-1 OU-2 Sites with Remedial Action	
Site ID	Site Description
DP-23	Old Surface Impoundment West of Facility 993
ST-18	Former Liquid Waste Storage Facility (Facility 993)

Of the 25 sites investigated at OU-1, only 8 sites were determined to require further action. The OU-1 ROD was signed on September 1999. Remedial actions identified in the OU-1 ROD are listed in Table 1-2:

Table 1-2 OU-1 Sites with Remedial Action	
Site ID	Site Description
DP-13	Drainage Ditch Disposal Area
FT-07E	North Fire Training Area- East Side
LF-03	Outboard Runway Landfill
LF-14	Old Salvage Yard Burial Site
LF-25	Northwest Landfill
RW-02	Wastewater Treatment Plant Annex Landfill
SD-20 ¹	Oil/Water Separator Canal and Earth Fissure
SD-38	Oil/Water Separator at the Old Auto Body Shop
SS-42	Bulk Fuel Storage Area

Note: ¹ The ROD did not include remedial action for SD-20, however after the first 5-year review, ADEQ requested for it to be added to the Long Term Monitoring (LTM) program.

Luke AFB was removed from the NPL in April 2002. The current and future land use for Luke AFB is expected to remain an active Air Force Base. Because it has been selected as the Air Force's F-35

Lightning II Pilot Training Center, the base is anticipated to be an active installation into the foreseeable future.

Site FT-07 is referred to as the North Fire Training Area, which was part of OU-2, but was not identified as a PSC with required remedial action in the Luke AFB ROD. During this FYR reporting period, FPM Remediations, Inc (FPM) and URS provided justification for and requested formal concurrence from ADEQ that Site FT-07 was eligible for site closure (SC) in accordance with the ROD.

Perfluoroalkyl Substance (PFAS) compounds, most notably Perfluorooctanoic Acid (PFOA) and Perfluorooctane Sulfonate (PFOS) may be present in soil and/or groundwater at Site FT-07 as a result of past firefighting training activities. PFASs are emerging contaminants in which there currently are no enforceable cleanup standards established by EPA for soil or groundwater; therefore it will not impact SC of FT-07 in accordance with the ROD. However, EPA relatively recently issued non-enforceable drinking water Health Advisories for, and that multiple states have established some kind of guidance or threshold criteria for (excluding Arizona). To investigate the potential presence of PFAS, the Air Force has initiated Preliminary Assessment/Site Investigation activities Air Force-wide. The Luke AFB Preliminary Assessment was completed in October 2015 and identified twenty sites for a Site Investigation (SI). Among these sites are sites RW-02, FT-06, FT-07, FT-07E, SD-20, SD-21, and SD-26. The SI work plan was approved by ADEQ and fieldwork began on 26 June 2017.

Site TU-044 is referred to as the Waterdog Recreation Annex and is located off Luke AFB but is under the base's jurisdiction. It is not listed as a Luke AFB site with required remedial action in either ROD and is under the regulatory jurisdiction of the ADEQ's Leaking Underground Storage Tank (LUST) program. Extensive soil and groundwater investigation and remediation efforts have been implemented at the site since the discovery of the UST release in 1991. In 2016, a BOS-200[®] injection groundwater remediation pilot test was implemented with subsequent performance monitoring events.

1.2 Five Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Luke Air Force Base OU-1, OU-2, FT-07, and TU-044		
EPA ID: AZ0570024133		
Region: 9	State: AZ	City/County: Glendale/Maricopa
SITE STATUS		
NPL Status: Deleted		
Multiple OUs? Yes	Has the site achieved construction completion? Yes	

REVIEW STATUS
Lead agency: Other Federal Agency <i>[If “Other Federal Agency”, enter Agency name]:</i> Luke Air Force Base
Author name (Federal or State Project Manager): Jeff Rackow, PE
Author affiliation: AECOM, AFCEC Contractor
Review period: 8/18/2016 - 6/2/2017
Date of site inspection: 9/27/2016
Type of review: Statutory
Review number: 4
Triggering action date: 7/17/2012
Due date (five years after triggering action date): 7/17/2017

2.0 RESPONSE ACTION SUMMARY

This section provides a history of investigations and response actions for each site addressed in this FYR. Initial responses were completed prior to the signing of each ROD. The primary sources of information in this section include the following reports:

- Final Remedial Investigation, Operable Unit No. 2, Luke Air Force Base, Arizona, October 20, 1992, Geraghty and Miller, Inc. (Geraghty Miller, 1992)
- Final Record of Decision, Operable Unit No. 2, Luke Air Force Base, Arizona, January 1994 (Geraghty and Miller, 1994)
- Final Remedial Investigation Report, Luke Air Force Base, Arizona, October 1997 (Geraghty Miller, 1997)
- Final OU-1 Record of Decision, Luke Air Force Base, Arizona, January 20, 1999, ARCADIS Geraghty and Miller, Inc. (ARCADIS Geraghty and Miller, 1999)
- FT-07 Site Closeout Request, Luke AFB, New Mexico - Arizona Group Performance Based Remediation (PBR), December 22, 2014 (FPM/URS, 2014).
- Final Remedial Pilot Test Work Plan, Remedial Design Characterization Report, TU044 – Waterdog Recreation Annex, Fish Creek, Arizona. ADEQ Facility ID 0-005339, ADEQ Leak ID 1933.01 - 1933.03, February 2016. (URS, 2016i).

2.1 Basis for Taking Action

Based on the results of the Remedial Investigations (RIs) conducted at OU-1 and OU-2, contaminants of concern (COCs) were identified for both soil and groundwater media. A summary of COCs for OU-1 and OU-2 are presented in Tables 2.1a and 2.1b below. RI results demonstrated that no further response actions were required for Site FT-07. For Site TU-44, the continued presence of benzene and methyl tert butyl ether (MTBE) above in groundwater above the Aquifer Water Quality Standard (AWQS) of 5 microgram per liter ($\mu\text{g/L}$) and $94 \mu\text{g/L}$ ¹, respectively, warrant further remediation (Table 2.1c).

Table 2.1a: Summary of COCs Detected in Soil Exceeding Applicable Screening Levels

Site	COCs	Screening Level ¹ (mg/kg)	Max Concentration ² (mg/kg)	Response Action
DP-23	Benzo(a)pyrene	0.061 ^a	3.3	Southern section remediated using onsite treatment cell. Internal land use controls documented in ICP on northern section.
	TRPH	4,100 ^b	2,000	
ST-18	Benzene	1.2 ^a	6.4	Internal land use controls documented in ICP and annual inspection of cap
	1,1-Dichloroethane	0.054 ^c	1.0	
	1,1,2,2-Tetrachloroethane	0.38 ^c	3.0	

¹ ADEQ defines a Tier 1 Cleanup Standard of $94 \mu\text{g/L}$ for MTBE as the AWQS if there are no drinking water wells threatened or impacted by the release site.

Site	COCs	Screening Level ¹ (mg/kg)	Max Concentration ² (mg/kg)	Response Action
DP-13	Benzo(a)anthracene	0.61 ^a	0.64	VEMUR filed with ADEQ to restrict future land use.
	Benzo(a)pyrene	0.061 ^a	0.56	
	Benzo(b)fluoranthene	0.61 ^a	0.63	
	Dibenzo(a,h)anthracene	0.061 ^a	0.11	
	TRPH	4,100 ^b	12,000	
	Arsenic	0.38 ^a	19	
	Beryllium	0.14 ^a	0.8	
	Chromium	210 ^a	15,900	
	Copper	2,800 ^a	3,900	
	Lead	400 ^{a,b}	36,000	
FT-07E	TRPH	4,100 ^b	27,000	VEMUR filed with ADEQ to restrict future land use.
	Arsenic	0.38 ^a	9.0	
LF-03	Arsenic	0.38 ^a	15.9	VEMUR filed with ADEQ to restrict future land use.
	Beryllium	0.14 ^a	0.7	
	Chromium	210 ^a	386	
	Copper	2,800 ^a	4,700	
	Lead	400 ^{a,b}	796	
LF-14	Benzo(a)pyrene	0.061 ^a	0.3	VEMUR filed with ADEQ to restrict future land use
	PCBs	0.066 ^a	37	
	TRPH	4,100 ^b	2,400	
	Arsenic	0.38 ^a	14	
	Beryllium	0.14 ^a	1.5	
	Chromium	210 ^a	376	
LF-25	Benzo(a)pyrene	0.061 ^a	0.1	Lead shot removal and VEMUR filed with ADEQ to restrict future land use
	TRPH	4,100 ^b	290	
	Antimony	31 ^a	368	
	Arsenic	0.38 ^a	16	
	Beryllium	0.14 ^a	7.6	
	Lead	400 ^{a,b}	10,100	
RW-02 ³	Benzo(a)pyrene	0.061 ^a	0.1	Annual radiation monitoring and VEMUR filed with ADEQ to restrict future land use
	TRPH	4,100 ^b	4,100	
	Arsenic	0.38 ^a	19	
	Beryllium	0.14 ^a	0.7	
	Cadmium	38 ^{a,b}	58	
	Copper	2,800 ^a	4,840	
	Lead	400 ^{a,b}	680	
	Radium-226	0.61 pCi/g	0.752 pCi/g	
	Radium-228	0.6025 pCi/g	0.739 pCi/g	
SD-20	Benzo(a)pyrene	0.061 ^a	0.3	LTM
	TRPH	4,100 ^b	3,700	
	Arsenic	0.38 ^a	26	
	Beryllium	0.14 ^a	0.9	
SD-38	TRPH	4,100 ^b	58,000	VEMUR filed with ADEQ to restrict future land use
	Arsenic	0.38 ^a	14	
	Beryllium	0.14 ^a	1.0	
	Lead	400 ^{a,b}	470	
SS-42	TRPH	4,100 ^b	33,900	Internal land use controls documented in ICP
	Benzo(b)fluoranthene	0.61 ^a	1.43	
Notes: ADEQ = Arizona Department of Environmental Quality COCs = Contaminants of Concern				

Site	COCs	Screening Level ¹ (mg/kg)	Max Concentration ² (mg/kg)	Response Action
mg/kg = milligrams per kilogram TRPH = total recoverable petroleum hydrocarbon LTM = long-term monitoring ICP = institutional control plan PCBs = polychlorinated biphenyls pCi/g = picocuries per gram VEMUR = Voluntary Environmental Use Restriction Maximum concentrations listed for FT-07E are post-remediation ¹ Screening level is the most conservative value of either the Arizona Soil Remediation Levels (SRLs) or the Region IX Preliminary Remediation Goals (PRGs) at time of ROD signing ² Source: OU-1 and OU-2 RIs ³ Radium-226 and Radium-228 do not have Region IX PRGs, so the average value of background samples was used; a = Based on 1996 EPA residential preliminary remediation goal (PRG) b = Based on 1997 Arizona residential soil remediation level (R-SRL) c = Based on 2000 EPA residential PRG				

It should be noted that no COCs were identified in soil at Site FT-07 and no response actions are required. Consequently, Site FT-07 has not been listed in Table 2.1a.

Table 2.1b: Summary of COCs Detected in Groundwater Exceeding Applicable Screening Levels

Site	COCs	Screening Level ¹ (mg/L)	Max Concentration ² (mg/L)	Response Action
ST-18	Arsenic	0.000045 ^a	0.019	LTM, annual sampling, inspection of cap, and reporting
	Lead	0.004 ^a	0.026	
FT-07E	Lead	0.004 ^a	0.008	LTM, sampling and reporting every 5 years
RW-02	Arsenic	0.000045 ^a	0.017	LTM for radiation in soil with annual results reporting
	Lead	0.004 ^a	0.018	
SD-20	Arsenic	0.000045 ^a	0.026	LTM, sampling and reporting every 5 years
	Lead	0.004 ^a	0.048	
SS-42	Arsenic	0.000045 ^a	0.007	LTM, annual sampling and reporting
	Chromium	0.1 ^b	3.84	
Notes: COCs = Contaminants of Concern mg/L = milligrams per liter LTM = Long Term Monitoring ¹ Screening level is the most conservative value of either the Arizona AWQS, EPA MCL, or the Region IX tap water PRG at time of ROD signing ² Source: OU-1 and OU-2 RIs a = Based on 1996 EPA residential preliminary remediation goal (PRG) b = Based on Arizona Aquifer Water Quality Standard (AWQS).				

Table 2.1c: Summary of COCs Detected in Groundwater at TU-44 Exceeding Applicable Screening Levels

Site	COCs	Screening Level ¹ (mg/L)	Max Concentration (mg/L)	Response Action
TU-44	Benzene	0.005	110	LTM, quarterly sampling and reporting
	Ethylbenzene	0.7	2.8	LTM, quarterly sampling and reporting
	MTBE	0.020 ^a	26	LTM, quarterly sampling and reporting
	Methylene	0.005	1.8	LTM, quarterly sampling and reporting

Site	COCs	Screening Level ¹ (mg/L)	Max Concentration (mg/L)	Response Action
	chloride			
	Toluene	1.0	14	
	Xylenes	10	15.7	LTM, quarterly sampling and reporting
	Manganese	0.98	8.19	LTM, quarterly sampling and reporting
	Naphthalene	0.140	0.190	LTM, quarterly sampling and reporting
	Nitrate	10	34.8	LTM, quarterly sampling and reporting
Notes: COCs = Contaminants of Concern mg/L = milligrams per liter LTM = Long Term Monitoring ¹ Screening level is the current Arizona AWQS or EPA drinking water MCL a = Based on the ADEQ UST Program Tier 1 Cleanup Standard (8/20/02)				

2.2 Response Actions

2.2.1 Site DP-23 Old Surface Impoundment West of Facility 993

Figure 2 shows the location of Site DP-23 within Luke AFB. Site DP-23 is an old surface impoundment and associated drainage swale located west of Building 999 and adjacent to the former south fire training area. The remedial objectives and the remedy components specified in the ROD for Site DP-23 are as follows:

- Remedial Objectives - To remediate soils impacted with COCs to levels below PRGs.
- Remedy Components – The remedial action selected for implementation at PSC DP-23 is soil excavation, ex-situ biological treatment, on-site disposal, and monitoring.

The old surface impoundment portion of Site DP-23 is a rectangular-shaped area north of Super Sabre Street that occupies approximately 3.3 acres (Figure 3). Currently, 80 percent of this area is either paved with asphalt, tarmac, or concrete and includes an equipment yard. In the late 1940's, an impoundment dam was constructed along a natural drainage/wash which flowed south off of Luke AFB. This area may have been used for the disposal of petroleum, oil, and lubricant (POL) waste until construction covered the site in 1969. The dam used to create the impoundment was buried, but not removed. The swale portion of the site is to the south of the impoundment area south of Super Sabre Street, and occupies approximately 19.4 acres. The swale flows south to an area of earth fissures located off Luke AFB.

In 1992, Geraghty & Miller oversaw the advancement of six soil borings at site DP-23 during two separate mobilizations. Based on results described in the OU-2 ROD, the COCs were determined to be the following polynuclear-aromatic hydrocarbons (PAHs): benzo(a,h)anthracene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, indeno(1,2,3-c,d)pyrene, and benzo(a)-pyrene (Geraghty & Miller, 1994). To facilitate remediation, DP-23 was divided into two portions separated by Super Sabre Street, the southern and northern portion. The remedy implemented for the southern portion was excavation, ex-situ soil treatment via composting, on-site disposal of treated soils, then subsequent monitoring (Stell/ARCADIS, 2012). Based on the findings of the base-wide risk assessment, the remedy for the northern portion of DP023 was no further action (NFA) including institutional controls (IC) and voluntary environmental mitigation use restrictions (VEMURs) to prohibit residential development (ARCADIS, 2002). The

northern portion is capped and affected soils are inaccessible to base and construction workers (HGL, 2007). Additional investigation activities were completed (see Figure 3a) in an attempt to close out the site to remove the ICs and VEMUR (see Section 3.1). Table 2.2.1 provides a summary of the chronology of events that have taken place at Site DP-23:

Table 2.2.1 Site Chronology for DP-23 Old Surface Impoundment West of Facility 993	
1940s	Impoundment dam constructed along natural drainage area/wash. May have been used to dispose of POL waste.
1969	Disposal activities cease, site covered by construction activities. Dam was buried but not removed.
1990	Base added to NPL. FFA signed, base regulated under CERCLA
1991 - 1992	Remedial investigation conducted, COCs identified including PAHs and TRPH.
1994	OU-2 ROD signed. Remedial design report prepared and approved for soil composting.
1995	Soil sampling conducted to further characterize contamination at the site. Four PAHs identified as COCs in excess of PRGs. Additional investigation recommended. Onsite treatment cell constructed and 625 cubic yards of contaminated soil was removed and placed in treatment cell for composting. Interim sampling conducted revealing that 25% of soil still remained above PRGs.
1997	Optimized soil amendment mix added to compost. Final sampling conducted with all concentrations below PRG. Treated soil used as fill and hydro seeded. Final site inspection conducted.
2001	EPA and ADEQ conducted final inspection and concluded that the remedy was constructed in accordance with the requirements of the ROD. Internal land use restriction filed. EPA concurred with Final close-out plan for the Base.
2002	First FYR completed, Luke AFB delisted from NPL.
2006	Site inspection completed
2007	Second FYR completed
2011	Site inspection completed
2012	Third FYR completed
2013	Performance-based remediation contract awarded.
2015	Soil samples collected for updated PAH analysis confirm PAH levels remain the same.
2016	Site inspection conducted.
Ongoing Activities	
2017	Fourth FYR Report due.
Notes: ADEQ = Arizona Department of Environmental Quality AFB = air force base CERCLA = comprehensive Environmental Response, Compensation, and Liability Act COCs = contaminants of concern EPA = United States Environmental Protection Agency FFA = Federal Facilities Agreement FYR = five-year review LTM = long term monitoring NPL = National Priorities List PAH = polynuclear-aromatic hydrocarbon POL = petroleum, oils, and lubricant PRGs = Preliminary Remediation Goals ROD = Record of Decision TRPH = total recoverable petroleum hydrocarbons	

At the southern portion of DP-23, an onsite treatment cell was constructed by emplacing berms and a liner and topped with 6 inches of native fill. In all, 625 cubic yards of soil impacted with benzo(a)pyrene at levels above the PRG were excavated and placed in the treatment cell for composting. Baseline samples were collected for later comparison to post-treatment samples. Soils were tilled and watered daily and monitored for temperature, oxygen content, and moisture levels. Confirmation soil samples were collected in 1997 to document the adequacy of treatment by comparing the results to the EPA Region IX Industrial PRG of 0.78 mg/Kg for benzo(a)pyrene. Detected concentrations of benzo(a)pyrene in confirmation samples were all less than the PRG, and no other PAHs were detected in the confirmation samples (ARCADIS, 2001). Once the composted soils were treated, they were used as fill to restore the original grade and the site was hydro-seeded to establish vegetative growth. The liner was disposed of at a local landfill (Stell/ARCADIS, 2012). Based on the collective site investigation and remediation-related sampling results, the southern portion of DP-23 has been adequately remediated and no additional investigation in this area is warranted.

2.2.2 ST-18 Former Liquid Waste Storage Facility (Facility 993)

Site ST-18 is located on the southern part of Luke AFB (Figure 2). The boundaries of the site are depicted on Figure 4. The remedial objectives and the remedy components specified in the OU-2 ROD for Site ST-18 are as follows:

- Remedial Objectives – To ensure the effectiveness of the concrete cap in preventing the potential migration of COCs so that protectiveness of human health and the environment will be maintained.
- Remedy Components – The remedial action selected for implementation at PSC ST-18 is capping, surface controls, and groundwater monitoring. In addition, a deed restriction associated with surface controls is a remedy component to prevent removal of the cap and excavation of soil in the future.

Site ST-18 was used from 1968 to 1983 as a liquid waste storage facility (Facility 993). Facility 993 consisted of a 5,000-gallon refueling tank truck which was coated and buried in 1968. This underground storage tank (UST) was used for temporary storage of petroleum, oil, lubricants and solvent wastes generated at the base. In 1972, two 10,000-gallon USTs were installed at Facility 993, and the area around the three USTs, approximately 0.2 acre, was enclosed with a fence. Closure of this facility began in 1982 to facilitate the construction of a new U.S. Air Force Reserve maintenance building. In 1983, all three USTs were removed (ARCADIS, 2012). The tank pit was excavated to a depth of 16 feet below ground surface (bgs) in an attempt to assess the extent of contamination. Based on field observations, highly impacted soils were manifested to a hazardous waste landfill. The moderately contaminated soils were aired for several weeks and replaced in the pit. Those soils deemed minimally contaminated were also replaced in the UST pit (ARCADIS, 2012).

Between 1985 and 1986, six soil borings were drilled (see Figure 4a), with depths ranging from 100 to 145 feet bgs, to characterize the extent of impacts in and around the Facility 993 site. Soil samples collected during this investigation were submitted for analysis of volatile organic compounds (VOCs), oil and grease, and toxicity metals. It was determined that soil beneath the former USTs had been impacted by fuel and organic solvents to a depth of 55 feet bgs. The site was capped in 1987 to satisfy part of the

Resource Conservation and Recovery Act (RCRA) post-closure requirements. Engineering controls were established to install a concrete cap and liner as well as a fence surrounding the impacted area. Table 2.2.2 provides a summary of the chronology of events that have taken place at Site ST-18:

Table 2.2.2 Site Chronology for ST-18 Former Liquid Waste Storage Facility (Facility 993)	
1979	Site classified as RCRA interim status treatment, storage, and disposal facility.
1980	RCRA Part A Hazardous Waste permit submitted.
1982	RCRA closure activities initiated in preparation for a new taxiway and maintenance building.
1983	Soil borings advanced to 50 feet bgs did not indicate contamination exists. Based on these results, a partial closure plan was submitted to and approved by the ADHS. Three USTs at Facility 993 are excavated and removed. Visual evidence of contamination is observed during excavation.
1985/1986	Site characterization activities were conducted under the IRP Phase I. Five soil borings were advanced and monitoring wells were installed. The deepest contamination occurred at 56.5 feet bgs.
1987	Site is capped with concrete taxiway.
1988	Letter prepared by ADEQ stated the cap was inspected and it is adequate.
1989	Basewide NPL proposal.
1990	Basewide NPL listing.
1990	FFA signed, transferring jurisdiction to CERCLA.
1991/1992	Multi-phase RI/FS conducted throughout OU-2. Soil samples contained TRPH, VOCs, and SVOCs; groundwater samples showed no contamination.
1993	May 12, 1993 Proposed Plan presented to the public and accepted.
1994	OU-2 ROD signed.
1996	Additional sampling conducted. The highest concentration of TRPH was reported at 18,000 mg/kg at 18 to 20 feet bgs. The risk assessment was recalculated and the selected remedial alternative identified in the ROD was determined to be adequate and protective.
1997	Final site inspection conducted.
1999	Repairs made to concrete cap.
2000	BGP revised to reflect land use restrictions at the site. Final site inspection by EPA and ADEQ conducted. Groundwater LTM Plan submitted.
2001	EPA concurrence with Final Close-Out Report.
2001	Repairs made to concrete cap.
2002	First FYR completed. Luke AFB delisted from NPL.
2003	Repairs made to concrete cap. Annual groundwater sampling and concrete cap inspection.
2004	Annual groundwater sampling and concrete cap inspection.
2005	Annual groundwater sampling and concrete cap inspection.
2006	Annual groundwater sampling and concrete cap inspection. Site inspection completed.
2007	Second FYR completed.
2008	Wells MW-114-S and MW-122-S installed and sampled during annual groundwater monitoring.
2009	Repairs made to concrete cap and annual groundwater monitoring and cap inspection completed.

2010	Annual groundwater sampling and concrete cap inspection. Repairs made to concrete cap.
2011	Annual groundwater sampling and concrete cap inspection.
2012	Third FYR report completed.
2013	Performance-based remediation contract awarded.
2014	Drilling conducted for updated VOC data. Results are above R-SRLs. Annual CAP inspection completed.
2015	Annual groundwater sampling and CAP inspection completed.
2016	Drilling conducted for VOC delineation and soil vapor sampling. Report to be submitted by mid-November 2017.
2016	Site inspection for fourth FYR completed. This included the annual cap inspection.
2016	Annual groundwater sampling completed.
Ongoing Activities	
2017	Fourth FYR Report due
Notes: ADEQ = Arizona Department of Environmental Quality ADHS = Arizona Department of Health Services AFB = air force base BGP = Base General Plan CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act COCs = contaminants of concern EPA = United States Environmental Protection Agency FFA = Federal Facilities Agreement FYR = five-year review IRP = Installation Restoration Program LTM = long term monitoring NPL = National Priorities List OU = operable unit PAH = polynuclear-aromatic hydrocarbon POL = petroleum, oils, and lubricant RCRA = Resource Conservation and Recovery Act RI/FS = Remedial Investigation/Feasibility Study R-SRLs = Residential Soil Remediation Levels USTs = underground storage tanks ROD = Record of Decision TRPH = total recoverable petroleum hydrocarbons SVOCs = semi-volatile organic compound VOCs = volatile organic compounds USTs = underground storage tanks	

2.2.3 Site DP-13 Drainage Ditch Disposal Area

Site DP-13 is located in the northwest corner of Luke AFB (Figure 2) and was part of a general landfill area that was expanded to include Site OT-10 (see Figure 5). The remedial objectives and the remedy components specified in the OU-1 ROD for Site DP-13 are as follows:

- Remedial Objectives – To implement and maintain ICs that ensure protectiveness of human health and the environment.

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- Remedy Components – The remedial action selected for implementation at DP-13 are ICs. Components of the ICs include:
 - o Execution of a VEMUR to restrict land usage of the site to non-residential purposes;
 - o Modification of the Base General Plan (BGP) to place constraints on future residential development of the site;
 - o Regulation of work practices that require use of personal protective equipment (PPE) while performing any excavation at the site. A requirement to add this constraint to the BGP through implementation of the digging permit process is a component of the work practices;
 - o Development and maintenance of an ICP to document the required ICs at Site DP-13 to include providing guidance to key personnel who are responsible for implementation of the remedy.

During the 1940's, Site DP-13 was the location of a drainage ditch which was reportedly used for general refuse disposal. The ditch was filled and covered when the base was deactivated in 1946 (HGL, 2007). Concrete and asphalt rubble from runway repair and extension operations were accumulated aboveground at Site OT-10 over time and disposed in a burial pit in 1974. There is no record of known or suspected hazardous wastes being disposed at Site OT-10. Due to Site OT-10 being located entirely within the boundaries of Site DP-13, the two sites were investigated as a single unit during the OU-1 RI (Geraghty and Miller, 1997).

As part of the OU-1 Phase I RI, geophysical and soil gas surveys were conducted at Luke AFB between September 16, 1991 and October 19, 1991. The geophysical and soil gas surveys conducted at Site DP-13 were an attempt to define the boundaries of the former landfill (Geraghty and Miller, 1997). The results of the geophysical survey suggested that non-localized disposal areas were predominant at this site. Clusters of anomalies and single anomalies were identified, which indicated the presence of unknown buried objects.

In November 1991, fifteen test pits were excavated to characterize the extent and contents of the anomalies identified in the geophysical survey. The test pits were approximately 30 feet long and 10 feet deep and were excavated using a backhoe. Seven of the fifteen test pits contained waste material which included concrete, wood, metal, plastic, asphalt, and wire. Samples collected from TP-12 at a depth of 5 feet bgs contained total chromium at a concentration of 15,900 milligrams per kilogram (mg/Kg), and lead at a concentration of 36,000 mg/Kg. These values exceeded residential screening levels.

Direct exposure to these concentrations is unlikely under current land use scenarios; however should the site be excavated or developed for residential purposes, exposure to these concentrations could result. Therefore, remedial alternatives were developed for Site DP-13 as a protective measure (Geraghty and Miller, 1997). The northern VEMUR portion of Site DP-13 (Figure 5a) has been the subject of the most recent additional site characterization activities conducted in 2015 (see Figure 5b). Table 2.2.3 provides a summary of the chronology of events that have taken place at Site DP-13:

Table 2.2.3 Site Chronology for DP-13 Drainage Ditch Disposal Area	
1940s	A drainage ditch was located onsite and was used for disposal of non-hazardous refuse
1946	Base deactivated, drainage ditch was filled in and covered
1951	Base reactivated
1974	Concrete rubble and asphalt from runway repair disposed within boundaries of DP-13
1990	Base added to NPL. FFA signed, base regulated under CERCLA
1991 through 1996	RI conducted, COCs identified including PAHs, TRPH, and metals
1997	Final inspection of OU-1 sites
1999	OU-1 ROD signed
2000	Land use restrictions added to BGP. Institutional control plan prepared and incorporated into BGP. VEMUR filed with ADEQ to restrict future land use.
2001	Final close-out report approved by EPA
2002	First FYR completed, Luke AFB delisted from NPL
2005	Site inspection completed
2007	Second FYR completed
2011	Site inspection completed
2012	Third FYR completed
2013	Performance-based remediation contract awarded.
2015	Additional investigation conducted at DP-13 to bring site to closure. Seventy-two soil borings were advanced and 251 samples were collected and analyzed for COCs.
2016	Remedial Action Completion Report submitted to ADEQ requesting concurrence that site was eligible for closure and removal of VEMUR.
2016	Site inspection completed
Ongoing Activities	
2017	Fourth FYR Report due
Notes: ADEQ = Arizona Department of Environmental Quality BGP = Base General Plan CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act COCs = contaminants of concern FYR = five-year review LTM = long term monitoring NPL = National Priorities List PAH = polynuclear-aromatic hydrocarbon ROD = Record of Decision TRPH = total recoverable petroleum hydrocarbons VEMUR = Voluntary Environmental Mitigation Use Restriction	

2.2.4 Site FT-07 North Fire Training Area – West Side

Site FT-07 is located in the northern portion of Luke AFB (Figure 2). Based on the results of the RI and conclusions in the OU-2 ROD, no remedy was determined to be required for Site FT-07. Therefore, no remedial objectives or remedy components are applicable to Site FT-07.

The western portion of FT-07 encompasses approximately 15 acres of land (Figure 6) and was used as a former fire training area between 1963 and 1973. The Site consisted of eight circular unlined bermed fire

training pits (FTP) approximately 100 feet in diameter, and one large circular area. These areas were identified through an historical aerial photographic search. POL waste was poured into the berms and set on fire for firefighting training. The fires were extinguished with water during training exercises.

The remedial investigation and feasibility study (RI/FS) results for OU-2 indicated that there were no COCs identified in soil that exceeded PRGs at Site FT-07, and that the selected remedial alternative was No Action. Furthermore, the ROD for OU-2, dated January 1994, includes a summary of Site risks associated with each of the PSCs at Luke AFB. Based on the results of the Site-specific Risk Assessment, Site FT-07 was determined to “not represent a significant hazard to human health.” The ROD further states that “both current and hypothetical future excess lifetime cancer risks (ELCRs) and hazard indexes (HIs) for exposure to soils at the OU-2 PSCs are below the USEPA’s risk-based remediation benchmarks (ELCR less than 10^{-4} , HI below 1.0). In addition, a vadose zone transport model was used to evaluate the current potential for COCs in soil at OU-2 to leach from the soil and cause impact to groundwater. Details about the model, which utilized a computer code known as MULTIMED to simulate one-dimensional vertical flow and solute transport in the unsaturated zone, is provided in the 1993 Final Feasibility Study Report, Appendix A, Vadose Zone Transport Model, OU-2, Luke AFB, Arizona. The model was not developed to be used to explain the presence of contaminants in groundwater which may have been the result of historical activities at Luke AFB. PSC-specific models were not constructed; rather, an extremely conservative, OU-2-specific model was developed. The model evaluated leaching of several COCs detected in soils from OU-2 PSCs using the actual concentrations detected and depths from which soil samples were collected and analyzed during the OU-2 RI.

The source concentration for each COC was assumed to equal the maximum possible concentration, regardless of the solubility of each compound in water. In addition, the source was assumed to have a constant concentration over time (i.e., no source decay). This, again, is a conservative assumption because the source is not constant (i.e., source is decaying). The predicted concentrations at the bottom of the vadose zone demonstrated that it is highly unlikely that the groundwater impacts will ever occur as a result of existing, unsaturated conditions at OU-2. Predicted concentrations for the six COCs analyzed range from less than 1×10^{-100} to 1.269×10^{-21} mg/L (Geraghty and Miller, 1994). Therefore, no action was selected for PSC FT- 07.

It should be noted that pursuant to the OU-2 ROD, no remedy is required for Site FT-07, and thus, the inclusion of this site does not require FYR. Although the ROD for OU-2 stated that no action was selected for FT-07, the Site was included in PBR Contract No. FA8903-13-C-0008 due to the undetermined status of well MW-109. Therefore, to complete Site restoration and achieve SC for FT-07 under the PBR contract, Luke AFB has transferred MW-109 from Site FT- 07 to Site FT -07E. Well MW-109 will be abandoned at a future date along with monitoring wells MW-118, MW- 118S, MW -123S, and MW-123D, as part of site restoration for FT-07E.

It should be noted that the RI/FS results for OU-2 indicated that there were no COCs identified in soil at Site FT-07 that exceeded PRGs, and that the selected remedial alternative was No Action. Consequently, the ROD for OU-2, stipulates that No Action for Site FT-07 is required. However, FT-07 has been included in this FYR report as a matter of AFCEC policy for all sites listed in the RODs.

In 1986, groundwater monitoring wells MW-109, MW-110, and MW-111 were installed at FT-07. Table 2.2.4 provides and summary of the chronology of events that have taken place at Site FT-07:

Table 2.2.4 Site Chronology for FT-07 North Fire Training Area – West Side	
1963 to 1973	FT-07 was a former fire training area consisting of eight circular unlined bermed FTPs approximately 100 feet in diameter, and one large circular area to dispense flammable petroleum, oils, and lubricant waste onto mock aircraft or similar structures. The fires were reportedly extinguished with water.
1986	Monitoring wells MW-109, MW-110, and MW-111 installed for use with LTM
1990	Base added to NPL. FFA signed, base regulated under CERCLA
1991 and 1992	Soil and groundwater sampling conducted as part of a RI for OU-2
1994	OU-2 ROD signed, no action selected for FT-07.
1996	MW-110 and MW-111 abandoned due to submerged screen and COCs not warranting additional monitoring.
2002	First FYR completed.
2007	Second FYR completed
2011	Site inspection completed
2012	Third FYR completed
2013	Performance-based remediation contract awarded
2014	Request for Site closure approved by ADEQ. Monitoring well MW-109 transferred to Site FT-07E and will be abandoned along with other wells in the future.
2016	Site inspection completed
Ongoing Activities	
2017	Fourth FYR Report due
Notes: ADEQ = Arizona Department of Environmental Quality CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act COCs = contaminants of concern FFA = Federal Facilities Agreement FYR = five-year review LTM = long term monitoring OU = operable unit ROD = Record of Decision VEMUR = Voluntary Environmental Mitigation Use Restriction	

2.2.5 Site FT-07E North Fire Training Area – East Side

Site FT-07E is located in the northern portion of Luke AFB, west of the Fire Department Training Facility 1355 (Figure 6). The remedial objectives and the remedy components specified in the OU-1 ROD for Site FT-07E are as follows:

- Remedial Objectives – To implement and maintain ICs that ensure protectiveness of human health and the environment.
- Remedy Components – The remedial action selected for implementation at FT-07E are ICs. Components of the ICs include:
 - o Execution of a VEMUR to restrict land usage of the site to non-residential purposes;

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- o Modification of the BGP to place constraints on future residential development of the site;
 - o Development and maintenance of an ICP to document the required ICs at Site FT-07E to include providing guidance to key personnel who are responsible for implementation of the remedy.

Site FT-07E encompasses approximately 2.9 acres of land and was used as a former fire training area between 1973 and 1989. The fire training area consisted of three bermed FTPs designated as FTP-3, FTP-4, and FTP-6. The two largest pits (FTP-3 and FTP-4) were constructed with sprinkler systems to dispense flammable POL waste onto mock aircraft or similar structures. The fires were extinguished with water and aqueous film forming foam (AFFF) during training exercises.

COCs were identified for both soil and groundwater in the 1999 ROD (Geraghty & Miller, 1999). For soil (post remediation), TPH and arsenic were identified as COCs. The Arizona action level for TPH was removed in 2007; therefore, TPH is no longer considered a COC. Arsenic detections in soil ranged from 6.0 to 9.0 mg/Kg. Arsenic was considered a COC due to detectable concentrations exceeding the EPA Region IX PRG of 0.38 mg/Kg. However, detectable concentrations of arsenic in soil were below the current Arizona SRL of 10 mg/Kg and within the range of naturally occurring concentrations included within the background data set for metals in soil at Luke AFB (Geraghty & Miller, 1997). More specifically, the October 31, 1997 Final Appendix B Baseline Basewide Risk Assessment Risk Assessment report (Volume II of II) for Luke AFB states the following for arsenic detections in background soils:

“Arsenic was reported above the PQLs in 33 of the total 190 results (17 percent prevalence) for background Luke AFB samples; the maximum value was 26 mg/kg. The PQLs for arsenic were generally < 5 mg/kg. The detections distribution was 8 detections in surficial samples and 22 detections in soils between 0 and 16 feet bgs. Mean arsenic concentrations were similar (3.7 mg/kg for surface soils; 3.5 mg/kg in soils from 0 to 16 feet bgs). The tolerance level for arsenic at Luke AFB is 8 mg/kg for surficial soils and 9 mg/kg for soils between 0 to 16 feet bgs and for all soils.”

In addition, arsenic is not expected to be related to past activities at Site ST-70E. Therefore, arsenic was no longer considered a COC.

During the RI, groundwater samples were collected and analyzed for both total and dissolved metals and lead was subsequently identified as a COC in the 1999 ROD due to detectable concentrations of total lead exceeding the EPA Region IX tap water PRG of 0.004 mg/L. Total lead concentrations ranged from 0.002 to 0.009 mg/L. Dissolved lead did not exceed the PRG in any of the samples analyzed. In addition, it was noted that the highest detectable concentration of lead in soil was 73 mg/Kg in soil boring SB-6 at a depth of 0 to 2 feet bgs (see Figure 6a). This concentration was below the PRG and is also below the current residential SRL, which are both 400 mg/Kg. More importantly, lead concentrations did not exceed the minimum groundwater protection level (GPL) of 290 mg/kg (ADEQ, 1996), which are used to determine if groundwater sampling is necessary for Site characterization. Table 2.2.5 provides a summary of the chronology of events that have taken place at Site FT-07E:

Table 2.2.5 Site Chronology for FT-07E North Fire Training Area – East Side	
1973 to 1989	FT-07E was a former fire training area consisting of three bermed FTPs designated as FTP-3, FTP-4, and FTP-6. The two largest pits (FTP-3 and FTP-4) were constructed with sprinkler systems to dispense flammable petroleum, oils, and lubricant waste onto mock aircraft or similar structures. The fires were extinguished with water and aqueous film forming foam during training exercises.
1984	Soil and groundwater sampling conducted at FTP-3 and FTP-4 as part of IRP investigation. Three monitoring wells installed.
1990	Base added to NPL. FFA signed, base regulated under CERCLA
1991 through 1996	RI conducted, COCs identified including TRPH, and arsenic. MW-118 and MW-123 were installed at the site.
1992	Additional soil sampling conducted at FTP-3, FTP-4, and FTP-6. Pilot Study for SVE. SVE system installed and operational for 9 months focusing on FTP-3 and FTP-4
1997	Final inspection of OU-1 Sites
1999	OU-1 ROD signed
2000	BGP revised to reflect land use restrictions at the site. Final site inspection by EPA and ADEQ conducted. LTM Plan for groundwater submitted to ADEQ. VEMUR filed with ADEQ to restrict future land use
2001	EPA concurrence with Final Close-Out Report
2002	First FYR completed. Monitoring wells MW-118 and MW-123 added to LTM program at request of ADEQ. Wells to be sampled at every 5-year review.
2007	Second FYR completed
2011	Site inspection completed
2012	Third FYR completed
2013	Performance-based remediation contract awarded.
2015	Additional soil borings advanced at FTP-3, FTP-4, and FTP-6. All COCs below Arizona R-SRLs. ADEQ approves request for concurrence that site can be closed. EPA requests updated VOC analytical results to close site for TRPH.
2016	Three additional soil borings advanced at FTP-3, FTP-4, and FTP-6 for updated VOC analysis. Report to be submitted by mid-September 2017 (refer to Section 3.5 for more detail).
2016	Site inspection completed
Ongoing Activities	
2017	Fourth FYR Report due
Notes: ADEQ = Arizona Department of Environmental Quality CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act COCs = contaminants of concern EPA = United States Environmental Protection Agency FFA = Federal Facilities Agreement FTP = fire training pit FYR = five-year review LTM = long term monitoring NPL = National Priorities List OU = operable unit R-SRLs = Residential Soil Remediation Levels SVE= Soil Vapor Extraction	

TRPH = total recoverable petroleum hydrocarbons
VEMUR = Voluntary Environmental Mitigation Use Restriction
VOC = volatile organic compound

2.2.6 LF-03 Outboard Runway Landfill

The former landfill area LF-03 is located on the western side of the Base (Figure 2). The remedial objectives and the remedy components specified in the OU-1 ROD for Site LF-03 are as follows:

- Remedial Objectives – To implement and maintain ICs that ensure protectiveness of human health and the environment.
- Remedy Components – The remedial action selected for implementation at LF-03 are ICs. Components of the ICs include:
 - o Execution of a VEMUR to restrict land usage of the site to non-residential purposes;
 - o Modification of the BGP to place constraints on future residential development of the site;
 - o Development and maintenance of an ICP to document the required ICs at Site LF-03 to include providing guidance to key personnel who are responsible for implementation of the remedy.

Site LF-03 consists of approximately 21 acres, 60 percent of which is covered by the outboard runway (Figure 7). The site was reportedly used for disposal of general refuse from 1951 to 1953. Refuse was disposed of in narrow trenches approximately 10 feet deep, burned, and covered on a daily basis. After a trench was filled it received a final 3 to 4 foot thick cover. Investigations of the landfill found primarily metals. The site is open land, well maintained, and inspected every five years. Table 2.2.6 provides a summary of the chronology of events that have taken place at Site LF-03:

Table 2.2.6 Site Chronology for LF-03 Outboard Runway Landfill	
1951 to 1953	The site was reportedly used for disposal of general refuse. Refuse was disposed of in narrow trenches approximately 10 feet deep, burned, and covered on a daily basis. After a trench was filled it received a final 3 to 4 foot thick cover
1990	Base added to NPL. FFA signed, base regulated under CERCLA
1991 through 1996	Remedial investigation conducted, metals identified as COCs.
1997	Final inspection of OU-1 Sites
1999	OU-1 ROD signed
2000	BGP revised to reflect land use restrictions at the site. VEMUR filed with ADEQ to restrict future land use
2001	EPA concurrence with Final Close-Out Report
2002	First FYR completed. Luke AFB delisted from NPL
2007	Second FYR completed
2011	Site inspection completed
2012	Third FYR completed
2013	Performance-based remediation contract awarded.
2016	Site inspection completed

Ongoing Activities	
2017	Fourth FYR due
Notes: ADEQ = Arizona Department of Environmental Quality ADHS = Arizona Department of Health Services AFB = air force base BGP = Base General Plan CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act COCs = contaminants of concern EPA = United States Environmental Protection Agency FFA = Federal Facilities Agreement FYR = five-year review NPL = National Priorities List OU = operable unit	

2.2.7 LF-14 Old Salvage Yard Burial Site

Site LF-14 consists of a former landfill area located in the northeastern corner of the Luke AFB (Figure 2). The remedial objectives and the remedy components specified in the OU-1 ROD for Site LF-14 are as follows:

- Remedial Objectives – To implement and maintain ICs that ensure protectiveness of human health and the environment.
- Remedy Components – The remedial action selected for implementation at LF-14 are ICs. Components of the ICs include:
 - o Execution of a VEMUR to restrict land usage of the site to non-residential purposes;
 - o Modification of the BGP to place constraints on future residential development of the site;
 - o Development and maintenance of an ICP to document the required ICs at Site LF-14 to include providing guidance to key personnel who are responsible for implementation of the remedy.

Site LF-14 is an “L” shaped area approximately 1,265 feet by 1,050 feet, with an average width of approximately 85 feet (Figure 8). The site was originally part of the main drainage canal in the 1940s and 1950s. The drainage was changed in the 1950s, and the abandoned canal may have been used as a landfill until it was filled and covered by 1962. According to interviews conducted with Base personnel, transformer fluids that contained polychlorinated biphenyls (PCBs) may have been disposed of at the landfill. During an investigation of the sites, low levels of TRPH, metals, and PCBs were detected. The ROD required Land Use Control/Institutional Controls, which are in place in the Institutional Control Plan (ICP) and BGP, and a VEMUR, which was recorded with Maricopa County. The site is currently unpaved and covered. Table 2.2.7 provides a summary of the chronology of events that have taken place at Site LF-14:

Table 2.2.7 Site Chronology for LF-14 Old Salvage Yard Burial Site	
1950s	The site was reportedly an abandoned drainage canal that was used as a landfill until it was filled and covered in 1962.
1990	Base added to NPL. FFA signed, base regulated under CERCLA

1991 through 1996	RI conducted, PAHs, PCBs, TRPH, and metals identified as COCs.
1997	Final inspection of OU-1 Sites
1999	OU-1 ROD signed
2000	BGP revised to reflect land use restrictions at the site. VEMUR filed with ADEQ to restrict future land use
2001	EPA concurrence with Final Close-Out Report
2002	First FYR completed. Luke AFB delisted from NPL
2007	Second FYR completed
2011	Site inspection completed
2012	Third FYR completed
2013	Performance-based remediation contract awarded.
2016	Site inspection completed
Ongoing Activities	
2017	Fourth FYR due
Notes: ADEQ = Arizona Department of Environmental Quality AFB = air force base BGP = Base General Plan CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act COCs = contaminants of concern FFA = Federal Facilities Agreement FYR = five-year review NPL = National Priorities List OU = operable unit PAH = polynuclear-aromatic hydrocarbon PCBs = polychlorinated biphenyls ROD = Record of Decision TRPH = total recoverable petroleum hydrocarbons VEMUR = Voluntary Environmental Mitigation Use Restriction	

2.2.8 LF-25 Northwest Landfill

Site LF-25 is a former landfill area along the southwestern boundary of the base, between the west perimeter and the northwest runway (Figure 2). The remedial objectives and the remedy components specified in the OU-1 ROD for Site LF-25 are as follows:

- Remedial Objectives – To implement and maintain ICs that ensure protectiveness of human health and the environment.
- Remedy Components – The remedial action selected for implementation at LF-25 include:
 - o Shallow soil remediation for lead shot removal;
 - o Execution of a VEMUR to restrict land usage of the site to non-residential purposes;
 - o Implementation and maintenance of occupational and environmental risk assessments for heavy metals in soil for all future excavation activities performed at the site.

Site LF-25 consists of approximately 43 acres and is depicted on Figure 9. Portions of the site are located immediately downrange of the Base skeet range. Small sections of the site were used for construction debris. The site was used for an undetermined length of time but has not been used since 1989. No liquid wastes have been disposed of at the landfill. Construction debris from the landfill was removed from the

southern sections during the Remedial Investigation. The extent of the landfill was determined and investigated using geophysical logging, soil-gas surveys, test pits, and soil borings. A shot recovery treatability study was conducted in 1998, which concluded that metals recovery was feasible for treatment of this area. Feasibility study recommended ICs and ex-situ physical treatment for metals recovery. Currently the site is open land and well maintained. Table 2.2.8 provides a summary of the chronology of events that have taken place at Site LF-25:

Table 2.2.8 Site Chronology for LF-25 Northwest Landfill	
Pre-1989	The site was reportedly used as a landfill for construction debris for an unknown period of time up until 1989. Portions of the site are located immediately downgradient of the base skeet shooting range.
1990	Geophysical and organic vapor survey conducted in southern portion of site. 80 subsurface metallic objects identified and catalogued. Construction debris from the landfill was removed from the southern portion. Base added to NPL. FFA signed, base regulated under CERCLA.
1991 through 1996	RI conducted focusing on the boundaries of the landfill.
1997	Final inspection of OU-1 Sites
1999	OU-1 ROD signed. Excavated surficial soil removed 2,800 pounds of lead shot. Soil was treated through metals recovery unit and used as backfill for excavation.
2000	BGP revised to reflect land use restrictions at the site. VEMUR filed with ADEQ to restrict future land use
2001	EPA concurrence with Final Close-Out Report
2002	First FYR completed. Luke AFB delisted from NPL
2007	Second FYR completed
2011	Site inspection completed
2012	Third FYR completed
2013	Performance-based remediation contract awarded.
2016	Site inspection completed
Ongoing Activities	
2017	Fourth FYR due
Notes: ADEQ = Arizona Department of Environmental Quality AFB = air force base CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act EPA = US Environmental Protection Agency FFA = Federal Facilities Agreement FYR = five-year review NPL = National Priorities List OU = operable unit ROD = Record of Decision VEMUR = Voluntary Environmental Mitigation Use Restriction	

2.2.9 RW-02 Wastewater Treatment Plant Annex Landfill

Site RW-02 is located at a former 28-acre landfill at the Luke AFB wastewater treatment plant (WWTP) annex located to the north of Glendale Avenue, 2 miles east of the main AFB. The former landfill is located in the northwestern portion of the WWTP annex, in the vicinity of the western bank of the Agua Fria River (Figure 10).

The remedial objectives and the remedy components specified in the OU-1 ROD for Site RW-02 are as follows:

- Remedial Objectives – To implement and maintain ICs that ensure protectiveness of human health and the environment.
- Remedy Components – The remedial action selected for implementation at RW-02 are ICs. Components of the ICs include:
 - o Execution of a VEMUR to restrict land usage of the site to non-residential purposes;
 - o Modification of the BGP to place constraints on future residential development of the site;
 - o Design/implementation of a radiological monitoring program to ensure safety of potential receptors and to provide a warning mechanism in case subsurface conditions change;
 - o Installation of perimeter fencing to provide a barrier that prevents direct exposure and inadvertent disturbance of the area.
 - o Development and maintenance of an ICP to document the required ICs at Site RW-02 to include providing guidance to key personnel who are responsible for implementation of the remedy.

Site RW-02 served as the Base's main landfill for the disposal of refuse from 1953 until 1970 (ARCADIS, 2012). A small quantity of low-level radioactive electron tubes and dials were buried at the site in 1956. The burial site area is 400 square feet, and located within the boundaries of the former Defense Reutilization Marketing Office storage yard (see Figure 10a). The area includes the fenced posted radioactive waste burial site, which is surrounded by a 6-foot-high chain-link fence (20 feet x 10 feet), and a 5 foot buffer zone outside the fence. A small concrete monument approximately 1 foot square and 1 foot high with a radioactive warning sign, protected by painted truck tires is present inside the fence (ARCADIS, 2012). The radioactive material was believed to have been encased in concrete and was disposed in a pit 12 feet deep with 4 feet of concrete cover and 6 feet of earth cover. Surrounding the fenced area are four vadose zone (dry) monitor points (MP-1 through MP-4). No further information is reported regarding the design features of the radioactive waste disposal site.

Table 2.2.9 provides a summary of the chronology of events that have taken place at Site RW-02:

Table 2.2.9 Site Chronology for RW-02 Wastewater Treatment Plant Annex Landfill	
1953 to 1970	The site was a 28-acre landfill used as the primary base landfill for general refuse.
1956	A small quantity of low-level radioactive electron tubes and dials were buried at the site. The site is surrounded by a 6-foot-high chain-link fence (20 feet x 10 feet), and a 5 foot buffer zone outside the fence. A small concrete monument approximately 1 foot square and 1 foot high with a radioactive warning sign, protected by painted truck tires is present inside the fence. The radioactive material was believed to have been encased in concrete and was disposed in a pit 12 feet deep with 4 feet of concrete cover and 6 feet of earth cover.
1990	Base added to NPL. FFA signed, base regulated under CERCLA
1991 through 1996	Remedial investigation conducted focusing on the boundaries of the landfill.
1997	Final inspection of OU-1 Sites

1999	OU-1 ROD signed. Radiological monitoring points installed to depth of 20 feet below ground surface. One background and four monitoring points.
2000	BGP revised to reflect land use restrictions at the site. VEMUR filed with ADEQ to restrict future land use. Radiological LTM plan completed.
2001	EPA concurrence with Final Close-Out Report
2002	First FYR completed. Site added to Luke AFB LTM program. MW-124 to be sampled every 5-Years. Luke AFB Delisted from NPL.
2003	Radiological monitoring event conducted
2004	Radiological monitoring event conducted
2005	Radiological monitoring event conducted
2006	Radiological monitoring event conducted. MW-124 collapsed. Site inspection completed.
2007	Second FYR completed
2008	MW-124S and MW-124D installed and sampled. MW-124 abandoned. Radiological monitoring event conducted
2009	Radiological monitoring event conducted
2010	Radiological monitoring event conducted
2011	Radiological monitoring event conducted. Site inspection completed. Groundwater samples collected from MW-124S
2012	Site inspection and radiological monitoring event conducted. Third FYR completed
2013	Performance-based remediation contract awarded.
2014	Site inspection and radiological monitoring event conducted
2015	Site inspection and radiological monitoring event conducted
2016	Site inspection and radiological monitoring event conducted
Ongoing Activities	
2017	Fourth FYR due
Notes: ADEQ = Arizona Department of Environmental Quality CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act EPA = United States Environmental Protection Agency FFA = Federal Facilities Agreement FYR = five-year review LTM = long term monitoring NPL = National Priorities List OU = operable unit ROD = Record of Decision VEMUR = Voluntary Environmental Mitigation Use Restriction	

2.2.10 SD-20 Oil/Water Separator Canal and Earth Fissure

Site SD-20 is located at the southern portion of Luke AFB (Figure 2). Based on the results of the Base-wide Risk Assessment (Geraghty & Miller, 1997), no remedy was determined to be necessary for Site SD-20. Therefore, there are no remedial objectives or remedy components associated with SD-20.

Site SD-20 includes an unlined canal which originates at oil/water separator (OWS) 912 and is part of the main storm sewer drainage systems for the industrial portion of the Base (Figure 11). The 912 OWS system receives flow from two storm sewer drainage systems, a 30-inch diameter system for drainage from areas to the northwest, and a 43-inch diameter system for drainage from areas to the northeast.

Previous investigations (see Figure 11a) have indicated historically, stagnant oily water in the 30-inch diameter drainage system overflowed into the oil/water separator canal during storm events. During the 1990s, Luke AFB completed upgrades to the base sewer system to prevent additional discharges to the canal. In response to the overflowing of the oil/water separator, several investigations were conducted in the late 1980s and early 1990s to characterize the extent of impact to soil and groundwater at Site SD-20. These investigations were summarized in the ROD for OU-1 (Geraghty & Miller, 1999).

Constituents of concern for both surficial and subsurface soil were identified as benzo(a)pyrene, TRPH, arsenic, and beryllium. COCs in soil at Site SD-20 are presented on Tables 2.1a and 2.1b above, and Tables 3-20 and 3-21 of the 1999 ROD.

The Base-wide Risk Assessment results indicated that the COCs identified at SD-20 were not present at concentrations high enough to cause adverse health effects under current land use scenarios (military/industrial) or even in the unlikely event the site is converted to residential usage in the future. Likewise, results of the vadose zone transport model show that COCs detected in the soil will not migrate to the underlying groundwater resources. As a result, there was no need to evaluate remedial alternatives for Site SD-20 in the OU-1 feasibility study (FS) (Geraghty & Miller, 1998).

Table 2.2.10 provides a summary of the chronology of events that have taken place at Site SD-20:

Table 2.2.10 Site Chronology for SD-20 Oil/Water Separator Canal and Earth Fissure	
1988	IRP investigation conducted, site is a drainage canal that originates at the building 912 OWS.
1990	Base added to NPL. FFA signed, base regulated under CERCLA
1992 through 1996	Remedial investigation conducted, TRPH and PAH identified as COCs.
1995	Investigation of hydrogeology, land subsidence, and earth fissures conducted by USGS.
1997	Final inspection of OU-1 Sites
1999	OU-1 ROD signed
2000	Final inspection conducted by EPA and ADEQ
2001	EPA concurrence with Final Close-Out Report
2002	First FYR completed. MW-112S, MW-112D, and MW-113 added to LTM program on ADEQ recommendation. Luke AFB delisted from NPL
2005	Site inspection completed.
2006	Groundwater sampling conducted as part of LTM.
2007	Second FYR completed
2008	MW-122S and MW-113-S installed and sampled. USGS completed earth fissure map.
2011	Groundwater sampling conducted as part of LTM. Site inspection completed.
2012	Third FYR completed
2013	Performance-based remediation contract awarded.
2015	Soil sampling completed for updated PAH analysis. All results below R-SRLs.
2014	Groundwater sampling completed.
2016	Soil sampling conducted for updated VOC analysis. Report to be submitted by late August 2017 (refer to Section 3.10 for more detail). Site inspection completed.
Ongoing Activities	
2017	Fourth FYR due

Notes:

ADEQ = Arizona Department of Environmental Quality
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act
COCs = contaminants of concern
EPA = United States Environmental Protection Agency
FFA = Federal Facilities Agreement
FYR = five-year review
IRP = Institution Restoration Program
LTM = long term monitoring
NPL = National Priorities List
OU = operable unit
OWS = oil/water separator
PAH = polynuclear-aromatic hydrocarbon
R-SRLs = Residential Soil Remediation Levels
TRPH = total recoverable petroleum hydrocarbons
USGS = United States Geological Survey

2.2.11 SD-38 Oil/Water Separator at the Old Auto Body Shop

Site SD-38 is located in the northeast portion of the Base (Figure 2). The remedial objectives and the remedy components specified in the OU-1 ROD for Site SD-38 are as follows:

- Remedial Objectives – To implement and maintain ICs that ensure protectiveness of human health and the environment.
- Remedy Components – The remedial action selected for implementation at SD-38 are ICs. Components of the ICs include:
 - o Execution of a VEMUR to restrict land usage of the site to non-residential purposes;
 - o Modification of the BGP to place constraints on future residential development of the site;
 - o Development and maintenance of an ICP to document the required ICs at Site SD-38 to include providing guidance to key personnel who are responsible for implementation of the remedy.

In 1989 the United States Army Corps of Engineers conducted a survey to identify potential solid waste management units (SWMUs) and areas of concern on Luke AFB. Two SWMUs were identified at the old Auto Hobby Shop. These SWMUs were identified as Unit numbers 116 and 128. SWMU number 116 was described as the southeast OWS with walls and floor constructed of concrete with an approximate capacity of 350 gallons. The unit was believed to be connected to the industrial sewer that flowed to the wastewater treatment plant.

SWMU number 128 was described as the southwest OWS with walls constructed of concrete with no floor installed; therefore, the floor of this OWS consisted of the soil underneath the separator. The capacity of the unit was not mentioned and it was believed to be connected to the wastewater treatment plant.

SWMU 128 was subsequently identified as Site SD-38 during the remedial investigation at Luke AFB. Site SD-38 is located in the northeast portion of Luke AFB (Figure 2). A site map of SD-38 is provided as Figure 12. Floor drains in the service bays of the old Auto Hobby Shop were reportedly connected to

SWMU 128 and then passed through SWMU 116 before discharging to the industrial sewer and eventually the wastewater treatment plant. Wastes reported to have been sent through the OWS include oil, antifreeze, transmission fluid, grease, and solvents (Geraghty & Miller, 1997).

During the RIs for OU-1 and OU-2, a total of six borings were advanced at Site SD-38. Soil borings SB-1 through SB-3 were advanced in 1992 and SB-5 through SB-7 were advanced in 1993. Due to a clerical error, SB-4 was not assigned to any of the boring locations. All samples were analyzed for VOCs, SVOCs, TRPH, and metals. VOCs and SVOCs were detected in samples collected from soil borings SB-3 and SB-5 with the highest concentrations detected in the samples collected from SB-3 between 6 to 8 and 8 to 10 feet bgs. Of the detected VOCs and SVOCs, only tetrachloroethylene (PCE) and TCE were detected at concentrations that exceeded the Arizona R-SRL at 0.51 mg/Kg and 3.0 mg/Kg, respectively, which are both 10^{-6} cancer risk levels. PCE was detected at a concentration of 450 and 20 mg/Kg in the 6 to 8 and 8 to 10 feet samples, respectively, from SB-3 while TCE was detected at 19 mg/Kg in the 6 to 8 foot sample from SB-3. However, due to concerns about the quality of the data, the sample results for VOCs and SVOCs were flagged “UQ” for unknown quality.

TRPH was detected in samples collected from soil borings SB-1, SB-2, SB-3, and SB-5 with the highest concentration (58,000 mg/Kg) detected in SB-3 at 6 to 8 feet bgs. Currently, there is no Arizona SRL for TRPH. The metals arsenic, barium, beryllium, cadmium, chromium, copper, nickel, lead, and zinc were detected in one or more samples collected from each soil boring. One or more samples collected from 0 to 4 feet bgs in soil borings SB-1 and SB-2 had arsenic concentrations at or above the Arizona R-SRL of 10 mg/Kg with concentrations ranging from 10 to 14 mg/Kg. With the exception of lead, these metals were determined to be naturally occurring or below their background upper threshold limit concluded in 1997 remedial investigation report (Geraghty and Miller, 1997).

During the OU-1 remedial investigation soil boring SB-6 was finished as a groundwater monitoring well (MW-117). The well was installed to evaluate if activities associated with the use of the OWS at Site SD-38 resulted in impacts to the groundwater beneath the Site. The monitoring well was installed in the apparent down gradient direction of the regional groundwater flow relative to the former OWS (Geraghty & Miller 1997). Between 1993 and 1995 four samples were collected and submitted for analysis of VOCs, SVOCs, and total and dissolved metals. A fifth sample was collected for VOCs only in 1995. VOCs and BNAs were not detected in any of the samples collected from monitoring well MW-117.

The metals arsenic, barium, chromium, copper, lead, nickel, and zinc were all detected at low levels in samples collected from MW-117. With the exception of nickel all concentrations were below their respective background upper threshold limits (UTLs). Two samples collected in 1993 were slightly above the UTL of 0.025 mg/L, but were “*within the range of naturally occurring concentrations included within the background data set*” (Geraghty & Miller, 1997).

Table 2.2.11 provides a summary of the chronology of events that have taken place at Site SD-38:

Table 2.2.11 Site Chronology for SD-38 Oil/Water Separator at the Old Auto Hobby Shop	
1990	Base added to NPL. FFA signed, base regulated under CERCLA
1991	Site is a former OWS for building 248, the old Auto Hobby Shop. During RCRA

	facilities inspection it was determined that the OWS had an earthen bottom,
1992	Site was originally part of the OU-2 investigation; however due to it potentially having a threat to groundwater; site was reclassified as an OU-1 site.
1992 through 1996	Remedial investigation conducted, TRPH and lead identified as COCs.
1997	Final inspection of OU-1 Sites
1999	OU-1 ROD signed
2000	BGP revised to reflect land use restrictions at the site. VEMUR filed with ADEQ to restrict future land use
2001	EPA concurrence with Final Close-Out Report
2002	First FYR completed. Luke AFB delisted from NPL
2007	Second FYR completed
2011	Site inspection completed
2012	Third FYR completed
2013	Performance-based remediation contract awarded.
2016	Site inspection completed
Ongoing Activities	
2017	Fourth FYR due
Notes: ADEQ = Arizona Department of Environmental Quality AFB = air force base CERCLA = Comprehensive Environmental Response, FFA = Federal Facilities Agreement Compensation, and Liability Act FYR = five-year review NPL = National Priorities List OU = operable unit OWS = oil/water separator RCRA = Resource Conservation and Recovery Act ROD = Record of Decision TRPH = total recoverable petroleum hydrocarbons VEMUR = Voluntary Environmental Use Restriction	

2.2.12 SS-42 Bulk Fuels Storage Area

Site SS-42 has been used as a bulk fuel terminal from prior to 1954 to the present. The location of Site SS-42 is on the northeast end of the Base (Figure 2). The remedial objectives and the remedy components specified in the OU-1 ROD for Site SS-42 are as follows:

- Remedial Objectives - To remediate soils impacted with COCs to levels below PRGs.
- Remedy Components – The remedial actions selected for implementation at PSC SS-42 include the following:
 - o Installing and operating an SVE system to remediate fuel-impacted soils; and
 - o Monitoring soil and groundwater to confirm the effectiveness of SVE remediation and potential migration of COCs from soil to groundwater.

Luke AFB records indicate that fuel was delivered to the site by rail car from 1954 until 1960. The fuel was pumped from the rail line east of the site through a pump house located at the southeast corner of the site. Fuel was then transferred to the aboveground storage tanks. The delivery system was changed in 1960 from rail cars to a pipeline, at which time the hydrants and part of the distribution system were abandoned (Geraghty & Miller, 1997).

SS-42 consists of a former LUST site located within the eastern portion of the bulk fuels storage area (Figure 13). The LUST was part of an OWS system that received condensate from the two large aboveground fuel tanks. In March 1993, unusually heavy rains caused the soil around the UST to settle (ARCADIS, 2012). The settling apparently caused the fill line to dislodge from the tank and resulted in a release. The OWS and UST were removed from service and excavated. In September 1993, a new OWS with an aboveground storage tank was installed approximately 150 feet to the southwest of the original OWS system location (ARCADIS, 2012).

In response to the release from the OWS, an environmental investigation was performed by Environmental Engineering Consultants, Inc. (EEC) in March 1993. Seven soil borings were advanced adjacent to the OWS and leaking UST. Results from the soil boring sampling indicated the presence of TPH and benzene, toluene, ethylbenzene, and total xylenes (BTEX) at depths between 70 feet and 160 feet. This investigation failed to delineate the horizontal extent of contamination. As a result of the investigation findings, Site SS-42 was identified as a PSC in the CERCLA investigation. Due to the depth of the impact and magnitude of the release, additional investigations were considered warranted because of the potential for groundwater impact. Therefore, Site SS-042 was assigned to OU-1 in August 1993 (ARCADIS, 2002; ARCADIS, 2012).

In 1994, the RI was conducted to define the horizontal extent of the impact detected at the former OWS and UST, identify other potential sources of contamination at the site, and to assess the groundwater quality. Sixteen soil borings were advanced and sampled to determine the horizontal and vertical extent of the impacts identified at the site (ARCADIS, 2002; ARCADIS, 2012).

A Base-wide Risk Assessment was completed in 1997. A review of the analytical results from previous RI soil sampling indicated TPH and BTEX were present at depths ranging from 10 to 160 feet bgs, with the highest concentrations at 70 ft. bgs. The Base-wide Risk Assessment concluded that contaminants detected at Site SS-042 were not present at concentrations high enough to cause adverse health effects under current land use scenarios, or under residential land use scenarios. Results of the vadose zone transport modeling, however, indicated that petroleum related contaminants (TPH and BTEX) detected in the soil could migrate to the underlying groundwater resource. For this reason, remedial alternatives were developed for the site (Malcolm Pirnie, 2009).

During the second FYR, it was noted that the well screens at monitoring wells MW-121 and MW-125R were submerged, as water levels had increased across the base due to decreased quantities of water drawn from the aquifer for irrigation purposes. Consequently, two new monitoring wells MW-121-S and MW-125R-S were installed in March/April 2008. The new wells were installed with a shallower screened interval at Site SS-042 to accommodate rising groundwater levels. The suffix “S” on the two additional wells denotes shallow screened interval (Hydrogeologic, 2007; ARCADIS, 2012).

Groundwater samples are collected annually at Site SS-042 under the Luke AFB LTM program. Internal land use controls, as documented in the BGP, are in place to prohibit residential development at SS-042. It should be noted that the internal LUCs were not part of the selected remedy (ARCADIS, 2012).

Table 2.2.12 provides a summary of the chronology of events that have taken place at Site SS-42:

Table 2.2.12 Site Chronology for SS-42 Bulk Fuels Storage Area	
1990	Base added to NPL. FFA signed, base regulated under CERCLA
1993	Settlement beneath a UST that was part of an OWS system caused a fill line to dislodge from the UST resulting in a loss of fuel. Investigation to delineate extent of contamination resulted in vertical delineation to 160 feet and horizontal undefined. Site was added to the FFA and assigned to OU-1.
1992 through 1994	RI conducted, TRPH and BTEX identified as COCs at depth. Remedial alternatives developed due to potential for contaminants to migrate to groundwater.
1995	Bioventing treatability study implemented for source removal.
1996	SVE system installed and started.
1997	Soil borings advanced to determine effectiveness of SVE system. Final inspection of OU-1 Sites.
1998	SVE System shutdown
1999	Additional soil borings advanced to determine effectiveness of SVE system. TRPH and BTEX detected, however modeling indicated levels would not impact groundwater at concentrations above AWQS. OU-1 ROD signed. LTM plan completed for SS-42.
2000	Final site inspection by EPA and ADEQ completed, LTM sampling completed. SVE and conformation soil sampling report submitted.
2001	EPA concurrence with Final Close-Out Report
2002	First FYR completed. Luke AFB delisted from NPL
2003 through 2006	Annual groundwater sampling completed.
2007	Second FYR completed
2008	MW-121-S and MW-125R-S installed and sampled during annual groundwater sampling event.
2009 through 2011	Annual groundwater sampling completed.
2011	Site inspection completed
2012	Third FYR completed
2013	Performance-based remediation contract awarded.
2013 through 2016	Annual groundwater sampling completed.
2016	Site inspection completed
Ongoing Activities	
2017	Fourth FYR due
Notes: ADEQ = Arizona Department of Environmental Quality AWQS = Aquifer Water Quality Standard BTEX = benzene, toluene, ethylbenzene, total xylenes CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act COCs = contaminants of concern EPA = United States Environmental Protection Agency FFA = Federal Facilities Agreement FYR = five-year review LTM = long term monitoring NPL = National Priorities List OU = operable unit OWS = oil/water separator RI = Remedial Investigation ROD = Record of Decision SVE = soil vapor extraction	

TRPH = total recoverable petroleum hydrocarbons UST = underground storage tank

2.2.13 TU-44 Waterdog Recreational Annex

The waterdog recreational annex (WRA) is located on 26 acres of land on the east side of Apache Lake in Maricopa County, Arizona approximately 0.5-mile west of Arizona Highway 88 (Apache Trail). A vicinity map identifying the Site TU-44 location is provided as Figure 14, and a map of the site itself that includes the existing monitoring wells is provided as Figure 14a.

Although Site TU-044 is under Luke AFB's jurisdiction, it is not included in either the OU-1 or OU-2 RODs because the activities being performed are not a CERCLA response, but rather a response required under the ADEQ Leaking Underground Storage Tank (LUST) program. Consequently, no remedial objectives or remedy components associated with Site TU-44 are applicable pursuant to a ROD. The inclusion of Site TU-44 in this FYR was requested by AFCEC as a means of documenting the site status and remedial progress to coincide with the FYR time period.

In 1957, Williams AFB received a special use permit from the National Forest Service (NFS) for the WRA to be used for the enjoyment of military personnel stationed at the base. After Williams AFB was Congressionally-mandated to close on September 30, 1993, Luke AFB assumed responsibility for WRA.

Prior to 1957, the WRA property was undeveloped land owned and managed by NFS. Several buildings, including a recreational building, twenty-one (21) cabins, a maintenance building, two maintenance sheds, and an old water treatment shed were built in 1958. A floating dock was constructed at the lake shore directly in front of the recreational building. A fuel pump was located near the floating dock for boat refueling. Four USTs were located onsite with conveyance piping to the boat dock. The USTs were used to store gasoline and pre-mix for the boating operation and consisted of one 3,750-gallon regular gasoline UST, one 2,000-gallon mixed gas/oil UST, and two 550-gallon mixed gas/oil USTs. The tanks were installed in 1979 and 1984. Two aboveground storage tanks (ASTs) were located approximately 500 feet east-southeast of the USTs. The volume and the content of the ASTs are unknown. In the early 1980s, 18 of the 21 cabins were torn down, and new slump block cabins were built in their place. In the late 1980s, the maintenance building was torn down and replaced with a new corrugated metal structure. Also in the mid to late 1980s, the east maintenance storage shed burned down. Waterdog was closed to visitors in 1993 when Williams AFB closed.

On June 12, 1991, Williams AFB personnel noticed a strong fuel odor, contaminated soil, and a sheen floating on Apache Lake. On June 13, 1991, a release from the USTs at Waterdog was reported to the ADEQ. On June 26, 1991, the remaining product was removed from the USTs. In July of 1991, gasoline-related contamination, including free product and dissolved-phase hydrocarbons, were discovered in groundwater at the site. The USTs and associated piping were removed in October 1991. In December 1991, approximately 135 cubic yards of soil were removed from the site, disposed of at a disposal facility, and the excavation was backfilled with clean fill.

Over the years at Site TU-44, multiple subsurface investigations have been implemented to define the nature and extent of petroleum hydrocarbons including BTEX, TPH, and MTBE in soil and groundwater.

To address these impacts, soil and groundwater remediation has been performed using multiple technologies including bioventing, SVE, air sparging, and two-phase extraction (TPE). In conjunction with significant fluctuating groundwater levels (up to approximately 8 feet), the geology and hydrogeology of the site consisting of weathered/fractured granite which makes it particularly difficult to remediate the contamination. At the present time, both benzene and MTBE exist in groundwater at 12 monitoring wells in concentrations exceeding the Arizona AWQS of 5 µg/L and the ADEQ Tier 1 remedial guidance level of 20 µg/L, respectively. In an effort to complete remediation, a BOS-200® injection pilot test was implemented in late September 2016 by URS under the current PBR contract. BOS-200® Trap & Treat is a proprietary mixture of activated carbon, nutrients, and electron acceptors that is injected into the subsurface to adsorb and degrade petroleum hydrocarbons. Post-injection performance monitoring commenced in October 2016. An assessment of the pilot test remedial performance will be provided in a results report anticipated to be submitted to ADEQ for review by September 8, 2017.

Table 2.2.13 provides a summary of the chronology of events that have taken place at Site TU-44:

Table 2.2.13 Site Chronology for TU-44 Waterdog Recreational Annex	
1957	Special use permit issued Williams AFB for recreational use
1958	Recreational building, cabins, maintenance building, maintenance sheds, and water treatment shed built.
1979 to 1984	Four USTs installed
Early 1980s	18 of 21 cabins demolished and replaced with slump block cabins
Late 1980s	Maintenance building demolished and replaced with corrugated metal structure. Maintenance storage shed burned down.
1991	Strong odor detected and sheen noticed on Apache Lake. Release reported to ADEQ, remaining fuel removed from USTs. USTs subsequently removed from the ground. 135 cubic yards of petroleum contaminated soil removed and disposed.
1993	WRA closes to visitors
1994	Environmental baseline survey conducted, preliminary site characterization, soil gas survey, and soil borings completed. Soil contamination confirmed.
1995	Bioventing system installed with one injection well (IW-1) and operated until January 1996. Groundwater sample collected from vapor monitoring point VMP-4. Benzene detected above Arizona standards.
1996	Groundwater sample collected from VMP-4, surface water sample collected from Apache Lake. Benzene detected above Arizona standard in VMP-4. Lake sample was non-detect. Four additional soil borings advanced, groundwater monitoring well MW-1 installed and sampled.
1997	Dye injection test conducted on MW-1. No dye observed in lake. Bioventing system converted to SVE system, operated for two months and shut down as no vapors detected in samples.
1998	Water level measurements, groundwater sampling, and elevation survey conducted.
1999	Three new wells installed (MW-2, MW-3, MW-4), soil samples collected, no TRPH or BTEX detected. VMP wells and injection well abandoned. Groundwater samples indicated contaminants above AWQS in all wells.
2000	Quarterly groundwater sampling conducted
2001	Passive soil gas survey, groundwater well installation and sampling (MW-5, MW-6, and MW-7), SVE design and installation.

2002	Complex resistivity survey completed. MW-8 and MW-9 installed.
2003	TPE system installed and operated until 2005. Bail down testing conducted on MW-4.
2004	Quarterly groundwater sampling.
2005	Air sampling conducted on TPE system. Influent vapor concentrations decreased, system shut down in September.
2006	Groundwater sampling conducted in January and May.
2007	Refraction seismic survey investigation completed. Blasé-Enhanced Fracturing proposed, but not implemented.
2008	NFA with MNA proposed
2010	Baseline Sampling Event Phase I conducted to support MNA. Results indicate extent of contamination not defined.
2011	TPE system decommissioned
2012	Quarterly groundwater monitoring completed.
2013	Performance-based remediation contract awarded.
2014	Quarterly groundwater monitoring completed.
2015	Quarterly groundwater monitoring completed
2016	Quarterly groundwater monitoring completed. Pilot Test Work Plan for BOS 200 [®] approved and pilot test implemented. Site inspection completed
2017	Preparing pilot test implementation results report. Anticipated submittal to ADEQ is September 2017.
Ongoing Activities	
2017	Fourth FYR due
Notes: ADEQ = Arizona Department of Environmental Quality AFB = air force base BTEX = benzene, toluene, ethylbenzene, total xylenes MNA = monitored natural attenuation NFA = No Further Action SVE = soil vapor extraction TPE = two phase extraction TRPH = total recoverable petroleum hydrocarbons USTs = underground storage tanks WRA = Waterdog Recreational Annex	

2.3 Status of Implementation

With the exception of the landfill PSCs LF-03, LF-14, LF-25, all the PSCs identified in the ROD for OU-1 and OU-2 at Luke AFB have undergone some degree of supplemental soil investigation over the past 3 years under the current PBR contract. The ultimate objective of implementing this work has been to proceed towards SC with UU/UE. Based on sampling data generated and evaluated from the supplemental soil investigations, either concurrence of eligibility for SC has been sought, or work plans for additional soil investigation have been proposed and/or approved by the ADEQ. In terms of FT-07, historic site soil data was evaluated to determine that the site was eligible for SC. The submittal of results reports, particularly for the investigation of VOCs in soil where TRPH had been identified as a COC in the RODs, is pending for sites ST-18, FT-07E, SD-20, and SD-38. It should be noted that thus far none of the work has resulted in requirements for implementing any active soil or groundwater remediation.

In terms of TU-44, a BOS-200[®] injection pilot test was implemented in late September in accordance with a February 2016 Remedial Pilot Test Work Plan (URS, 2016k). Prior to commencement of the

remedial injections, baseline data was collected during a quarterly groundwater monitoring event whereby 15 of the site monitoring wells were sampled for VOCs, nitrate, sulfate, and ferrous iron in August, 2016. Since that time, there have been four performance monitoring events of select wells including immediately after the injections, and at 2, 4 and 8 weeks following the injections. A report of the data analysis and interpretation is pending.

ICs have remained in place for ten PSCs that consist of administrative measures to restrict access and limit exposure to impacted areas of the site. The required measures are described in the September 2014 ICP (ARCADIS, 2014a), and are presented in the IC summary table below.

2.4 Institutional Control Summary Table

ICs have remained in place for ten PSCs that consist of administrative measures to restrict access and limit exposure to impacted areas of the site. The required measures are described in the September 2014 ICP (ARCADIS, 2014a), and are presented in the IC summary table below.

Impacted Parcel(s)	Media, engineered controls, and areas that do not support UU/UE based on current conditions	ICs Needed	ICs Called for in the Decision Documents	IC Objective	Title of IC Instrument Implemented and Date (or planned)
DP-23	Soil	Yes	Yes	Restricts a portion of the Site to non-residential use.	Internal Land Use Restriction per BGP
ST-18	Soil and Groundwater	Yes	Yes	Periodic maintenance and annual inspection of concrete cap which serves to prevent potential leaching of contaminants to groundwater. Annual LTM for groundwater	OU-2 ROD (1994)
DP-13	Soil	Yes	Yes	Restricts a portion of the Site to non-residential use. Requires risk assessments for heavy metals for all future excavation activities.	VEMUR (2000)
FT-07E	Soil	Yes	Yes	Restricts a portion of the Site to non-residential use.	VEMUR (2000)

Impacted Parcel(s)	Media, engineered controls, and areas that do not support UU/UE based on current conditions	ICs Needed	ICs Called for in the Decision Documents	IC Objective	Title of IC Instrument Implemented and Date (or planned)
LF-03	Soil	Yes	Yes	Restricts a portion of the Site to non-residential use.	VEMUR (2000)
LF-14	Soil	Yes	Yes	Restricts a portion of the Site to non-residential use.	VEMUR (2000)
LF-25	Soil	Yes	Yes	Restricts a portion of the Site to non-residential use. Requires risk assessments for heavy metals for all future excavation activities	VEMUR (2000)
RW-02	Soil	Yes	Yes	Restricts a portion of the Site to non-residential use. Includes perimeter fencing and signage at the low-level radioactive waste disposal area. Requires annual geophysical monitoring for radioactivity in soil at and adjacent to disposal area.	VEMUR (2000)
SD-38	Soil	Yes	Yes	Restricts a portion of the Site to non-residential use.	VEMUR (2000)
SS-42	Groundwater	Yes	Yes	Annual LTM for groundwater	OU-1 ROD (1999)
Notes: BGP - Base General Plan IC- institutional control LTM - long-term monitoring UU/UE - unlimited use and unrestricted exposure VEMUR - Voluntary Environmental Mitigation Use Restriction					

2.5 System Operations/Operations and Maintenance

No environmental-related operations and maintenance (O&M) activities are taking place for active remediation systems at the PSCs. Furthermore, there were no O&M activities performed for active

remediation systems during the previous FYR, and no plans in the foreseeable future for implementing active remediation requiring O&M. However, the concrete cap at Site ST-18 is required to be monitored annually in accordance with the ICP (ARCADIS, 2014b), and implementation of cap maintenance is required when warranted based on observations made during the annual inspections. For this FYR, recommendations have been made to repair cracks in the cap (see Section 6.0).

In September 2016 at Site TU-44, four injection points were drilled and BOS-200[®] product injections were performed for groundwater remediation pilot testing at the site. In late September and early October 2016, 11 new monitoring wells were constructed at the injection point boreholes, to replace two unusable wells, and at five new locations for use with post-injection performance groundwater monitoring. If the pilot test is successful, a full-scale remediation system will be designed for conducting BOS-200[®] product injections.

3.0 PROGRESS SINCE LAST REVIEW

In the third FYR report, recommendations for follow-up actions were provided for Sites ST-18, LF-25, RW-02, and SS-42. The progress of these recommendations since the third FYR is provided in Sections 3.2, 3.8, 3.9, and 3.12. In addition, the Third FYR report provided a recommendation to update the ICP and BGP (now known as the Installation Development Plan [IDP]) to include land use restrictions for appropriate OU-1 and OU-2 sites. The schedule for completing this work was planned to be within one year for updating the BGP, and within two years for updating the ICP from when the final Third FYR Report was issued (July 2012). The updated IDP was finalized in April 2014, and the updated ICP was finalized in September 2014.

For the 2013 PBR Contract, Performance Objectives were established by AFCEC for the ROD-identified sites that include achieving concurrence from applicable regulatory authorities of Response Complete, and/or achieving Site Closeout (SC) with UU/UE to the extent possible to do so. In an effort to meet these Performance Objectives, URS has implemented additional soil characterization activities at most of the PSC sites as described below. The majority of the soil investigation activities were conducted to address historic TRPH and/or VOC exceedances to Arizona NR-SRLs or EPA PRGs resulting in ICs (including VEMURs) at most of the sites. Because of the time period since the RI was performed in the early to mid-1990s, natural attenuation of COCs to concentrations below regulated cleanup levels and/or risk-based screening levels was anticipated at some sites, which if demonstrated, could result in the ability to achieve Response Complete or SC determinations for such sites. In addition, TRPH once identified as a COC at some sites is no longer a regulated COC by the ADEQ, and therefore, documenting that TRPH is not a concern prompted supplemental site characterization activities to evaluate potential VOC concentration exceedances associated with the TRPH.

A considerable amount of activity has occurred over the fourth FYR reporting period in an effort to further investigate and proceed towards SC at multiple sites. Sections 3.1 through 3.13 provide more detailed information about the work that has been performed primarily under AFCEC's existing PBR contract with URS, which commenced in 2013.

3.1 Site DP-23 Old Surface Impoundment West of Facility 993

The following documents the progress of work at Site DP-23 that has been conducted by URS since its involvement at Luke AFB under the September 2013 PBR contract with AFCEC. Major work progress completed at Site DP-23 in 2012 that occurred between the end of the 2011 FYR and the beginning of the PBR contract, appears to have been limited to completing the third FYR report.

August 2015 Work Plan

Because soils in the area north of Super Sabre Street were not remediated and had detected COCs above present R-SRLs, URS proposed additional investigation for PAHs as described in an August 2015 Work Plan. The ADEQ accepted the Work Plan in its approval letter dated August 20, 2015 (ADEQ, 2015a). The objective of the work was to demonstrate that DP-23 soil concentrations north of Super Sabre Street are either below the applicable R-SRLs, or sufficiently low that they pose no risk to human health or the environment.

September 2015 Soil Boring Sampling

In September 2015, 12 soil borings were drilled and sampled to a depth of 14 feet bgs. The boring locations, shown on Figure 3a, were selected to provide representative sampling results for the area of concern relative to 1) the locations and results of previous soil borings drilled in 1996 by Environmental Chemical Corporation and Dames & Moore (D&M) which had soil impacts above PRGs; 2) the locations of 1996 soil borings which had no detectable concentrations of COCs in samples, but that had elevated laboratory method reporting limits (MRLs) that exceeded current established R-SRLs and 3) the locations and results of previous soil borings drilled during the RI in 1992 by Geraghty and Miller which had soil impacts above established R-SRLs.

A total of 54 soil samples were collected from the 12 soil borings including 48 field original and 6 field duplicate samples. In addition, 3 water samples (equipment blanks) were collected. All the samples were analyzed by an Arizona Department of Health Services (ADHS)-certified laboratory for PAHs using EPA Method 8270C-SIM. Five PAHs specified as COCs in the ROD were reported consisting of benzo(a,h)anthracene, benzo(b)fluoranthene, dibenzo(a,h)-anthracene, indeno(1,2,3-c,d)pyrene, and benzo(a)pyrene. The results of the completed September 2015 soil sampling indicated that there were some exceedances to R-SRLs in soil.

Confirmation of Suitability for Industrial Use

Because results of the September 2015 soil boring sampling indicated that some PAH concentrations exceeded R-SRLs, URS sought concurrence from ADEQ that the land remains suitable for industrial use considering the conclusions reported in the 1998 D&M Risk Assessment report. In response to URS' formal request for concurrence, the ADEQ expressed agreement with the conclusions of the D&M report and issued a concurrence letter dated May 3, 2016 (ADEQ, 2016a). More specifically, ADEQ agreed that the levels of detected contamination in the northern section of DP-23 are protective of the current industrial land use, and that any land use restrictions in place shall remain in effect. Luke AFB intends to maintain the ICs for Site DP-23 which prohibits residential land development.

3.2 ST-18 Former Liquid Waste Storage Facility (Facility 993)

The following documents the progress of work at Site ST-18 that has been conducted by URS since its involvement at Luke AFB under the 2013 PBR contract with AFCEC. The contract was authorized on September 20, 2013. Major work progress completed at Site ST-18 in 2012 that occurred between the end of the 2011 FYR and the beginning of the PBR contract, appears to have been limited to completing the third FYR report.

November 2014 Soil Boring Sampling

In accordance with an August 2014 soil sampling work plan prepared by URS (URS, 2014a), five soil borings were advanced to 60 feet and soil samples were collected at five-foot intervals for analysis of benzene and total xylenes. Figure 4a identifies the locations of these borings in relation to the historic soil investigation borings previously drilled/sampled at the site. Implementation of the August 2014 work plan occurred on November 17 (4 soil borings) and November 24, 2014 (1 soil boring). A total of 13 soil samples, including 12 field originals and one duplicate, were collected from each of the five borings. Samples were collected at 5-foot intervals starting at 5 feet using a split-spoon sampler and preserved in the field with methanol.

The samples from two borings, SB-18 and SB-22 (see Figure 4a), contained VOCs at concentrations above the R-SRLs. Multiple VOCs (BTEX, sec-butylbenzene, n-butylbenzene, 1,2-dichlorobenzene, naphthalene, isopropylbenzene, n-propylbenzene, 1,2,4-trimethylbenzene, and 1,3,5-trimethylbenzene) were detected in samples to the total depth of the boring (60 ft bgs) at SB-18. The detections however were less than the R-SRLs at total depth. Benzene, 1,2-dichlorobenzene, and naphthalene were detected at 60 feet bgs, but not above the limit of quantitation (LOQ). In SB-22, only 1,2,4-trimethylbenzene was detected at the total depth of the boring (60 ft. bgs), but not above the LOQ. Results of analysis of the samples collected from borings SB-18 and SB-22 included multiple compounds where the limit of detection was greater than the respective R-SRL. The samples with raised limits of detection are generally coincident with detections of other VOCs.

April 2016 Work Plan

The results of the November 2014 soil boring sampling indicated that site soils at two boring locations (SB-18 and SB-22) exceeded the pre-determined R-SRLs. Therefore, URS and representatives from Luke AFB met with representatives of the ADEQ on July 13, 2015 to discuss options for closure of ST-18. A risk evaluation with the objective of demonstrating that site soils do not pose a risk to human health was proposed using a risk-based evaluation similar to that accepted by the ADEQ UST Section for Tier 3 risk-based corrective action. As a result of that meeting, URS developed and issued a work plan in April 2016 that described the means and methods to collect sufficient soil and soil vapor data that would determine whether or not Site ST-18 could be closed with no restrictions (URS, 2016a). The proposed soil boring and vapor sampling locations are identified on Figure 4a. The scope of suggested sampling included the following:

- Analysis of current vertical extent of VOC concentrations using the full Arizona VOC list and including six tentatively identified compounds (TICs)
- Analysis of current vertical extent of PAH concentrations in the source area
- Delineation of horizontal extent of VOCs and PAHs in soil
- Analysis of VOCs in soil vapor for areas where subsurface soils (i.e., those soils at depths greater than 15 feet bgs) exceed R-SRLs
- Evaluation of the potential for vapor intrusion to indoor air with a residential exposure scenario

July 2016 Soil Boring and Vapor Sampling

The direct push technology (DPT) drilling for VOC delineation and soil vapor sampling was performed in July 2016, in accordance with the April 2016 Work Plan (URS, 2016a). Three soil borings were drilled (SB-24, SB-27, and SB-28) and multiple samples were collected from each for laboratory analysis of VOCs and PAHs. In soil boring SB-24, a total of 11 field original samples were collected at depths of 6, 10, 15, 20, 25, 30, 40, 50, 60, 70, and 80 feet bgs. In borings SB-27 and SB-28, a total of 7 field original samples were collected in each boring at depths of 6, 10, 15, 20, 25, 30, and 40 feet bgs. In addition, one duplicate sample and one matrix spike/matrix spike duplicate sample from each boring was collected for QA/QC of laboratory results. In terms of the soil vapor sampling, it was discovered upon receipt of the samples at the laboratory that 3 of the six Summa[®] canisters used to collect vapor samples

did not fill. Additional soil vapor sampling to evaluate the potential risk of vapor intrusion at Site ST-18 was performed in February 2017. The reporting of results for the July 2016 soil and soil vapor sampling and the February 2017 supplemental DPT drilling/soil vapor sampling is pending. The anticipated submittal date of a draft-final results report to the ADEQ for review is by mid-November 2017.

Annual CAP inspections 2014, 2015, 2016

The OU-2 ROD documents the cap as the selected remedial action and describes the requirements for inspection, maintenance, and repair of the concrete cap. According to design data previously provided by Luke AFB, the cap consists of a 30-millimeter high density polyethylene (HDPE) liner covered with six inches of aggregate base and a nine-inch thick reinforced-concrete cap.

URS performed visual inspections of the concrete cap at Site ST-18 on December 8, 2014 and on December 15, 2015. Additionally, the concrete cap was inspected during the FYR site visit on September 27, 2016. In accordance with previous inspection reports and the protocol presented in the Luke AFB Long-Term Monitoring Work Plan, the inspection consisted of orienting the available site maps with features observed in the field and then walking several transects of the concrete cap area. Cracks, joints, former penetrations, previous repairs, and other features of interest that potentially may affect the integrity of the cap were photographed and recorded in field notes. Photographs of the cap during the September 27, 2016 inspection at Site ST-18 are included in Attachment B.

Since URS' commenced work at Luke AFB under the existing PBR contract, the objective of the inspections has been to identify potential worsening conditions and to determine whether or not replacement of portions of the cap is warranted versus performing maintenance by sealing new cracks with a suitable sealant(s), and/or replacing asphaltic sealant previously used that has degraded. The inspections specifically targeted visual observation of joints, cracks, and previous repairs, as these locations represent the most likely potential routes of minor surface water infiltration. Based on the cap conditions observed during the annual inspections for the past three years, the cap integrity appears stable, without noticeable buckling or differential settlement. Significant vertical displacement has not been observed at cracks or expansion joints. Furthermore, no unusual cracking patterns were observed that suggest heaving or settlement in the soil below the cap. However, URS does recommend that old degraded asphaltic sealant be cleaned from the most prominent cracks, and then replaced with a suitable new concrete sealant (see Section 6.0).

2014 and 2015 Annual Groundwater Monitoring/Reporting

A final annual groundwater monitoring report associated with sampling activities performed on October 21, 2014 and December 23, 2015 was prepared by URS and submitted to Luke AFB and ADEQ on January 31, 2017 (URS, 2017). The report combined the results of monitoring activities from three sites: SS-42, ST-18, and RW-02. Prior to this, the draft final annual LTM report for Sites SS-42, ST-18, and RW-02 had been submitted to the ADEQ for review comments. The ADEQ provided comments to the draft final report in a letter dated September 13, 2016 (ADEQ, 2016f). On January 10, 2017, the ADEQ provided concurrence that the responses to comments were acceptable to finalize the report (ADEQ, 2017).

Analytical results for both the October 2014 and December 2015 groundwater sampling events showed that there were no detectable concentrations of VOCs present above established Arizona AWQS or Tier 1 guidance levels.

Status of Recommendations from Previous FYR

The 2012 Third FYR Report provided a recommendation that water levels continue to be monitored at Site ST-18 and SS-42 to track the rising groundwater elevations at the site. Water levels (i.e., depth-to-water measurements and calculated associated groundwater elevations) have been collected annually at both ST-18 and SS-42. A discussion of the rate of rising water levels is provided in Section 6.0.

Additionally, two recommendations associated with the ST-18 concrete cap were made: 1) that the cap should be inspected annually, and that cracks should continue to be repaired with silicone sealant; and 2) to apply for funding in 2013 to perform an analysis to evaluate costs and benefits of continued maintenance versus cap replacement. The cap has been annually inspected and maintained. Applying for funding to perform a cost/benefit analysis was not done because the objective under the PBR contract has been to achieve SC which was considered possible. If SC is achieved, continuing to maintain the cap and/or potentially replacing it would still be necessary because the cap is a required part of the remedy as specified in the January 1994 ROD for OU-2. Assuming SC is achieved, the air force intends to submit an appropriate CERCLA decision document to remove the cap as a required remedy component of ST-18, so that continued cap maintenance no longer would be required.

3.3 Site DP-13 Drainage Ditch Disposal Area

The following documents the progress of work at Site DP-13 that has been conducted by URS since its involvement at Luke AFB under the September 2013 PBR contract with AFCEC. Major work progress completed at Site DP-23 in 2012 that occurred between the end of the 2011 FYR and the beginning of the PBR contract, appears to have been limited to completing the third FYR report.

August 2015 Work Plan

A map of Site DP-13 is provided on Figure 5. The COCs in soil identified at select areas of Site DP-13 included the metals chromium, copper and lead, and the PAHs benzo(a)pyrene and dibenzo(a,h)anthracene. With the objective of obtaining SC with UU/UE, URS prepared a soil sampling and excavation work plan consisting of advancing soil borings in the area surrounding TP-12 that had been restricted by the VEMUR (see Figure 5a).

Depending on the results of the soil boring investigation for chromium, copper, or lead, URS proposed to conduct either of the following:

- If analytical results indicated chromium, copper, or lead concentrations exceeding R-SRLs, and the extent of the impacts had been defined as a result of the investigation, URS would proceed by implementing remedial excavation to remove and dispose of the impacted soil.
- If the impacted area could be adequately characterized during the soil boring investigation, URS would use all acceptable new and historic data for Site DP-13 and calculate a 95% Upper

Confidence Level (UCL) for chromium, copper, and lead based on the Chebyshev inequality, using the EPA ProUCL statistical software program. The results would be compared to the Arizona R-SRLs to evaluate if these COCs posed an unacceptable risk to human health or the environment.

For the COCs benzo(a)pyrene and dibenzo(a,h)anthracene, URS proposed to conduct the following:

- Advance soil borings in the vicinity of SB-11 which had detectable concentrations of benzo(a)pyrene and dibenzo(a,h)anthracene above the current R-SRLs (reference Figure 5b). The results would be compared to the Arizona R-SRLs to evaluate if these COCs pose an unacceptable risk to human health or the environment. The soil boring methodology is further discussed in Section 3.4 of this work plan

Depending on the results of the soil boring investigation, URS proposed to conduct either of the following:

- If analytical results from the soil boring investigation indicated benzo(a)pyrene or dibenzo(a,h)anthracene concentrations exceed R-SRLs and the extent of the impacts had been defined as a result of the investigation, URS would proceed by implementing remedial excavation to remove and dispose of the impacted soil.
- If the impacted area could not be found during the soil boring investigation, URS would use all acceptable new and historic data for Site DP-13 and calculate a 95% UCL for benzo(a)pyrene and dibenzo(a,h)anthracene based on the Chebyshev inequality, using the EPA ProUCL statistical software program. The results would be compared to the Arizona R-SRLs to evaluate if these COCs pose an unacceptable risk to human health or the environment.

September and November 2015 Soil Boring Sampling

During the months of September and November 2015, URS conducted soil sampling at Site DP-13 to address the COCs chromium, copper, lead, benzo(a)pyrene, and dibenzo(a,h)anthracene identified in the 1999 ROD for OU-1 with the goal of obtaining SC with no land use restrictions or requirements to conduct 5-year reviews under the EPA CERCLA program. Two areas were identified for further investigation and a total of 72 borings were advanced at Site DP-13 and 251 soil samples were collected. The locations of the soil borings are identified on Figure 5b. One hundred sixty one samples were analyzed for total chromium, copper, and lead. Ninety samples were analyzed for the PAHs benzo(a)pyrene and dibenzo(a,h)anthracene.

October 2016 RACR

Based on the results of the soil boring sampling program, a remedial action completion report (RACR) was completed and submitted to the ADEQ and Luke AFB in October 2016 (URS, 2016b). The following describes the results and conclusions documented in the RACR.

September and November 2015 Soil Boring Sampling Results

The first investigated area was the boundaries of the VEMUR which included historical soil samples from SB-8, SB-9, SB-10, and TP-12 (reference Figure 5a). This area contained the highest detectable concentrations observed during the RI for the COCs chromium (15,900 mg/kg), copper (3,900 mg/kg), and lead (36,000 mg/kg). During the investigation conducted by URS, detectable concentrations of chromium, copper, and lead were reported in all of the samples analyzed ranging 13.7 to 47.9 mg/kg (total chromium), 13.7 to 59.2 mg/kg (copper), and 6.59 to 385 mg/kg (lead). These concentrations are all below their respective R-SRLs. For concentrations of total chromium above the hexavalent chromium R-SRL of 30 mg/kg, URS requested the laboratory to analyze these samples for hexavalent chromium and the results ranged from 0.673 to 21.7 mg/kg, which all are below the R-SRL for hexavalent chromium.

The second investigated area was focused around historical soil boring SB-11 with the COCs benzo(a)pyrene and dibenzo(a,h)anthracene (reference Figure 5b). During the investigation conducted by URS, detectable concentrations of benzo(a)pyrene and dibenzo(a,h)anthracene ranged from 0.000828 to 0.638 mg/kg and 0.000702 and 0.0479 mg/kg, respectively. These concentrations were below the 1×10^{-5} R-SRL of 0.69 mg/kg for both analytes. Concentrations for dibenzo(a,h)anthracene also were below the 1×10^{-6} R-SRL of 0.069 mg/kg.

Statistical Evaluation of soil Boring Sampling Results

Based on the results of the September and November 2015 soil boring sampling conducted by URS, the high concentrations reported for chromium, copper, and lead during the RI were not reproduced. To determine if additional investigation or remedial action would be necessary, URS used the EPA ProUCL statistical software program to identify any outliers in the concentrations reported at Site DP-13. Based on the results of the outlier tests, the highest concentrations observed during the RI for chromium, copper, and lead were all determined to be outliers. After these concentrations were removed from the data set, the remaining concentrations were all below the R-SRLs for each COC. Therefore, URS concluded that the 95% UCL evaluation for chromium was not needed and no further action for chromium, copper, and lead was necessary.

Similarly, the results of the sampling conducted by URS in the area surrounding SB-11 indicated that the concentrations for benzo(a)pyrene and dibenzo(a,h)anthracene are all below the 1×10^{-5} R-SRL. The carcinogen risk level was determined as adequate to meet the Air Force's goal for no land use restrictions for Site DP-13 or the need to conduct 5-year reviews under the EPA CERCLA program.

ADEQ Concurrence

URS concluded that based on the soil boring sampling results and statistical evaluation of the data, the RAO's had been achieved and that no further action is required for the COCs at this time. Therefore, URS requested ADEQ's concurrence that Site DP-13 could be closed with no land use restrictions or requirements for 5-year reviews under the CERCLA program for the COCs identified in the ROD.

In its letter dated October 19, 2016 (ADEQ, 2016b), the ADEQ concurred that the removal of chromium and lead from the VEMUR was acceptable.

3.4 Site FT-07 North Fire Training Area – West Side

The following documents the progress of work at Site FT-07 that was completed by URS since its involvement at Luke AFB under the September 2013 PBR contract with AFCEC. Major work progress completed at Site FT-07 in 2012 that occurred between the end of the 2011 FYR and the beginning of the PBR contract, appears to have been limited to completing the third FYR report.

December 2014 Final Closeout Request

In December 2014, FPM Remediations in association with URS submitted a final Site FT-07 closeout request letter report to the ADEQ (FPM/URS, 2015). Based on this document and the preceding draft document submitted in March 2014, the ADEQ concurred with the information supporting the request and issued approval in a letter dated April 1, 2015 (ADEQ, 2015b).

3.5 Site FT-07E North Fire Training Area – East Side

The following documents the progress of work at Site FT-07E that was completed by URS since its involvement at Luke AFB under the September 2013 PBR contract with AFCEC. Major work progress completed at Site FT-07E in 2012 that occurred between the end of the 2011 FYR and the beginning of the PBR contract, appears to have been limited to completing the third FYR report.

November 2014 Work Plan

URS prepared a November 2014 draft-final work plan intended to support evaluation of FT-07E for SC (URS, 2014b). With the removal of the TRPH cleanup level in 2007, (i.e., TRPH no longer is regulated by the ADEQ), Site FT-07E was believed to be eligible for SC. However, based on review of the site documents, it appeared that soil samples collected during previous investigations did not include analysis for PAHs. Documentation of PAHs below the R-SRLs was therefore planned to demonstrate the justification for SC.

URS proposed to advance three soil borings and collect soil samples at the locations of three fire test pits: FTP-3, FTP-4, and FTP-6. The locations of the soil borings were proposed to be placed as close as possible to the previous borings in each fire test pit that contained the highest detected concentrations of COCs (see Figure 6a).

March 2015 Soil Boring Sampling and Results

URS and its subcontractor Enviro Drill Inc. mobilized to Site FT-07E on March 2, 2015 to advance three soil borings, one in each of the former FTPs (see Figure 6a). Soil boring SB-27 was advanced to 20 feet bgs at the former location of FTP-4, SB-28 was advanced to 50 feet bgs at the former location of FTP-3, and SB-29 was advanced to 20 feet bgs at the former location of FTP-6.

A total of 20 soil samples (18 field original, 2 field duplicate) and one water sample (equipment blank) were collected and delivered to an appropriately licensed laboratory for analysis of PAHs via EPA Method 8270C by SIM. The sample analytical results for samples collected from soil borings indicated detectable concentrations of one or more analytes above the laboratory reporting limit (LRL) with

concentrations ranging from 0.00075 to 35 milligrams per kilogram (mg/Kg). However, no analytes were detected at concentrations exceeding the Arizona R-SRLs.

August 2015 Closure Justification Memorandum

Based on the sample analytical results from the March 2015 soil borings, as well as the history of groundwater sample results for total and dissolved lead, URS prepared a detailed technical memorandum of the soil characterization information and SC justification for FT-07E that was submitted to ADEQ.

In response to review of the technical information, ADEQ issued a letter of concurrence on September 9, 2015 that Site FT-07E was eligible for closure for the COCs identified in the ROD. However, after receiving ADEQ's concurrence, AFCEC and URS contacted the EPA to inquire about whether a ROD amendment or an Explanation of Significant Differences (ESD) was required under the CERCLA program. After discussions with EPA and ADEQ, the parties agreed that an ESD would be an appropriate mechanism to close the Site. However, before the EPA would concur that the site was eligible for closure, updated VOC data for soil in lieu of TRPH analysis would be required for evaluation of petroleum constituents.

August 2016 Work Plan for VOCs

In August of 2016, URS submitted a final work plan for evaluating the potential presence of regulated VOCs at the areas where TRPH had been reported in soil samples at FT-07E (URS, 2016c). The work plan included, but was not limited to, an explanation of data gap analysis and scope of work described below.

Explanation of Data Gap Analysis

Although the remedy of an IC was appropriate at the time due to the presence of TRPH in surficial soil (e.g., soil < 15 feet bgs), relatively recent changes to the Arizona SRLs had eliminated the cleanup standard for petroleum hydrocarbon mixtures (range C10 through C32), pursuant to Appendix A of the Arizona Administrative Code (AAC) Title 18, Chapter 7, March 5, 2007 (AAC, 2007). Therefore, in lieu of a cleanup standard for TRPH, individual petroleum constituents which have an SRL and are detected in soil are used as cleanup levels. For petroleum constituents, this may include VOCs, PAHs, and MTBE. Assuming it has been demonstrated that there are no petroleum constituents above an applicable SRL, a request for concurrence from ADEQ that Site FT-07E is eligible for closure for the COCs identified in the ROD would be made by Luke AFB. Once concurrence was received, the IC no longer would be applicable and the site restoration process could be initiated including a request that the VEMUR be removed.

Based on the results of the sampling, it was proposed to either proceed with SC or conduct additional soil investigation.

Proposed Soil Boring Sampling for VOCs

URS proposed to drill and sample three investigative soil borings at FT-07E via hollow stem auger, one in each of the former FTPs. Figure 6a shows the locations of each of the borings. One of the borings (SB-30) was planned to be advanced at FTP-4 to a total depth of 30 feet bgs near the locations of SB-2, SB-23, and SB-27. The depth of SB-30 was determined from review of previous sampling results at

locations SB-2 and SB-23, where TRPH was not detected deeper than 10 feet bgs. A second soil boring (SB-31) was planned to be advanced at FTP-3 to a total depth of 50 feet bgs near the locations of SB-6, SB-21, and SB-28. The depth of SB-31 was determined from review of previous sampling results at locations SB-6 and SB-21, where TRPH was not detected greater than the former R-SRL of 400 mg/kg at depths greater than 40 feet bgs. The third soil boring (SB-32) was planned to be advanced to a total depth of 20 feet bgs at FTP-6 in the center of the pit near the location of SB-26 and SB-29. The depth of SB-32 was determined from review of previous sampling results at location SB-26, where TRPH was not detected greater than the former R-SRL of 400 mg/kg at depths greater than 2 feet bgs.

The ADEQ approved the August 2016 Work Plan as documented in its review letter dated August 31, 2016 (ADEQ, 2016c).

October 2016 Soil Boring Sampling for VOCs

In October 2016, URS implemented the work described in the ADEQ-approved work plan involving drilling and sampling one investigative soil boring at each of the three former FTPs consisting of FTP-3, FTP-4, and FTP-6 (reference Figure 6a). The proposed borings (SB-30, SB-31, and SB-32) were located using historical aerial photographs and global positioning system (GPS) equipment to place them as close as possible to the previous borings in each pit that contained the highest detected concentrations of COCs.

The first 5 feet of each borehole was advanced using a hand auger to confirm no underground utilities were present. At a depth of 1.5 feet bgs, a drive sampler equipped with a 6-inch brass sleeve was used to collect a soil sample from 1.5 to 2.0 feet bgs. Once retrieved, the soil in the brass sleeve was sub sampled. The remaining soil was placed into a Ziploc® bag and screened with a photoionization detector (PID). If the PID reading exceeded 100 parts per million (ppm), the sample was submitted to the laboratory for analysis of VOCs using EPA Method 8260B. The remaining soil samples within the borings were collected every 5 feet in depth. Each borehole was logged by the field geologist for material type, color, and soil characteristics. All soil samples were collected from the vadose zone.

May 2017 Soil Boring Re-Sampling for VOCs

The samples collected during the October 2016 soil boring sampling for VOCs were mishandled by the laboratory which caused the data to be unusable. Therefore, a field investigation involving drilling and re-sampling three soil borings for VOCs was implemented on May 3, 2017 at Site FT-07E. The analytical results were received and are currently being validated. Following preparation and submittal of a draft results report to AFCEC, and after incorporating AFCEC's review comments, URS anticipates that a results report will be provided to ADEQ for review by no later than mid-September 2017.

3.6 LF-03 Outboard Runway Landfill

A description of Site LF-03 and chronology of major work is provided in Section 2.2.6. The only work that has been completed at the site since the previous FYR is the execution of the 2013 PBR contract and the September 2016 site inspection for the fourth FYR. Because the site is behind the fighter aircraft flight line (over 60% of Site LF-03 is located in a runway area), inspection of the site in September 2016

was limited to photographing the area from a distance and confirming with Luke AFB environmental personnel that use of the land has remained unchanged since the previous FYR.

3.7 LF-14 Old Salvage Yard Burial Site

A description of Site LF-14 and chronology of major work is provided in Section 2.2.7. The only work that has been completed at the site since the previous FYR is the execution of the 2013 PBR contract and the September 2016 site inspection for the fourth FYR. With the exception of a considerable amount of small animal burrow holes observed along the north end of Site LF-14, the site was observed to be in good condition with no residential or other land development. A recommendation to fill the burrow holes to assure protectiveness is included in Section 6.0.

3.8 LF-25 Northwest Landfill

A description of Site LF-25 and chronology of major work is provided in Section 2.2.8. The only work that has been completed at the site since the previous FYR is the execution of the 2013 PBR contract and an attempt to inspect the site on September 27, 2016 for the fourth FYR. Access to the site was restricted by Luke AFB on that date. However, Mr. Jeff Rothrock, Environmental Chief of Luke AFB indicated at that time that there have been no changes to the site (i.e., no excavation or land development) since the previous FYR inspection.

The third FYR report indicates that during the subsequent five year period, Luke AFB would re-evaluate surface conditions at LF-25. This was reportedly an oversight by Luke AFB and not performed. Funding for this effort is not likely to be available until fiscal year 2020, as allocations for Fiscal Year 2018 and 2019 have been solidified/locked. However, Luke AFB plans to secure funding for fiscal year 2020 to re-evaluate surface conditions that will include sampling at Site LF-25 to assess the concentrations and extent of lead in soil.

3.9 RW-02 Wastewater Treatment Plant Annex Landfill

The following documents the progress of work at Site RW-02 that has been conducted by URS since its involvement at Luke AFB under the September 2013 PBR contract with AFCEC. Major work progress at Site RW-02 in 2012 that occurred between the end of the 2011 FYR and the beginning of the PBR contract is documented in Table 2.2.9.

2014 and 2015 Annual Radiological Monitoring/Reporting

Annual radiological monitoring at Site RW-002, as required by the OU-1 ROD, was conducted on December 8, 2014 and on December 17, 2015. The procedures involving gamma radiation monitoring were conducted in accordance with the Luke AFB LTM Work Plan (Malcolm Pirnie, 2009). For both the December 2014 and 2015 monitoring events, gamma radiation measurements collected at monitoring locations MP-1 to MP-4 were consistent with the gamma radiation measurements collected from the background location BG-1 (see Figure 10a). No measurements over the action level of 24,122 counts per minute were recorded, therefore no notifications were made. The 2014 and 2015 data were consistent with the historical data, indicating there was no change in the subsurface gamma radiation levels. Additionally, exposure rate measurements collected during 2014 and 2015 monitoring at the site were

within background levels. Therefore, it was determined that in 2014 and 2015 that Site RW-02 did not present a gamma radiation exposure hazard to the public.

November 2016 Final Decommissioning Plan

A decommissioning plan was prepared by URS to describe the remedial activities that will be necessary to remove the low-level radioactive waste burial vault. The overall approach at Site RW-002 is to remove the concrete waste containment structure and send it for disposal at a facility licensed to accept radium-contaminated material. The concrete cap will also be removed and sent for disposal at an appropriate facility. Prior to this remedial action, the infrastructure of the vault (features and size) need to be investigated by careful soil excavation. The procedures for this, including collection of soil samples surrounding the containment to determine if the soil is impacted, is the subject of the decommissioning plan. The decommissioning plan is only required to address soil contamination. A Removal Action Plan will be prepared after implementation of the decommissioning plan to address physical removal and disposal of the burial vault.

December 2016 Gamma Radiation Monitoring

On December 15, 2016, gamma radiation monitoring at the RW-02 low level radioactive waste area was conducted by URS in accordance with the Luke AFB Long Term Monitoring Work Plan. The radioactive material, believed to be encased in concrete, is surrounded by a fence and four vadose zone (dry) monitor points (MP-1 through MP-4) as shown in Figure 10a. Gamma radiation measurements were collected from each of the monitoring points. A draft results report for annual radiological monitoring at Site RW-02 was provided to AFCEC for review in late June 2017. After review comments are received, responses to AFCEC's comments are prepared, and comments are incorporated, URS anticipates that a draft results report will be submitted for review to EPA and ADEQ in early August 2017.

Status of Recommendations from Previous FYR

The 2012 Third FYR Report provided a recommendation that Luke AFB work with ADEQ prior to the May 2012 monitoring event to assess the appropriateness of the current action level for gamma radiation monitoring. As written in the LTM Plan, the current action level is based on two-times the value of the lowest measured concentration of gamma radiation in the background monitoring point (BG-1). The Air Force engaged in conversations with the ADEQ about the action level; ADEQ was interested in establishing a firm action level rather than a "floating" level. The Air Force evaluated the historical action levels derived from annual monitoring and determined that the levels have been relatively steady over time. A copy of the historical gamma radiation action levels is included in Attachment F. The Air Force has indicated that it cannot recall if the data table was sent out to the agencies for comments, and documentation as such by the Air Force is not available. A recommendation to revisit this matter has been provided in Section 6.0.

SD-20 Oil/Water Separator Canal and Earth Fissure

The following documents the progress of work at Site SD-20 that was completed by URS since its involvement at Luke AFB under the September 2013 PBR contract with AFCEC. Information regarding

work progress at Site SD-20 that occurred between the end of the 2011 FYR and the beginning of the PBR contract is noted in the summary table in Section 2.2.10.

August 2015 Work Plan

Based on the information provided for Site SD-20 within the 1999 ROD for OU-1, the COC remaining at the site requiring further evaluation is benzo(a)pyrene in soil. Therefore, to obtain ADEQ's concurrence for SC with UU/UE for COCs, URS prepared a work plan to conduct additional soil sampling to determine if benzo(a)pyrene concentrations remain above R-SRLs (URS, 2015a).

Benzo(a)pyrene was detected in the sample collected during the RI at soil boring location SB-1 (see Figure 11). The boring was drilled to a depth of 40 feet bgs and samples were collected from depth intervals of 0-2, 6-8, 16-18, 24-26, and 38-40 feet bgs. The sample collected from the depth interval of 0-2 feet had a detectable concentration of benzo(a)pyrene (0.18 mg/Kg) above the current R-SRL of 0.069 mg/Kg. To evaluate if benzo(a)pyrene concentrations remained above the R-SRL, URS proposed to hand auger to a depth of four feet bgs and collect samples from 0-2 and 2-4 feet bgs.

A more complete description of the planned work included the following with the objective of completing the SC process for Site SD-20 with UU/UE:

- Advancement of one soil boring (SB-15, adjacent to previous boring SB-1) and collection of soil samples from 0-2 and 2-4 feet bgs for analysis of benzo(a)pyrene (see Figure 11a).
- Advancement of additional delineation soil borings to the north, south, east, and west if SB-15 analytical results indicated that benzo(a)pyrene concentrations are above R-SRLs (Figure 11a); and
- Excavation and disposal of impacted soils (if any) and collection of confirmation soil samples, if necessary.

URS also proposed to abandon monitoring wells MW-112S, MW112S-S, MW-112D, MW-113, and MW-113S in accordance with Arizona Administrative Code Title 12, Chapter 15, Section 816 (A.A.C. R12-151-816) and the ADWR guidance manual *Well Abandonment Handbook, October, 2008*. The ADEQ accepted the August 2015 Work Plan in its review letter dated September 23, 2015 (ADEQ, 2015c).

February 2016 Soil Boring Sampling and Results

On February 25, 2016, URS mobilized to Site SD-20 to advance one soil boring (SB-15) in the drainage ditch discharge on the south side of Super Sabre Street (see Figure 11a). Soil boring SB-15 was advanced to approximately 2.5 feet bgs using a hand auger. The proposed total depth of soil boring advancement had been 4 feet bgs; however, refusal was encountered at approximately 2.5 feet bgs. GPS coordinates for SB-15 were collected using a Geo XH 6000. Soil samples for analysis ultimately were collected between 0-2 feet bgs and 2-2.5 feet bgs.

A total of three (3) samples were submitted to the laboratory for analysis of benzo(a)pyrene via EPA Method 8270 SIM. Samples included both field original and field duplicate from 0-2 feet bgs and one (1) sample from 2-2.5 feet bgs (placed on hold pending analytical results from 0-2 feet bgs). Analytical results were compared to the Arizona R-SRL found in Appendix A of the AAC, Title 18, Chapter 7, Remedial Action, dated March 31, 2009 (AAC, 2009). Benzo(a)pyrene results for samples collected from 0-2 feet bgs were non-detect at the reported detection limit (<0.00600 mg/Kg) and below the established Arizona R-SRL. Therefore, additional analysis was not warranted and the analysis of the sample collected from 2-2.5 feet bgs was suspended. URS concluded that benzo(a)pyrene did not pose an unacceptable risk to human health and the environment at Site SD-20. Furthermore, URS concluded that SC with UU/UE was appropriate for benzo(a)pyrene, and all other COCs identified in the 1999 ROD.

October 2016 Work Plan Addendum

The results from the RI at SD-20 identified TRPH as present in soil; therefore, TRPH was identified in the ROD as a COC. Consistent with requirement for Site FT-07E (see Section 3.5 above), in February 2016 EPA indicated that in order to obtain SC for SD-20, addressing TRPH by collecting samples for analysis of VOCs would be required. Thus, URS prepared an addendum to the August 2016 soil sampling work plan to address TRPH (URS, 2016d).

Proposed Soil Sampling

URS proposed to collect additional samples at RI locations SD-10, SD-11, SD-12, SD-16, SD-17, and SD-18 (see Figure 11a). For RI locations SD-10, SD-11, and SD-12, URS proposed to hand-auger to a depth of two feet bgs and collect samples from 0.5 to 1.0 and 1.5 to 2.0 feet bgs. For RI locations SD-16, SD-17, and SD-18, URS proposed to collect samples from 0 to 3.0 inches and 3.0 to 6.0 inches bgs. Soil samples would be collected utilizing a drive sampler equipped with either three (SD-16, SD-17, and SD-18) or six (SD-10, SD-11, and SD-12) inch brass sleeves.

Samples were proposed to be submitted to an ADHS-certified analytical laboratory, under standard chain-of-custody procedures for analysis of VOCs by EPA Method 8260B. The second sample from each location (e.g. the 3.0 to 6.0 inch and 1.5 to 2.0 feet bgs) would be put on hold pending the results of the shallow samples (e.g. 0 to 3.0 inches and 0.5 to 1.0 feet bgs). URS proposed that if any of the VOC concentrations in the shallow samples exceeded an applicable R-SRL, the laboratory would be directed to analyze the deeper sample. Following sample collection, the borehole location will be abandoned by returning the native soil back into the borehole.

The ADEQ approved the Work Plan Addendum in its October 19, 2016 review comments letter to the draft final work plan addendum (ADEQ, 2016d).

Additional Delineation Sampling

If any analytical results for VOCs exceeded an applicable R-SRL, URS proposed to re-mobilize to the Site to delineate the horizontal and vertical extent (if necessary) of VOC concentrations above the R-SRL in preparation for remedial excavation. Four additional borings would be advanced within a radius of 5 feet from the original sample locations, and collected at the same depths as the original samples.

December 2016 Soil Sampling for VOCs

On December 1, 2016, URS implemented soil sampling for VOCs in accordance with October 2016 work plan addendum. Sample analytical results have been received and the VOC data has been validated. The results of all detected VOCs indicate no concentration exceedances to the Arizona NR-SRLs. A draft RACR is being prepared for submittal to AFCEC. After review comments are received, responses to AFCEC's comments are prepared, and comments are incorporated, URS anticipates that a draft results report will be sent to ADEQ for review by late August 2017.

3.10 SD-38 Oil/Water Separator at the Old Auto Body Shop

The following documents the progress of work at Site SD-38 that was completed by URS since its involvement at Luke AFB under the September 2013 PBR contract with AFCEC. Major work progress at Site SD-38 in 2012 that occurred between the end of the 2011 FYR and the beginning of the PBR contract is documented in Table 2.2.11.

January 2016 Closure Justification Technical Memorandum

URS prepared a technical memorandum for closure of Site SD-38 and submitted it to Luke AFB on January 8, 2016 (URS, 2016e). Justification was provided for obtaining a determination of SC with UU/UE for the COCs identified in the OU-1 ROD. Based on review of previous investigations and the COCs identified in the ROD, the VEMUR recorded at Site SD-38 was believed to no longer be applicable due to the removal of the TRPH regulatory cleanup standard. In addition, with the exception of lead, no other COCs at the Site were identified that required removal action.

URS used all available data for lead at Site SD-38 to calculate the 95% UCL for comparisons to the current Arizona R-SRL, which is equivalent to the EPA Region IX residential PRG established in the ROD. The results indicated that 1) the 95% UCL calculated for Site SD-38 is 262.8 mg/Kg, which is less than the Arizona R-SRL and residential PRG of 400 mg/Kg; 2) the lead results support the determination that it does not pose an unacceptable risk at Site SD-38; and 3) implementation of any remedial actions to address lead impacted soils at SD-38 are not required. Therefore, URS concluded that Site SD-38 was eligible for SC with UU/UE.

However, as was the case for Sites FT-07E and SD-20, EPA subsequently indicated that in order to demonstrate that TRPH was not an issue, soil sample analysis for VOCs collected from areas where former detections of TRPH exceeded regulatory limits was required.

August 2016 Work Plan for VOCs

To address EPA's request to sample for VOCs at areas where TRPH exceedances in soil had been detected, URS prepared and submitted a work plan for agency approval. The ADEQ approved the August 2016 Work Plan (URS, 2016f) as documented in its review letter dated August 31, 2016 (ADEQ, 2016c).

One soil boring (SB-9) was proposed to be advanced to a total depth of 21.5 feet bgs at the former location of the southwest OWS at SD-38 (see Figure 12). The depth of SB-9 (21.5 feet) was determined from review of previous sampling results at locations SB-3 and SB-8, and the location would be determined using historical aerial photographs and GPS equipment to place it as close as possible to historic borings SB-3 and SB-8. Four samples were planned for collection on 5-foot intervals (6.5 feet,

11.5 feet, 16.5 feet, and 21.5 feet bgs) using a California-modified split spoon lined with brass sleeves. Upon collection of each sample, it would immediately be sub-sampled using a disposable core sampling device (e.g., Terracore®), then extracted in the field with methanol. The samples all would be analyzed using EPA Method 8260B for VOCs.

October 2016 Soil Sampling for VOCs

In October 2016, URS implemented the work described in the ADEQ-approved work plan involving drilling and sampling one investigative soil boring (SB-9) at Site SD-38 (see Figure 12). The laboratory results indicate that there were no detections of VOCs in the bottom three collected samples. It was discovered that the laboratory mis-handled the shallow soil sample collected at a depth of 2 feet bgs which resulted in exceedance of the analytical method holding time. Therefore, re-sampling soil adjacent to SB-9 at that same depth was performed on May 3, 2017. Sample analytical results were received and the VOC data has been validated. The results of all detected VOCs indicate no concentration exceedances to the Arizona NR-SRLs. A draft results report is being prepared for submittal to AFCEC. After review comments are received, responses to AFCEC's comments are prepared, and comments are incorporated, URS anticipates that a draft results report will be sent to ADEQ for review by late August 2017.

3.11 SS-42 Bulk Fuels Storage Area

The following documents the progress of work at Site SS-42 that was completed by URS since its involvement at Luke AFB under the 2013 PBR contract with AFCEC. The contract was authorized on September 20, 2013. For information regarding work progress at Site SS-42 in 2012 that occurred between the end of the 2011 FYR and the beginning of the PBR contract, refer to the site chronology summary table in Section 2.2.12.

November 2014 LTM Work Plan

URS issued an updated final LTM work plan for groundwater monitoring at Site SS-42 in November 2014 (URS, 2014c). Prior to issuance of the final LTM work plan, the ADEQ approved the draft final work plan in its review letter dated October 27, 2014 (ADEQ, 2014). The LTM work plan serves to 1) specify that TRPH will be eliminated from groundwater sample analysis because it is no longer regulated with a federal MCL, or by an Arizona AWQS; 2) describe the field activities and data collection means and methods to conduct groundwater monitoring; and 3) describe the content and schedule for annual groundwater monitoring and reporting including providing an evaluation of data trends with recommendations about future monitoring needs and optimization action as applicable.

The field activities described in the LTM work plan include collecting annual water level measurements and conducting low-flow purging/sampling of two existing monitoring wells (MW-121-S and MW-125R-S; reference Figure 13) at Site SS-042. The plan stipulates that all collected samples (field originals plus QA/QC samples) will be submitted to an ADHS certified analytical laboratory for analysis of VOCs by EPA Method 8260B (or equivalent). The scope of reporting includes providing a summary description of field activities; a water level elevation contour and sample results map(s); a summary table of analytical results; a comparison of analytical results to the AWQSs; data verification of the analytical results; and copies of field notes and the laboratory report as appendices to the report.

2014 and 2015 Annual Monitoring/Reporting

A final annual groundwater monitoring report associated with sampling activities performed on October 21, 2014 and December 2-3, 2015 was prepared by URS and submitted to Luke AFB and the ADEQ on January 31, 2017 (URS, 2017). The report combined the results of monitoring activities from three sites: SS-42, ST-18, and RW-02². Prior to this, the draft final annual LTM report for Sites SS-42, ST-18, and RW-02 had been submitted to the ADEQ for review comments. The ADEQ provided comments to the draft final report in a letter dated September 13, 2016 (ADEQ, 2016f). On January 10, 2017, the ADEQ provided concurrence that the responses to comments were acceptable to finalize the report (ADEQ, 2017).

Analytical results for both the October 2014 and December 2015 groundwater sampling events showed that there were no detectable concentrations of VOCs present above established Arizona AWQS or Tier 1 guidance levels.

Status of Recommendations from Previous FYR

The 2012 Third FYR Report provided a recommendation that water levels continue to be monitored at Site ST-18 and SS-42 to track the rising groundwater elevations at the site. Water levels (i.e., depth-to-water measurements and calculated associated groundwater elevations) have been collected annually at both ST-18 and SS-42. A discussion of the rate of rising water levels is provided in Section 6.0.

3.12 Site TU-44 Waterdog Recreation Annex

The following documents the progress of work at Site TU-44 that was completed by URS since its involvement at Luke AFB under the September 2013 PBR contract with AFCEC. Major work progress at Site TU-44 in 2012 that occurred between the end of the 2011 FYR and the beginning of the PBR contract appears to have been limited to conducting quarterly groundwater monitoring. Work preceding 2012 is summarized in Table 2.2.13.

2014 - 2016 Groundwater Sampling Events

Groundwater monitoring of up to 16 wells was performed as part of PBR efforts for Luke AFB. The frequency of monitoring is generally quarterly, although some deviations to this schedule have occurred (see below). Groundwater monitoring event activities were performed in accordance with the Versar SAP (Versar, 2009), HASP (URS, 2013a) and the Uniform Federal Policy QAPP (URS, 2013b).

Quarterly groundwater monitoring events were conducted by URS at the Waterdog Site TU-44 during the following months of 2014 through 2016:

- 2014 - February, May, August, October

² The monitoring work at Site RW-02 consisted of radiological monitoring at the low-level radioactive waste burial pit area and no groundwater monitoring.

- 2015 - February/April, August, November
- 2016 – February, April, August, October

2016 Mid-Year Monitoring Recommendations

Throughout the LTM period, benzene and MTBE were detected above applicable groundwater screening criteria at Site TU-44. Based on the sampling results, URS recommended the following:

- Continuing quarterly monitoring based on current and historical exceedances of regulatory criteria at Site TU-44 for benzene and MTBE in groundwater.
- Updating the existing SAP (Versar, 2009) to include transition from low-flow purge sampling to non-purge sampling (i.e. investigative methodology as per ADEQ's leaking underground Storage Tank program guidance). Monitoring well purging prior to sampling is not necessary unless demonstrating compliance at or below AWQSS. Note that when required, compliance sampling would be conducted using low-flow purging methodology.

February 2016 Pilot Test Work Plan

A final work plan for implementation of a groundwater remediation pilot test was prepared by URS and submitted to ADEQ and Luke AFB in February 2016 (URS, 2016i). The work plan was approved by the ADEQ in its review letter dated May 24, 2016 (ADEQ, 2016e). The locations of the monitoring wells and planned injection point locations at Site TU-44 are identified on Figures 14 and 14a.

The purpose of the work plan was to present the technical basis and procedures for conducting a proposed pilot test to gather information needed to implement BOS-200[®] injections at the TU-44 site. BOS-200[®] consists of activated carbon, sulfate reduction media, and micronutrients, that are mixed with a proprietary mixture of petroleum-degrading microbes to treat sites impacted with petroleum hydrocarbons.

The work plan describes the specific objectives of the pilot test which are to:

- Determine the radius of influence (ROI) of BOS-200[®]: The ROI was planned to be tested at several depths in each injection location.
- Monitor pressure response in the aquifer during injection using pressure transducers placed in the existing wells.
- Monitor injection pressure, flow rate, pressure response, and other groundwater conditions to evaluate and mitigate the potential uncontrolled spreading of petroleum contaminants in the subsurface beyond the limits of the characterized impact zone.
- Determine if injecting BOS-200[®] would significantly reduce concentrations of VOCs in groundwater at monitoring well locations surrounding injection points (MW-1, MW-3, MW-9 and MW-13).

The work plan also specifies the pilot test results reporting that will occur following an appropriate post-injection performance data collection period. The content of the report was planned at a minimum to

include:

- Findings obtained by the use of a downhole camera survey of injection boreholes
- Results of the pilot test including:
 - Post injection sample results (samples to be collected immediately upon completion of the injections, and after 2 weeks, 4 weeks, and 8 weeks following the completion of the injections)
 - Injection rates, pressures, and volumes
 - Mass of BOS-200[®] injected
- Tables and figures
- If applicable based on anticipated successful pilot test results, providing recommendations for full-scale design along with the materials, permits, and a schedule for full-scale injection.

September/October 2016 Initiation of BOS-200[®] Pilot Test Injections

Injection Point Drilling, BOS-200[®] Injection, and Installation of Monitoring Wells

In September 2016, four injection points were drilled and BOS-200[®] product injections were performed at Site TU-44. Cascade Drilling performed the injection point drilling and Technical Services and Alpine Remediation, Inc. conducted the pressurized BOS-200[®] product injections. In late September and early October 2016, seven new monitoring wells were constructed in multiple injection point boreholes and at new locations for use with post-injection performance groundwater monitoring. The new wells were identified as MW-17 through MW-23. Furthermore, existing wells MW-5 and MW-12 were over-drilled and replaced.

Post-Injection Performance Groundwater Sampling

In accordance with the February 2016 approved pilot test work plan, post-injection performance groundwater monitoring was implemented following BOS-200[®] product injections. The purpose of sampling is to enable evaluation of geochemical parameters and the rate and degree of petroleum hydrocarbon concentration declines in groundwater monitoring wells over time. Baseline (pre-injection) sampling was conducted in September 2016 to coincide with 3rd quarter groundwater monitoring event. Three post-injection monitoring/sampling events followed in October, November, and December 2016, representing initial, 2 week, 4 week, and 8 week performance monitoring events, respectively. The results of the performance sampling will be included in a pending pilot test results report.

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4.0 FIVE YEAR REVIEW PROCESS

4.1 Review Team and Schedule

Members of the review team are listed in Section 1.0. The components/activities and schedule of the fourth FYR is provided in Table 4.1.

Table 4.1 Schedule of Five Year Review Activities	
Component/Activity	Time Period
Provide Public Notification	23 November 2016
Conduct Reference Documents Review	September 2016 - October 2016
Complete Interviews	November 2016 - December 2016
Perform Site Inspections	September 2016 - December 2016 ¹
Prepare Draft FYR Report	November 2016 - January 2017
Prepare Review Comments on Draft FRY Report by Internal Review Team	February 2017 - March 2017
Prepare Draft-Final FYR Report and Submit to Regulatory Agencies	March 2017 - May 2017
Prepare Review Comments on Draft-Final FYR Report by Regulatory Agencies	May 2017 - June 2017
Incorporate Regulatory Agency Review Comments into Draft-Final Report	June 2017 – September 2017
Submit Final FYR Report to Regulatory Agencies	September 2017
Notify Community of Completed FYR and Availability of Report	October 2017
¹ With the exception of Sites SD-20 and LF-25, all sites at Luke AFB were inspected on 09/27/16. Site SD-20 was inspected on 12/29/16. Access to LF-25 was restricted. Site TU-44 (off Base at Apache Lake) was inspected on 10/05/16. FYR = five year review	

4.2 Community Notification, Involvement, and Site Interviews

The restoration advisory board (RAB) was disbanded in 1999. One former RAB member (Glendale Councilmember Elect Ms. Joyce Clark) was able to be contacted and interviewed as part of the 5-Year Review process. A copy of Ms. Clark's interview responses is included in Attachment C.

A public notice announcing the start of the FYR process was published as a legal notification in the Arizona Republic on 23 November 2016. The public notice is provided below in italicized text. The affidavit of the public notice is provided in Attachment D.

PUBLIC NOTICE - The Air Force Civil Engineer Center (AFCEC) announces that a five-year review will be conducted for Luke Air Force Base. Response actions on Installation Restoration Program (IRP) Sites RW002 (Low-Level Radioactive Burial Site), LF003 (Outboard Runway Landfill), FT007 (North Fire Training Area – West), FT007E (North Fire Training Area – East), DP023 (Old Surface Impoundment), DP013 (Drainage Ditch Disposal Area), LF014 (Old Salvage Yard Burial Site), ST018 (Liquid Waste Storage Facility), SD020 (Oil/Water Separator Canal and Earth Fissure), LF025 (Northwest Landfill), SD038 (OWS at Auto Hobby Shop), SS042 (Bulk Fuels Storage Area), and TU044 (Waterdog Annex) at

Luke Air Force Base (AFB) have been conducted in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), which requires that a five-year review be conducted. The review will be conducted in accordance with the United States Environmental Protection Agency Five-Year Review Guidance. The Air Force is the lead agency for this five-year review.

The review will be conducted to ensure that the response action and final recommendations for these Sites at Luke AFB remain protective of human health and the environment. This review will commence in November 2016 and is scheduled for completion in September 2017. A second notice will be provided to the public regarding the availability of the final five-year review report at the Glendale Public Library, Main Branch on 5959 W. Brown St., Glendale, Arizona; the Peoria Public Library on 8463 West Monroe Avenue, Peoria, Arizona; and the following website: <http://afcec.publicadmin-record.us.af.mil/Search.aspx>.

The Department of Defense (DoD) recognizes the importance of public participation in the Luke AFB IRP and encourages your involvement. Therefore, all parties interested in contributing to, or have questions or concerns associated with the five-year review process may contact:

*Ms. Stephanie McCary,
Air Force Civil Engineer Center
5960 Swaab Boulevard, Nellis AFB, NV 89191
Phone: (702) 652-9365,
E-mail: Stephanie.mccary@us.af.mil.*

Interviews were conducted with Mr. Jeff Rothrock (Luke AFB, Environmental Flight Chief), Ms. Joyce Clark (former RAB member), and Ms. Laura Fischer (ADEQ, Project Manager). The interviews are summarized in Attachment C.

4.3 Data Review

The following regulatory guidance documents and publications were reviewed during preparation of this Fourth FYR:

- Arizona Numeric Water Quality Criteria (Arizona, 1996)
- Environmental Protection Agency Region 9 Preliminary Remediation Goals (EPA, 1996)
- Comprehensive FYR Guidance (EPA, 2001)
- National Primary and Secondary Drinking Water Standards (EPA, 2003)
- Arizona Soil Remediation Levels (Arizona, 2007)

The following historical site documents and reports were reviewed during preparation of this Fourth FYR. The documents were provided by Luke AFB:

- Final Remedial Investigation Report, Operable Unit No. 2. Luke Air Force Base, Arizona. (Geraghty and Miller, 1992)
- Record of Decision Operable Unit 2 (Geraghty and Miller, 1994)
- Final Remedial Investigation Report, Volumes I and II, and Appendix B Baseline Basewide Risk Assessment (Geraghty & Miller, 1997)

- Record of Decision Operable Unit 1 (ARCADIS Geraghty and Miller, 1999)
- Luke Air Force BGP (Luke AFB, 2002)
- Final First FYR (ARCADIS, 2002)
- Final Second FYR (HGL, 2007)
- Final Third FYR (Stell & ARCADIS, 2012)
- Luke Air Force Base Institutional Control Plan (ARCADIS, 2014b)
- Final Long-Term Monitoring Plan SS-42 Bulk Fuels Storage Area (URS, 2014d)
- FT-07 Site Closeout Request (URS, 2015b)
- Luke 2014 Annual Monitoring Report RW-002 (URS, 2015c)
- Final DP013 Remedial Action Completion Report, Luke Air Force Base (URS, 2016b)
- Determination of Approval of Final Site DP-23 Phase II Remedial Design Report, Luke Air Force Base, Arizona – April 1998 (URS, 2016g)
- Luke Air Force Base 2014-2015 Draft-Final Long Term Monitoring Report SS-042 Bulk Fuels Storage Facility, ST-018 – Facility 993, RW-002 – Low-Level Radioactive Waste Burial Pit (URS, 2016h)

4.4 Site Inspection

AECOM representatives Mr. Darren Berg, EIT and Mr. Jeff Rackow, PE conducted site inspections at Luke AFB on September 27, 2016 and December 29, 2016. Site SD-20 was inspected on December 29; all other sites except for LF-25 were inspected on September 27, 2016. For the September 27, 2016 inspections, AECOM was accompanied by Mr. Jeff Rothrock (Luke Environmental Chief) and Ms. Stephanie McCary (Luke Restoration Program Manager). In addition, Mr. Darren Berg performed the Site inspection of the Waterdog Recreation Annex on October 5, 2016. There were no invitations or notifications sent to members of Regulatory Agencies to attend the fourth FYR site inspections.

The site inspection checklists from the Fourth FYR Review are provided as Attachment A. The purpose of the inspections was to assess the visual protectiveness of the remedy, including the presence of fencing and/or gates to restrict access, the integrity of the concrete cap at Site ST-18, the status of the land use restrictions, and the overall condition of each restricted area. No significant issues were identified during the Site inspections.

The ICs in place include prohibiting the use or disturbance of soil, excavation activities, and any other activities or actions that might interfere with the implemented remedy. No activities were observed during the Site visits that were not in accordance with the implemented remedy.

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5.0 TECHNICAL ASSESSMENT

The purpose of this Technical Assessment is to determine whether the selected remedies in the Luke AFB OU-1 and OU-2 RODs continue to remain effective in protecting human health and the environment, through the control of exposure pathways potentially representing unacceptable risk. The following sections assess the continued effectiveness of the remedies at each of the sites, following a question and answer format prescribed by EPA guidance for use in FYR reports. Any new site characterization information and/or new Applicable or Relevant and Appropriate Requirements (ARARs) applicable to the sites since the third FYR were reviewed to evaluate whether or not they affect the effectiveness of each remedy. The results of the site inspections were also used to assess the continued effectiveness of each site remedy.

The collective remedial actions for the Luke AFB OU-1 and OU-2 sites have included soil treatment, capping for surface control of sources, LTM for groundwater (presently at Sites FT-07, ST-18, and SS-042), LTM for low level gamma radiation (Site RW-02), and ICs, some of which include VEMURs filed with the Maricopa County recorder that serve to restrict land usage to non-residential purposes.

At Site TU-44, there has been a history of implemented soil and groundwater remediation utilizing different technologies including bioventing, SVE, air sparging, TPE, and most recently BOS 200[®] injections in September 2016. The remediation work was performed in conjunction with groundwater monitoring activities to evaluate performance of remediation and the effects of remediation on the overall protectiveness of the site. As described in Section 2.2.13, the geologic and hydrogeologic characteristics of the site have limited the effectiveness of remediation. However, a comprehensive monitoring well network is in place for use with evaluating contaminant concentration reduction and stability of the groundwater plume.

5.1 Site DP-23 Old Surface Impoundment West of Facility 993

Question A: Is the remedy functioning as intended by the decision documents?

Yes. The current remedy consists of ICs in place for the northern portion of the site which prohibit residential land use under the IDP.

The concrete and asphalt pavement encompass a large portion of the site were observed to be good, as there was no pavement settlement or spalling observed, and only a limited amount of small/ insignificant cracks noticed. The unpaved landscape areas of the site were observed to be well-maintained with little to no surface erosion, and no pits, open excavations, or surface stains were observed. Consequently, the ability of storm water to infiltrate ground excessively through surface disturbance potentially mobilizing contaminants from the vadose zone to groundwater is considered improbable. Based on the aforementioned information, and in conjunction with ICs at the site, it is believed that the existing physical conditions at Site DP-23 are adequately protective.

The site inspection confirmed that no use of the land for residential purposes exists. Although the results of the September 2016 soil boring sampling within the northern portion of the site indicated that some

remaining exceedances to R-SRLs are present, confirmation that the land remains suitable for industrial use was confirmed by the ADEQ (see Section 3.1).

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

It is believed that the protectiveness of the remedy has been maintained with respect to the COCs. Furthermore, the assumptions used during the Base-wide Risk Assessment have not changed.

Yes, these factors are still valid. Since the time of the previous FYR, URS is not aware of any changes in soil toxicity data or changes in soil cleanup levels associated with the Site COCs.

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

No.

5.2 Site ST-18 Former Liquid Waste Storage Facility

Question A: Is the remedy functioning as intended by the decision documents?

Yes. The combination of the 9-inch thick concrete cap (underlain with a 30 mil HDPE liner), groundwater LTM, and ICs, all of which comprise the remedy, have maintained site protectiveness as specified in the ROD. The ICs stipulate that residential development of the land is prohibited, and the September 27, 2016 site inspection verified that land use remains devoid of such development. The results of annual LTM of onsite wells MW-114-S and MW-122-S indicate that no COCs are present in concentrations above AWQSSs, and there are no increasing contaminant concentration trends of concern.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

Yes. The assumptions of the Base-wide Risk Assessment for the Site have not changed. As described in Section 3.2, a risk evaluation with the objective of demonstrating that site soils do not pose a risk to human health was proposed using a risk-based evaluation similar to that accepted by the ADEQ UST Section for Tier 3 risk-based corrective action. Consistent with the April 2016 work plan approved by ADEQ (URS, 2016a), URS implemented supplemental soil boring and initial soil vapor sampling at the Site in July 2016. Additional soil vapor sampling was conducted in February 2017 to support an evaluation of vapor intrusion risk to indoor air at the site. The results report for these activities is pending. The anticipated submittal date of a draft-final results report to the ADEQ for review is by mid-November 2017.

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

No. Cracks in the concrete cap have been repaired multiple times in the past to maintain the integrity of the cap (see Table 2.2.2 in Section 2.2.2). Based on the cap conditions observed during the September 27, 2016 inspection, URS is recommending that repairs be conducted to re-seal the cracks with suitable engineered product(s). Although the density of the cracks and degree of concrete degradation is not considered a significant risk to the current protectiveness of the cap, maintenance for long-term protection

of this remedy is suggested. Consideration of the crack characteristics and Arizona climate will be important for selection of an appropriate product(s).

5.3 Site DP-13 Drainage Ditch Disposal Area

Question A: Is the remedy functioning as intended by the decision documents?

Yes. The site remedy is ICs that are protective. A VEMUR was filed with ADEQ for Site DP-13 that prohibits residential land development and any soil excavation requires completion of a human health risk assessment. Based on the September 27, 2016 site inspection, land use has not changed and is devoid of any residential development. No excavation was reported during the 5 YR period.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

Yes. An extensive soil investigation for the COCs identified in the ROD has been completed as documented in the October 2016 RACR (URS, 2016b). As a result of the collective work, SC was granted by the ADEQ (See Section 3.3).

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

No. SC has been granted by the ADEQ.

5.4 Site FT-07 North Fire Training Area - West Side

Question A: Is the remedy functioning as intended by the decision documents?

Not Applicable. No required remedy for Site FT-07 was identified in the OU-2 ROD.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

Not applicable. No required remedy for Site FT-07 was identified in the OU-2 ROD.

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

Not applicable. No required remedy for Site FT-07 was identified in the OU-2 ROD. However, PFAS compounds (most notably PFOA/PFOS) may be present in soil and/or groundwater at Site FT-07 as a result of past firefighting training activities that may reopen this site for future investigation/remediation. PFASs are emerging contaminants in which there are no enforceable cleanup standards yet established by EPA for soil or groundwater. However, EPA relatively recently issued non-enforceable drinking water Health Advisories for, and that multiple states, excluding Arizona, have established some kind of guidance or threshold criteria for PFAS.

5.5 Site FT-07E North Fire Training Area - East Side

Question A: Is the remedy functioning as intended by the decision documents?

Yes. ICs including a VEMUR remain in place for Site FT-07E. The ICs stipulate that residential development of the land is prohibited, and the September 27, 2016 site inspection confirmed that land use remains devoid of such development.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

Yes. It is believed that the protectiveness of the remedy has been maintained in consideration of the past risk assessment results which indicated that buried wastes at the site pose no exposure risk under the current land use and the associated VEMUR. The results of the March 2015 soil boring sampling investigation and the August 2015 closure justification memorandum provided a determination from the ADEQ that the site is eligible for SC for the COCs identified in the ROD. However, additional subsurface investigation for VOCs was later requested by the EPA and ADEQ to address TRPH (see Section 3.5). The OU-1 ROD stipulates TRPH as a COC for Site FT-07E. Under the existing PBR Contract, the Performance Objectives set-forth by AFCEC included Response Complete and/or achieving SC with UU/UE for the various ROD sites. The objective is to attain SC for Site FT-07E; therefore, a VOC constituent investigation was undertaken at this specific site as required by ADEQ and EPA for comparison of results to established Arizona SRLs. Because there are numerous VOC constituents reported by the analytical method required to test collected soil samples (i.e., EPA Method 8260B), the use of Arizona SRLs rather than a single cleanup level for TRPH is considered more protective to human health and the environment.

The samples collected during the October 2016 soil boring sampling for VOCs were mishandled by the laboratory which caused the data to be unusable. After a lengthy period associated with reaching an agreement with the laboratory, a field investigation involving drilling and re-sampling three soil borings for VOCs was implemented on May 3, 2017 at Site FT-07E. The analytical results were received and are currently being validated. Following preparation and submittal of a draft results report to AFCEC, and after incorporating AFCEC's review comments, URS anticipates that a results report will be provided to EPA and ADEQ for review by no later than mid-September 2017.

Groundwater beneath FT-07E was determined not to be a concern as the sampling results of the monitoring wells at FT-07 and FT-07E (see Figure 6) were documented as consistently below AWQs for more than eight years. Approval to eliminate sampling the wells was obtained in 2015 by ADEQ (ADEQ, 2015d).

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

The remedy is protective under the current ROD. However, PFASs compounds (most notably PFOA/PFOS) may be present in soil and/or groundwater at Site FT-07E as a result of past firefighting training activities that may reopen this site for future investigation/remediation. . PFASs are emerging contaminants in which EPA has relatively recently issued non-enforceable drinking water Health Advisories for, and that multiple states, excluding Arizona, have established some kind of guidance or threshold criteria for PFAS.

5.6 Site LF-03 Outboard Runway Landfill

Question A: Is the remedy functioning as intended by the decision documents?

Yes. ICs including a VEMUR remain in place for Site LF-03. The ICs stipulate that residential development of the land is prohibited, and the September 27, 2016 site inspection confirmed that land use remains devoid of such development.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

Yes. The site is located on an aircraft runway area at the AFB, and there have been no changes to the physical conditions or use of the land. Furthermore, the assumptions of the Base-wide Risk Assessment for the Site have not changed.

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

No.

5.7 Site LF-14 - Old Salvage Yard Burial Site

Question A: Is the remedy functioning as intended by the decision documents?

Yes. It was determined by the risk assessment that the wastes buried at the site do not represent an exposure risk under the current land use. Therefore, ICs as specified in the ROD which now include a VEMUR remain in place at Site LF-14. The ICs stipulate that residential development of the land is prohibited, and the September 27, 2016 site inspection confirmed that land use remains devoid of such development.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

Yes. The protectiveness of the existing ICs remedy is in place and the exposure scenarios developed under the Basewide Risk Assessment have not changed. Since the time of the previous FYR, AECOM is not aware of any changes in soil toxicity data or changes in soil cleanup levels associated with the Site COCs. Consequently, it is believed that the protectiveness of the remedy has been maintained with respect to the COCs.

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

No.

5.8 Site LF-25 - Northwest Landfill

Question A: Is the remedy functioning as intended by the decision documents?

Yes. Based on the results of the RI and subsequent remedial action (see Section 2.2.8) environmental protectiveness has been achieved at the Site. The ICs stipulate that 1) residential development of the land is prohibited; and 2) occupational and environmental risk assessments for heavy metals need to be

implemented and maintained for all future excavation activities at the site. Access to Site LF-25 was not possible on September 27, 2016 when the other FYR inspections were performed. However, a telephone inquiry with Luke AFB's environmental manager confirmed that the land use remains devoid of such development, and no soil excavation was conducted over the FYR reporting period.

Question B: *Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?*

Yes. The protectiveness of the existing ICs remedy is in place and the exposure scenarios developed under the Basewide Risk Assessment have not changed. Since the time of the previous FYR, AECOM is not aware of any changes in soil toxicity data or changes in soil cleanup levels associated with the Site COCs. Consequently, it is believed that the protectiveness of the remedy has been maintained with respect to the COCs.

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

No. It should be noted that as identified during the third FYR, lead shot from the adjacent skeet shooting range near the southwest portion of Site LF-25 continues to fall onto the land. The VEMUR and site constraints described in the BGP include land use restrictions and use of PPE by workers to prevent exposure during any future soil excavation activities at the site.

5.9 Site RW-02 - Wastewater Treatment Plant Annex Landfill

Question A: *Is the remedy functioning as intended by the decision documents?*

Yes. The results of the downhole radiological monitoring performed in December 2016 (URS, 2016h) indicate that the concrete burial vault is functioning properly to contain the low level radioactive waste. Based on the results of the September 27, 2016 site inspection, the ICs which include perimeter security fencing and placarding at the area of the underground vault are in place and appear to be in good condition. The land use restrictions (ICs including a VEMUR) which prohibit residential land development were also verified by the site inspection.

Question B: *Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?*

Yes. The exposure scenarios developed under the Base-wide Risk Assessment have not changed.

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

No.

5.10 Site SD-20 - Oil/Water Separator Canal and Earth Fissure

Question A: *Is the remedy functioning as intended by the decision documents?*

Not applicable. No required remedy for Site SD-20 was identified in the OU-1 ROD.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

No required remedy for Site SD-20 was identified in the OU-1 ROD. However, The OU-1 ROD stipulates TRPH as a COC for Site SD-20. Under the existing PBR Contract, the Performance Objectives set-forth by AFCEC included Response Complete and/or achieving SC with UU/UE for the various ROD sites. The objective for Site SD-20 is SC; therefore, a VOC constituent investigation was undertaken as required by ADEQ and EPA for comparison of VOC results to established Arizona SRLs. This was required in lieu of sampling for TRPH because the cleanup level for TRPH in Arizona has been rescinded. Because there are numerous VOC constituents reported by the analytical method used to test collected soil samples (i.e., EPA Method 8260B), the use of Arizona SRLs for VOCs rather than a single cleanup level for TRPH is considered more protective to human health and the environment.

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

No required remedy for Site SD-20 was identified in the OU-1 ROD. However, oil was observed on surface water and soil of the storm water drainage ditch located on the south side of Super Saber Street, extending an estimated 200 to 275 feet downstream from the culvert structure (see Attachment B, Photographic Log). The oil, which was observed at the time of the five-year report inspection on December 29, 2016, reportedly originated from overflow of the upstream OWS during a heavy storm event. Storm water flows into the OWS after passing through a junction box located adjacent to the OWS. The junction box contains a concrete weir. Under low flow conditions, storm water is diverted by the weir and enters the OWS. Oil skims into a collection chamber and the water is pumped to the base wastewater treatment plant via a lift station. Under high flow conditions, the weir is overtopped and this flow bypasses the OWS and goes directly to the drainage ditch. It is believed that this storm event was large enough to flood the OWS to the point that flow reversed to pull oil from the OWS over the weir and into the drainage ditch. Another possibility is oil accumulation in the storm water pipes prior to the junction box. Due to land subsidence, there is little to no gradient in this area of the base. Oil accumulations in the line could be from months or even years of runoff. With a large enough storm event this accumulation is flushed out of the lines. Upon discovery of the oil prior to the five-year review inspection, Luke AFB responded by pumping the oil and water in the ditch, and placing oil-sorbent booms at the culvert outfall area. Additionally, oil eating bacteria were added to the spill area. After several days the bacteria had significantly cleared the remaining standing water. Sampling the oil for laboratory analysis was also performed. A decision to conduct additional sampling activities to assess the vertical and lateral extent of oil impacts has been made by Luke AFB for implementation when the drainage ditch dries up after the winter storm season.

The location of the point of compliance (POC) for storm water monitoring identified in the National Pollutant Discharge Elimination System (NPDES) permit is at an outfall located considerably further downstream at the Munitions Storage area on the south side of the AFB. Continuation of pollution prevention activities and monitoring at the culvert area and the POC in accordance with the NPDES permit is being performed.

5.11 Site SD-38 - Oil/Water Separator at Old Auto Body Hobby Shop

Question A: Is the remedy functioning as intended by the decision documents?

Yes. The remedy for Site SD-38 is ICs including a VEMUR which prohibit residential development of the land at the site. The September 27, 2016 site inspection confirmed that land use remains devoid of residential development.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

Yes. The exposure scenarios developed under the Base-wide Risk Assessment have not changed.

The OU-1 ROD stipulates TRPH as a COC for Site SD-38. Under the existing PBR Contract, the Performance Objectives set-forth by AFCEC included Response Complete and/or achieving SC with UU/UE for the various ROD sites. The objective for Site SD-38 is SC; therefore, a VOC constituent investigation was undertaken as required by ADEQ and EPA for comparison of VOC results to established Arizona SRLs. This was required in lieu of sampling for TRPH because the cleanup level for TRPH in Arizona has been rescinded. Because there are numerous VOC constituents reported by the analytical method used to test collected soil samples (i.e., EPA Method 8260B), the use of Arizona SRLs for VOCs rather than a single cleanup level for TRPH is considered more protective to human health and the environment.

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

No. However, TRPH is no longer regulated by SRLs in Arizona. To address the uncertainty over the composition of TRPH detected at Site SD-20 during the RI, supplemental soil characterization for VOCs is being required by EPA and ADEQ in order to obtain SC. In accordance with the August 2016 work plan approved by ADEQ (URS, 2016c), URS implemented soil sampling for VOCs at the site in October 2016 and early May 2017 (See Section 3.11). After review comments are received, responses to AFCEC's comments are prepared, and comments are incorporated, URS anticipates that a draft results report will be sent to ADEQ for review by late August 2017.

5.12 Site SS-42 - Bulk Fuels Storage Area

Question A: Is the remedy functioning as intended by the decision documents?

Yes. The interim remedy selected for Site SS-42 was soil remediation by SVE for the release of petroleum hydrocarbons from the former UST system. The COCs of BTEX and TRPH were remediated; the ROD stipulated LTM for groundwater to confirm it had not been impacted by the UST system release. The BGP includes ICs that prohibit residential development of the land at SS-42, and the September 27, 2016 site inspection confirmed that no residential use exists at the site.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

Yes. The exposure scenarios developed under the Base-wide Risk Assessment have not changed. The LTM plan approved by the ADEQ includes collecting annual water level measurements and sampling

wells MW-121-S and MW-125R-S at Site SS-042 (see Figure 13). Analytical results for both the October 2014 and December 2015 groundwater sampling events indicated that there were no detectable concentrations of VOCs present above established Arizona AWQS or Tier 1 guidance levels.

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

Yes. On August 2, 2016, a Jet A fuel release incident occurred during construction-related activities when an underground fuel pipeline was struck by an excavator. An estimated 30,000 gallons of Jet A fuel was released which drained across a major portion of the fuel storage yard saturating soil and pooling in some areas. Emergency response and initial cleanup efforts were promptly implemented.

A soil remediation work plan was developed by URS that includes performing delineation soil sampling of fuel impacts, and ultimately soil remediation by excavation if concentrations of petroleum hydrocarbons exceed NR-SRLs. URS initiated soil boring delineation sampling in December 2016. Additional soil sampling was performed in late March and early May 2017. With the exception of select VOCs in several soil boring samples, analytical results indicate that concentrations of petroleum hydrocarbons detected in all soil samples collected at and below 3 feet bgs are less than Arizona NR-SRLs. Soil remediation is planned at the soil boring areas in which concentration exceedances to NR-SRLs was reported. If required by the United States Army Corps of Engineers (USACE), characterization of impacts to surface soil above 3 feet bgs will be conducted under an approved work plan to compare soil sample analytical results to NR-SRLs. If sample results indicate any hydrocarbon detections above NR-SRLs, soil remediation at applicable areas by excavation may be required.

In addition to soil sampling performed to characterize the lateral and extent of impacts from the Jet A fuel release, sampling to evaluate exposure to volatile hydrocarbons in air within the SS-042 fuel storage yard was performed in February 2017. The results indicated that detected concentrations of volatile hydrocarbons were less than Occupational Safety and Health Administration air quality standards, and less than recommended health-based exposure limits published by the National Institute of Occupational Safety and Health and the American Conference of Governmental Industrial Hygienists.

A new pump house structure with a control room is being constructed in the fuels storage yard in an area that was impacted by the August 2016 fuel release. A passive SVE system is being installed to mitigate the potential vapor intrusion pathway into indoor air of the control room. After construction of the pump house is complete, ambient air quality sampling will be performed in the control room to confirm the protectiveness of the remedy.

5.13 Site TU-44 - Waterdog Recreational Annex

Although Site TU-44 is under Luke AFB's jurisdiction, it was not part of the RI or RODs for either the OU-1 or OU-2 facilities at Luke AFB. The inclusion of Site TU-44 was requested by AFCEC as a means of documenting the site status and progress made under the FYR process.

Question A: Is the remedy functioning as intended by the decision documents?

Yes. Past remedies for soil and groundwater at the site have included bioventing, SVE, air sparging, and TEP. Due to the complex geology and hydrogeology of the site (weathered and fractured granite),

including fluctuating groundwater levels related to surface water elevation changes on the adjacent Apache Lake (affected by periodic damn releases), past remediates have had limited effectiveness at achieving cleanup goals. The continued groundwater investigation under the 2013 PBR contract over the past several years has been effective for purposes of remedy selection. More specifically, the data has been used for development and implementation of a BOS 200[®] pilot test to evaluate the feasibility and benefits of employing the technology for continued groundwater remediation at the site.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

Not applicable. Site TU-44 is not listed in either of the Luke AFB OU-1 or OU-2 RODs.

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

No.

6.0 ISSUES AND RECOMMENDATIONS/FOLLOW-UP ACTIONS

Issues that have been identified during this FYR are described below. Suggestions or recommendations to address the issues are presented for consideration by AFCEC where applicable.

- Site FT-07 and FT-07E North Fire Training Area - West and East Sides. The Air Force intends to complete the activities presented in AFCEC's work plans, and it is recommended that AFCEC continue to track any new regulatory guidance and/or requirements for the investigation or remediation of PFAS.
- Site ST-18 Former Liquid Waste Storage Facility (Facility 993). The concrete cap contains some cracks that were identified during previous annual and FYR inspections. The cracks have been repaired on multiple occasions over the years as summarized in Table 2.2.2 above. Based on current conditions, it is recommended that repairs be made to clean and re-seal the cracks with a suitable engineered product(s) so that water intrusion can be minimized to prevent additional cracking, widening of the cracks, and/or spalling. Although the density of the cracks and degree of concrete degradation is not considered a significant risk to the current protectiveness of the cap, maintenance for long-term protection of this remedy is recommended. Photographs of the more significant cracks observed during the September 27, 2016 inspection that warrant repair are included in Attachment B.
- Sites SD-20, SD-38 and FT-07E. In an effort to obtain SC of each of these sites, soil investigation for VOCs has relatively recently been conducted pursuant to EPA and ADEQ requirements. The investigation work has been focused at areas where TRPH had been detected above applicable screening levels during the RI. It should be noted that VOCs as a class of compounds had not been listed as COCs in the RODs for these sites. Nevertheless, soil boring investigations have been implemented at each of these sites in accordance with ADEQ-approved work plans to determine if any detectable VOCs above SRLs are present. Depending on the results, either SC will be possible or supplemental site characterization and/or remediation may be required. In an effort to realize the objective of attaining SC with UU/UE, the Air Force intends to complete the VOC-related investigations, data evaluation, and results reporting. If SC can be achieved an appropriate CERCLA decision document will be required to document final closure.
- Site SD-20 OWS-Related Hydrocarbons. During the FYR inspection on December 29, 2016, AECOM observed oil on surface water and apparent oil staining on the banks of the unlined storm water drainage ditch on the south side of Super Sabre Street. A description of the estimated extent of the visible oil, Luke AFB's initial response actions, and its preliminary plans to conduct characterization of the extent of oil impacts is provided in Section 5.10. Luke AFB will conduct a characterization project to determine the vertical and lateral extent of oil impacts in the ditch. Based on the future soil characterization results, remediation may be warranted to remove the oil impacts from the drainage ditch in accordance with applicable regulatory requirements.
- LTM Status at Sites FT-07E, RW-02, and SD-20. No groundwater monitoring has been performed at the Sites FT-07E, RW-02, and SD-20 since the third FYR period ended in May

2011. Groundwater monitoring for these three sites is not included in the existing PBR contract between AFCEC and URS. It should be noted however, that based on review of the LTM groundwater sampling results, no exceedances to AWQs had been reported since at least July 2008 (ARCADIS, 2012). It is recommended that an historical review and evaluation of all available data associated with groundwater LTM at the sites be conducted. Based on the evaluation results, seeking concurrence from ADEQ and EPA that no further LTM at one or more of these sites may be warranted.

- Lead Material from Skeet Shooting Range Adjacent to Site LF-25. An active skeet shooting range exists adjacent to the southwest portion of Site LF-25 (see Figure 9). Lead-shot from shooting is routinely dispersed onto the unpaved ground at Site LF-25. The ICs in place include provisions that prohibit residential land development, and for worker protection to minimize or eliminate exposure from soil excavation activities (ARCADIS, 2014b). The remedy was selected based on completing an assessment of the Site LF-25 surface conditions. In December 1999, Luke AFB recovered the lead/metal shot from the LF-25 surface soil as part of the remedial alternative. Confirmation soil samples indicated that remaining lead and antimony concentrations were protective of human health.

The third FYR report indicates that during the subsequent five year period, Luke AFB would re-evaluate surface conditions at LF-25. This reportedly was not conducted. It is recommended that a surface soil evaluation be implemented, in part, to characterize the extent of lead-shot dispersion and the levels of lead and antimony in surface soils within the shot dispersion zone. It is anticipated that portable X-Ray Fraction meter could be used for delineation of metals within the shot zone. Depending on sampling results, consideration for removing the lead/metal shot from surface soil by excavation and screening techniques is suggested over the next FYR reporting period.

- Appropriate CERCLA Decision Document for Arsenic at Multiple Sites. Based on maximum detected concentrations of arsenic in comparison to the screening level of 0.38 mg/kg (1996 EPA residential PRG), seven sites were identified in the RODs with arsenic as a COC. As detailed in Table 2.1a, these sites include DP-13, FT-07E, LF-03, LF-25, RW-02, SD-20, and SD-38. Concentrations of arsenic in typical Arizona soils often considerably exceed the 0.38 mg/kg residential PRG for arsenic. The Arizona R-SRL and NR-SRL for arsenic is 10 mg/kg. Therefore, it is recommended that an appropriate CERCLA decision document be prepared for the Luke AFB OU-1 and OU-2 RODs, which adopts the Arizona SRLs for arsenic of 10 mg/kg or site-specific background.
- Assessing Future Potential Vapor Intrusion Risks. Vapor intrusion risks do not presently exist at Sites DP-13, FT-07, FT-07E, LF-03, LF-14, LF-25, RW-02, SD-20, and TU-44 due to the absence of any enclosed structures within or near the contaminant source area(s) that could be occupied by personnel. However, if plans are made in the future to construct new enclosed buildings or other structures on any of these sites, the vapor intrusion risk to human health should be evaluated. Considerations for the evaluation may include the proximity of planned structure(s) to soil contamination area(s); the inclusion of engineering controls in construction of the structure(s) to protect against vapor intrusion; whether or not the site has achieved SC, etc.

- Rising Groundwater Elevation. Based on review of groundwater level measurements collected at Sites ST-18 and SS-42 under the PBR contract over the past four years, the groundwater elevation rose at an average rate of approximately 4 feet per year. A rise in elevation of up to 5 feet per year since the early 1980s was reported in the third FYR report (ARCADIS, 2012). If the trend continues, some of the wells presently being used for LTM may no longer be appropriate for sampling within the next 5 to 10 years because the well screens will be fully submerged. Replacement wells with appropriate screened intervals may be necessary to install for continued LTM. There is also a risk that if groundwater levels continue to rise, contaminant impacts to groundwater could occur as a result of dissolution of contaminants from soil into the rising saturated zone. The deepest detections of COCs greater than ARARs were reported to have been encountered at 141 feet bgs (ARCADIS, 2011). During the October 2016 annual LTM event, the shallowest depth to static groundwater was measured to be 212.55 ft bgs at well MW-125R-S on Site SS-42. Based on the current rate of approximately 4 feet per year of rise in groundwater elevation, the shallowest contaminant impacts in the vadose zone (141 feet bgs) would not be encountered for approximately 18 years. The Air Force intends to track the rise in groundwater elevation over time by preparing and/or updating hydrographs for select wells being monitored on-base, so that planning for potential future well abandonments and replacements will be possible.

- Removal of Drums Containing IDW at Site TU-44. During the site inspection on October 5, 2016, a total of 36 labeled drums containing both soil cuttings (26 drums) and well development/groundwater (11 drums) were observed at the site. These 55-gallon drums were used to contain wastes generated during the time period of the BOS 200[®] pilot test when injection boreholes and seven new monitoring wells were installed. Collection of composite samples from the drums for laboratory analysis was performed by URS on October 13, 2017 to characterize the IDW to obtain approval for proper off-site treatment and/or disposal of the wastes. The Air Force will ensure that the drums are removed by a qualified waste contractor and transported to an appropriate licensed disposal facility or facilities.

- Filling Animal Burrow Holes at Site LF-14. During the September 27, 2016 FYR inspection of Site LF-14, a considerable number of small animal burrow holes (presumably from rodents) were observed along the northern portion of the site. To mitigate enhanced infiltration of stormwater into the waste materials below, the Air Force intends to fill the burrow holes with clean soil and/or re-grade the affected area in a manner that fills the holes.

- Soil Remediation and Confirmatory Indoor Air Sampling at SS-042. AECOM recommends implementing the planned soil excavation remediation at the localized areas in which samples collected from two soil borings indicated petroleum hydrocarbon exceedances to NR-SRLs (see Section 5.12, Question C). In addition, after construction is complete we recommend conducting the indoor air quality sampling within the control room of the pump house to confirm that there are no vapor intrusion health risks.

- Gamma Radiation Action Level for Site RW-02. The 2012 Third FYR Report provided a

recommendation that Luke AFB work with ADEQ prior to the May 2012 monitoring event to assess the appropriateness of the current action level for gamma radiation monitoring. The matter was discussed with the ADEQ and the Air Force had compiled and evaluated the action level data (see Section 3.9 and Attachment F). It is recommended that prior to the next Site RW-02 annual monitoring event in December 2107, that the action level issue be revisited between the Air Force, EPA, and/or ADEQ for concurrence.

7.0 PROTECTIVENESS STATEMENTS

URS, on behalf of AFCEC, has completed this fourth FYR for the period of 2011 through 2016 at Luke AFB. Over the past several years, a considerable amount of work under the PBR contract has been performed in an effort to proceed towards closure of multiple PSC sites. This work has involved conducting additional site characterization of the lateral and vertical extent of COCs in soil, and some assessments of risk to human health based on statistical evaluations of past and new COC concentration data. The available results support the conclusion that the existing remedies at Luke AFB are protective. The following provides a protectiveness statement for each of the two Luke AFB OUs, along with a separate general protectiveness statement for Site TU-44 that is not a site included in either of the RODs.

Protectiveness Statement for OU-2 Sites

The OU-2 sites stipulated in the Luke AFB ROD are:

- DP-23 Old Surface Impoundment West of Facility 993
- ST-18 Former Liquid Waste Storage Facility (Facility 993)

The remedy for Site DP-23 required by the January 1994 ROD for OU-2 stipulated excavation, ex-situ biological treatment, confirmation sampling, and on-site disposal of impacted soils from the canal portion of PSC DP-23. These activities were all historically completed. The current response actions for Site DP-23 are internal land use controls documented in ICP on northern section of the site. For Site ST-18, the remedy stipulated in the ROD is inspection and maintenance of the cap. The current response actions for ST-18 are LTM, annual sampling, inspection of cap, and reporting. Based on the results of this FYR, it is believed that the response actions being exercised since the completion of the third FYR have maintained protectiveness to human health and the environment at the sites.

The ROD for OU-2, dated January 1994, includes a summary of Site risks associated with each of the PSCs at Luke AFB. Based on the results of the Site specific risk assessment, Site FT-07 was determined to “*not represent a significant hazard to human health.*” Therefore, site FT-07 was considered protective and not listed as a PSC in the ROD.

Protectiveness Statement for OU-1 Sites

The OU-1 sites stipulated in the January 1999 ROD for OU-1 include the following:

- DP-13 Drainage Ditch Disposal Area
- FT-07E North Fire Training Area - East Side
- LF-03 Outboard Runway Landfill
- LF-14 Old Salvage Yard Burial Site
- LF-25 Northwest Landfill
- RW-02 Wastewater Treatment Plant Annex Landfill

- SD-20 Oil/Water Separator Canal and Earth Fissure³
- SD-38 Oil/Water Separator at the Old Auto Body Shop
- SS-42 Bulk Fuels Storage Area

The required remedies for the nine above-listed OU-1 sites are described in the OU-1 ROD, and the response actions are listed in Table 2.1a. It is believed that the remedies and response actions for the nine OU-1 sites remain protective of human health and the environment. The IC remedies are designed to eliminate, to the practical extent possible, exposure pathways representing unacceptable risk to human health. LTM is also used to evaluate whether or not COCs detected in soil may have leached downward and affected groundwater. The ICs listed in the Section 2.4 table have all been maintained. The LTM results indicate that no detections of COCs above current regulatory standards have been observed. Therefore, the protectiveness of the OU-1 remedies at Luke AFB has been sustained since the previous FYR.

Protectiveness Statement for Site TU-44 Waterdog Recreational Annex

Going forward, regardless of the ultimate remedy or remedies used to perform groundwater remediation at Site TU-044, the network of monitoring wells will be used to assess the on-going protectiveness of the remedy by providing a means to evaluate the hydrogeologic conditions at the site including the stability, nature, and extent of the contaminant plume.

A relatively extensive network of 27 groundwater monitoring wells is present at Site TU-44. This includes four injection points converted into monitoring wells, two replacement wells, and five new monitoring wells installed in 2016 to support the BOS 200[®] pilot test. The wells are being used to monitor groundwater conditions including contaminant levels, remedial performance in response to the BOS 200[®] injections, and the overall stability of the plume. The results of monitoring will also be used to evaluate the site protectiveness against the migration of contaminants towards the adjacent Apache Lake.

³ SD-20 did not require remedial action per the ROD, however, this site was added to the LTM at ADEQ's request after the first five-year review.

8.0 NEXT REVIEW

The next FYR for the OU-1 and OU-2 sites at Luke AFB, and for Site TU-44 located off the base, will be performed in year 2022.

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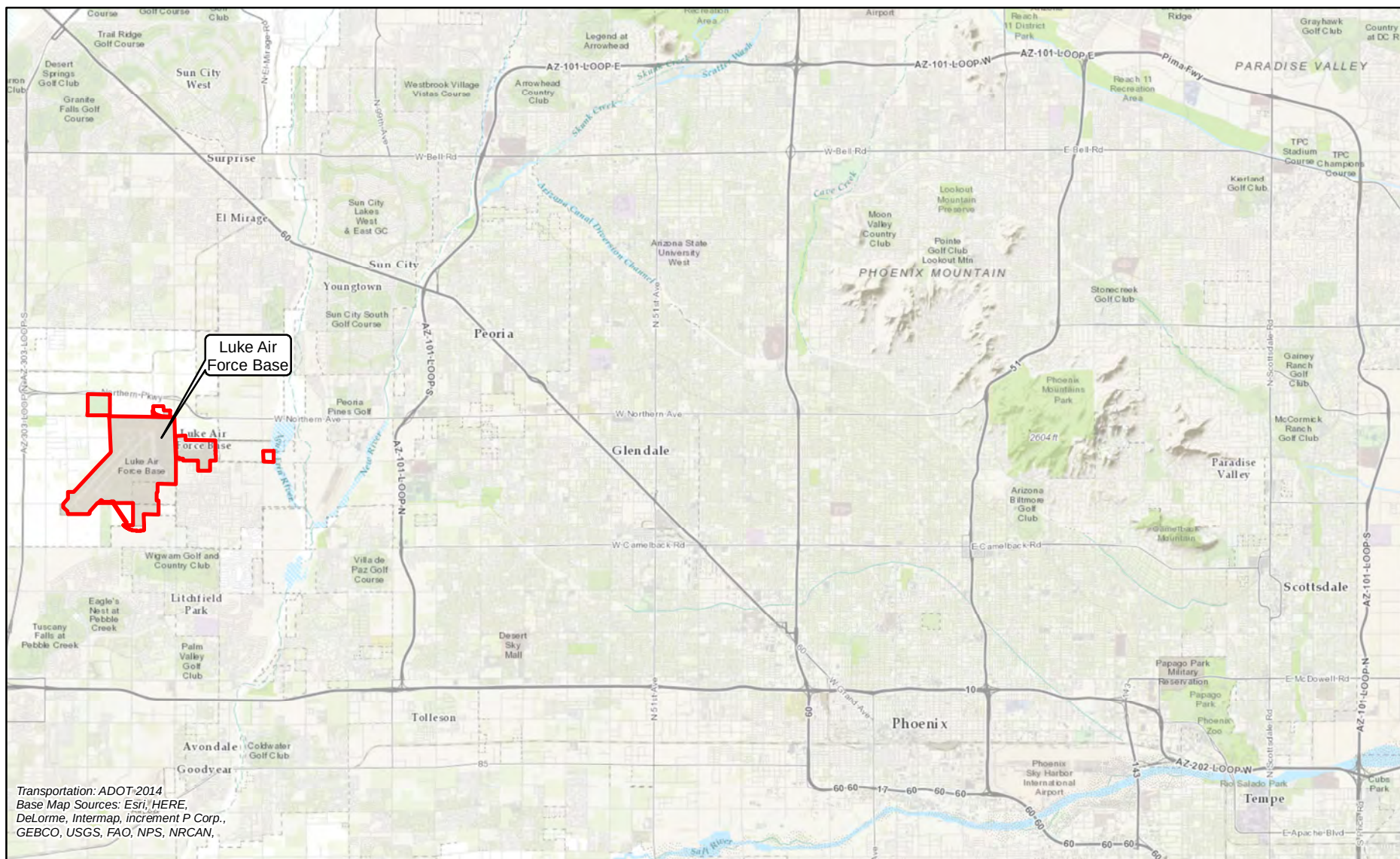
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FIGURES

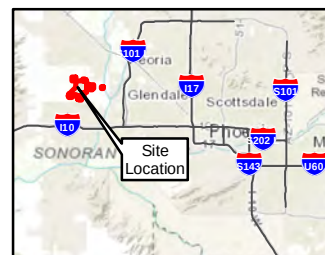
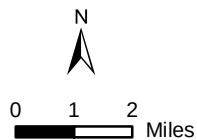
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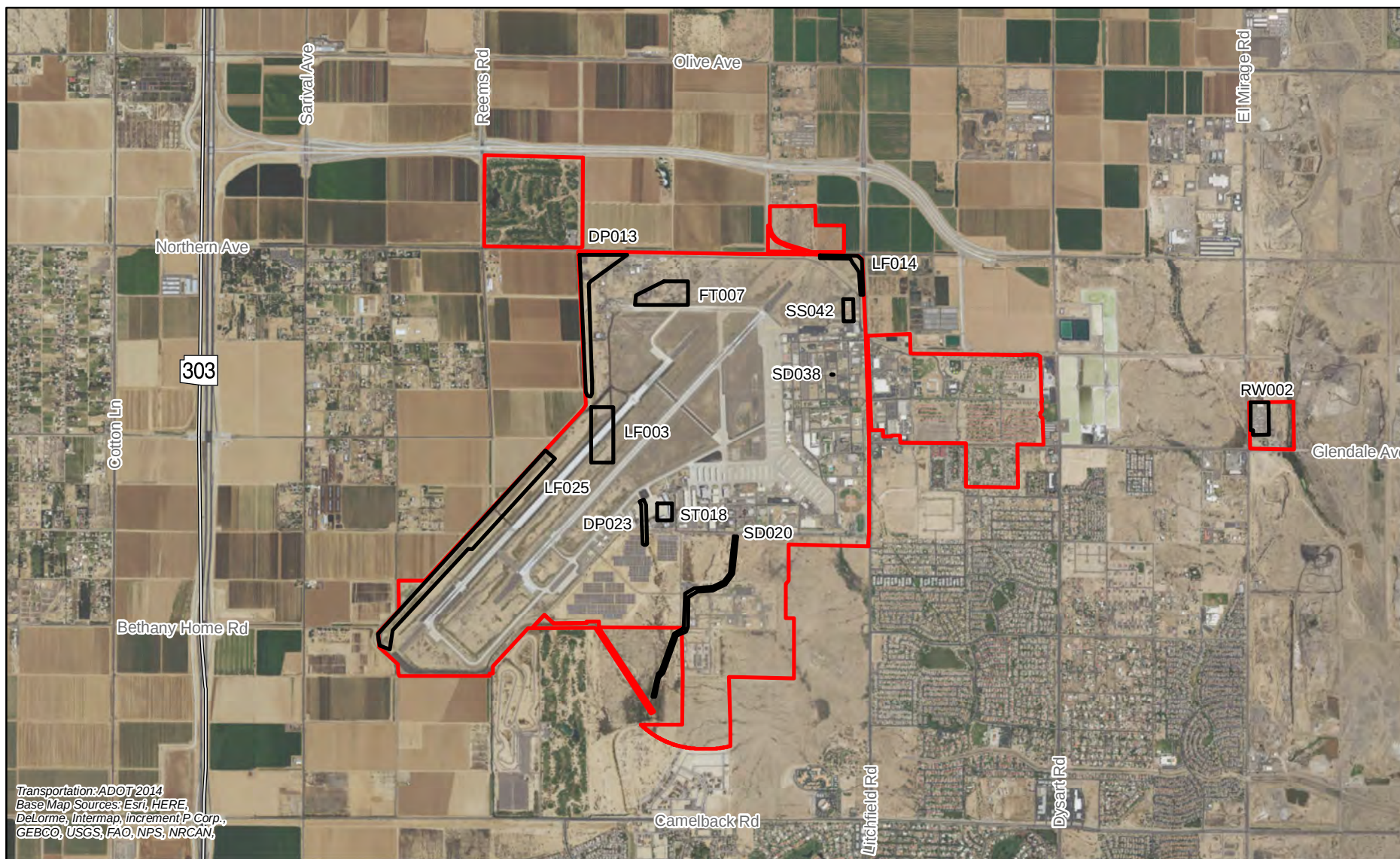
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- Installation Boundary
- Road



Location Map
 Luke Air Force Base
 Glendale, Arizona
 Figure 1



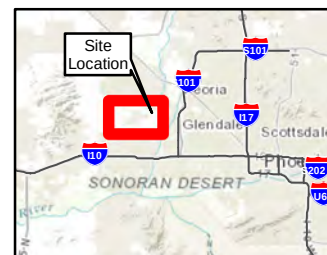
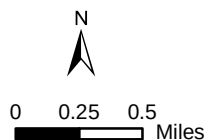


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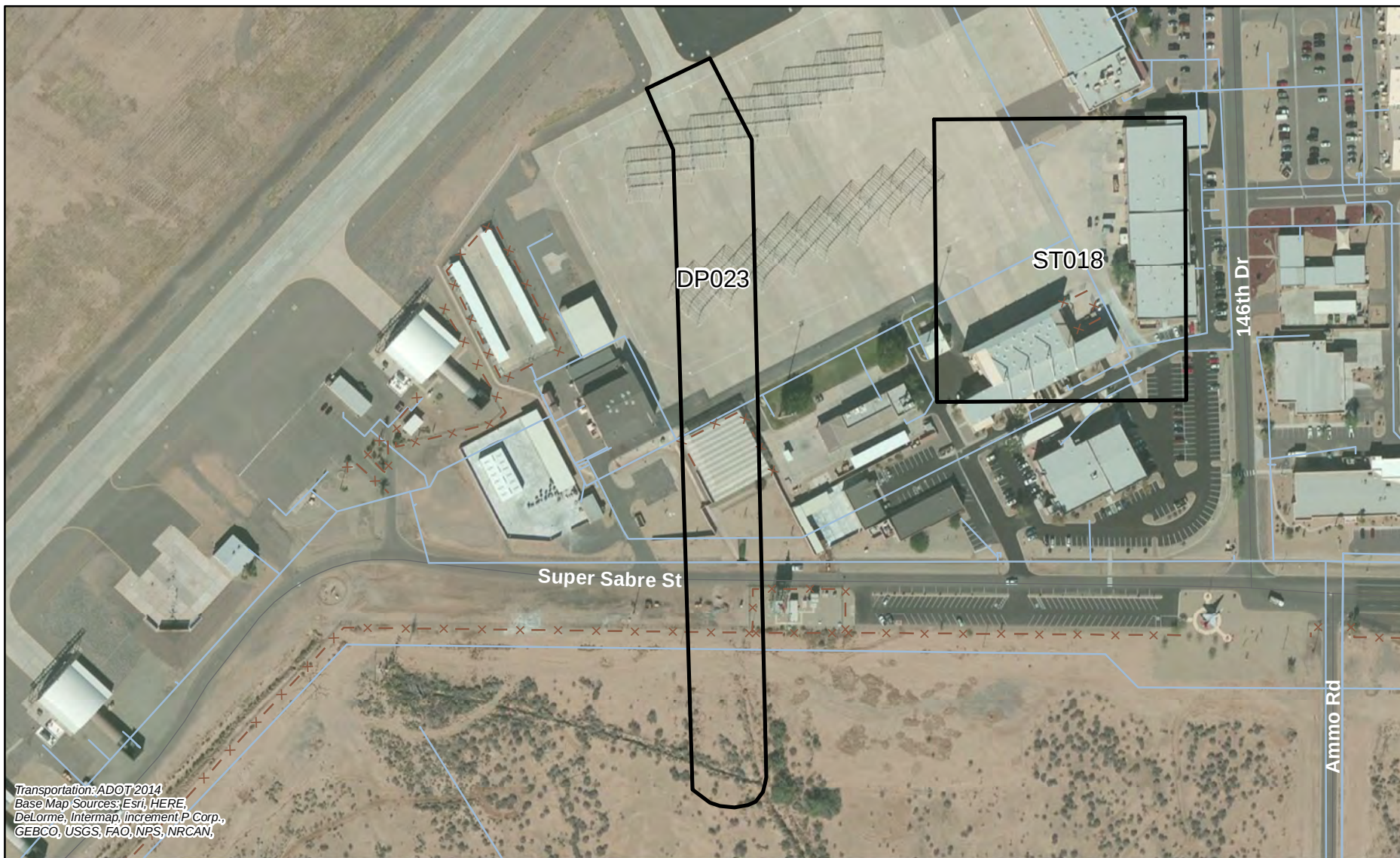
- Installation Boundary
- Site Boundary
- State Route
- Road

SS042 = Bulk Fuel Storage Area
ST018 = Former Liquid Waste Storage Facility
FT007E = Eastern Portion of North Fire Training Area
SD020 = Oil/Water Separator at Auto Body Shop
RW002 = Wastewater Treatment Plant
SD038 = Oil/Water Separator at Auto Body Shop
DP013 = Drainage Ditch Disposal Area
LF003 = Outboard Runway Landfill
LF025 = Northwest Landfill
DP023 = Old Surface Impoundment West of Facility 993
LF014 = Old Salvage Yard Burial Site



Facility Layout Map
Luke Air Force Base
Glendale, Arizona
Figure 2



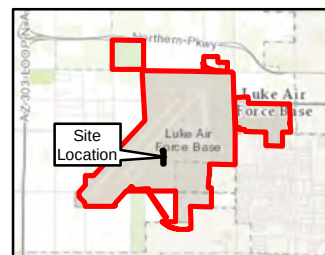
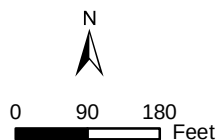


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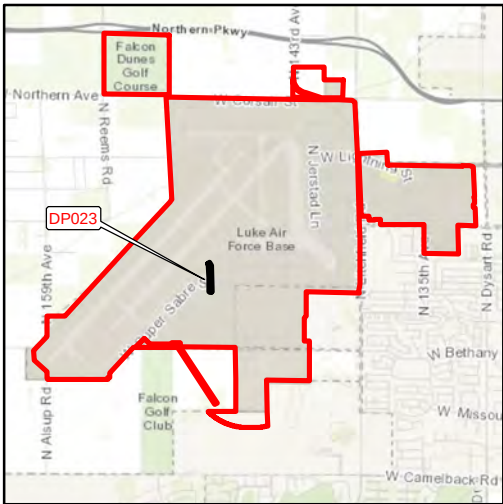
- Installation Boundary
- Site Boundary
- x Fence
- Utility
- Road

ST018 = Former Liquid Waste Storage Facility
DP023 = Old Surface Impoundment West of Facility 993



Site DP-23 Map
Luke Air Force Base
Glendale, Arizona
Figure 3

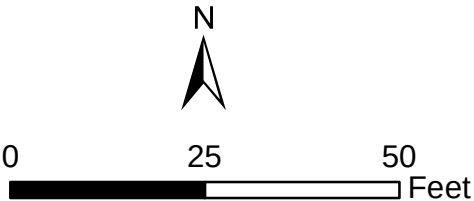




Legend

- Installation Boundary
- Approximate DP023 Boundary
- ECC Sample Point (Approximate)
- Dames and Moore Sample Point (Approximate)
- Remedial Investigation Sample Point (Approximate)
- URS Group Sample Location 09/2015
- Utility
- Fence

Transportation: ADOT 2014
Base Map Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community
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URS

Site DP-23 Soil Boring
Sample Locations
Luke Air Force Base
Glendale, AZ

Fig 3a

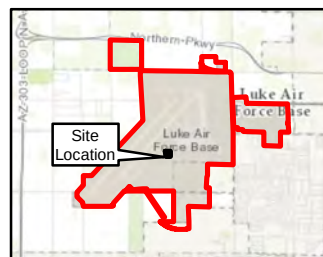
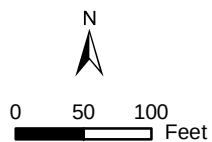


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GEBCO, USGS, FAO, NPS, NRCAN,

Legend

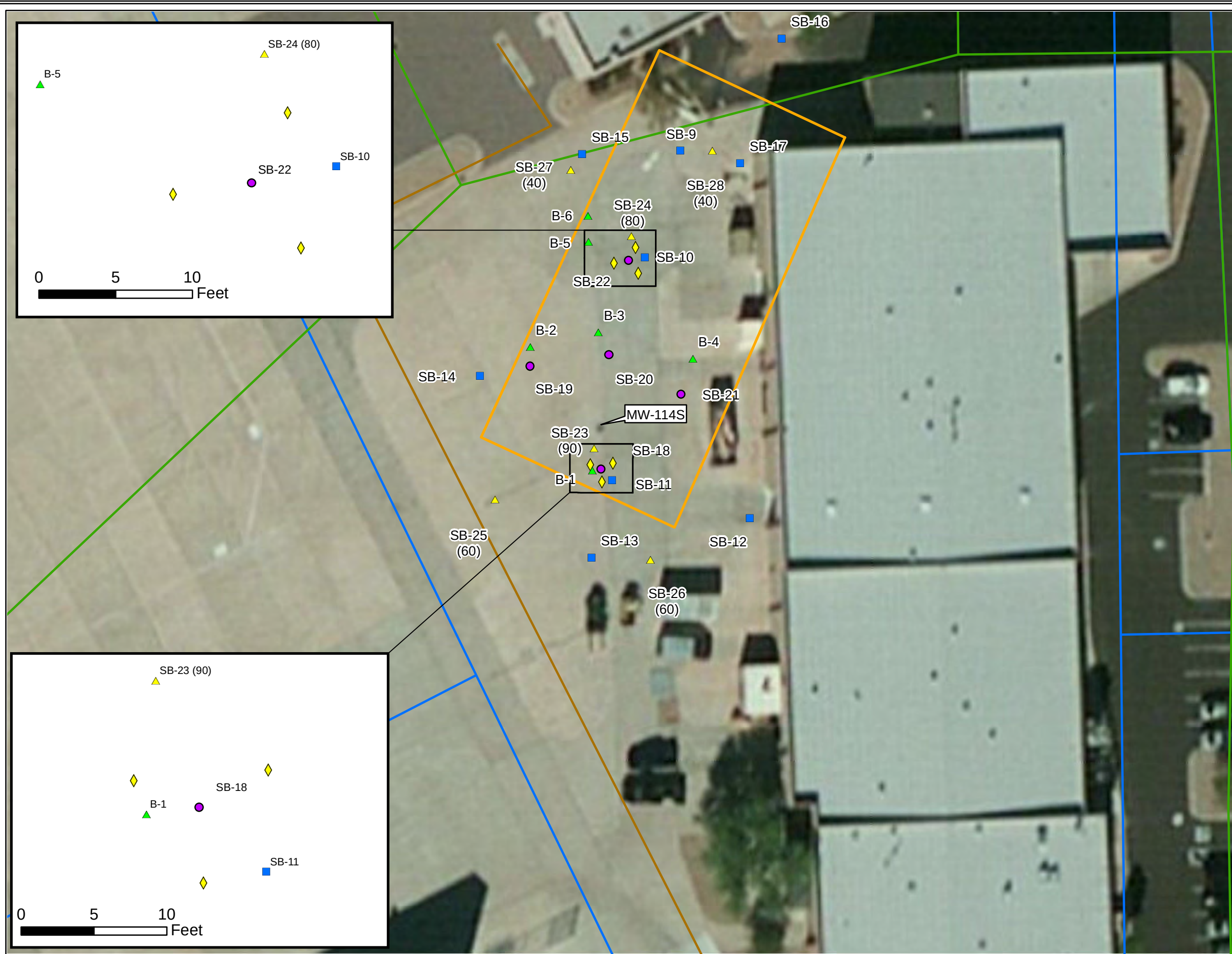
- Installation Boundary
- Site Boundary
- State Route
- Road

ST018 = Former Liquid Waste Storage Facility
DP023 = Old Surface Impoundment West of Facility 993



Site ST-18 Map
Luke Air Force Base
Glendale, Arizona
Figure 4





Legend

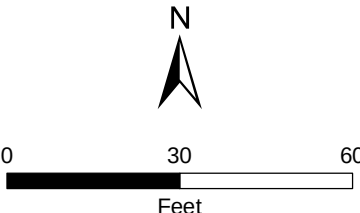
- Installation Boundary
- ST018 Boundary
- 2014 Soil Boring Location
- 1986 Soil Boring Location
- 1996 Soil Boring Location
- Soil Boring Location (proposed depth) in feet bgs
- Soil Vapor Location
- 1996 Soil Borings
- 1986 Soil Boring
- Water Line
- Sewer Line
- Drain Line

Note:
All features are approximate locations.

ST018 boundary referenced from:
Geraghty & Miller, Inc. 1997. Appendix B, Baseline Risk Assessment, Luke Air Force Base, Arizona. October.

Coordinate System:
NAD 1983 StatePlane Arizona Central FIPS 0202 Feet Intl
Projection: Transverse Mercator
Datum: North American 1983

Base Map Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community

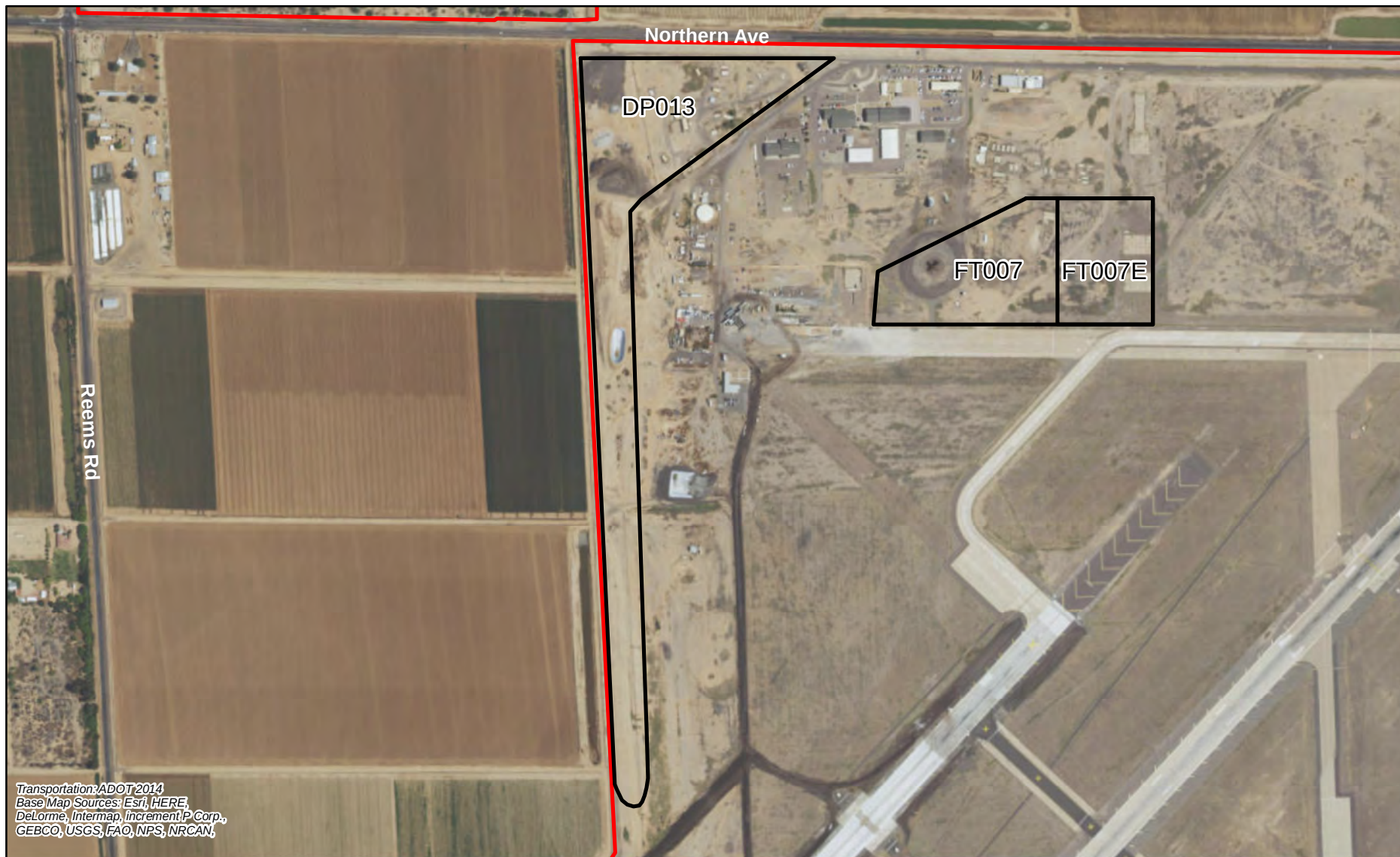


Site ST-18
Soil Boring and Soil Vapor Sample Locations
Luke Air Force Base
Glendale, Arizona



URS

Figure 4a

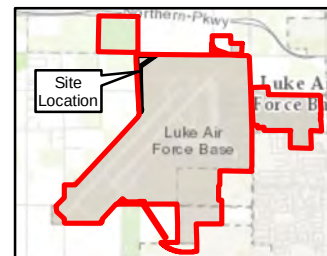
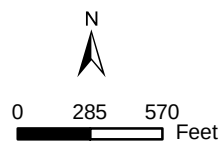


Transportation: ADOT 2014
 Base Map Sources: Esri, HERE,
 DeLorme, Intermap, increment P Corp.,
 GEBCO, USGS, FAO, NPS, NRCAN,

Legend

- Installation Boundary
- Site Boundary
- State Route

FT007 = Western Portion of North Fire Training Area
 FT007E = Eastern Portion of North Fire Training Area
 DP013 = Drainage Ditch Disposal Area



Site DP-13 Map
 Luke Air Force Base
 Glendale, Arizona
 Figure 5

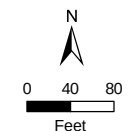




-  Installation Boundary
-  Approximate DP013 Boundary
-  RI Soil Boring
-  RI Test Pit
-  VEMUR Location
-  Utility
-  Fence
-  Road

Note:
RI Soil Boring and Test Pit Locations are
approximate.

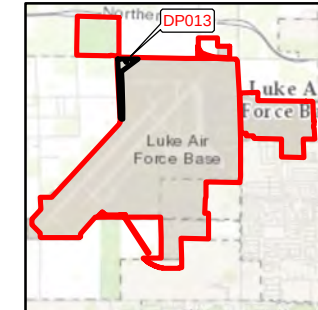
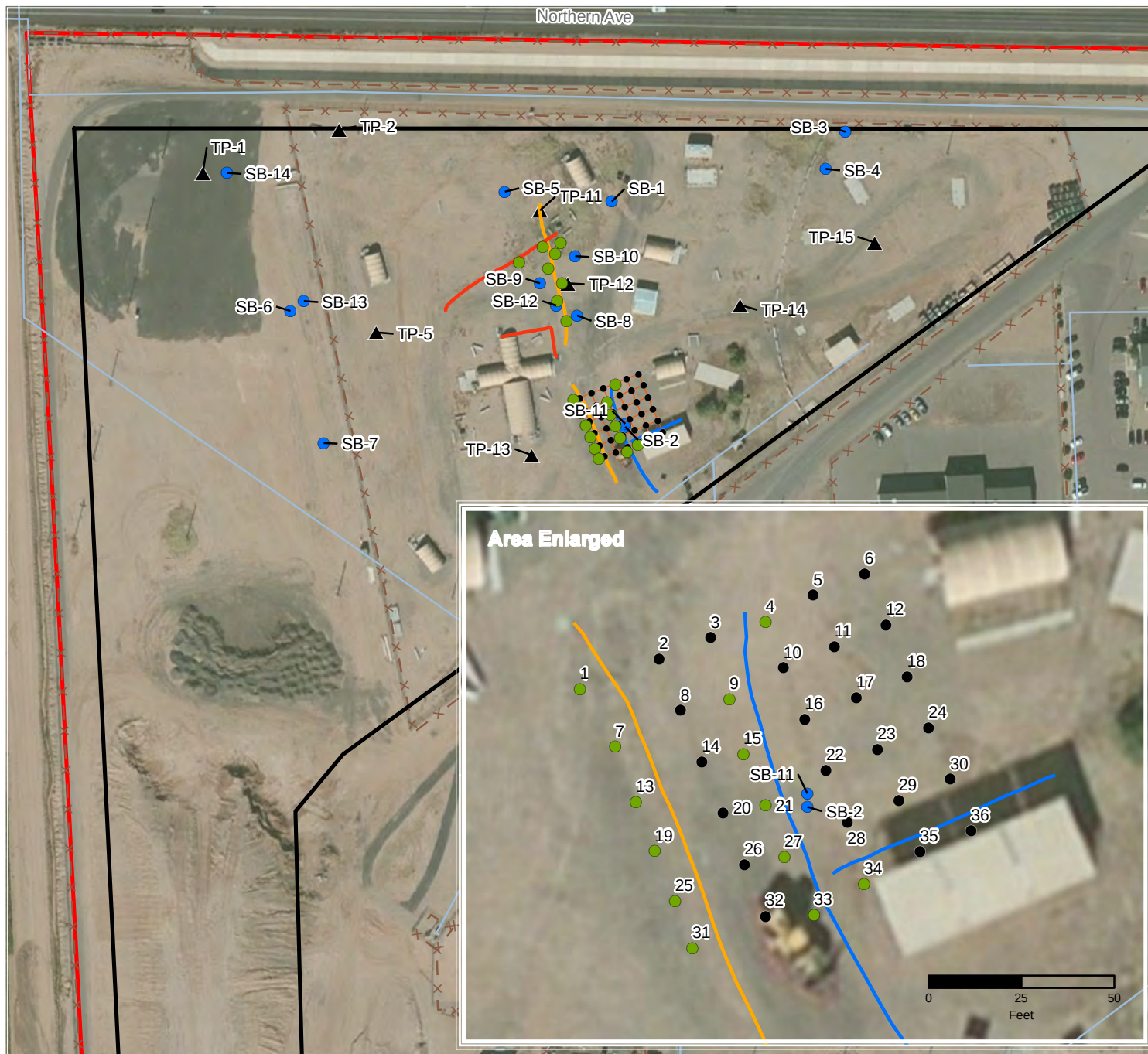
Transportation: ADOT 2014
Base Map Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



Site DP-13 VEMUR Location Map
Luke Air Force Base
Glendale, Arizona
Figure 5a



URS

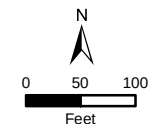


Legend

- Installation Boundary
- Approximate DP013 Boundary
- 15x15 Grid
- Proposed Boring Location
- Corrected Boring Location
- RI Soil Boring
- ▲ RI Test Pit
- Utility
- Communication
- Electrical
- Water
- x Fence
- Road

Note:
RI Soil Boring and Test Pit Locations are approximate.

Transportation: ADOT 2014
Base Map Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



Site DP-13 Soil Boring
Sample Locations
Luke Air Force Base
Glendale, Arizona



URS

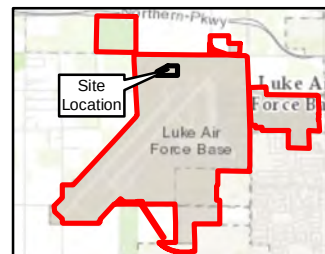
Figure 5b



Legend

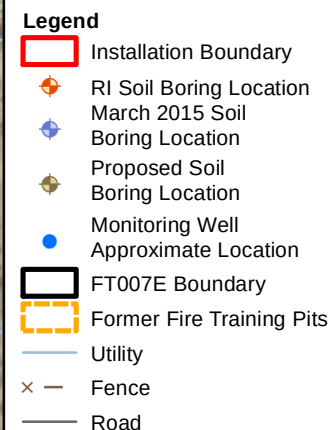
- Monitoring Well
- Approximate Location
- Installation Boundary
- Site Boundary
- State Route
- Road

FT007 = Western Portion of North Fire Training Area
FT007E = Eastern Portion of North Fire Training Area
DP013 = Drainage Ditch Disposal Area



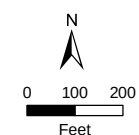
Site FT-07 and FT-07E Map
Luke Air Force Base
Glendale, Arizona
Figure 6





Note:
RI soil boring locations are approximate.

Transportation: ADOT 2012
 Base Map Sources: Esri, HERE, DeLorme, Intermap, increment
 P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN,
 Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China
 (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap
 contributors, and the GIS User Community
 Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics,
 CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid,
 IGN, IAG, swisstopo, and the GIS User Community



FT-07E Soil Boring
Sample Locations
Luke Air Force Base
Glendale, Arizona
Figure 6a



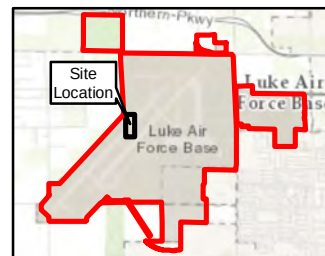
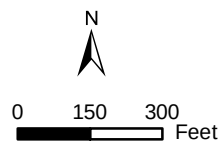
URS



Legend

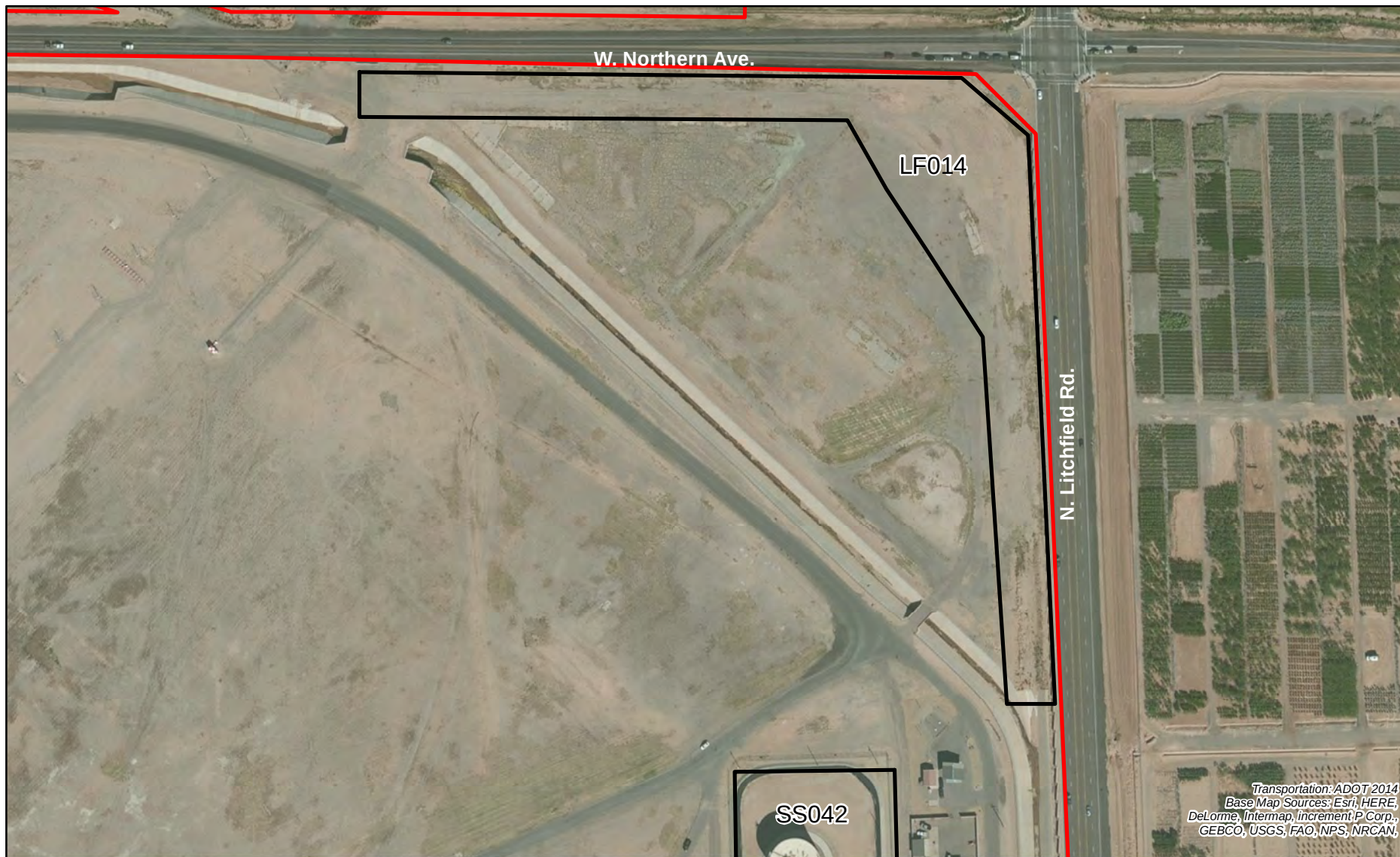
- Installation Boundary
- Site Boundary
- State Route
- Road

DP013 = Drainage Ditch Disposal Area
LF003 = Outboard Runway Landfill
LF025 = Northwest Landfill



Site LF-03 Map
Luke Air Force Base
Glendale, Arizona
Figure 7



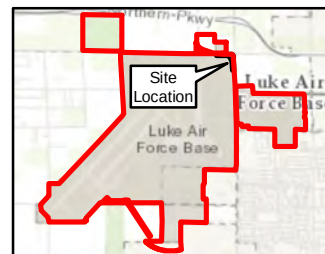
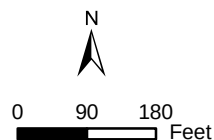


Transportation: ADOT 2014
Base Map Sources: Esri, HERE,
DeLorme, Intermap, increment P Corp.,
GEBCO, USGS, FAO, NPS, NRCAN,

Legend

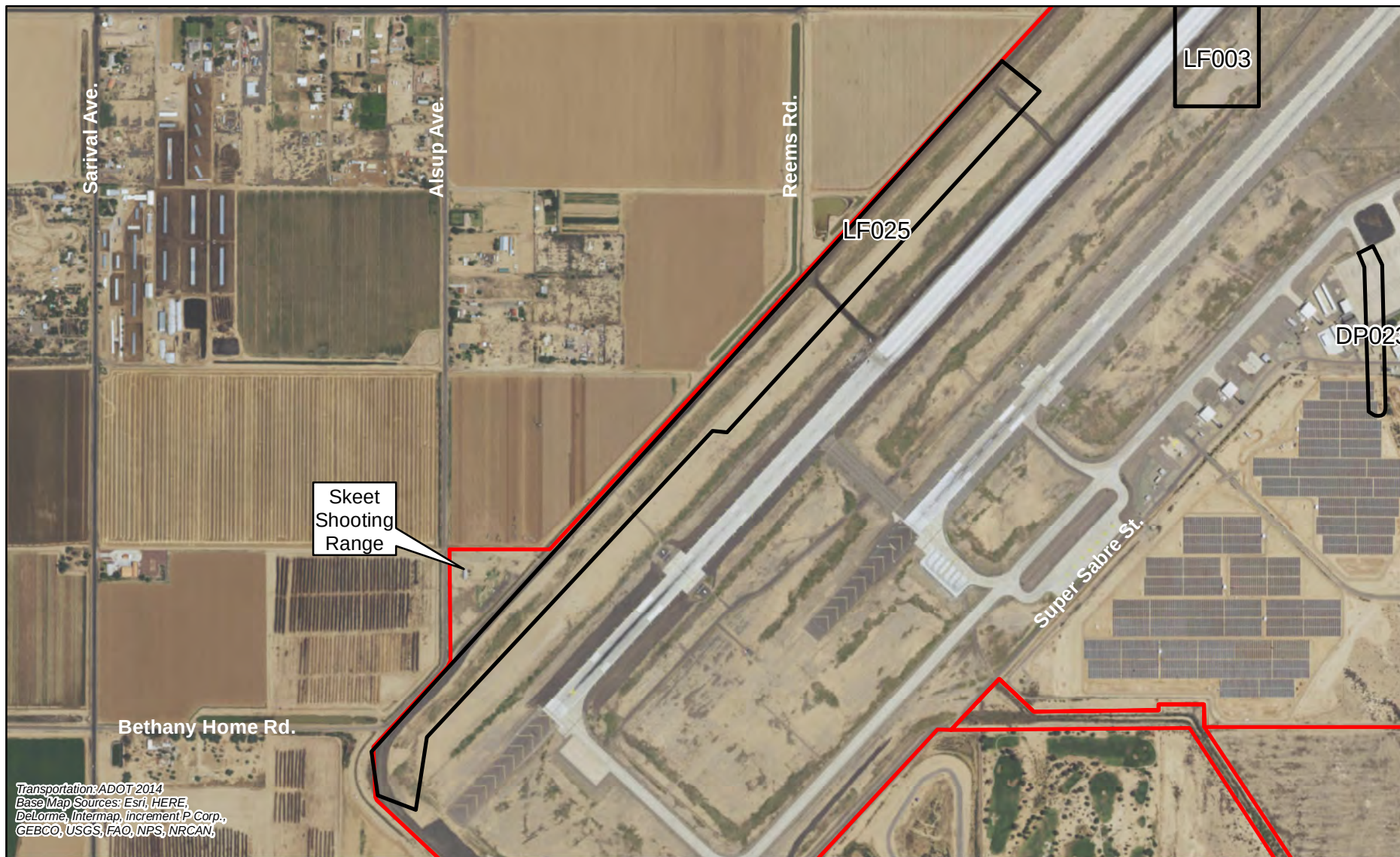
- Installation Boundary
- Site Boundary
- State Route
- Road

SS042 = Bulk Fuel Storage Area
LF014 = Old Salvage Yard Burial Site



Site LF-14 Map
Luke Air Force Base
Glendale, Arizona
Figure 8

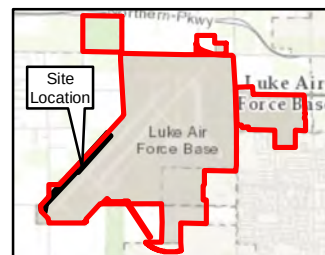
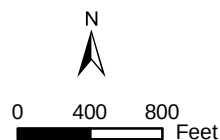




Legend

- Installation Boundary
- Site Boundary
- State Route
- Road

LF003 = Outboard Runway Landfill
 LF025 = Northwest Landfill
 DP023 = Old Surface Impoundment West of Facility 993



Site LF-25 Map
 Luke Air Force Base
 Glendale, Arizona
 Figure 9

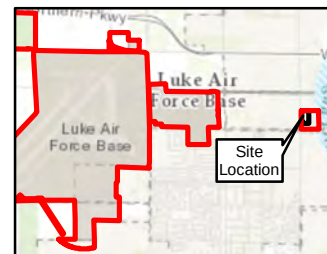
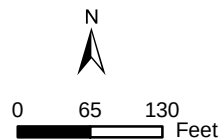




Legend

- Installation Boundary
- Site Boundary
- State Route
- Road

RW002 = Wastewater Treatment Plant



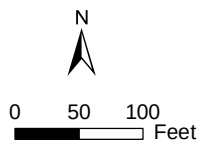
Site RW-02 Map
Luke Air Force Base
Glendale, Arizona
Figure 10





Legend

- Installation Boundary
- RW-002 Site Boundary
- Groundwater Monitoring Well Approximate Location
- Gamma Radiation Monitor Point
- Gamma Radiation Background Monitor Point
- x — Fence

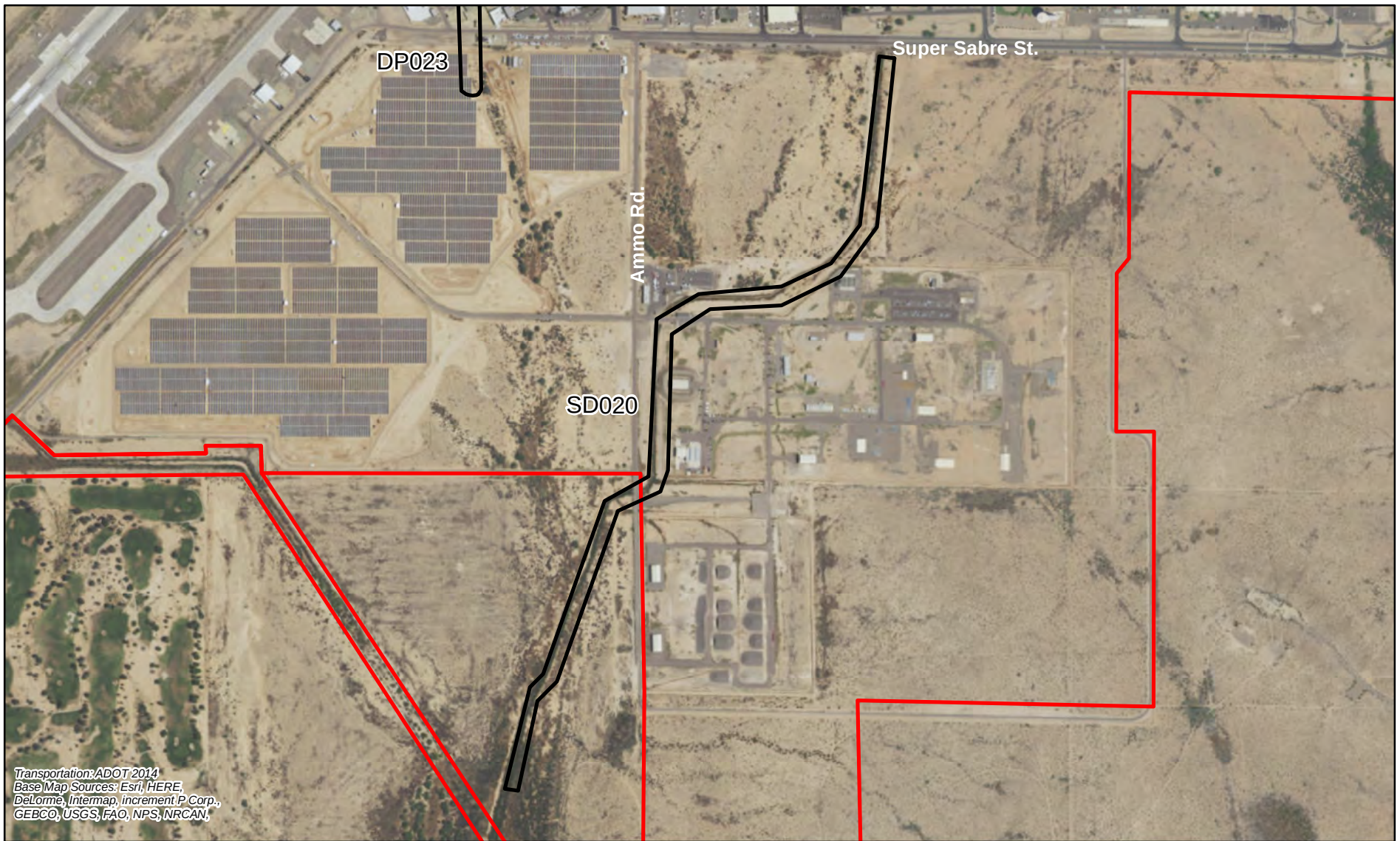


Transportation: ADOT 2014
Base Map Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Site RW-2 Gamma Radiation
Monitoring Point Locations
Luke Air Force Base
Glendale, Arizona
Figure 10a



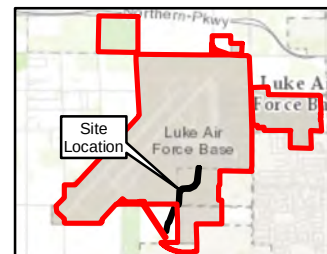
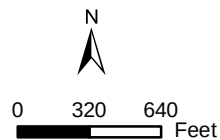
URS



Legend

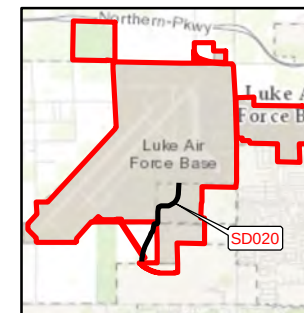
- Installation Boundary
- Site Boundary
- State Route
- Road

SD020 = Oil/Water Separator at Auto Body Shop
DP023 = Old Surface Impoundment West of Facility 993



Site SD-20 Map
Luke Air Force Base
Glendale, Arizona
Figure 11



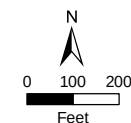


Legend

- Installation Boundary
- Proposed Soil Boring Location
- RI Sediment Sample
- Canal
- Utility
- Fence
- Road
- Channel Flow Direction

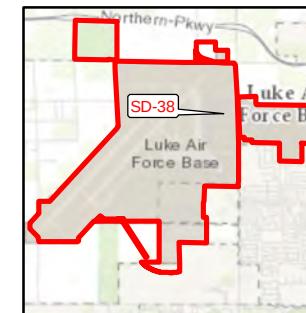
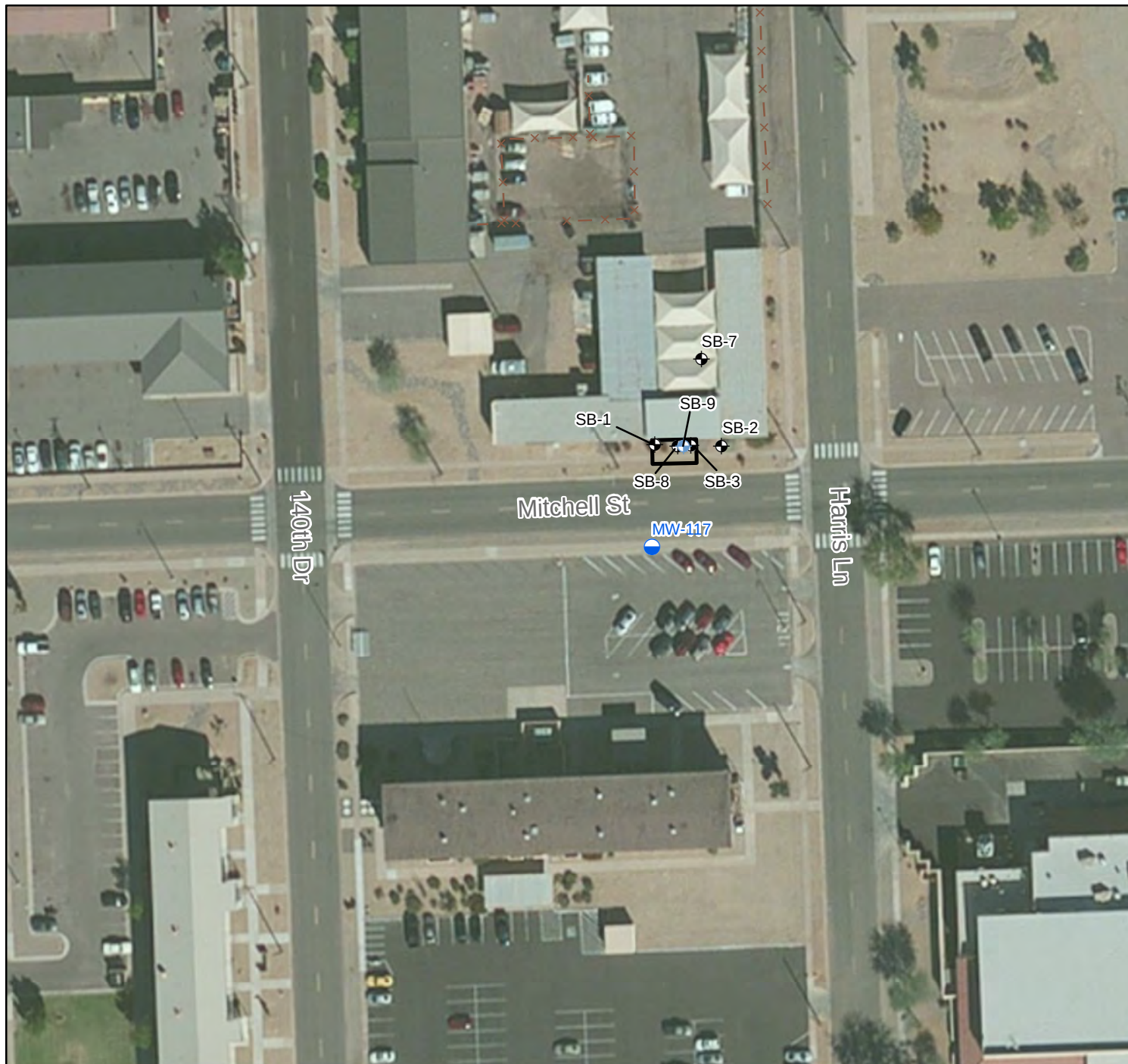
Note:
RI Sample locations are approximate.

Transportation: ADOT 2012
Base Map Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid,



Site SD-20 Soil Boring
Sample Locations
Luke Air Force Base
Glendale, Arizona
Figure 11a

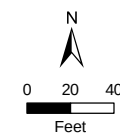




Legend

- Approximate Site Boundary
- + Proposed Soil Boring
- + RI Soil Boring
- Monitoring Well

Transportation: ADOT 2014
 Monitoring Well Locations: Based on figure from Geraghty & Miller Inc 01/07/1997
 Base Map Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community
 Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



Site SD-38 Map
 Old Auto Hobby Shop
 Luke Air Force Base
 Glendale, Arizona
 Figure 12

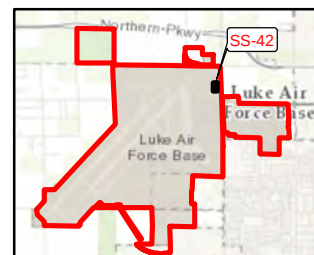
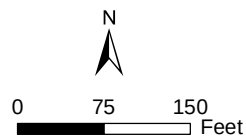


URS



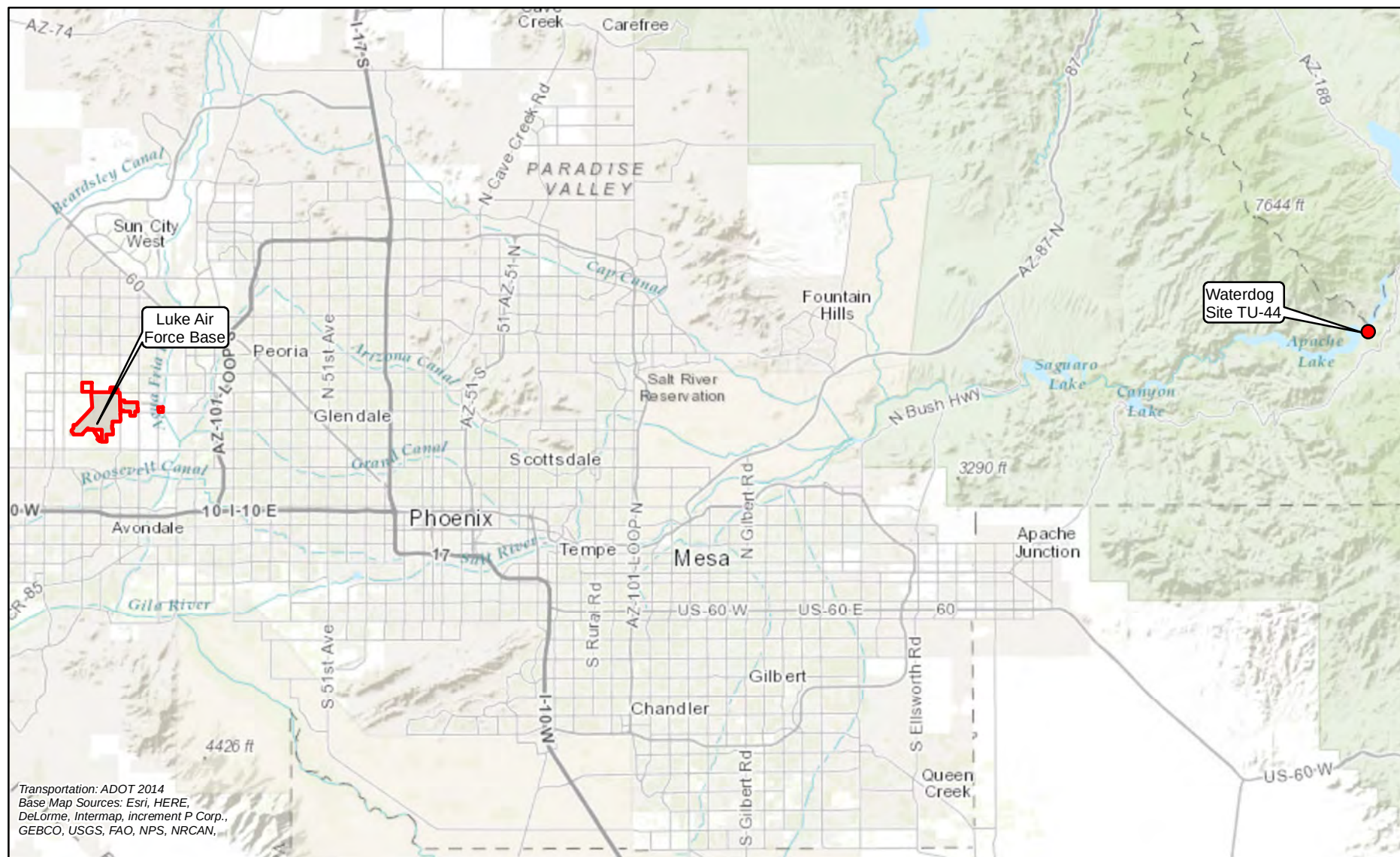
Legend

- SS-042 Boundary
- Monitoring Well (approximate location)



Site SS-42 Map
 Luke Air Force Base
 Glendale, Arizona
 Figure 13

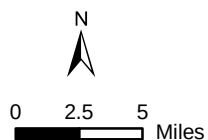




Transportation: ADOT 2014
 Base Map Sources: Esri, HERE,
 DeLorme, Intermap, increment P Corp.,
 GEBCO, USGS, FAO, NPS, NRCAN,

Legend

- Installation Boundary
- Road



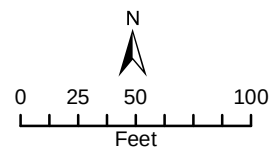
Site TU-44 Location Map
 Luke Air Force Base Ownership
 Maricopa County, Arizona
 Figure 14





LEGEND

- Monitor Well
- Replaced Monitor Well
- ⊗ MW-4 Abandoned June 2011
- Double Nested Well
- Triple Nested Well
- ⊙ IP Injection Point (for BOS-200 Pilot Test)



Site TU-44 Map
Waterdog Recreational Map
Tortilla Flats, Arizona
Figure 14a

ATTACHMENT A

Site Inspection Forms

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1. SITE INFORMATION	
Site Name: DP-23	Inspection Date: 9/27/2016
Location: Luke AFB	EPA ID: AZ0570024133
Five-Year Review Lead: Luke AFB	Weather: Breezy, overcast, 82° F
Remedy Includes: Institutional Control (non-residential use)	
Attachments: Site maps provided as Figures 3 and 3a of 5YR report	
2. INTERVIEWS	
Mr. Charles "Jeff" Rothrock, Environmental Chief/AFB Oversight	
3. ON-SITE DOCUMENTS AND RECORDS VERIFIED	
Not applicable; site described in OU-2 ROD	
4. O&M COSTS	
Not applicable	
5. ACCESS AND INSTITUTIONAL CONTROLS	
Basewide security signed VEMUR to restrict future use to non-residential; DP-23 is listed in Base General Plan and Institutional Control Plan; AF Form 332 submitted prior to any onsite development or construction, will trigger notification of the Restoration Program Manager.	
6. GENERAL SITE CONDITIONS	
Surface conditions adequate. Concrete storm water culvert structure is partially full of water. It also contains an acceptable amount of vegetation so as not to impede adequate flow.	
7. LANDFILL COVERS	
Not applicable	
8. VERTICAL BARRIER WALLS	
Not applicable	
9. GROUNDWATER/SURFACE WATER REMEDIES	
Not applicable	
10. OTHER REMEDIES	
Not applicable	
11. OVERALL OBSERVATIONS	
Institutional control is in place and physical conditions appear acceptable to maintain protectiveness.	

1. SITE INFORMATION	
Site Name: ST-18	Inspection Date: 9/27/2016
Location: Luke AFB	EPA ID: AZ0570024133
Five-Year Review Lead: Luke AFB	Weather: Breezy, overcast
Remedy Includes: Institutional controls.	
Attachments: Site maps provided as Figures 4 and 4a of 5YR report	
2. INTERVIEWS	
Mr. Charles "Jeff" Rothrock, Environmental Chief/AFB Oversight	
3. ON-SITE DOCUMENTS AND RECORDS VERIFIED	
Not applicable; site described in OU-2 ROD	
4. O&M COSTS	
Not applicable	
5. ACCESS AND INSTITUTIONAL CONTROLS	
Perimeter fencing in good condition. Basewide security signed VEMUR to restrict future use to non-residential; ST-18 is listed in Base General Plan and Institutional Control Plan; AF Form 332 submitted prior to any onsite development or construction, will trigger notification of the Restoration Program Manager.	
6. GENERAL SITE CONDITIONS	
Concrete cap is in overall good condition to maintain protectiveness. However, there are multiple thin cracks in the cap where previous applied asphaltic and other sealants have weathered in a manner that they no longer appear to be fully effective. Cleaning of weathered sealants from cracks and re-application of suitable sealants is recommended to prevent possible further expansion and/or degradation of cracks.	
7. LANDFILL COVERS	
Not applicable	
8. VERTICAL BARRIER WALLS	
Not applicable	
9. GROUNDWATER/SURFACE WATER REMEDIES	
Annual LTM of groundwater is on-going. Wellhead flush-to-grade vaults appear to be in good condition.	
10. OTHER REMEDIES	
Not applicable	
11. OVERALL OBSERVATIONS	
Site access restricted by fencing and concrete cap integrity is acceptable to maintain protectiveness against any exposure.	

1. SITE INFORMATION	
Site Name: DP-13	Inspection Date: 9/27/2016
Location: Luke AFB	EPA ID: AZ0570024133
Five-Year Review Lead: Luke AFB	Weather: Breezy, 84° F
Remedy Includes: Institutional Controls	
Attachments: Site maps provided as Figures 5, 5a, and 5b of 5YR report.	
2. INTERVIEWS	
Mr. Charles "Jeff" Rothrock, Environmental Chief/AFB Oversight	
3. ON-SITE DOCUMENTS AND RECORDS VERIFIED	
Not applicable; site described in OU-1 ROD	
4. O&M COSTS	
Not applicable	
5. ACCESS AND INSTITUTIONAL CONTROLS	
Basewide security signed VEMUR to restrict future use of a portion of the site to non-residential; DP-13 is listed in Base General Plan and Institutional Control Plan; AF Form 332 submitted prior to any onsite development or construction, will trigger notification of the Restoration Program Manager.	
6. GENERAL SITE CONDITIONS	
Surface conditions of unpaved site in acceptable condition with no evidence of active or inactive surface excavation. Locked fence to restrict access is in good condition. Military tents present; reported occasional military training exercises for land use.	
7. LANDFILL COVERS	
Not applicable	
8. VERTICAL BARRIER WALLS	
Not applicable	
9. GROUNDWATER/SURFACE WATER REMEDIES	
Not applicable	
10. OTHER REMEDIES	
Not applicable	
11. OVERALL OBSERVATIONS	
Institutional controls are in place and appear effective in preventing any potential exposure.	

1. SITE INFORMATION	
Site Name: FT07 & FT-07E	Inspection Date: 9/27/2016
Location: Luke AFB	EPA ID: AZ0570024133
Five-Year Review Lead: Luke AFB	Weather: Breezy, overcast, 82° F
Remedy Includes: Institutional controls.	
Attachments: Site maps provided as Figures 6 and 6a of 5YR report	
2. INTERVIEWS	
Mr. Charles "Jeff" Rothrock, Environmental Chief/AFB Oversight	
3. ON-SITE DOCUMENTS AND RECORDS VERIFIED	
Not applicable; site described in OU-1 ROD	
4. O&M COSTS	
Not applicable	
5. ACCESS AND INSTITUTIONAL CONTROLS	
Basewide security signed VEMUR to restrict future use to non-residential; FT-07E is listed in Base General Plan and Institutional Control Plan; AF Form 332 submitted prior to any onsite development or construction, will trigger notification of the Restoration Program Manager. At FT-07, locked fenced with signage that surrounds propane tank and monitoring wells MW-123S and MW-123D is in good condition.	
6. GENERAL SITE CONDITIONS	
Unpaved surface conditions in acceptable condition; no residential development and no visual evidence of fire training facilities remain at FT-07E. Signage restricting access at FT-07, and fire training area with aircraft shell within bermed area appears well-maintained.	
7. LANDFILL COVERS	
Not applicable	
8. VERTICAL BARRIER WALLS	
Not applicable	
9. GROUNDWATER/SURFACE WATER REMEDIES	
Not applicable	
10. OTHER REMEDIES	
Not applicable	
11. OVERALL OBSERVATIONS	
Institutional control is in place and site conditions appear effective at maintaining protectiveness.	

1. SITE INFORMATION	
Site Name: LF-03	Inspection Date: 9/27/2016
Location: Luke AFB	EPA ID: AZ0570024133
Five-Year Review Lead: Luke AFB	Weather: Breezy, overcast, 82° F
Remedy Includes: Landfill cover/containment.	
Attachments: Site map provided as Figure 7 to 5YR report	
2. INTERVIEWS	
Mr. Charles "Jeff" Rothrock, Environmental Chief/AFB Oversight	
3. ON-SITE DOCUMENTS AND RECORDS VERIFIED	
Not applicable; site described in OU-1 ROD	
4. O&M COSTS	
Not applicable	
5. ACCESS AND INSTITUTIONAL CONTROLS	
Basewide security signed VEMUR to restrict future use to non-residential; LF-03 is listed in Base General Plan and Institutional Control Plan; AF Form 332 submitted prior to any onsite development or construction, will trigger notification of the Restoration Program Manager.	
6. GENERAL SITE CONDITIONS	
Not applicable.	
7. LANDFILL COVERS	
Runway partially covers the landfill. Site maintained for flight training operations	
8. VERTICAL BARRIER WALLS	
Not applicable	
9. GROUNDWATER/SURFACE WATER REMEDIES	
Not applicable	
10. OTHER REMEDIES	
Not applicable	
11. OVERALL OBSERVATIONS	
Observed from remote distance as access to Site is restricted for aircraft training. Site reportedly well maintained with institutional controls in-place and remains protective.	

1. SITE INFORMATION	
Site Name: LF-14	Inspection Date: 9/27/2016
Location: Luke AFB	EPA ID: AZ0570024133
Five-Year Review Lead: Luke AFB	Weather: Breezy, overcast, 80° F
Remedy Includes: Landfill cover/containment, Institutional controls.	
Attachments: Site map is provided as Figure 8 to 5YR report.	
2. INTERVIEWS	
Mr. Charles "Jeff" Rothrock, Environmental Chief/AFB Oversight	
3. ON-SITE DOCUMENTS AND RECORDS VERIFIED	
Not applicable; site described in OU-1 ROD	
4. O&M COSTS	
Not applicable	
5. ACCESS AND INSTITUTIONAL CONTROLS	
Basewide security signed VEMUR to restrict future use to non-residential; LF-14 is listed in Base General Plan and Institutional Control Plan; AF Form 332 submitted prior to any onsite development or construction, will trigger notification of the Restoration Program Manager.	
6. GENERAL SITE CONDITIONS	
Block wall fencing is in good shape and provides restricted access along Litchfield Road and Northern Avenue.	
7. LANDFILL COVERS	
Spotty areas of grass. Considerable number of small animal burrow holes observed at north portion of Site.	
8. VERTICAL BARRIER WALLS	
Not applicable	
9. GROUNDWATER/SURFACE WATER REMEDIES	
Not applicable	
10. OTHER REMEDIES	
Not applicable	
11. OVERALL OBSERVATIONS	
Protectiveness is adequate as institutional controls are in place and land conditions are acceptable.	

1. SITE INFORMATION	
Site Name: LF-25	Inspection Date: 9/27/2016
Location: Luke AFB	EPA ID: AZ0570024133
Five-Year Review Lead: Luke AFB	Weather: Breezy, overcast, 82° F
Remedy Includes: Landfill cover/containment, Institutional controls.	
Attachments: Site map is provided as Figure 9 to 5YR report.	
2. INTERVIEWS	
Mr. Charles "Jeff" Rothrock, Environmental Chief/AFB Oversight	
3. ON-SITE DOCUMENTS AND RECORDS VERIFIED	
Not applicable; site described in OU-1 ROD	
4. O&M COSTS	
Not applicable	
5. ACCESS AND INSTITUTIONAL CONTROLS	
Basewide security signed VEMUR to restrict future use to non-residential; LF-14 is listed in Base General Plan and Institutional Control Plan; AF Form 332 submitted prior to any onsite development or construction, will trigger notification of the Restoration Program Manager.	
6. GENERAL SITE CONDITIONS	
Site restricted at time of inspection as it is in close proximity to flight line. Skeet shooting range reportedly still active adjacent to the southwest portion of Site. No excavation activities reportedly performed over the past 5 years.	
7. LANDFILL COVERS	
Reportedly adequate and no excavation the past 5 years	
8. VERTICAL BARRIER WALLS	
Not applicable	
9. GROUNDWATER/SURFACE WATER REMEDIES	
Not applicable	
10. OTHER REMEDIES	
Not applicable	
11. OVERALL OBSERVATIONS	
Protectiveness is adequate as institutional controls are in place and land conditions reportedly are acceptable	

1. SITE INFORMATION	
Site Name: RW-02	Inspection Date: 9/27/2016
Location: Luke AFB	EPA ID: AZ0570024133
Five-Year Review Lead: Luke AFB	Weather: Breezy, overcast, 80°
Remedy Includes: Institutional controls with radiological LTM.	
Attachments: Site maps are provided as Figures 10 and 10a to the 5YR report	
2. INTERVIEWS	
Mr. Charles "Jeff" Rothrock, Environmental Chief/AFB Oversight	
3. ON-SITE DOCUMENTS AND RECORDS VERIFIED	
Not applicable; site described in OU-1 ROD	
4. O&M COSTS	
Not applicable	
5. ACCESS AND INSTITUTIONAL CONTROLS	
Site area is fenced and posted with signs. Basewide security signed VEMUR to restrict future use to non-residential; RW-02 is listed in Base General Plan and Institutional Control Plan; AF Form 332 submitted prior to any onsite development or construction, will trigger notification of the Restoration Program Manager.	
6. GENERAL SITE CONDITIONS	
Institutional controls including security fencing and signage around radiological burial vault site are in good condition. Flush-to-grade surface conditions of existing monitoring wells all appear in good condition.	
7. LANDFILL COVERS	
Not applicable	
8. VERTICAL BARRIER WALLS	
Not applicable	
9. GROUNDWATER/SURFACE WATER REMEDIES	
Not applicable	
10. OTHER REMEDIES	
Not applicable	
11. OVERALL OBSERVATIONS	
Protectiveness is being maintained as physical institutional controls are in place and radiological monitoring levels are below action levels (see attachment E).	

1. SITE INFORMATION	
Site Name: SD-20	Inspection Date: 12/29/2016
Location: Luke AFB	EPA ID: AZ0570024133
Five-Year Review Lead: Luke AFB	Weather: Clear, 60°F
Remedy Includes: Institutional controls.	
Attachments: Site maps provided as Figures 11 and 11a to 5YR report	
2. INTERVIEWS	
Mr. Charles "Jeff" Rothrock, Environmental Chief/AFB Oversight	
3. ON-SITE DOCUMENTS AND RECORDS VERIFIED	
Not applicable; site described in OU-1 ROD	
4. O&M COSTS	
Not applicable	
5. ACCESS AND INSTITUTIONAL CONTROLS	
Basewide security signed VEMUR to restrict future use to non-residential; SD-20 is listed in Base General Plan and Institutional Control Plan; AF Form 332 submitted prior to any onsite development or construction, will trigger notification of the Restoration Program Manager.	
6. GENERAL SITE CONDITIONS	
Concrete storm water drainage swale and culvert inlet structure at north side of Super Sabre Street in good condition. Some grass/vegetation in culvert inlet structure; however, not to a degree that would significantly impede flow. Floating oil observed on surface water at discharge/outfall structure on south side of Super Sabre Street. Plume on water within drainage ditch extends an estimated 250 to 275 feet downstream where the drainage ditch then becomes dry. Presumed oil staining on banks of unlined drainage ditch also observed beyond the surface water. Oil sorbant boom placed at discharge/outfall structure within the oil plume. Wellhead vault of monitoring well at south portion of drainage observed to be in acceptable condition.	
7. LANDFILL COVERS	
Not applicable	
8. VERTICAL BARRIER WALLS	
Not applicable	
9. GROUNDWATER/SURFACE WATER REMEDIES	
Not applicable	
10. OTHER REMEDIES	
Not applicable	
11. OVERALL OBSERVATIONS	
Conditions north of Super Sabre Street appear protective at controlling site access and potential exposure. Conditions south of Super Sabre Street with oil in unlined drainage ditch are human a health and ecological exposure concern.	

1. SITE INFORMATION	
Site Name: SD-38	Inspection Date: 9/27/2016
Location: Luke AFB	EPA ID: AZ0570024133
Five-Year Review Lead: Luke AFB	Weather: Breezy, overcast, 82° F
Remedy Includes: Institutional controls.	
Attachments: Site map provided as Figure 12 to 5YR report	
2. INTERVIEWS	
Mr. Charles "Jeff" Rothrock, Environmental Chief/AFB Oversight	
3. ON-SITE DOCUMENTS AND RECORDS VERIFIED	
Not applicable; site described in OU-1 ROD	
4. O&M COSTS	
Not applicable	
5. ACCESS AND INSTITUTIONAL CONTROLS	
Basewide security signed VEMUR to restrict future use to non-residential; SD-38 is listed in Base General Plan and Institutional Control Plan; AF Form 332 submitted prior to any onsite development or construction, will trigger notification of the Restoration Program Manager.	
6. GENERAL SITE CONDITIONS	
Evidence of construction activity associated with right-of-way/sidewalk improvements immediate adjacent to east side of Site. Institutional control in place. No open excavations at or adjacent to Site.	
7. LANDFILL COVERS	
Not applicable	
8. VERTICAL BARRIER WALLS	
Not applicable	
9. GROUNDWATER/SURFACE WATER REMEDIES	
Not applicable	
10. OTHER REMEDIES	
Not applicable	
11. OVERALL OBSERVATIONS	
Protectiveness appears to be maintained as institutional control is in place and land conditions are acceptable.	

1. SITE INFORMATION	
Site Name: SS-42	Inspection Date: 9/27/2016
Location: Luke AFB	EPA ID: AZ0570024133
Five-Year Review Lead: Luke AFB	Weather: Breezy, overcast, 83° F
Remedy Includes: Access controls, Monitored natural attenuation.	
Attachments: Site map provided as Figure 13 to 5YR report	
2. INTERVIEWS	
Mr. Charles "Jeff" Rothrock, Environmental Chief/AFB Oversight	
3. ON-SITE DOCUMENTS AND RECORDS VERIFIED	
Not applicable; site described in OU-1 ROD	
4. O&M COSTS	
Not applicable	
5. ACCESS AND INSTITUTIONAL CONTROLS	
Perimeter fencing. Basewide security signed VEMUR to restrict future use to non-residential; SS-42 is listed in Base General Plan and Institutional Control Plan; AF Form 332 submitted prior to any onsite development or construction, will trigger notification of the Restoration Program Manager. LTM of groundwater part of institutional controls. Visible condition of wellheads/vaults to maintain protection are in acceptable condition.	
6. GENERAL SITE CONDITIONS	
Security fencing and protective groundwater monitoring wellhead vaults observed to be in good condition. Evidence of construction-related soil excavation observed near yard boundary. White sorbent booms placed around portion of the perimeter of yard reportedly for storm water run-on/runoff control (see below). Kinder Morgan fuel pipeline (new) encroaches on Site at south end. Secondary containment around ASTs appears to be in adequate condition.	
7. LANDFILL COVERS	
Not applicable	
8. VERTICAL BARRIER WALLS	
Not applicable	
9. GROUNDWATER/SURFACE WATER REMEDIES	
Not applicable. LTM of select groundwater monitoring wells performed annually.	
10. OTHER REMEDIES	
Not applicable	
11. OVERALL OBSERVATIONS	
Site is secure and institutional controls are in place. Reported release of Jet A fuel to ground in POL yard occurred during construction-related trenching activities in early August 2016. Visual evidence of some stained soil observed as well as placement of booms for storm water run-on/runoff control along portions of yard perimeter. Work Plan associated with fuel release characterization and remediation reportedly is being prepared for submittal to agencies for review.	

1. SITE INFORMATION	
Site Name: TU-44 Waterdog Annex	Inspection Date: 10/05/2016
Location: Apache Lake, AZ	EPA ID: AZ0570024133
Five-Year Review Lead: Luke AFB	Weather: Sunny, breezy, 75° F
Remedy Includes: Remedial injections of BOS 200 to clean hydrocarbons	
Attachments: Site maps are provided as Figures 14 and 14a to the 5YR report	
2. INTERVIEWS	
Mr. Charles "Jeff" Rothrock, Environmental Chief/AFB Oversight	
3. ON-SITE DOCUMENTS AND RECORDS VERIFIED	
Not applicable	
4. O&M COSTS	
Costs associated with BOS 200 field pilot study tests thus far incurred include those for installing new injection wells, injection specialty contracting; BOS 200 product; and pot-injection performance monitoring.	
5. ACCESS AND INSTITUTIONAL CONTROLS	
In accordance with Luke AFB requirements. This site is not listed as a PSC in the Luke AFB OU-1 or OU-2 RODs. Access restricted by two separate locked gates along Davis Wash Road and barbed wire fencing along property boundaries.	
6. GENERAL SITE CONDITIONS	
The two access gates along Davis Wash Road are padlocked and observed to be in acceptable condition. Some localized but considerable erosion along portions of the unpaved access roads both to and on the Site. Monitoring well vaults appear to be in adequate condition to protect the wellheads. Some localized erosion was observed in near vicinity of wellhead MW-11 which warrants filling/compaction. Labeled 55-gallon drums are present that contain soil cuttings and well development water generated from recent injection and monitoring well installation activities in preparation for BOS 200 remediation pilot test.	
7. LANDFILL COVERS	
Not applicable	
8. VERTICAL BARRIER WALLS	
Not applicable	
9. GROUNDWATER/SURFACE WATER REMEDIES	
BOS 200 field pilot test for remediation of gasoline constituents in groundwater was recently implemented. The reporting of results from performance groundwater monitoring is pending.	
10. OTHER REMEDIES	
Not applicable	
11. OVERALL OBSERVATIONS	
Road maintenance for most significant soil erosion along on-site roads used access monitoring wells is recommended for safety. Locked gates and barbed wire that restrict site access are in acceptable condition. Wellhead vaults also are in acceptable condition. Labeled drums containing soil cuttings and well development water will require removal from Site and disposal at a licensed/permitted facility(s).	

ATTACHMENT B

Site Inspection Photographic Log

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PHOTOGRAPH 1 – Site DP-13: North portion of site looking in direction of SB-10 area (view to NE)



PHOTOGRAPH 2 – Site DP-13: VEMUR location where soil boring investigation was implemented (view to NW)



PHOTOGRAPH 3 – Site DP-13: Northeast portion of site (view to NE)



PHOTOGRAPH 4 – Site DP-13: Tents at north central portion of site (view to SW)



PHOTOGRAPH 5 – Site LF-25: Sign indicating restricted access at north end of LF-25 (view to south)



PHOTOGRAPH 6 - Site FT-07E: MW-118 and MW-118S area at northwest end of site (view to west)



PHOTOGRAPH 7 – Site FT-07/-07E: Fire Training area sign near northeast and northwest boundary of FT-07 and FT-07E, respectively (view to SW)



PHOTOGRAPH 8 – Site FT-07: Warning sign located north of fenced propane tank area (view to SW)



PHOTOGRAPH 9 – Site FT-07: West side gate entrance to propane tank area (view to east)



PHOTOGRAPH 10 – Site FT-07: Bermed Fire Training area with aircraft (view to north)



PHOTOGRAPH 11 – Site FT-07 vicinity: Monitor Well MW-109 northwest of FT-07 site (view to north)



PHOTOGRAPH 12 - Site LF-14: Northwest end of site parallel to W. Northern Ave (view to south)



PHOTOGRAPH 13 – Site LF-14: Multiple animal burrow holes through surface at north central portion of site (view to west)



PHOTOGRAPH 14 – Site LF-14: Presumed manhole or utility vault cover at northeast portion of site (view to south)



PHOTOGRAPH 15 – Site LF-14: Water line backflow assembly at east side of site (view to south)



PHOTOGRAPH 16 – Site SS-42: Fenced Bulk Fuels area with storage tanks (view to north)



PHOTOGRAPH 17 – Site SS-42: South fenceline of Bulk Fuels area with stormwater control booms (view to W/NW)



PHOTOGRAPH 18 – Site SS-42: Fenced Bulk Fuels area in vicinity of well MW-121 (view to west)



PHOTOGRAPH 19 – Site SD-38: Site area (view to east)



PHOTOGRAPH 20 – Site SD-38: Site area (view to west)



PHOTOGRAPH 21 – Site SD-38: View from site towards well MW-117 (view to SW)



PHOTOGRAPH 22 – Site SD-38: Site area (view to north)



PHOTOGRAPH 23 – Site DP-23: Concrete stormwater swale and adjacent discharge structure in area adjacent north of Super Sabre St. (view to north)



PHOTOGRAPH 24 – Site DP-23: Northwest landscape area portion of site near Super Sabre St. (view to east)



PHOTOGRAPH 25 – Site DP-23: Concrete stormwater drainage structure (view to south)



PHOTOGRAPH 26 – Site LF-25: Looking towards site from south of aircraft runways (view to NW)



PHOTOGRAPH 27 – Site LF-03: Looking towards site from south of aircraft runways (view to north)



PHOTOGRAPH 28 – Site ST-18: Concrete cap at area of wells MW-114 and MW-114S (view to NE)



PHOTOGRAPH 29 – Site ST-18: Concrete cap showing previous tar/asphaltic sealant repair of cracks (view to west)



PHOTOGRAPH 30 – Site ST-18: Crack in concrete cap near center portion of site (view to west)



PHOTOGRAPH 31 – Site ST-18: Closeup of crack in concrete cap in area west of MW-114S



PHOTOGRAPH 32 – Site ST-18: Closeup of crack in concrete cap



PHOTOGRAPH 33 – Site RW-02: Fenced low level radioactive waste burial pit at north portion of site (view to south)



PHOTOGRAPH 34 – Site RW-02: Well MW-124 at northwest portion of site (view to NW)



PHOTOGRAPH 35 – Site RW-02: Well MW-124S (foreground) and MW-124 (background) (view to NW)



PHOTOGRAPH 36 – Site SD-20: Drainage culvert structure on north side of W. Strike Eagle Street (view to west)



PHOTOGRAPH 37 – Site SD-20: Drainage culvert structure on south side of Super Sabre St. Note oil and sorbent booms floating on surface water (view to NW)



PHOTOGRAPH 38 – Site SD-20: Drainage ditch with oil and sorbent booms floating on surface water (view to north)



PHOTOGRAPH 39 – Site SD-20: Drainage ditch with clear water and with oil in foreground and background, respectively (view to north)



PHOTOGRAPH 40 – Site SD-20: Monitoring well MW-113-S located at south portion of drainage ditch west of Warhawk St. (view N/NE)



PHOTOGRAPH 41 – Site TU-44: Access road with erosion adjacent to well MW- 11 (view to NE)



PHOTOGRAPH 42 – Site TU-44: Well MW-15 at north end of well network near bank of Apache Lake (view to west)



PHOTOGRAPH 43 – Site TU-44: Well MW-14 at northeast end of well network (view to SW)



PHOTOGRAPH 44 – Site TU-44: Drums containing drill cuttings and well development water staged new well MW-16 (view to west)

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ATTACHMENT C

Interview Questionnaires

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INTERVIEW RECORD			
Site Name: Luke Air Force Base		EPA ID No.: AZ0570024133	
Subject: Luke AFB Five Year Review Report		Time:	Date: 10/13/16
Type: ☐ Telephone ☐ Visit ☒ Other		☐ Incoming ☐ Outgoing	
Location of Visit:			
Contact Made By:			
Name: Jeff Rackow, PE		Title: Sr. Environ. Engineer	Organization: AECOM
Individual Contacted:			
Name: Joyce Clark		Title: Councilmember Elect	Organization: City of Glendale
Telephone No: 623-772-9795		Street Address:	
Fax No:		City, State, Zip:	
E-Mail Address: clarkjv@aol.com			
Summary Of Conversation			
1. What is your overall impression of the project? (general sentiment) My overall impression of the project was a positive one. The results of the project made LAFB and the surrounding areas safer by remediating possible groundwater contamination. It had a positive PR as well as well as a physical/environmental effect on adjacent communities. 2. What effects have site operations had on the surrounding community? As Arizona's communities rely on water banking by replenishing groundwater supplies, it is reassuring to them to know that LAFB's efforts have reduced the possibility of contamination due to its operations. 3. Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details NO.			

INTERVIEW RECORD			
Site Name: Luke Air Force Base		EPA ID No.: AZ0570024133	
Subject: Luke AFB Five Year Review Report		Time:	Date: 10/13/16
Type: ☐ Telephone ☐ Visit ☒ Other		☐ Incoming ☐ Outgoing	
Location of Visit:			
Contact Made By:			
Name: Jeff Rackow, PE	Title: Sr. Environ. Engineer	Organization: AECOM	
Individual Contacted:			
Name: Joyce Clark	Title: Councilmember Elect	Organization: City of Glendale	
Telephone No: 623-772-9795		Street Address:	
Fax No:		City, State, Zip:	
E-Mail Address: clarkjv@aol.com			
Summary Of Conversation			
4. Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, please give details. No .			
5. Do you feel well informed about the site's activities and progress? Since I have been retired from Glendale city council and will not resume my elected position until December, 2016, I have had no public information about activities or progress. I think it would be helpful if LAFB periodically updated the public on such.			
6. Do you have any comments, suggestions, or recommendations regarding the site's management or operation? No .			

INTERVIEW RECORD			
Site Name: Luke Air Force Base		EPA ID No.:	
Subject:		Time:	Date:
Type: ☐ Telephone ☐ Visit ☒ Other		☐ Incoming ☐ Outgoing	
Location of Visit:			
Contact Made By:			
Name: Jeff Rackow, PE		Title: Sr. Environ. Engineer	Organization: AECOM
Individual Contacted:			
Name: Laura Fischer		Title: Project Manager	Organization: ADEQ
Telephone No: 602-771-0200		Street Address: 1110 W Washington St	
Fax No:		City, State, Zip: Phoenix, AZ 85007	
E-Mail Address: lf4@azdeq.gov			
Summary Of Conversation			
1. What is your overall impression of the project? (general sentiment) I believe the project is moving forward as good as expected. 2. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please give purpose and results. No. 3. Have there been any complaints, violations, or other incidents related to the site requiring a response by your office? If so, please give details of the events and results of the responses. None that I am aware of.			

INTERVIEW RECORD		
Site Name: Luke Air Force Base		EPA ID No.:
Subject: Luke AFB 5 Year Review		Time: Date: 1/16/17
Type: ☐ Telephone ☐ Visit ☒ Other		☐ Incoming ☐ Outgoing
Location of Visit:		
Contact Made By:		
Name: Jeff Rackow, PE	Title: Sr. Environ. Engineer	Organization: AECOM
Individual Contacted:		
Name: Laura Fischer	Title: Project Manager	Organization: ADEQ
Telephone No: 602-771-0200	Street Address: 1110 W Washington St	
Fax No:	City, State, Zip: Phoenix, AZ 85007	
E-Mail Address: lf4@azdeq.gov		
Summary Of Conversation		
4. Do you feel well informed about the site's activities and progress? Yes. 5. Do you have any comments, suggestions, or recommendations regarding the site's management or operation? None at this time.		

INTERVIEW RECORD		
Site Name: Luke Air Force Base		EPA ID No.: AZ0570024133
Subject: Five Year Review		Time: Date: 1/19/17
Type: ☐ Telephone ☐ Visit ☒ Other Location of Visit: N/A		☐ Incoming ☐ Outgoing
Contact Made By:		
Name: Jeff Rackow, PE	Title: Sr. Environ. Engineer	Organization: AECOM
Individual Contacted:		
Name: Charles "Jeff" Rothrock	Title: Environmental Chief	Organization: Luke AFB
Telephone No: 623-856-3832	Street Address: 13970 Gillespie Drive	
E-Mail Address: charles.rothrock@us.af.mil	City, State, Zip: Luke AFB, AZ 85309	
Summary Of Conversation		
1. What is your overall impression of the project? (general sentiment) It was a great success. Since it was essentially a low complexity investigation and cleanup, i.e. no groundwater contamination, all parties (AF, EPA, ADEQ, CoE, ARCADIS) were focused on completing the project, on getting it done. Everyone could visualize the end and worked together as a team to reach it. Our Restoration Advisory Board was pleased with the project and impressed by our use of innovative technology for the cleanups we did. We were so successful at completing site closures that we were the first Air Force base delisted fence-to-fence from the EPAs National Priorities List. 2. Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please give purpose and results. The Air Force conducts annual groundwater monitoring at sites ST018 and SS042; annual concrete cap inspection at site ST018; and annual radiation monitoring at site RW002. Additionally, the Air Force performs these Five Year Reviews. The Luke AFB environmental office routinely reviews Work Orders to ensure the effectiveness of institutional controls which are in place for some of the sites. 3. Have there been any complaints, violations, or other incidents related to the site requiring a response by your office? If so, please give details of the events and results of the responses. No.		

INTERVIEW RECORD		
Site Name: Luke Air Force Base		EPA ID No.:
Subject: Luke AFB 5 Year Review		Time: Date: 1/19/17
Type: ☐ Telephone ☐ Visit ☒ Other		☐ Incoming ☐ Outgoing
Location of Visit:		
Contact Made By:		
Name: Jeff Rackow, PE	Title: Sr. Environ. Engineer	Organization: AECOM
Individual Contacted:		
Name: Charles "Jeff" Rothrock	Title: Environmental Chief	Organization: Luke AFB
Telephone No: 623-856-3832	Street Address: 13970 Gillespie Drive	
Fax No:	City, State, Zip: Luke AFB, AZ 85309	
E-Mail Address: charles.rothrock@us.af.mil		
Summary Of Conversation		
4. Do you feel well-informed about the site's activities and progress? Yes. AFCEC and AECOM do a great job of communicating with the base. 5. Have there been any major unexpected difficulties or costs at the site in the last five years affecting the site remedies or protectiveness? If so, please give details. No. 6. Have any problems or difficulties been encountered which have significantly impacted progress or implementability? No. 7. Do you have any comments, suggestions, or recommendations regarding the project? No.		

ATTACHMENT D

Affidavit of Public Notice

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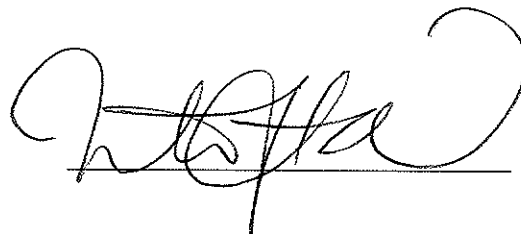
THE ARIZONA REPUBLIC

STATE OF ARIZONA
COUNTY OF MARICOPA } SS.

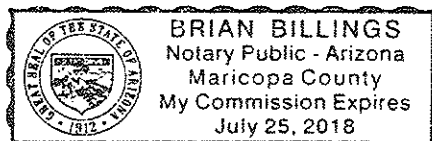
Melissa Hoekstra, being first duly sworn, upon oath deposes and says: That she is a legal advertising representative of the Arizona Business Gazette, a newspaper of general circulation in the county of Maricopa, Coconino, Pima and Pinal, State of Arizona, published at Phoenix, Arizona, by Phoenix Newspapers Inc., which also publishes The Arizona Republic, and that the copy hereto attached is a true copy of the advertisement published in the said paper on the dates as indicated.

The Arizona Republic
Zone 1/5/18/19/20

11/23/2016



Sworn to before me this
25TH day of
November A.D. 2016



Notary Public

FT007 (North Fire Training Area - West), FT007E (North Fire Training Area - East), DP023 (Old Surface Impoundment), DP013 (Drainage Ditch Disposal Area), LP014 (Old Salvage Yard Burial Site), ST018 (Liquid Waste Storage Facility), SD020 (Oil/Water Separator Canal and Earth Fissure), LF025 (Northwest Landfill), SD038 (OWS at Auto Hobby Shop), SS042 (Bulk Fuels Storage Area), and TJ044 (Waterdog Annex) at Luke AFB have been conducted in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), which requires that a five-year review be conducted. The review will be conducted in accordance with the United States Environmental Protection Agency Five-Year Review Guidance. The Air Force is the lead agency for this five-year review. The review will be conducted to ensure that the response action and final recommendations for these sites at Luke AFB remain protective of human health and the environment. This review will commence in November 2016 and is scheduled for completion in September 2017. A second notice will be provided to the public regarding the availability of the final five-year review report at the Glendale Public Library Main Branch on 5559 W. Brown St., Glendale, Arizona; the Peoria Public Library on 8463 West Monroe Ave., Peoria, Arizona; and the following website: <http://afcec.publicaffairs.af.mil/Record.us.af.mil/Search.asp>. Both libraries and the website also contain all past documents associated with the investigation, response actions, and monitoring activities completed for these sites that are available for public review. The Department of Defense (DoD) recognizes the importance of public participation in the Luke AFB IRP and encourages your involvement. Therefore, all parties interested in contributing to, or have questions or concerns associated with the five-year review process may contact: Ms. Stephanie McCary, Air Force Civil Engineer Center 5960 Swaab Boulevard, Nellis AFB, NV 89191. Phone: (702) 652-9365, E-mail: Stephanie.mccary@us.af.mil. Pub: Nov. 23, 2016

PUBLIC NOTICE
LUKE AIR FORCE BASE
ENVIRONMENTAL
RESTORATION PROGRAM
ANNOUNCES A 5-YEAR
REVIEW
PUBLIC NOTICE - The Air Force Civil Engineer Center (AFCEC) announces that a five-year review will be conducted for Luke Air Force Base (AFB). Response actions on Installation Restoration Program (IRP) Sites RW002 (Low-Level Radioactive Burial Site), LF003 (Outboard Runway Landfill),

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ATTACHMENT E

VEMURS

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Unofficial Document

When recorded mail to:

00-0455841 06/15/00 02:19
BECKY 5 OF 7

CAPTION HEADING:_____

DO NOT REMOVE

This is part of the official document.

NOTICE OF VOLUNTARY ENVIRONMENTAL MITIGATION USE RESTRICTION BY OWNERS

Pursuant to A.R.S. §49-152(B), the United States Air Force owner of the following described property: T2N, R1W, S5 has remediated a portion of the above-described property, that remediated portion is described as follows: T2N, R1W, S5 (PSC DP-13); a drainage ditch that was thought to have been used for general refuse disposal.

The portion of PSC DP-13, Drainage Ditch Disposal Area, to be included in the VEMUR is that property lying within the boundary denoted by the following points:

Northing	Easting	Latitude	Longitude
928231.64	557919.72	33 33 02.66187	112 22 58.90204
928253.11	558017.37	33 33 02.87867	112 22 57.74925
928155.41	558038.83	33 33 01.91301	112 22 57.49049
928133.97	557941.18	33 33 01.69655	112 22 58.64326

Constituents of Concern are chromium and lead. Wastes collected from Test Pit TY-12 at a depth of 5 feet bgs contained chromium at 15,900 mg/kg and lead at 36,000 mg/kg. Because the wastes are buried and the surface area is maintained, direct exposure is not likely to occur at current land use scenarios. However, exposure to these buried wastes could result if excavation were to occur at certain areas of the site or if the site were developed for residential purposes.

The date when the remediation was complete is: Institutional Controls were adopted as a remedy on 9 September 1999.

The undersigned owner voluntarily agrees to limit and restrict the use of the remediated portion of the property to non-residential uses, as defined in A.R.S. §49-151(A). Unofficial Document

No property rights, including, in particular, any restrictive covenants, are being created in favor of or behalf of the state or any other party, by filing of the voluntary environmental mitigation use restriction (VEMUR) notice.

The state's approval of the VEMUR notice is to verify the propriety of the format of the notification, and the accuracy of the assertion that the cleanup conducted is protective for non-residential use.

Approved:

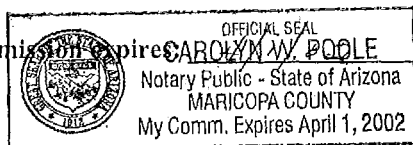

(ADEQ official)

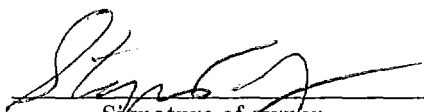
STATE OF ARIZONA

County of Maricopa

This instrument was acknowledged before me this 24th day of May, 2000
by David R. Chavito
Carolyn W. Poole
Notary Public

My commission expires



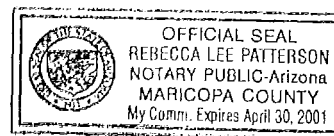

Signature of owner

STATE OF ARIZONA

County of Maricopa

This instrument was acknowledged before me this 12th day of May, 2000
by Stephen T. Sargeant
Rebecca Lee Patterson
Notary Public

My commission expires: 30 April 2001

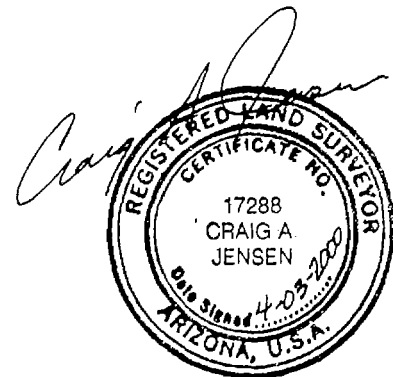


PSC Location Information
For Use with VEMURS
Luke Air Force Base, AZ

PSC	Reference Point	Northing	Easting	Latitude	Longitude
SD-38	1	925083.77	564394.52	33 32 31.79928	112 21 42.23444
	2	925086.23	564459.55	33 32 31.82639	112 21 41.46624
	3	925054.43	564459.55	33 32 31.51181	112 21 41.46462
	4	925052.32	564394.52	33 32 31.48816	112 21 42.23284
FT-07E	5	927655.96	559904.62	33 32 57.05395	112 22 35.41772
	6	927655.97	560404.58	33 32 57.07601	112 22 29.51024
	7	926995.95	560404.54	33 32 50.54591	112 22 29.47623
	8	926995.93	559904.60	33 32 50.52387	112 22 35.38345
DP-13	9	928231.64	557919.72	33 33 02.66187	112 22 58.90204
	10	928253.11	558017.37	33 33 02.87867	112 22 57.74925
	11	928155.41	558038.83	33 33 01.91301	112 22 57.49049
	12	928133.97	557941.18	33 33 01.69655	112 22 58.64326
LF-03	13	924204.27	557788.56	33 32 22.81036	112 23 00.23760
	14	924204.27	558288.57	33 32 22.83259	112 22 54.33013
	15	922704.25	558288.59	33 32 07.99184	112 22 54.25045
	16	922704.25	557788.58	33 32 07.96962	112 23 00.15764
LF-25	17	918337.72	552234.71	33 31 24.51630	112 24 05.53072
	18	919802.79	553585.30	33 31 39.07344	112 23 49.65696
	19	919531.71	553879.36	33 31 36.40492	112 23 46.16850
	20	918066.64	552528.79	33 31 21.84790	112 24 02.04189
LF-14	21	928384.04	564227.42	33 33 04.44425	112 21 44.37635
	22	928259.92	565225.31	33 33 03.25843	112 21 32.57864
	23	927923.37	565227.01	33 32 59.92883	112 21 32.54168
	24	927923.37	565127.00	33 32 59.92461	112 21 33.72332
	25	928290.99	564915.28	33 33 03.55277	112 21 36.24371
	26	928300.96	564227.43	33 33 03.62219	112 21 44.37206
	31	928363.57	565124.48	33 33 04.27968	112 21 33.77532
RW-02	27	924067.08	576120.61	33 32 22.21683	112 19 23.64194
	28	924067.76	576148.57	33 32 22.22457	112 19 23.31171
	29	924027.62	576149.44	33 32 21.82752	112 19 23.29953
	30	924026.58	576119.61	33 32 21.81604	112 19 23.65195

U. S. State Plane, Arizona Central Zone
NAD 1983 Datum
Grid Coordinates : International Feet

This survey was completed on March 24, 2000.
Using GPS Real Time Kinematic methods
NGS Control stations used for this survey "Lithchfield" PID #DV2034
and "Farm" PID #DV2235



Unofficial Document

When recorded mail to:

00-0455842

06/15/00

02:19

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6 OF 7

CAPTION HEADING: _____

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NOTICE OF VOLUNTARY ENVIRONMENTAL MITIGATION USE RESTRICTION BY OWNERS

Pursuant to A.R.S. §49-152(B), the United States Air Force owner of the following described property: T2N, R1W, S5NE quarter has remediated a portion of the above-described property, that remediated portion is described as follows T2N, R1W, S5NE quarter (PSC FT-07E); three fire training pits where POL waste was used.

The portion of PSC FT-07E, the Eastern Portion of North Fire Training Pit, to be included in the VEMUR is that property lying within the boundary denoted by the following points:

Northing	Easting	Latitude	Longitude
927655.96	559904.62	33 32 57.05395	112 22 35.41772
927655.97	560404.58	33 32 57.07601	112 22 29.51024
926995.95	560404.54	33 32 50.54591	112 22 29.47623
926995.93	559904.60	33 32 50.52387	112 22 35.38345

Constituents of Concern are TRPH. Although COC were not present at concentrations high enough to cause adverse health effects under current land use scenarios (military/industrial), remedial alternatives were developed as a protective measure should residential scenarios be considered.

The date when the remediation was complete is: Dec 1992.

The undersigned owner voluntarily agrees to limit and restrict the use of the remediated portion of the property to non-residential uses, as defined in A.R.S. §49-151(A).

Unofficial Document

No property rights, including, in particular, any restrictive covenants, are being created in favor of or behalf of the state or any other party, by filing of the voluntary environmental mitigation use restriction (VEMUR) notice.

The state's approval of the VEMUR notice is to verify the propriety of the format of the notification, and the accuracy of the assertion that the cleanup conducted is protective for non-residential use.

Approved:

Jim Epel
(ADEQ official)

Stephen T. Sargeant
Signature of owner

STATE OF ARIZONA

STATE OF ARIZONA

County of Maricopa

County of Maricopa

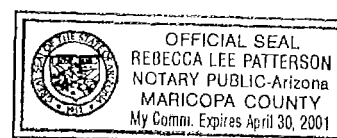
This instrument was acknowledged before me this 24th day of May, 2000

This instrument was acknowledged before me this 12th day of May, 2000

by Carolyn W. Poole
Notary Public
My commission expires: April 1, 2002

by Stephen T. Sargeant
Notary Public

My commission expires: 30 April 2001

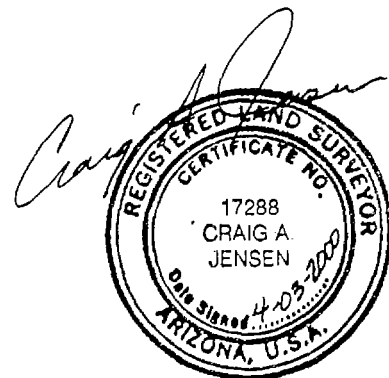


PSC Location Information
For Use with VEMURS
Luke Air Force Base, AZ

PSC	Reference Point	Northing	Easting	Latitude	Longitude
SD-38	1	925083.77	564394.52	33 32 31.79928	112 21 42.23444
	2	925086.23	564459.55	33 32 31.82639	112 21 41.46624
	3	925054.43	564459.55	33 32 31.51181	112 21 41.46462
	4	925052.32	564394.52	33 32 31.48816	112 21 42.23284
FT-07E	5	927655.96	559904.62	33 32 57.05395	112 22 35.41772
	6	927655.97	560404.58	33 32 57.07601	112 22 29.51024
	7	926995.95	560404.54	33 32 50.54591	112 22 29.47623
	8	926995.93	559904.60	33 32 50.52387	112 22 35.38345
DP-13	9	928231.64	557919.72	33 33 02.66187	112 22 58.90204
	10	928253.11	558017.37	33 33 02.87867	112 22 57.74925
	11	928155.41	558038.83	33 33 01.91301	112 22 57.49049
	12	928133.97	557941.18	33 33 01.69655	112 22 58.64326
LF-03	13	924204.27	557788.56	33 32 22.81036	112 23 00.23760
	14	924204.27	558288.57	33 32 22.83259	112 22 54.33013
	15	922704.25	558288.59	33 32 07.99184	112 22 54.25045
	16	922704.25	557788.58	33 32 07.96962	112 23 00.15764
LF-25	17	918337.72	552234.71	33 31 24.51630	112 24 05.53072
	18	919802.79	553585.30	33 31 39.07344	112 23 49.65696
	19	919531.71	553879.36	33 31 36.40492	112 23 46.16850
	20	918066.64	552528.79	33 31 21.84790	112 24 02.04189
LF-14	21	928384.04	564227.42	33 33 04.44425	112 21 44.37635
	22	928259.92	565225.31	33 33 03.25843	112 21 32.57864
	23	927923.37	565227.01	33 32 59.92883	112 21 32.54168
	24	927923.37	565127.00	33 32 59.92461	112 21 33.72332
	25	928290.99	564915.28	33 33 03.55277	112 21 36.24371
	26	928300.96	564227.43	33 33 03.62219	112 21 44.37206
	31	928363.57	565124.48	33 33 04.27968	112 21 33.77532
RW-02	27	924067.08	576120.61	33 32 22.21683	112 19 23.64194
	28	924067.76	576148.57	33 32 22.22457	112 19 23.31171
	29	924027.62	576149.44	33 32 21.82752	112 19 23.29953
	30	924026.58	576119.61	33 32 21.81604	112 19 23.65195

U. S. State Plane, Arizona Central Zone
NAD 1983 Datum
Grid Coordinates : International Feet

This survey was completed on March 24, 2000.
Using GPS Real Time Kinematic methods
NGS Control stations used for this survey "Lithchfield" PID #DV2034
and "Farm" PID #DV2235



Unofficial Document

When recorded mail to:

BEILE MATTHEWS
56 CES/CEUR
13970 W. Lightning St
LUKE AFB AZ 85309
-1149



M/

00-

BECKY

1 OF 2

CAPTION HEADING:_____

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NOTICE OF VOLUNTARY ENVIRONMENTAL MITIGATION USE RESTRICTION BY OWNERS

Pursuant to A.R.S. §49-152(B), the United States Air Force owner of the following described property: T2N, R1W, S Section 4 SE quarter has remediated a portion of the above-described property, which remediated portion is described as follows: T2N, R1W, S Section 4 SE quarter (PSC LF - 03); an oil/water separator that seeped contaminants into the ground.

The portion of PSC LF-03, Outboard Runway Landfill, to be included in the VEMUR is that property lying within the boundary denoted by the following points:

Northing	Easting	Latitude	Longitude
924204.27	557788.56	33 32 22.81036	112 23 00.23760
924204.27	558288.57	33 32 22.83259	112 22 54.33013
922704.25	558288.59	33 32 07.99184	112 22 54.25045
922704.25	557788.58	33 32 07.96962	112 23 00.15764

Constituents of Concern are chromium. Samples of the wastes collected from Test Pit TP-5 at depths of 8 foot bgs and a 7-8 foot bgs contained chromium at concentrations of 349 and 386 mg/kg. Because the metallic wastes containing elevated concentrations of chromium are buried and extend below the outboard runway, direct exposure is not likely under current land use scenarios. Long term exposure to these buried wastes could result if the runways were removed and the site was developed for residential purposes.

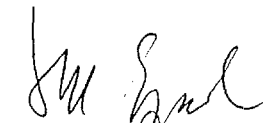
The date when the remediation was complete is: Institutional Controls were adopted as a remedy on 9 September 1999.

The undersigned owner voluntarily agrees to limit and restrict the use of the remediated portion of the property to non-residential uses, as defined in A.R.S. §49-151(A).

No property rights, including, in particular, any restrictive covenants, are being created in favor of or behalf of the state or any other party, by filing of the voluntary environmental mitigation use restriction (VEMUR) notice.

The state's approval of the VEMUR notice is to verify the propriety of the format of the notification, and the accuracy of the assertion that the cleanup conducted is protective for non-residential use.

Approved:



(ADEQ official)

STATE OF ARIZONA

County of Maricopa

This instrument was acknowledged before me this

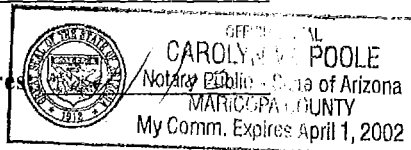
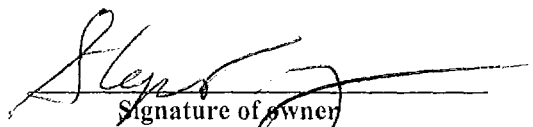
24th day of May, 2000

by David M. Baposta

Carolyn H. Poole

Notary Public

My commission expires

Signature of owner

STATE OF ARIZONA

County of Maricopa

This instrument was acknowledged before me this

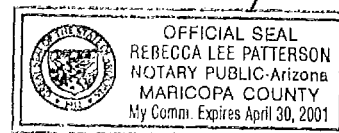
12th day of May, 2000

by Stephen T. Sargeant

Rebecca Lee Patterson

Notary Public

My commission expires: 30 April 2001



PSC Location Information
For Use with VEMURS
Luke Air Force Base, AZ

PSC	Reference Point	Northing	Easting	Latitude	Longitude
SD-38	1	925083.77	564394.52	33 32 31.79928	112 21 42.23444
	2	925086.23	564459.55	33 32 31.82639	112 21 41.46624
	3	925054.43	564459.55	33 32 31.51181	112 21 41.46462
	4	925052.32	564394.52	33 32 31.48816	112 21 42.23284
FT-07E	5	927655.96	559904.62	33 32 57.05395	112 22 35.41772
	6	927655.97	560404.58	33 32 57.07601	112 22 29.51024
	7	926995.95	560404.54	33 32 50.54591	112 22 29.47623
	8	926995.93	559904.60	33 32 50.52387	112 22 35.38345
DP-13	9	928231.64	557919.72	33 33 02.66187	112 22 58.90204
	10	928253.11	558017.37	33 33 02.87867	112 22 57.74925
	11	928155.41	558038.83	33 33 01.91301	112 22 57.49049
	12	928133.97	557941.18	33 33 01.69655	112 22 58.64326
LF-03	13	924204.27	557788.56	33 32 22.81036	112 23 00.23760
	14	924204.27	558288.57	33 32 22.83259	112 22 54.33013
	15	922704.25	558288.59	33 32 07.99184	112 22 54.25045
	16	922704.25	557788.58	33 32 07.96962	112 23 00.15764
LF-25	17	918337.72	552234.71	33 31 24.51630	112 24 05.53072
	18	919802.79	553585.30	33 31 39.07344	112 23 49.65696
	19	919531.71	553879.36	33 31 36.40492	112 23 46.16850
	20	918066.64	552528.79	33 31 21.84790	112 24 02.04189
LF-14	21	928384.04	564227.42	33 33 04.44425	112 21 44.37635
	22	928259.92	565225.31	33 33 03.25843	112 21 32.57864
	23	927923.37	565227.01	33 32 59.92883	112 21 32.54168
	24	927923.37	565127.00	33 32 59.92461	112 21 33.72332
	25	928290.99	564915.28	33 33 03.55277	112 21 36.24371
	26	928300.96	564227.43	33 33 03.62219	112 21 44.37206
	31	928363.57	565124.48	33 33 04.27968	112 21 33.77532
RW-02	27	924067.08	576120.61	33 32 22.21683	112 19 23.64194
	28	924067.76	576148.57	33 32 22.22457	112 19 23.31171
	29	924027.62	576149.44	33 32 21.82752	112 19 23.29953
	30	924026.58	576119.61	33 32 21.81604	112 19 23.65195

U. S. State Plane, Arizona Central Zone
NAD 1983 Datum
Grid Coordinates : International Feet

This survey was completed on March 24, 2000.
Using GPS Real Time Kinematic methods
NGS Control stations used for this survey "Lithchfield" PID #DV2034
and "Farm" PID #DV2235



Unofficial Document

When recorded mail to:

HELEN PURCELL

00-0455840 06/15/00 02:19

BECKY

4 OF 7

CAPTION HEADING:_____

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NOTICE OF VOLUNTARY ENVIRONMENTAL MITIGATION USE RESTRICTION BY OWNERS

Pursuant to A.R.S. §49-152(B), the United States Air Force owner of the following described property: T2N, R1W, S Section 4 NE quarter has remediated a portion of the above-described property, which remediated portion is described as follows: T2N, R1W, S Section 4 NE quarter (PSC LF-14); an old landfill where PCB-container transformer fluids may have been placed.

The portion of PSC LF-14, Old Salvage Yard Burial Site, to be included in the VEMUR is that property lying within the boundary denoted by the following points:
Location of PSC LF-14

Northing	Easting	Latitude	Longitude
928384.04	564227.42	33 33 04.44425	112 21 44.37635
928259.92	565225.31	33 33 03.25843	112 21 32.57864
927923.37	565227.01	33 32 59.92883	112 21 32.54168
927923.37	565127.00	33 32 59.92461	112 21 33.72332
928290.99	564915.28	33 33 03.55277	112 21 36.24371
928300.96	564227.43	33 33 03.62219	112 21 44.37206
928363.57	565124.48	33 33 04.27968	112 21 33.77532

Constituents of Concern are PCBs. Concentration of PCB were detected at 2,300 mg/kg at a depth greater than 16 feet bgs.

The date when the remediation was complete is: Institutional Controls were adopted as a remedy on 9 September 1999.

Unofficial Document

The undersigned owner voluntarily agrees to limit and restrict the use of the remediated portion of the property to non-residential uses, as defined in A.R.S. §49-151(A).

No property rights, including, in particular, any restrictive covenants, are being created in favor of or behalf of the state or any other party, by filing of the voluntary environmental mitigation use restriction (VEMUR) notice.

The state's approval of the VEMUR notice is to verify the propriety of the format of the notification, and the accuracy of the assertion that the cleanup conducted is protective for non-residential use.

Approved:

[Signature]
(ADEQ official)

[Signature]
Signature of owner

STATE OF ARIZONA

STATE OF ARIZONA

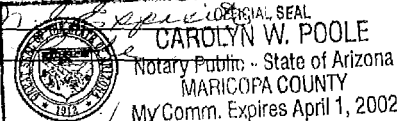
County of Maricopa

County of Maricopa

This instrument was acknowledged before me this

24th day of May, 2000

by David M. [Signature]
Notary Public



My commission expires: 4/1/02

This instrument was acknowledged before me this

12th day of May, 2000

by Stephen T. Sargeant
Notary Public

My commission expires: 30 April 2001

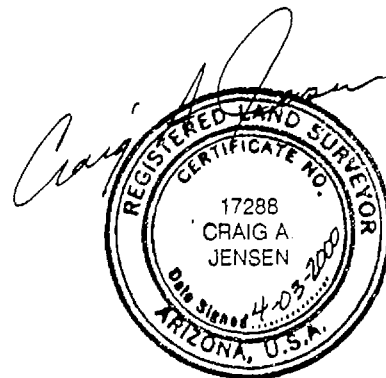


PSC Location Information
For Use with VEMURS
Luke Air Force Base, AZ

PSC	Reference Point	Northing	Easting	Latitude	Longitude
SD-38	1	925083.77	564394.52	33 32 31.79928	112 21 42.23444
	2	925086.23	564459.55	33 32 31.82639	112 21 41.46624
	3	925054.43	564459.55	33 32 31.51181	112 21 41.46462
	4	925052.32	564394.52	33 32 31.48816	112 21 42.23284
FT-07E	5	927655.96	559904.62	33 32 57.05395	112 22 35.41772
	6	927655.97	560404.58	33 32 57.07601	112 22 29.51024
	7	926995.95	560404.54	33 32 50.54591	112 22 29.47623
	8	926995.93	559904.60	33 32 50.52387	112 22 35.38345
DP-13	9	928231.64	557919.72	33 33 02.66187	112 22 58.90204
	10	928253.11	558017.37	33 33 02.87867	112 22 57.74925
	11	928155.41	558038.83	33 33 01.91301	112 22 57.49049
	12	928133.97	557941.18	33 33 01.69655	112 22 58.64326
LF-03	13	924204.27	557788.56	33 32 22.81036	112 23 00.23760
	14	924204.27	558288.57	33 32 22.83259	112 22 54.33013
	15	922704.25	558288.59	33 32 07.99184	112 22 54.25045
	16	922704.25	557788.58	33 32 07.96962	112 23 00.15764
LF-25	17	918337.72	552234.71	33 31 24.51630	112 24 05.53072
	18	919802.79	553585.30	33 31 39.07344	112 23 49.65696
	19	919531.71	553879.30	33 31 36.40492	112 23 46.16850
	20	918066.64	552528.79	33 31 21.84790	112 24 02.04189
LF-14	21	928384.04	564227.42	33 33 04.44425	112 21 44.37635
	22	928259.92	565225.31	33 33 03.25843	112 21 32.57864
	23	927923.37	565227.01	33 32 59.92883	112 21 32.54168
	24	927923.37	565127.00	33 32 59.92461	112 21 33.72332
	25	928290.99	564915.28	33 33 03.55277	112 21 36.24371
	26	928300.96	564227.43	33 33 03.62219	112 21 44.37206
	31	928363.57	565124.48	33 33 04.27968	112 21 33.77532
RW-02	27	924067.08	576120.61	33 32 22.21683	112 19 23.64194
	28	924067.76	576148.57	33 32 22.22457	112 19 23.31171
	29	924027.62	576149.44	33 32 21.82752	112 19 23.29953
	30	924026.58	576119.61	33 32 21.81604	112 19 23.65195

U. S. State Plane, Arizona Central Zone
NAD 1983 Datum
Grid Coordinates : International Feet

This survey was completed on March 24, 2000.
Using GPS Real Time Kinematic methods
NGS Control stations used for this survey "Litchfield" PID #DV2034
and "Farm" PID #DV2235



Unofficial Document

When recorded mail to:

00-0455838

06/15/00

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2 OF 7

CAPTION HEADING: _____

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NOTICE OF VOLUNTARY ENVIRONMENTAL MITIGATION USE RESTRICTION BY OWNERS

Pursuant to A.R.S. §49-152(B), the United States Air Force owner of the following described property: T2N, R1W, S Section 4 SE quarter has remediated a portion of the above-described property, which remediated portion is described as follows: T2N, R1W, S Section 4 SE quarter (PSC LF - 25 Skeet Range);

The portion of PSC LF-25, the Northwest Landfill, to be included in the VEMUR is that property lying within the boundary denoted by the following points:

Northing	Easting	Latitude	Longitude
918337.72	552234.71	33 31 24.51630	112 24 05.53072
919802.79	553585.30	33 31 39.07344	112 23 49.65696
919531.71	553879.36	33 31 36.40492	112 23 46.16850
918066.64	552528.79	33 31 21.84790	112 24 02.04189

Contaminants of concern were lead and antimony.

The date when the remediation was complete is: 20 Dec 1999.

The undersigned owner voluntarily agrees to limit and restrict the use of the remediated portion of the property to non-residential uses, as defined in A.R.S. §49-151(A).

Unofficial Document

No property rights, including, in particular, any restrictive covenants, are being created in favor of or behalf of the state or any other party, by filing of the voluntary environmental mitigation use restriction (VEMUR) notice.

The state's approval of the VEMUR notice is to verify the propriety of the format of the notification, and the accuracy of the assertion that the cleanup conducted is protective for non-residential use.

Approved:

Jim Enslin
(ADEQ official)

Stephen T. Sargeant
Signature of owner

STATE OF ARIZONA

STATE OF ARIZONA

County of Maricopa

County of Maricopa

This instrument was acknowledged before me this 24th day of March, 2000
by David G. S. S. S. S.

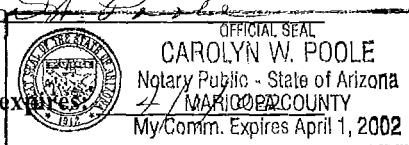
This instrument was acknowledged before me this 12th day of May, 2000
by Stephen T. Sargeant

Notary Public

Notary Public

My commission expires

My commission expires: 30 April 2001



PSC Location Information
For Use with VEMURS
Luke Air Force Base, AZ

PSC	Reference Point	Northing	Easting	Latitude	Longitude
SD-38	1	925083.77	564394.52	33 32 31.79928	112 21 42.23444
	2	925086.23	564459.55	33 32 31.82639	112 21 41.46624
	3	925054.43	564459.55	33 32 31.51181	112 21 41.46462
	4	925052.32	564394.52	33 32 31.48816	112 21 42.23284
FT-07E	5	927655.96	559904.62	33 32 57.05395	112 22 35.41772
	6	927655.97	560404.58	33 32 57.07601	112 22 29.51024
	7	926995.95	560404.54	33 32 50.54591	112 22 29.47623
	8	926995.93	559904.60	33 32 50.52387	112 22 35.38345
DP-13	9	928231.64	557919.72	33 33 02.66187	112 22 58.90204
	10	928253.11	558017.37	33 33 02.87867	112 22 57.74925
	11	928155.41	558038.83	33 33 01.91301	112 22 57.49049
	12	928133.97	557941.18	33 33 01.69655	112 22 58.64326
LF-03	13	924204.27	557788.56	33 32 22.81036	112 23 00.23760
	14	924204.27	558288.57	33 32 22.83259	112 22 54.33013
	15	922704.25	558288.59	33 32 07.99184	112 22 54.25045
	16	922704.25	557788.58	33 32 07.96962	112 23 00.15764
LF-25	17	918337.72	552234.71	33 31 24.51630	112 24 05.53072
	18	919802.79	553585.30	33 31 39.07344	112 23 49.65696
	19	919531.71	553879.36	33 31 26.40492	112 23 46.16850
	20	918066.64	552528.79	33 31 21.84790	112 24 02.04189
LF-14	21	928384.04	564227.42	33 33 04.44425	112 21 44.37635
	22	928259.92	565225.31	33 33 03.25843	112 21 32.57864
	23	927923.37	565227.01	33 32 59.92883	112 21 32.54168
	24	927923.37	565127.00	33 32 59.92461	112 21 33.72332
	25	928290.99	564915.28	33 33 03.55277	112 21 36.24371
	26	928300.96	564227.43	33 33 03.62219	112 21 44.37206
	31	928363.57	565124.48	33 33 04.27968	112 21 33.77532
RW-02	27	924067.08	576120.61	33 32 22.21683	112 19 23.64194
	28	924067.76	576148.57	33 32 22.22457	112 19 23.31171
	29	924027.62	576149.44	33 32 21.82752	112 19 23.29953
	30	924026.58	576119.61	33 32 21.81604	112 19 23.65195

U. S. State Plane, Arizona Central Zone
NAD 1983 Datum
Grid Coordinates : International Feet

This survey was completed on March 24, 2000.
Using GPS Real Time Kinematic methods
NGS Control stations used for this survey "Lithchfield" PID #DV2034
and "Farm" PID #DV2235



Unofficial Document

When recorded mail to:

00-0455839

06/15/00

02:19

BECKY

3 OF 7

CAPTION HEADING:_____

DO NOT REMOVE

This is part of the official document.

**NOTICE OF VOLUNTARY ENVIRONMENTAL MITIGATION
USE RESTRICTION BY OWNERS**

Pursuant to A.R.S. 949-152(B), the United States Air Force owner of the following described property: T2N, R1W, S Section 1 SW quarter has remediated a portion of the above-described property, which remediated portion is described as follows: T2N, R1W, S Section 1 SW quarter (PSC RW-02); a former base landfill for the disposal of refuse and a small quantity of low-level radioactive electron tubes and dials.

The portion of PSC RW-02, Wastewater Treatment Annex Landfill, to be included in the VEMUR is that property lying within the boundary denoted by the following points: The portion of PSC RW-02, Wastewater Treatment Annex Landfill, to be included in the VEMUR is that property lying within the boundary denoted by the following points:

Northing	Easting	Latitude	Longitude
924067.08	576120.61	33 32 22.21683	112 19 23.64194
924067.76	576148.57	33 32 22.22457	112 19 23.31171
924027.62	576149.44	33 32 21.82752	112 19 23.29953
924026.58	576119.61	33 32 21.81604	112 19 23.65195

Constituents of Concern are unclassified low-level radioactive waste consisting of low-level radioactive tubes and dials that were buried at the site in 1956. The radioactive material was encased in concrete and was disposed of in a pit 12 feet deep with 4 feet of concrete cover and 6 feet of earth cover.

The date when the remediation was complete is: Institutional Controls were adopted as a remedy on 9 September 1999.

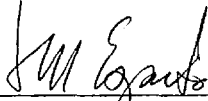
Unofficial Document

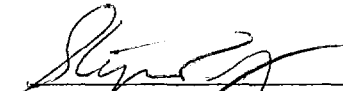
The undersigned owner voluntarily agrees to limit and restrict the use of the remediated portion of the property to non-residential uses, as defined in A.R.S. 949-151(A).

No property rights, including, in particular, any restrictive covenants, are being created in favor of or behalf of the state or any other party, by filing of the voluntary environmental mitigation use restriction (VEMUR) notice.

The state's approval of the VEMUR notice is to verify the propriety of the format of the notification, and the accuracy of the assertion that the cleanup conducted is protective for non-residential use.

Approved:


(ADEQ official)


Signature of owner

STATE OF ARIZONA

STATE OF ARIZONA

County of Maricopa

County of Maricopa

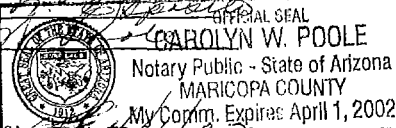
This instrument was acknowledged before me this This instrument was acknowledged before me this

24th day of May, 2000

12th day of May, 2000

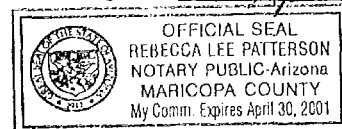
by David J. Barger
Notary Public

by Stephen T. Barger
Notary Public



My commission expires: April 1, 2002

My commission expires: 30 April 2001

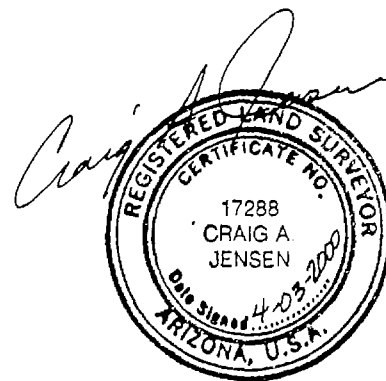


PSC Location Information
For Use with VEMURS
Luke Air Force Base, AZ

PSC	Reference Point	Northing	Easting	Latitude	Longitude
SD-38	1	925083.77	564394.52	33 32 31.79928	112 21 42.23444
	2	925086.23	564459.55	33 32 31.82639	112 21 41.46624
	3	925054.43	564459.55	33 32 31.51181	112 21 41.46462
	4	925052.32	564394.52	33 32 31.48816	112 21 42.23284
FT-07E	5	927655.96	559904.62	33 32 57.05395	112 22 35.41772
	6	927655.97	560404.58	33 32 57.07601	112 22 29.51024
	7	926995.95	560404.54	33 32 50.54591	112 22 29.47623
	8	926995.93	559904.60	33 32 50.52387	112 22 35.38345
DP-13	9	928231.64	557919.72	33 33 02.66187	112 22 58.90204
	10	928253.11	558017.37	33 33 02.87867	112 22 57.74925
	11	928155.41	558038.83	33 33 01.91301	112 22 57.49049
	12	928133.97	557941.18	33 33 01.69655	112 22 58.64326
LF-03	13	924204.27	557788.56	33 32 22.81036	112 23 00.23760
	14	924204.27	558288.57	33 32 22.83259	112 22 54.33013
	15	922704.25	558288.59	33 32 07.99184	112 22 54.25045
	16	922704.25	557788.58	33 32 07.96962	112 23 00.15764
LF-25	17	918337.72	552234.71	33 31 24.51630	112 24 05.53072
	18	919802.79	553585.30	33 31 39.07344	112 23 49.65696
	19	919531.71	553879.36	33 31 36.40492	112 23 46.16850
	20	918066.64	552528.79	33 31 21.84790	112 24 02.04189
LF-14	21	928384.04	564227.42	33 33 04.44425	112 21 44.37635
	22	928259.92	565225.31	33 33 03.25843	112 21 32.57864
	23	927923.37	565227.01	33 32 59.92883	112 21 32.54168
	24	927923.37	565127.00	33 32 59.92461	112 21 33.72332
	25	928290.99	564915.28	33 33 03.55277	112 21 36.24371
	26	928300.96	564227.43	33 33 03.62219	112 21 44.37206
	31	928363.57	565124.48	33 33 04.27968	112 21 33.77532
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	28	924067.76	576148.57	33 32 22.22457	112 19 23.31171
	29	924027.62	576149.44	33 32 21.82752	112 19 23.29953
	30	924026.58	576119.61	33 32 21.81604	112 19 23.65195

U. S. State Plane, Arizona Central Zone
NAD 1983 Datum
Grid Coordinates : International Feet

This survey was completed on March 24, 2000.
Using GPS Real Time Kinematic methods
NGS Control stations used for this survey "Lithchfield" PID #DV2034
and "Farm" PID #DV2235



Unofficial Document

When recorded mail to:

BELLE MATTHEWS
56 CES/CEUR
13970 W. LIGHTNING ST.
LUKE AFB AZ
85309-1149

00-0455843

06/15/00

02:19

BECKY

7 OF 7

CAPTION HEADING:_____

DO NOT REMOVE

This is part of the official document.

NOTICE OF VOLUNTARY ENVIRONMENTAL MITIGATION USE RESTRICTION BY OWNERS

Pursuant to A.R.S. §49-152(B), the United States Air Force owner of the following described property: T2N, R1W, S 5 has remediated a portion of the above-described property, which remediated portion is described as follows: T2N, R1W, S 5 (PSC SD-38); an oil/water separator located at the Auto Hobby Shop that seeped contaminants into the ground.

The northing and easting information was converted to latitude and longitude using NAD 83 Geographic horizontal data.

The portion of PSC SD-38, Oil /Water Separator located at the Auto Hobby Shop, to be included in the VEMUR is that property lying within the boundary denoted by the following points:

Northing	Easting	Latitude	Longitude
925083.77	564394.52	33 32 31.79928	112 21 42.23444
925086.23	564459.55	33 32 31.82639	112 21 41.46624
925054.43	564459.55	33 32 31.51181	112 21 41.46462
925052.32	564394.52	33 32 31.48816	112 21 42.23284

Constituents of Concern are TRPH where the highest concentration was 58,000 mg/kg in the sample collected directly below the former separator at a depth of 8 feet bgs. The deepest detection of TRPH was at a depth of 256 feet bgs at 90 mg/kg.

The date when the remediation was complete is: Institutional Controls were adopted as a remedy on 9 September, 1999.

Unofficial Document

The undersigned owner voluntarily agrees to limit and restrict the use of the remediated portion of the property to non-residential uses, as defined in A.R.S. §49-151(A).

No property rights, including, in particular, any restrictive covenants, are being created in favor of or behalf of the state or any other party, by filing of the voluntary environmental mitigation use restriction (VEMUR) notice.

The state's approval of the VEMUR notice is to verify the propriety of the format of the notification, and the accuracy of the assertion that the cleanup conducted is protective for non-residential use.

Approved:

Jim Epoul
(ADEQ official)

Stephen T. Sargeant
Signature of owner

STATE OF ARIZONA

County of Maricopa

This instrument was acknowledged before me this

24th day of May, 2000

by Carolyn W. Poole
Notary Public



My commission expires: April 1, 2002

STATE OF ARIZONA

County of Maricopa

This instrument was acknowledged before me this

12th day of May, 2000

by Stephen T. Sargeant
Notary Public

My commission expires: 30 April 2001

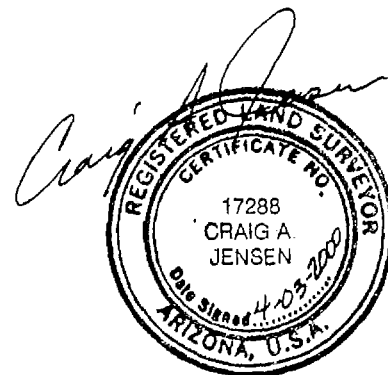


PSC Location Information
For Use with VEMURS
Luke Air Force Base, AZ

PSC	Reference Point	Northing	Easting	Latitude	Longitude
SD-38	1	925083.77	564394.52	33 32 31.79928	112 21 42.23444
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	3	925054.43	564459.55	33 32 31.51181	112 21 41.46462
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	8	926995.93	559904.60	33 32 50.52387	112 22 35.38345
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	19	919531.71	553879.36	33 31 36.40492	112 23 46.16850
	20	918066.64	552528.79	33 31 21.84790	112 24 02.04189
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	23	927923.37	565227.01	33 32 59.92883	112 21 32.54168
	24	927923.37	565127.00	33 32 59.92461	112 21 33.72332
	25	928290.99	564915.28	33 33 03.55277	112 21 36.24371
	26	928300.96	564227.43	33 33 03.62219	112 21 44.37206
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	28	924067.76	576148.57	33 32 22.22457	112 19 23.31171
	29	924027.62	576149.44	33 32 21.82752	112 19 23.29953
	30	924026.58	576119.61	33 32 21.81604	112 19 23.65195

U. S. State Plane, Arizona Central Zone
NAD 1983 Datum
Grid Coordinates : International Feet

This survey was completed on March 24, 2000.
Using GPS Real Time Kinematic methods
NGS Control stations used for this survey "Litchfield" PID #DV2034
and "Farm" PID #DV2235



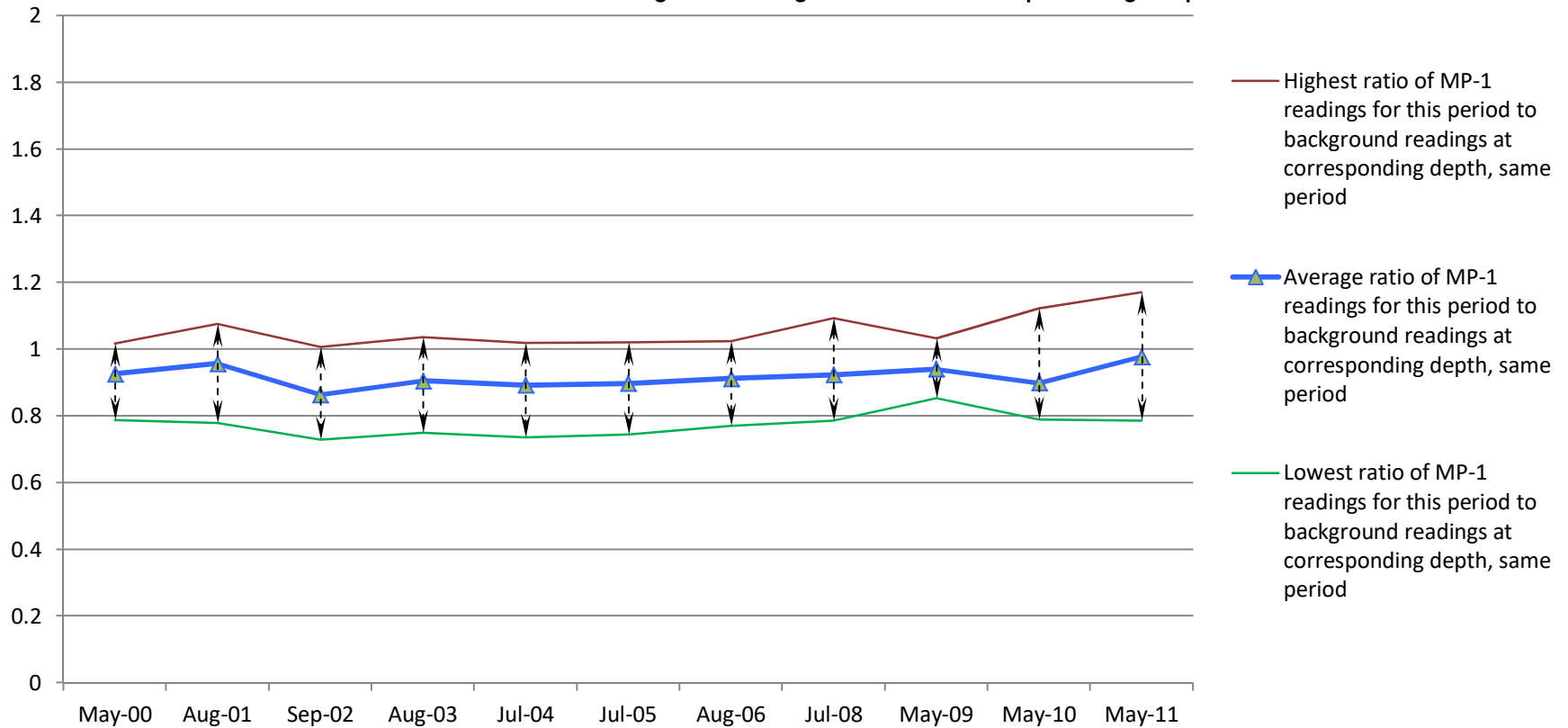
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ATTACHMENT F

GAMMA RADIATION ACTION LEVELS

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MP-1: Ratio of Gamma Readings to Background at Corresponding Depth



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ATTACHMENT G

CORRESPONDENCES TO REGULATORY

AGENCIES COMMENTS ON

DRAFT-FINAL REPORT

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Douglas A. Ducey
Governor

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY



Misael Cabrera
Director

EMAIL AND U.S. MAIL

June 9, 2017

FPU 17-215

Stephanie McCary
Environmental Restoration
5960 Swaab Boulevard
Nellis AFB, NV 89191

Re: LAFB – ADEQ Review of Draft Final Fourth Five-Year Review Report OU1, OU2 and TU-44, received May 8, 2017

Dear Ms. McCary:

The Arizona Department of Environmental Quality (ADEQ) has reviewed the above referenced document for Luke Air Force Base and has the following comments:

General Comments:

- 1) In the List of Figures, the first three have the dotted line following them, for consistency please remove the dotted line.
- 2) To maintain consistency throughout the document, please use either “monitor well” or “monitoring well”. It is acknowledged that both terms are used in the industry.
- 3) There appear to me numerous instances throughout the text where the company name “URS” is used and other times where “AECOM” is used. There does not appear to be consistent usage based on pre- or post-merger timeframes. Please review and revise as appropriate.
- 4) The last figure that is referenced in Section 2 is Figure 14a. Figures 3a, 4a, 5a and b, 6a, 11, and 11a are not referenced until Section 3. Typically Figures are referenced in sequential order in documents. Please revise appropriately.
- 5) Figure 10a is included in the List of Figures and is attached to the report, however, this figure does not appear to be referenced in the document. Please review and provide a text reference if appropriate.
- 6) There are several acronyms that are included in the Acronyms List but not defined in the text, for example AECOM, ELCR, HI. Please review and update as appropriate.

Main Office

1110 W. Washington Street • Phoenix, AZ 85007
(602) 771-2300

Southern Regional Office

400 W. Congress Street • Suite 433 • Tucson, AZ 85701
(520) 628-6733

www.azdeq.gov

printed on recycled paper

- 7) There appear to be several acronyms included in the Acronyms List but not used in the text, for example NPDES, OCDD, POC. Please review and update as appropriate.
- 8) The acronym for RCRA is incorrect. It should be defined as **Resource** Conservation and Recovery Act. Please revise in List of Acronyms and in the text.
- 9) Table 3.1 is included in the List of Tables but is neither referenced in the text nor included in the document. Please review and revise as appropriate.
- 10) The purpose of the Five Year Review is to review the sites and the work performed during the previous five years. Since this is the fourth review, the full history of each site does not need to be included, but instead a brief summary is suggested.
- 11) Please call out acronyms the first time they are used in the text and ensure all are included in the List of Acronyms.

Specific Comments:

- 1) **Page 1-1, Section 1.0;** Please include a statement indicating the time period covered by this report.
- 2) **Page 1-1, Section 1.0, Fourth paragraph, Fourth sentence;** Please revise as follows: "In addition, an additional site TU-044..."
- 3) **Page 1-2, Section 1.1, First paragraph, Fourth sentence;** Please revise "Lightening" to "Lightning" when referring to the F-35 throughout the document.
- 4) **Page 2-7, Section 2.2.2, Table 2.2.2;** The first entry for 2016 indicates that results from VOC delineation and soil vapor sampling are pending. Please add text indicating when the anticipated report containing the results will be submitted to the Agencies.
- 5) **Page 2-10 and 2-11, Section 2.2.4;** Throughout this section, Site FT-07 is referred in both the OU-1 and dOU-2 ROD. It is only in the OU-2 ROD. It also appears that the last paragraph on page 2-10 and the first three paragraphs on page 2-11 ultimately state the same thing. Suggest reviewing and revising if needed.
- 6) **Page 2-11, Section 2.2.4, Fourth paragraph, Second sentence;** Please remove "During" from the beginning of the sentence.
- 7) **Page 2-11, Section 2.2.4, First paragraph, Third sentence;** There is a reference to a vadose zone transport model indicating that COCs will not migrate to and impact groundwater. Please provide a brief summary of the model and any limitations.

- 8) **Page 2-13, Section 2.2.5, Table 2.2.5;** The first entry for 2016 indicates that results from VOC analysis are pending. Please add text indicating when the anticipated report containing the results will be submitted to the Agencies.
- 9) **Page 2-20, Section 2.2.10, Table 2.2.10;** The first entry for 2016 indicates that results from VOC analysis are pending. Please add text indicating when the anticipated report containing the results will be submitted to the Agencies.
- 10) **Page 2-22, Section 2.2.11, Second paragraph;** There is a reference to Figure 35-2 and Table 35-1 of Attachment 2. This attachment is not included in the report. Please provide.
- 11) **Page 2-25, Section 2.2.12, Table 2.2.12;** Please revise the entry for 1996 to read "SVE system installed **and** started."
- 12) **Page 2-26, Section 2.2.13, Fifth paragraph, First sentence;** Please remove "The" before "On" at the beginning of the sentence.
- 13) **Page 2-27, Section 2.2.13, First paragraph;** The last sentence indicates that an assessment of the pilot test remedial performance is pending. Please add text indicating when the anticipated report containing the results will be submitted to the Agencies.
- 14) **Page 2-29, Section 2.3, First full paragraph, First sentence;** There is a reference to Table 3.3. This table was not provided with the report and is not included in the List of Tables in the Table of Contents. Please review and revise accordingly.
- 15) **Page 3-3, Section 3.2, First paragraph, First sentence;** The sentence indicates that DPT drilling for VOC delineation and soil vapor sampling was performed. For clarity, please state which work plan this drilling is associated with and callout DPT.
- 16) **Page 3-9, Section 3.5, Last paragraph, Second sentence;** The sentence indicates that a report will be submitted to ADEQ during the first quarter of 2017. If this submittal occurred, please update the text to indicate the report was submitted. If not, please update the text to indicate when the submittal is anticipated.
- 17) **Page 3-10, Section 3.7, Last sentence;** The sentence indicates that a September 2016 site inspection was conducted. Please provide a brief summary of the results of the site inspection.
- 18) **Page 3-10, Section 3.8, Last sentence;** The sentence indicates that a September 2016 site inspection was conducted. Please provide a brief summary of the results of the site inspection.
- 19) **Page 3-14, Section 3.12, First paragraph, Last sentence;** It appears RW_02 is identified when it should be SS-42. Please review and revise accordingly.

- 20) **Page 3-15, Section 3.13; First partial paragraph;** Please provide the missing reference information.
- 21) **Page 5-1, Section 5.0, Last paragraph, First sentence;** There is a reference to the acronym "TEP". Please review and confirm that this reference shouldn't be for two-phase extraction (TPE).
- 22) **Page 5-2, Section 5.2, Paragraph for Question B, Last sentence;** The sentence indicates that a report is pending based on additional soil vapor sampling during the first quarter of 2017. If this sampling occurred, please update the text to indicate that the sampling occurred and when the report is anticipated to be issued. If not, please update the text to indicate when the sampling is anticipated to occur.
- 23) **Page 5-4, Section 5.5, Paragraph for Question C;** There are references to PFAS, PFOA, and PFOS. Please callout and add to the List of Acronyms.
- 24) **Page 5-6, Section 5.11, Paragraph for Question C, Last sentence;** The sentence indicates that a soil sampling report is pending. If this submittal occurred, please update the text to indicate that the report was submitted. If not, please update the text to indicate when the submittal is anticipated.
- 25) **Page 5-7, Section 5.12, Question C;** The response to Question C includes a lengthy discussion of a Jet A fuel release. It would seem appropriate to include this discussion in Section 3.12 as progress to date. The discussion of sample results and potential excavation can be included in this section to document the protectiveness.

Should you have any comments or questions regarding this matter, please do not hesitate to contact me at (602) 771-0200 or lf4@azdeq.gov.

Sincerely,



Laura Fischer
Project Manager
Federal Projects Unit
Waste Programs Division, ADEQ

Cc: Chad Coker – Matrix (electronic)



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

June 8, 2017

Ms. Stephanie McCary
Remedial Project Manager
AFCEC/CZOW
5690 Swaab Blvd., Building 565
Nellis AFB, NV 89191

Re: Review of the Draft-Final Fourth Five-Year Review Report, OU1, OU2 and TU-44, Luke Air Force Base, Glendale, Arizona, May 2017

Dear Ms. McCary:

The U.S. Environmental Protection Agency (EPA) Region 9 has received the Draft-Final Fourth Five-Year Review Report, OU1, OU2 and TU-44, Luke Air Force Base, Glendale, Arizona, dated May 5, 2017. We have reviewed the document and our comments are enclosed.

If there are any questions, please feel free to contact me at (415) 972-3002.

Sincerely,

A handwritten signature in blue ink, which appears to read "Xuan Mai", is positioned above the printed name.

Xuan-Mai Tran
Remedial Project Manager
Federal Facilities and Site Cleanup Branch

Email Distribution:

Laura Fischer, AZDEQ

**Review of the Draft-Final Fourth Five-Year Review Report, OU1, OU2 and TU-44
Luke Air Force Base, Glendale, Arizona, May 2017**

GENERAL COMMENTS

1. The Draft-Final Fourth Five-Year Review Report, OU1, OU2 and TU-44, Luke Air Force Base, Glendale, Arizona, May 2017 (Five-Year Review) does not include a copy of all appropriate site Voluntary Environmental Mitigation Use Restrictions (VEMURs). Please update the Five-Year Review to include all appropriate site VEMURs on a CD when the final document is submitted.
2. There are several sites where sampling was done in 2016, but the tables indicate that results are pending (e.g., Table 2.2.5, Site Chronology for FT-07E North Fire Training Area-East Side, Page 2-13; Table 2.2.10, Site Chronology for SD-20 Oil/Water Separator Canal and Earth Fissure, Page 2-20; etc.). As such, it is unclear if this data was intended for inclusion in the Five-Year Review and if it will be included for the Final version. Please revise the text and tables to include this data or discuss when the pending data will be available.
3. The Five-Year Review does not discuss vapor intrusion risk for any sites with shallow contamination (e.g., for Sites TU-44, SD-20, SS-42, etc.). Please revise the Five-Year Review to discuss this issue including information on when the risk from vapor intrusion will be addressed.
4. Total Recoverable Petroleum Hydrocarbons (TRPH) was identified in the Record of Decision (ROD) as a Contaminant of Concern (COC) for DP-23, DP-13, FT-07E, LF-14, LF-25, RW-02, SD-20, SD-38, and SS-42. The Five-Year Review indicates that the Arizona Department of Environmental Quality (ADEQ) has recently rescinded the Soil Remediation Level (SRL) for TRPH, and that as a result, individual petroleum constituents that have an SRL and are detected in soil are being used as cleanup levels. The technical assessment section of the Five-Year Review should discuss whether this constitutes a change in the cleanup level, and if so, whether it affects the protectiveness of the remedy. It also appears that as of February 2016, an Explanation of Significant Differences (ESD) was contemplated to address this issue (Page 3-8 of the Five-Year Review). In the recommendations section, the FYR should discuss whether an ESD is still necessary and planned, and when it would be initiated.

SPECIFIC COMMENTS

1. **Section 1.1, Site Background, Page 1-3 and Section 5.4, Site FT-07, North Fire Training Area – West Side, Page 5-3:** The Five-Year Review does not discuss potential per- and polyfluoroalkyl substances (PFAS) contamination at Site FT-07, North Fire Training Area, which was in use until 1973. Aqueous Film Forming Foam (AFFF), which contains PFAS, was used by the Air Force beginning in 1970 for fire-fighting

training and for fire-fighting. Although the text in Section 2.2.4 states that water was used to extinguish fires at Site FT-07, AFFF could have been used from 1970-1973. Even an extensive record search would not be sufficient to confirm that only water was used at the eight fire-training pits and large circular area at this site, so sampling for PFAS should be conducted. Further, AFFF was used at Site FT-07E so it is possible that it was also used at Site FT-07. At a minimum, the potential for PFAS contamination of soil and groundwater should be acknowledged under Question C in Section 5.4. Although concurrence for closure has been requested, this site needs to be tested for PFAS. If the site is closed, it may have to be reopened if PFAS contamination is found. Please revise the text to discuss the potential for PFAS contamination at Site FT-07 and how this data gap will be addressed.

2. **Section 2.2.2, ST-18 Former Liquid Waste Storage Facility (Facility 993), Page 2-6 and Table 2.2.2, Site Chronology for ST-18 Former Liquid Waste Storage Facility (Facility 993), Pages 2-7 and 2-8:** Table 2.2.2 states that groundwater samples have been collected, but the Section 2.2.2 text does not discuss whether there are exceedances of any criteria. Similarly, since there was extensive volatile organic compound (VOC) contamination, it is unclear if there is vapor intrusion risk. Please revise the text to discuss any exceedances of criteria during groundwater sampling and the potential for vapor intrusion risk at Site ST-18.
3. **Section 2.2.5, Site FT-07E North Fire Training Area - East Side, Page 2-12 and Table 2.2.5, Site Chronology for FT-07E North Fire Training Area - East Side, Page 2-13 through 2-14:** Section 2.2.5 and Table 2.2.5 state that AFFF was used during fire training exercises; however, samples for PFAS analysis have not been collected. Before site closure is considered, soil and groundwater samples should be analyzed for PFAS. Please revise the text to include discuss how this data gap will be addressed at Site FT-07E.
4. **Section 2.2.5, Site FT-07E North Fire Training Area - East Side, Page 2-12:** The text states that, “Arsenic was considered a COC due to detectable concentrations exceeding the EPA Region IX PRG of 0.38 mg/Kg. However, detectable concentrations of arsenic in soil were below the current Arizona SRL of 10 mg/Kg; therefore, arsenic was no longer considered a COC.” Please elaborate on the second sentence since it is not clear why arsenic results that are below the Arizona SRL but above the EPA Region IX PRG would lead to arsenic no longer being considered a COC.
5. **Section 2.2.8, LF-25 Northwest Landfill, Page 2-16:** The Remedial Objectives and Remedy Components are missing for LF-25 Northwest Landfill. It is unclear if remedial objectives and/or remedy components exist for Site LF-25. Please revise the text to include remedial objectives and remedy components for Site LF-25.
6. **Section 2.2.9, RW-02 Wastewater Treatment Plan Annex Landfill, Page 2-18 and Table 2.2.9, Site Chronology for RW-02 Wastewater Treatment Plan Annex Landfill, Page 2-18 through 2-19:** The remedy components include “a geophysical monitoring program,” but Table 2.2.9 only includes radiological monitoring, which

appears to be inconsistent with the remedy component description. If a geophysical monitoring program exists, monitoring events should be included in the table. Alternatively, the list of remedy components should include the radiological monitoring program. Please resolve this discrepancy.

7. **Section 2.2.11, SD-38 Oil/Water Separator at the Old Auto Body Shop, Page 2-21 and Figure 12, Site SD-38 Map:** Figure 12 should include the features discussed in Section 2.2.11 (e.g., solid waste management unit [SWMU] 116 and SWMU 128). It is unclear if one or both SWMUs are located within the Site Boundary on Figure 12. Section 2.2.11 refers to Figure 12 as a site map, but it contains insufficient detail to function as a site map. Please revise Figure 12 to include the features discussed in Section 2.2.11, including the SWMUs.
8. **Section 3.0, Progress Since Last Review, Page 3-1:** This section should specifically address status of recommendations from previous Five-Year Review.
9. **Section 3.1, Site DP-23, Old Surface Impoundment West of Facility 993, Pages 3-1 and 3-2; Section 5.1, Site DP-23 Old Surface Impoundment West of Facility 993, Page 5-1; and Section 6.0, Issues and Recommendations/Follow-Up Actions, Page 6-1:** The third bullet point of Section 6.0 states that to obtain site closure for Sites DP-23 and FT-07E, a soil investigation for VOCs is required by the EPA and the Arizona Department of Environmental Quality (ADEQ) because total recoverable petroleum hydrocarbons (TRPH) were detected. However, TRPH and requirements for VOC testing are not consistently discussed throughout the text. For example, Section 3.1 does not mention the presence of TRPH, nor does Section 5.1. The text is inconsistent throughout the document regarding which sites are impacted by the EPA and ADEQ requirements for VOC testing at sites with detected TRPH. Please revise the text to clearly state which sites with previously detected TRPH are impacted by VOC testing requirements.
10. **Section 3.2, ST-18 Former Liquid Waste Storage Facility (Facility 993), Page 3-3 and Section 5.2, Site ST-18 Former Liquid Waste Storage Facility, Page 5-2:** The text states that reporting results are pending for July 2016 and February 2017 soil and soil vapor sampling results for ST-18. Please explain when results are expected and whether they will be made available to reviewing agencies before the next Five-Year Review.
11. **Section 3.5, Site FT-07E North Fire Training Area - East Side, Page 3-9 and Section 5.5, Site FT-07E North Fire Training Area-East Side, Page 5-3:** The text states that results of soil boring investigations at FT-07E for VOCs will be reported to ADEQ during first quarter of 2017. Please update to explain whether these results have been received. If they have not yet been received, the review should indicate when they are expected, and whether they will be provided to reviewing agencies prior to the next Five-Year Review.
12. **Section 3.9, RW-02 Wastewater Treatment Plant Annex Landfill, Page 3-10:** The text states that the gamma radiation report for RW-02 is pending. The Five-Year Review

should indicate when this report is expected, and whether it will be provided to reviewing agencies prior to the next Five-Year Review.

13. **Section 3.10, SD-20 Oil/Water Separator Canal and Earth Fissure, Page 3-12:** The text states that VOC sample results are pending for SD-20. The Five-Year Review should indicate when these results are expected, and whether they will be provided to reviewing agencies prior to the next Five-Year Review.
14. **Section 3.11, SD-38 Oil/Water Separator at the Old Auto Body Shop, Page 3-14:** The text states that resampling at SD-38 will be performed in the first quarter of 2017. The Five-Year Review should indicate whether this has occurred, and whether results will be provided to reviewing agencies prior to the next Five-Year Review.
15. **Section 3.12, SS-42 Bulk Fuels Storage Area, 2014 and 2015 Annual Groundwater Monitoring/Reporting, Page 3-14; Section 3.2, ST-18 Former Liquid Waste Storage Facility (Facility 993), Page 3-2; and Section 3.9, RW-02 Waste Water Treatment Plant Annex Landfill, Page 3-10:** Section 3.12 states that a final annual groundwater monitoring report was prepared and submitted on January 31, 2017 (URS, 2017) combining the results of monitoring activities from SS-42, ST-18, and RW-02; however, neither monitoring activities nor the final annual groundwater monitoring report are mentioned in sections discussing Sites ST-18 and RW-02, which includes Sections 3.2 and Section 3.9. Please revise Sections 3.2 and 3.9 to include the final annual groundwater monitoring report discussion submitted on January 31, 2017 in the discussion of monitoring activities for Sites ST-18 and RW-02.
16. **Section 3.13, Site TU-44 Waterdog Recreation Annex, Page 3-17 and Figure 14a, Site TU-44 Map:** Section 3.13 states that seven new monitoring wells (MW) were constructed (MW-17 through MW-23); however, these wells are not presented on Figure 14a. Figure 14a should include all of the monitoring wells installed at TU-44. Moreover, the text states that existing wells MW-5 and MW-12 were over-drilled and replaced, but Figure 14a does not identify replacement wells and wells that have been abandoned. Please revise Figure 14a to include all newly constructed monitoring wells, in addition to wells that have been abandoned and/or replaced.
17. **Section 4.0, Five-Year Review Process, Page 4-1:** While Section 4.0 contains information regarding community notification, involvement, and site interviews, it does not contain information regarding administrative components of the Five-Year Review process such as the identification of members of the review team or outline of components and Five-Year Review schedule. The EPA Comprehensive Five-Year Review Guidance (Guidance) dated June 2001 indicates that members of the review team and a review schedule should be included in the Five-Year Review. Please revise Section 4.0 to include additional details on the administrative components of the Five-Year Review.
18. **Section 4.3, Site Inspection, Page 4-3:** Section 4.3 presents the attendees of the site inspection, but it is unclear if the Regulatory Agencies were invited to participate or if

they attended. Please revise the text to clarify whether the Regulatory Agencies were invited to participate in the site inspection.

19. **Section 5.1, Site DP-23 Old Surface Impoundment West of Facility 993, Page 5-1:** The text states “The physical conditions in conjunction with the ICs at the site are believed to be adequately protective.” Please elaborate on what is meant by “physical conditions,” and how those relate to protectiveness for DP-23.
20. **Section 5.5, Site FT-07E North Fire Training Area - East Side, Page 5-4:** The text states that, “as described for Site ST-07 above, PFAS compounds” This is the first and only reference to “ST-07”. Is this a separate site or is it supposed to be FT-07? In addition, there is no preceding discussion of PFAS compounds for any sites. The Five-Year Review should elaborate on any new information regarding PFAS compounds at the facility, and any plans for addressing PFAS compounds.
21. **Section 5.11, Site SD-38 - Oil/Water Separator at Old Auto Body Hobby Shop, Page 5-6 and Section 5.12 Site SS-42 Bulk Fuels Storage Area, Page 5-7:** The texts state that “Changes in soil and groundwater ARARs or toxicity values would not affect the protectiveness of the remedy.” and “Changes in soil and groundwater toxicity values do not affect the protectiveness of the remedy.” respectively. These require additional explanation/support. For these sites, and for any other where the same statement is used, please explain first whether there have been any changes in soil and groundwater ARARs or toxicity values. If there have been such changes, the Five-Year Review should elaborate on why these are not expected to affect the protectiveness of the remedy.
22. **Section 5.13, Site TU-44 Waterdog Recreational Annex, Page 5-8:** The answer to Question B is somewhat misleading because there were no RAOs or remedies selected for this site through the RODs.
23. **Section 6.0, Issues and Recommendations/Follow-Up Actions, Page 6-1 and Section 5.10, Site SD-20, Oil/Water Separator Canal and Earth Fissure, Page 5-6:** The text of the fourth bullet in Section 6.0 states that Section 5.10 discusses the discovery, initial response actions, and the intent to conduct characterization due to the discovery of oil on surface water and oil staining on soil at Site SD-20, but Section 5.10 does not include this information. Please revise Section 5.10 to include this information; alternatively, provide a reference to where this information can be found.
24. **Section 6.0, Issues and Recommendations/Follow-Up Actions, Page 6-1:** It is unclear whether groundwater monitoring was performed at RW-02 after the third Five-Year Review. The fifth bullet point of Section 6.0, LTM [Long Term Monitoring] Status at Site FT-07E, RW-02, and SD-20, states that groundwater monitoring has not been performed at Sites FT-07E, RW-02, and SD-20 since the third Five-Year Review period ended in May 2011. However, Section 3.12, SS-42 Bulk Fuels Storage Area, states that a final annual groundwater monitoring report combined the monitoring activities from sites SS-42, ST-18, and RW-02. Please revise the text to clarify whether groundwater monitoring activities occurred at Site RW-02 after the Third Five-Year Review.

25. **Section 6.0, Issues and Recommendation/Follow-up Actions, Sites DP-23 and FT-07E, Page 6-1:** The Five-Year Review should discuss the Air Force's proposed follow-up actions regarding VOC-related investigations, data evaluation, and results reporting, rather than discussing URS's recommendations.
26. **Section 6.0, Issues and Recommendations/Follow-Up Actions, Page 6-2 and Section 3.8, LF-25 Northwest Landfill, Page 3-10:** The first bullet on Page 6-2 states that the re-evaluation of surface conditions at LF-25 was not conducted, but this information was not included in the discussion of the progress since the last review section for this site. Specifically, this information should be presented earlier in the text in Section 3.8, LF-25 Northwest Landfill. Please revise Section 3.8 to include text stating that the re-evaluation of surface conditions at LF-25 was not conducted. However, if re-evaluating surface conditions at Site LF-25 is necessary to determine protectiveness, please provide proposed course of action.
27. **Section 7.0, Protectiveness Statement, Page 7-1:** There should be a separate protectiveness statement for each OU, as well as a site-wide protectiveness statement per 2012 Guidance: "Clarifying the Use of Protectiveness Determinations for CERCLA Five Year Reviews". Protectiveness statements should follow language and format specified in that guidance. Specifically, the Air Force should determine that the remedy is protective, short-term protective, will be protective, protectiveness deferred, or not protective ("adequately protective" is not an option provided in the guidance).
28. **Section 7.0, Protectiveness Statement, Page 7-1:** Additional explanation would be helpful to explain how the network of groundwater monitoring wells at Site TU-44 relates (or doesn't relate) to the protectiveness of the remedies.
29. **Attachment A, Site Inspection Forms and Section 6.0, Issues and Recommendations/Follow-Up Actions, Page 6-1:** The TU-44 Site Inspection Form notes that drums containing soil cuttings and well development water require removal but this recommendation was not included in Section 6.0. Please revise Section 6.0 to include text regarding a recommendation to remove drums containing soil cuttings and well development water.
30. **Appendix B, Site Inspection Photographic Log, Page 4 of 11 and Section 6.0, Issues and Recommendations/Follow-Up Actions, Page 6-1:** Photograph 23 shows multiple animal burrow holes but Section 6.0 does not recommend that the animal burrows be filled. Moreover, Photograph 23 appears to be mislabeled and should likely be Photograph 13, as another Photograph 23 is presented on Page 6 of 11. Please revise Section 6.0 to include a recommendation regarding filling the animal burrows shown in the Photograph 23 and resolve the apparent numbering discrepancy.

MINOR COMMENTS

1. **Section 1.0, Introduction, Page 1-1:** In the fourth paragraph, fourth sentence should read, “In addition, one additional site,” rather than “on additional site.”
2. **Section 3.3, Site DP-13 Drainage Ditch Disposal Area, Page 3-6:** There was a typo in third and fourth lines of the fourth paragraph (“has was” and “adequate to meet ... the need to conduct 5-year reviews ...”).
3. **Section 3.11, SD-38 Oil/Water Separator at the Old Auto Body Shop, Page 3-13:** The first paragraph states that major work progress at Site SD-38 is documented in Table 2.2.9; however, this table corresponds to the Site Chronology for RW-02 Waste Water Treatment Plant Annex Landfill and not the site chronology for Site SD-38. Table 2.2.11, Site Chronology for SD-38 Oil/Water Separator at the Old Auto Body Shop presents this information. Please revise this section to state that the major work progress at Site SD-38 is presented in Table 2.2.11.
4. **Section 3.12, SS-42 Bulk Fuels Storage Area, Page 3-14:** The first paragraph incorrectly references Site RW-02 by stating, “For information regarding work progress at Site RW-02...” Please revise the text to refer to Site SS-42.
5. **Section 3.13, Site TU-44 Waterdog Recreation Annex, Page 3-15:** There is a missing reference at the bottom of the page where the text states “and Luke AFB in February 2016 (ref???)” Please revise the text to include the appropriate reference.
6. **Section 6.0, Issues and Recommendations/Follow-up Actions, Page 6-2:** Word missing in the third line down, “Based on the evaluation results...” For the sites referenced in this paragraph, recommendation should be stated in terms of Air Force’s plans for follow-up steps, rather than URS’s recommendations.
7. **Section 7.0, Protectiveness Statement, Page 7-1:** The final paragraph appears to be a different size font than the rest of the document.
8. **Figures:** While Section 2.1, Basis for Taking Action (Pages 2-1 through 2-4), includes tables providing a summary of COCs detected in soil or groundwater exceeding applicable screening levels, adding the most relevant values and/or exceedances to figures would be helpful to clarify the extent of contamination at each site. Please revise the figures to include this information.

28 June 2017

MEMORANDUM

TO: Don Ficklen, AFCEC/CZRW
Stephanie McCary, AFCEC/CZOW
Jeff Rothrock, USAF AETC 56 CES/CEIE

FROM: John Kim, AECOM Project Manager

CC: Jeff Rackow, AECOM Task Manager

Re: Responses to the ADEQ Review of Draft-Final Fourth Five-Year Review Report, OU1, OU2 and TU-44 Luke Air Force Base, Glendale, Arizona, May 2017 Contract FA8903-16-D-0029 Task Order 0004, Subtask 3.3, CDRL A001e

GENERAL COMMENTS

1. In the List of Figures, the first three have the dotted line following them, for consistency please remove the dotted line.

AECOM RESPONSE: Dotted lines have been removed.

2. To maintain consistency throughout the document, please use either "monitor well" or "monitoring well". It is acknowledged that both terms are used in the industry.

AECOM RESPONSE: Throughout the document the term "monitor well" was replaced with "monitoring well".

3. There appear to me numerous instances throughout the text where the company name "URS" is used and other times where "AECOM" is used. There does not appear to be consistent usage based on pre- or post-merger timeframes. Please review and revise as appropriate.

AECOM RESPONSE: All historical activities were performed by URS under a performance based remediation contract (PBR). URS (under contract) is still conducting work at Luke AFB under the PBR. The Five Year Review is being performed by AECOM; therefore, to be consistent with historical and current activities "URS" was replaced with "AECOM" when the activity involved the FYR.

4. The last figure that is referenced in Section 2 is Figure 14a. Figures 3a, 4a, 5a and b, 6a, 11, and 11a are not referenced until Section 3. Typically Figures are referenced in sequential order in documents. Please revise appropriately.

AECOM RESPONSE: Text has been added to appropriate subsections in Section 2 to ensure figures are identified in sequential order.

5. The Figure 10a is included in the List of Figures and is attached to the report, however, this figure does not appear to be referenced in the document. Please review and provide a text reference if appropriate.

AECOM RESPONSE: Text has been added in Sections 2.2.9 and 3.9 referencing Figure 10a.

6. There are several acronyms that are included in the Acronyms List but not defined in the text, for example AECOM, ELCR, HI. Please review and update as appropriate

AECOM RESPONSE: The text has been updated to define the applicable acronyms.

7. There appear to be several acronyms included in the Acronyms List but not used in the text, for example NPDES, OCDD, POC. Please review and update as appropriate.

AECOM RESPONSE: Unused acronyms have been deleted.

8. The acronym for RCRA is incorrect. It should be defined as **Resource** Conservation and Recovery Act. Please revise in List of Acronyms and in the text.

AECOM RESPONSE: The acronym for RCRA has been corrected in the List of Acronyms and in Section 2.2.2.

9. Table 3.1 is included in the List of Tables but is neither referenced in the text nor included in the document. Please review and revise as appropriate.

AECOM RESPONSE: Reference to Table 3.1 has been deleted in the List of Tables.

10. The purpose of the Five Year Review is to review the sites and the work performed during the previous five years. Since this is the fourth review, the full history of each site does not need to be included, but instead a brief summary is suggested.

AECOM RESPONSE: Propose to keep site history as is to keep consistent with past FYRs.

11. Please call out acronyms the first time they are used in the text and ensure all are included in the List of Acronyms.

AECOM RESPONSE: Acronyms have been called out accordingly when they are first used in the text and have been included in the List of Acronyms, as applicable.

SPECIFIC COMMENTS

1. **Page 1-1, Section 1.0;** Please include a statement indicating the time period covered by this report.

AECOM RESPONSE: The following text has been added at the end of the 2nd sentence in the 3rd paragraph of Section 1.0: *“Therefore, the time period covered by this report is from July 2012 to July 2017.”*

2. **Page 1-1, Section 1.0, Fourth paragraph, Fourth sentence;** Please revise as follows: "In addition, an additional site TU-044... "

AECOM RESPONSE: The referenced sentence was revised as follows: "In addition, *one* additional site TU-044... ".

3. **Page 1-2, Section 1.1, First paragraph, Fourth sentence;** Please revise "Lightening" to "Lightning" when referring to the F-35 throughout the document.

AECOM RESPONSE: The requested revision has been made.

4. **Page 2-7, Section 2.2.2, Table 2.2.2;** The first entry for 2016 indicates that results from VOC delineation and soil vapor sampling are pending. Please add text indicating when the anticipated report containing the results will be submitted to the Agencies.

AECOM RESPONSE: The reference text has been modified as follows: *“Report to be submitted by mid-November 2017.”*

5. **Page 2-10 and 2-11, Section 2.2.4;** Throughout this section, Site FT-07 is referred in both the OU-1 and OU-2 ROD. It is only in the OU-2 ROD. It also appears that the last paragraph on page 2-10 and the first three paragraphs on page 2-11 ultimately state the same thing. Suggest reviewing and revising if needed.

AECOM RESPONSE: All references to the Operable Unit in which Site FT-07 is identified have been corrected to “OU-2”.

6. **Page 2-11, Section 2.2.4, Fourth paragraph, Second sentence;** Please remove "During" from the beginning of the sentence.

AECOM RESPONSE: The requested deletion has been made.

7. **Page 2-11, Section 2.2.4, First paragraph, Third sentence;** There is a reference to a vadose zone transport model indicating that COCs will not migrate to and impact

groundwater. Please provide a brief summary of the model and any limitations.

AECOM RESPONSE: The referenced sentence was modified, as follows: *“In addition, a vadose zone transport model was used to evaluate the current potential for COCs in soil at OU-2 to leach from the soil and cause impact to groundwater. The model was not developed to be used to explain the presence of contaminants in groundwater which may have been the result of historical activities at Luke AFB. PSC-specific models were not constructed; rather, an extremely conservative, OU-2-specific model was developed. The model evaluated leaching of several COCs detected in soils from OU-2 PSCs using the actual concentrations detected and depths from which soil samples were collected and analyzed during the OU-2 RI.*

The source concentration for each COC was assumed to equal the maximum possible concentration, regardless of the solubility of each compound in water. In addition, the source was assumed to have a constant concentration over time (i.e., no source decay). This, again, is a conservative assumption because the source is not constant (i.e., source is decaying). The predicted concentrations at the bottom of the vadose zone demonstrated that it is highly unlikely that the groundwater impacts will ever occur as a result of existing, unsaturated conditions at OU-2. Predictions concentrations for the six COCs analyzed range from less than 1×10^{-100} to 1.269×10^{-21} mg/L (Geraghty and Miller, 1994).”

8. **Page 2-13, Section 2.2.5, Table 2.2.5;** The first entry for 2016 indicates that results from VOC analysis are pending. Please add text indicating when the anticipated report containing the results will be submitted to the Agencies.

AECOM RESPONSE: The reference text has been modified as follows: *“Report to be submitted by mid-September 2017 (refer to Section 3.5 for more detail).”*

9. **Page 2-20, Section 2.2.10, Table 2.2.10;** The first entry for 2016 indicates that results from VOC analysis are pending. Please add text indicating when the anticipated report containing the results will be submitted to the Agencies.

AECOM RESPONSE: The reference text has been modified as follows: *“Report to be submitted by late August 2017 (refer to Section 3.10 for more detail).”*

10. **Page 2-22, Section 2.2.11, Second paragraph;** There is a reference to Figure 35-2 and Table 35-1 of Attachment 2. This attachment is not included in the report. Please provide.

AECOM RESPONSE: This reference has been removed.

11. **Page 2-25, Section 2.2.12, Table 2.2.12;** Please revise the entry for 1996 to read "SVE system installed and started."

AECOM RESPONSE: The requested revision has been made.

12. **12) Page 2-26, Section 2.2.13, Fifth paragraph, First sentence;** Please remove "The" before "On" at the beginning of the sentence.

AECOM RESPONSE: The requested deletion has been made.

13. **Page 2-27, Section 2.2.13, First paragraph;** The last sentence indicates that an assessment of the pilot test remedial performance is pending. Please add text indicating when the anticipated report containing the results will be submitted to the Agencies.

AECOM RESPONSE: The reference sentence was modified, as follows: "An assessment of the pilot test remedial performance *will be provided in a results report anticipated to be submitted to ADEQ for review by September 8, 2017.*" In addition a row has been added in Table 2.2.13 referencing the pilot test activities for 2017.

14. **Page 2-29, Section 2.3, First full paragraph, First sentence;** There is a reference to Table 3.3. This table was not provided with the report and is not included in the List of Tables in the Table of Contents. Please review and revise accordingly.

AECOM RESPONSE: The first sentence to the referenced paragraph has been deleted.

15. **Page 3-3, Section 3.2, First paragraph, First sentence;** The sentence indicates that DPT drilling for VOC delineation and soil vapor sampling was performed. For clarity, please state which work plan this drilling is associated with and callout DPT.

AECOM RESPONSE: The first sentence in the referenced paragraph has been modified, as follows: "The *direct push technology* (DPT) drilling for VOC delineation and soil vapor sampling was performed in July 2016, *in accordance with the April 2016 Work Plan (URS, 2016a).*" In addition "DPT" was added to the List of Acronyms".

16. **Page 3-9, Section 3.5, Last paragraph, Second sentence;** The sentence indicates that a report will be submitted to ADEQ during the first quarter of 2017. If this submittal occurred, please update the text to indicate the report was submitted. If not, please update the text to indicate when the submittal is anticipated.

AECOM RESPONSE: The following information has been added as the last sub-section of Section 3.5 which describes the status of the pending report submittal to ADEQ:

"May 2017 Soil Boring Re-Sampling for VOCs"

The samples collected during the October 2016 soil boring sampling for VOCs were mishandled by the laboratory which caused the data to be unusable. Therefore, a field investigation involving drilling and re-sampling three soil borings for VOCs was implemented on May 3, 2017 at Site FT-07E. The analytical results were received and are currently being validated. Following

preparation and submittal of a draft results report to AFCEC, and after incorporating AFCEC's review comments, URS anticipates that a results report will be provided to ADEQ for review by no later than mid-September 2017."

17. **Page 3-10, Section 3.7, Last sentence;** The sentence indicates that a September 2016 site inspection was conducted. Please provide a brief summary of the results of the site inspection.

AECOM RESPONSE: The following statement has been added to Section 3.7: *"With the exception of a considerable amount of small animal burrow holes observed along the north end of Site LF-14, the site was observed to be in good condition with no residential or other land development. A recommendation to fill the burrow holes to assure protectiveness is included in Section 6.0."*

18. **Page 3-10, Section 3.8, Last sentence;** The sentence indicates that a September 2016 site inspection was conducted. Please provide a brief summary of the results of the site inspection.

AECOM RESPONSE: The referenced sentence has been revised, as follows: *"The only work that has been completed at the site since the previous FYR is the execution of the 2013 PBR contract and an attempt to inspect the site on September 27, 2016 for the fourth FYR. Access to the site was restricted by Luke AFB on that date. However, Mr. Jeff" Rothrock, Environmental Chief of Luke AFB indicated at that time that there have been no changes to the site (i.e., no excavation or land development) since the previous FYR inspection."*

19. **Page 3-14, Section 3.12, First paragraph, Last sentence;** It appears RW-02 is identified when it should be SS-42. Please review and revise accordingly.

AECOM RESPONSE: "RW-02" was changed to "SS-42".

20. **Page 3-15, Section 3.13; Last partial paragraph;** Please provide the missing reference information.

AECOM RESPONSE: The missing reference was updated to (URS, 2016i).

21. **Page 5-1, Section 5.0, Last paragraph, First sentence;** There is a reference to the acronym "TEP". Please review and confirm that this reference shouldn't be for two-phase extraction (TPE).

AECOM RESPONSE: The acronym "TEP" was revised to "TPE"

22. **Page 5-2, Section 5.2, Paragraph for Question B, Last sentence;** The sentence indicates that a report is pending based on additional soil vapor sampling during the first quarter of 2017. If this sampling occurred, please update the text to indicate that the sampling occurred and when the report is anticipated to be issued. If not, please update the text to indicate when the sampling is anticipated to occur.

AECOM RESPONSE: The following statements have been added to the end of the paragraph under Section 5.2, Question B: *“Additional soil vapor sampling was conducted in February 2017 to support an evaluation of vapor intrusion risk to indoor air at the site. The results report for these activities is pending. The anticipated submittal date of a draft-final results report to the ADEQ for review is by mid-November 2017.”*

23. **Page 5-4, Section 5.5, Paragraph for Question C;** There are references to PFAS, PFOA, and PFOS. Please callout and add to the List of Acronyms.

AECOM RESPONSE: The acronyms for PFAS, PFOA, and PFOS have been called out in a previous section of the report and added to the List of Acronyms.

24. **Page 5-6, Section 5.11, Paragraph for Question C, Last sentence;** The sentence indicates that a soil sampling report is pending. If this submittal occurred, please update the text to indicate that the report was submitted. If not, please update the text to indicate when the submittal is anticipated.

AECOM RESPONSE: Modifications and additions to the last paragraph have been made as follows: *“No. However, TRPH is no longer regulated by SRLs in Arizona. To address the uncertainty over the composition of TRPH detected at Site SD-20 during the RI, supplemental soil characterization for VOCs was required by EPA and ADEQ in order to obtain SC. In accordance with the August 2016 work plan approved by ADEQ (URS, 2016c), URS implemented soil sampling for VOCs at the site in October 2016 and early May 2017 (See Section 3.11). After review comments are received, responses to AFCEC’s comments are prepared, and comments are incorporated, URS anticipates that a draft results report will be sent to ADEQ for review by late August 2017.”*

25. **Page 5-7, Section 5.12, Question C;** The response to Question C includes a lengthy discussion of a Jet A fuel release. It would seem appropriate to include this discussion in Section 3.12 as progress to date. The discussion of sample results and potential excavation can be included in this section to document the protectiveness.

AECOM RESPONSE: Since this release is a new discovery during this FYR timeframe it does seem to be appropriate to discuss in Section 3.12.

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28 June 2017

MEMORANDUM

TO: Don Ficklen, AFCEC/CZRW
Stephanie McCary, AFCEC/CZOW
Jeff Rothrock, USAF AETC 56 CES/CEIE

FROM: John Kim, AECOM Project Manager

CC: Jeff Rackow, AECOM Task Manager

**Re: Response to USEPA Review of Draft-Final Fourth Five-Year Review Report, OU1, OU2 and TU-44, Luke Air Force Base, Glendale, Arizona, May 2017
Contract FA8903-16-D-0029 Task Order 0004, Subtask 3.3, CDRL A001e**

GENERAL COMMENTS

1. The Draft-Final Fourth Five-Year Review Report, OU1, OU2 and TU-44, Luke Air Force Base, Glendale, Arizona, May 2017 (Five-Year Review) does not include a copy of all appropriate site Voluntary Environmental Mitigation Use Restrictions (VEMURs).

Please update the Five-Year Review to include all appropriate site VEMURs on a CD when the final document is submitted.

AECOM RESPONSE: Copies of all the VEMURs will be included with the final FYR document as Attachment E.

2. There are several sites where sampling was done in 2016, but the tables indicate that results are pending (e.g., Table 2.2.5, Site Chronology for FT-07E North Fire Training Area-East Side, Page 2-13; Table 2.2.10, Site Chronology for SD-20 Oil/Water Separator Canal and Earth Fissure, Page 2-20; etc.). As such, it is unclear if this data was intended for inclusion in the Five-Year Review and if it will be included for the Final version. Please revise the text and tables to include this data or discuss when the pending data will be available.

AECOM RESPONSE: Updated information regarding the status of the response actions and anticipated submittal dates for reporting results has been incorporated into the narrative and summary tables of the revised FYR report.

3. The Five-Year Review does not discuss vapor intrusion risk for any sites with shallow contamination (e.g., for Sites TU-44, SD-20, SS-42, etc.). Please revise the Five-Year Review to discuss this issue including information on when the risk from vapor intrusion will be addressed.

AECOM RESPONSE: Vapor intrusion risks do not presently exist at Sites DP-13, FT-07, FT-07E, LF-03, LF-14, LF-25, RW-02, SD-20, and TU-44 due to the absence of any enclosed structures within or near the contaminant source area that could be occupied by personnel. For site SS-42, a future vapor intrusion risk associated with a fuel pipeline release that occurred on August 2, 2016 has been identified for a pump house structure that is currently under construction. This structure will have an enclosed control room occupied by up to several workers. A description about how this risk will be addressed using a passive soil vapor extraction (SVE) system has been added to Section 5.12, Question C. In addition, a recommendation for follow-up soil remediation and confirmatory air sampling associated with the fuel release at Site SS-042 has been described in a new bulleted paragraph at the end of Section 6.0.

4. Total Recoverable Petroleum Hydrocarbons (TRPH) was identified in the Record of Decision (ROD) as a Contaminant of Concern (COC) for DP-23, DP-13, FT-07E, LF-14, LF-25, RW-02, SD-20, SD-38, and SS-42. The Five-Year Review indicates that the Arizona Department of Environmental Quality (ADEQ) has recently rescinded the Soil Remediation Level (SRL) for TRPH, and that as a result, individual petroleum constituents that have an SRL and are detected in soil are being used as cleanup levels. The technical assessment section of the Five-Year Review should discuss whether this constitutes a change in the cleanup level, and if so, whether it affects the protectiveness of the remedy. It also appears that as of February 2016, an Explanation of Significant Differences (ESD) was contemplated to address this issue (Page 3-8 of the Five-Year Review). In the recommendations section, the FYR should discuss whether an ESD is still necessary and planned, and when it would be initiated.

AECOM RESPONSE: Within Section 5.0, Technical Assessment, Question B, we have added an explanation for each of the applicable sites in which Arizona SRLs are now being used as cleanup criteria for VOCs in soil, rather than using the rescinded TRPH cleanup standard. Based upon the Performance Objectives under the existing PBR contract, these include Sites FT-07E, SD-20, and SD-38. The VOC testing to determine concentrations of individual constituents in lieu of using the TRPH cleanup level does constitute a change in the cleanup criteria, and this is considered more protective to human health and the environment than the TRPH cleanup standard. More specifically, under Question B in 5.5 for FT-07E the following explanation has been added: *The OU-1 ROD stipulates TRPH as a COC for Site FT-07E. Under the existing PBR Contract, the Performance Objectives set-forth by AFCEC included Response Complete and/or achieving SC with UU/UE for the various ROD sites. The objective for Site FT-07E is SC; therefore, a VOC constituent investigation was undertaken as required by ADEQ and EPA for comparison of VOC results to established Arizona SRLs. This was*

required in lieu of sampling for TRPH because the cleanup level for TRPH in Arizona has been rescinded. Because there are numerous VOC constituents reported by the analytical method used to test collected soil samples (i.e., EPA Method 8260B), the use of Arizona SRLs for VOCs rather than a single cleanup level for TRPH is considered more protective to human health and the environment.”

Similar language has also been added to Question B of Sections 5.10 and 5.11 for Sites D-20 and SD-38, respectively.

In addition, the following statement was added at the end of the 3rd bullet in Section 6.0: *“If SC can be achieved an ESD will be required to document final closure.”*

SPECIFIC COMMENTS

1. **Section 1.1, Site Background, Page 1-3 and Section 5.4, Site FT-07, North Fire Training Area – West Side, Page 5-3:** The Five-Year Review does not discuss potential per- and polyfluoroalkyl substances (PFAS) contamination at Site FT-07, North Fire Training Area, which was in use until 1973. Aqueous Film Forming Foam (AFFF), which contains PFAS, was used by the Air Force beginning in 1970 for fire-fighting training and for fire-fighting. Although the text in Section 2.2.4 states that water was used to extinguish fires at Site FT-07, AFFF could have been used from 1970-1973. Even an extensive record search would not be sufficient to confirm that only water was used at the eight fire-training pits and large circular area at this site, so sampling for PFAS should be conducted. Further, AFFF was used at Site FT-07E so it is possible that it was also used at Site FT-07. At a minimum, the potential for PFAS contamination of soil and groundwater should be acknowledged under Question C in Section 5.4. Although concurrence for closure has been requested, this site needs to be tested for PFAS. If the site is closed, it may have to be reopened if PFAS contamination is found. Please revise the text to discuss the potential for PFAS contamination at Site FT-07 and how this data gap will be addressed.

AECOM RESPONSE: An explanation of the potential for PFAS impacts to soil and groundwater from past fire training exercises at Site FT-07 has been prepared. The following information has been added to the fourth paragraph of Section 1.1 that discusses Site FT-07: *“Perfluoroalkyl Substance (PFAS) compounds, most notably Perfluorooctanoic Acid (PFOA) and Perfluorooctane Sulfonate (PFOS) may be present in soil and/or groundwater at Site FT-07 as a result of past firefighting training activities. PFASs are emerging contaminants in which there currently are no enforceable cleanup standards established by EPA for soil or groundwater; therefore it will not impact SC of FT-07 in accordance with the ROD. However, EPA relatively recently issued non-enforceable drinking water Health Advisories for, and that multiple states have established some kind of guidance or threshold criteria for (excluding Arizona). To investigate the potential*

presence of PFAS, the Air Force has initiated Preliminary Assessment/Site Investigation activities Air Force-wide. The Luke AFB Preliminary Assessment was completed in October 2015 and identified twenty sites for a Site Investigation (SI). Among these sites are sites RW-02, FT-06, FT-07, FT-07E, SD-20, SD-21, and SD-26. The SI work plan was approved by EPA and ADEQ and fieldwork began on 26 June 2017.”

Additionally, the following text was added at the end of the second sentence in Question C of Section 5.4: “However, PFAS compounds (most notably PFOA/PFOS) may be present in soil and/or groundwater at Site FT-07 as a result of past firefighting training activities that may reopen this site for future investigation/remediation. PFASs are emerging contaminants in which there are no enforceable cleanup standards yet established by EPA for soil or groundwater. However, EPA relatively recently issued non-enforceable drinking water Health Advisories for, and that multiple states, excluding Arizona, have established some kind of guidance or threshold criteria for PFAS.”

2. **Section 2.2.2, ST-18 Former Liquid Waste Storage Facility (Facility 993), Page 2-6 and Table 2.2.2, Site Chronology for ST-18 Former Liquid Waste Storage Facility (Facility 993), Pages 2-7 and 2-8:** Table 2.2.2 states that groundwater samples have been collected, but the Section 2.2.2 text does not discuss whether there are exceedances of any criteria. Similarly, since there was extensive volatile organic compound (VOC) contamination, it is unclear if there is vapor intrusion risk. Please revise the text to discuss any exceedances of criteria during groundwater sampling and the potential for vapor intrusion risk at Site ST-18.

AECOM RESPONSE: AECOM has modified and updated some of the requested information for year 2016 in Table 2.2.2. This information pertains to noting the annual groundwater monitoring and cap inspection activities performed in year 2016 at the site.

Information regarding the results of annual groundwater monitoring performed in 2014 and 2015 at Site ST-18 has been added to Section 3.2 of the report. In addition, Section 3.2 includes information regarding implementation of soil vapor sampling in July 2016 for use with evaluating the potential vapor intrusion risk to indoor air due to the buildings routinely occupied by workers at the Site.

3. **Section 2.2.5, Site FT-07E North Fire Training Area - East Side, Page 2-12 and Table 2.2.5, Site Chronology for FT-07E North Fire Training Area - East Side, Page 2-13 through 2-14:** Section 2.2.5 and Table 2.2.5 state that AFFF was used during fire training exercises; however, samples for PFAS analysis have not been collected. Before site closure is considered, soil and groundwater samples should be analyzed for PFAS. Please revise the text to include discuss how this data gap will be addressed at Site FT-07E.

AECOM RESPONSE: Presence of PFAS should not impact closure of a site in accordance with the current ROD; however, it is an emerging compound that should be assessed for each appropriate site. Information has been added to the FYR report that discusses the actions that are voluntarily being undertaken by the Air Force to assess the presence of PFAS at multiple sites located within the base. Two of the Sites include FT-07 and FT-07E. A Preliminary Assessment associated with PFAS was completed in October 2015, a Site Investigation Work Plan has been prepared and approved, and field investigation work to characterize soil and groundwater for the potential presence of PFAS commenced on June 26, 2017. The PFAS-related information is now included in Sections 1.1, 5.4, 5.5, and 6.0 of the report.

4. **Section 2.2.5, Site FT-07E North Fire Training Area - East Side, Page 2-12:** The text states that, “Arsenic was considered a COC due to detectable concentrations exceeding the EPA Region IX PRG of 0.38 mg/Kg. However, detectable concentrations of arsenic in soil were below the current Arizona SRL of 10 mg/Kg; therefore, arsenic was no longer considered a COC.” Please elaborate on the second sentence since it is not clear why arsenic results that are below the Arizona SRL but above the EPA Region IX PRG would lead to arsenic no longer being considered a COC.

AECOM RESPONSE: The subject text has been expanded as follows to more completely provide the rationale as to why arsenic was no longer considered a COC: “Arsenic was considered a COC due to detectable concentrations exceeding the EPA Region IX PRG of 0.38 mg/Kg. However, detectable concentrations of arsenic in soil were below the current Arizona SRL of 10 mg/Kg, *and within the range of naturally occurring concentrations included within the background data set for metals in soil at Luke AFB (Geraghty & Miller, 1997). In addition, arsenic is not expected to be related to past activities at Site FT-70E.* Therefore, arsenic was no longer considered a COC.”

In addition, Section 6.0 has been revised to provide a recommendation that an Explanation of Significant Differences (ESD) be prepared to regulate arsenic at select Luke ROD sites based on Arizona SRLs of 10 mg/kg arsenic rather than the 1996 PRG of 0.38 mg/kg arsenic. It also states that regulation of arsenic should also consider the background data set for metals in soil at Luke AFB.

5. **Section 2.2.8, LF-25 Northwest Landfill, Page 2-16:** The Remedial Objectives and Remedy Components are missing for LF-25 Northwest Landfill. It is unclear if remedial objectives and/or remedy components exist for Site LF-25. Please revise the text to include remedial objectives and remedy components for Site LF-25.

AECOM RESPONSE: The requested information has been incorporated into the text of Section 2.2.8, as follows: “*The remedial objectives and the remedy components specified in the OU-1 ROD for Site LF-25 are as follows:*

- *Remedial Objectives – To implement and maintain ICs that ensure protectiveness of human health and the environment.*

- *Remedy Components – The remedial action selected for implementation at LF-25 include:*
 - *Shallow soil remediation for lead shot removal;*
 - *Execution of a VEMUR to restrict land usage of the site to non-residential purposes;*
 - *Implementation and maintenance of occupational and environmental risk assessments for heavy metals in soil for all future excavation activities performed at the site.”*

6. **Section 2.2.9, RW-02 Wastewater Treatment Plan Annex Landfill, Page 2-18 and Table 2.2.9, Site Chronology for RW-02 Wastewater Treatment Plan Annex Landfill, Page 2-18 through 2-19:** The remedy components include “a geophysical monitoring program,” but Table 2.2.9 only includes radiological monitoring, which appears to be inconsistent with the remedy component description. If a geophysical monitoring program exists, monitoring events should be included in the table. Alternatively, the list of remedy components should include the radiological monitoring program. Please resolve this discrepancy.

AECOM RESPONSE: Use of the word “geophysical” associated with monitoring at Site RW-02 is incorrect. The monitoring being performed annually is radiological monitoring (for gamma radiation) in the soil surrounding the fenced low level radioactive waste burial site. Therefore, the word “geophysical” has been replaced with “radiological” in the third sub-bullet under Remedy Components.

7. **Section 2.2.11, SD-38 Oil/Water Separator at the Old Auto Body Shop, Page 2-21 and Figure 12, Site SD-38 Map:** Figure 12 should include the features discussed in Section 2.2.11 (e.g., solid waste management unit [SWMU] 116 and SWMU 128). It is unclear if one or both SWMUs are located within the Site Boundary on Figure 12. Section 2.2.11 refers to Figure 12 as a site map, but it contains insufficient detail to function as a site map. Please revise Figure 12 to include the features discussed in Section 2.2.11, including the SWMUs.

AECOM RESPONSE: AECOM has reviewed multiple major reference documents in an attempt to find a past figure or map that identifies the specific locations of SWMUs 116 and 128 at Site SD-38. These documents include the RCRA Facility Assessment (Geraghty & Miller, 1993), Final RI report (Geraghty & Miller, 1997), Final FS report (Geraghty & Miller, 1998), and the Final OU-1 ROD (ARCADIS Geraghty & Miller, 1999). However, a map with this information cannot be found. Therefore, AECOM proposes not to provide a new figure that shows the requested features because at the present time, one cannot be accurately developed. In the absence of an historic map, we request that the narrative explanation of the SWMUs (both oil/water separators) and their general locations provided in the Section 2.2.11 be considered sufficient.

8. **Section 3.0, Progress Since Last Review, Page 3-1:** This section should specifically address status of recommendations from previous Five-Year Review.

AECOM RESPONSE: The following statement was added in front of the first paragraph of Section 3.0: *“In the third FYR report, recommendations for follow-up actions were provided for Sites ST-18, LF-25, RW-02, and SS-42. The progress of these recommendations since the third FYR is provided in Sections 3.2, 3.8, 3.9, and 3.12. In addition, the Third FYR report provided a recommendation to update the Institutional Control Plan (ICP) and Base General Plan (now known as the Installation Development Plan [IDP]) to include land use restrictions for appropriate OU-1 and OU-2 sites. The schedule for completing this work was planned to be within one year for updating the BGP, and within two years for updating the ICP from when the final Third FYR Report was issued (July 2012). Both of the documents were updated and approved by the EPA. The updated IDP was finalized in April 2014, and the updated ICP was finalized in September 2014.”*

In addition a subsection was added at the end of each above referenced section detailing the status of recommendations from previous FYR, as follows:

- Under Section 3.2 for Site ST-18:

“Status of Recommendations from Previous FYR

The 2012 Third FYR Report provided a recommendation that water levels continue to be monitored at Site ST-18 and SS-42 to track the rising groundwater elevations at the site. Water levels (i.e., depth-to-water measurements and calculated associated groundwater elevations) have been collected annually at both ST-18 and SS-42. A discussion of the rate of rising water levels is provided in Section 6.0.

Additionally, two recommendations associated with the ST-18 concrete cap were made: 1) that the cap should be inspected annually, and that cracks should continue to be repaired with silicone sealant; and 2) to apply for funding in 2013 to perform an analysis to evaluate costs and benefits of continued maintenance versus cap replacement. The cap has been annually inspected and maintained. Applying for funding to perform a cost/benefit analysis was not done because the objective under the PBR contract has been to achieve SC which was considered possible. SC would of course, negate the need to replace the cap.”

- Section 3.12 for SS-42 :

“Status of Recommendations from Previous FYR

The 2012 Third FYR Report provided a recommendation that water levels continue to be monitored at Site ST-18 and SS-42 to track the rising groundwater elevations at the site. Water levels (i.e., depth-to-water measurements and calculated associated groundwater elevations) have

been collected annually at both ST-18 and SS-42. A discussion of the rate of rising water levels is provided in Section 6.0.”

- Section 3.9 for RW-02:
“The 2012 Third FYR Report provided a recommendation that Luke AFB work with ADEQ prior to the May 2012 monitoring event to assess the appropriateness of the current action level for gamma radiation monitoring.

- Modify/add to the last sentence in Section 3.8 for LF-25:

“The third FYR report indicates that during the subsequent five year period, Luke AFB would re-evaluate surface conditions at LF-25. This was reportedly an oversight by Luke AFB and not performed. Funding for this effort is not likely to be available until fiscal year 2020, as allocations for Fiscal Year 2018 and 2019 have been solidified/locked. However, Luke AFB plans to secure funding for fiscal year 2020 to re-evaluate surface conditions that will include sampling at Site LF-25 to assess the concentrations and extent of lead in soil.”

9. **Section 3.1, Site DP-23, Old Surface Impoundment West of Facility 993, Pages 3-1 and 3-2; Section 5.1, Site DP-23 Old Surface Impoundment West of Facility 993, Page 5-1; and Section 6.0, Issues and Recommendations/Follow-Up Actions, Page 6-1:** The third bullet point of Section 6.0 states that to obtain site closure for Sites DP-23 and FT-07E, a soil investigation for VOCs is required by the EPA and the Arizona Department of Environmental Quality (ADEQ) because total recoverable petroleum hydrocarbons (TRPH) were detected. However, TRPH and requirements for VOC testing are not consistently discussed throughout the text. For example, Section 3.1 does not mention the presence of TRPH, nor does Section 5.1. The text is inconsistent throughout the document regarding which sites are impacted by the EPA and ADEQ requirements for VOC testing at sites with detected TRPH. Please revise the text to clearly state which sites with previously detected TRPH are impacted by VOC testing requirements.

AECOM RESPONSE: DP-23 was erroneously added into the referenced bullet. Under the current Performance-Based Remediation (PBR) contract, investigation for VOCs rather than TRPH has been performed at ROD sites FT-07E, SD-20, and SD-38 per ADEQ’s requirements for consideration of SC. AECOM has revised the referenced bullet to provide the correct three sites (FT-07E, SD-20, and SD-38) undergoing the TRPH to VOCs demonstration for SC. In addition, the following statement was added to Question B of Sections 5.5 for FT-07E: *“The OU-1 ROD stipulates TRPH as a COC for Site (Select: FT-07E, SD-20, or SD-38). Under the existing PBR Contract, the Performance Objectives set-forth by AFCEC included Response Complete and/or achieving SC with UU/UE for the various ROD sites. The objective for Site (Select: FT-07E, SD-20, or SD-38) is SC; therefore, a VOC constituent investigation was undertaken as required by*

ADEQ and EPA for comparison of VOC results to established Arizona SRLs. This was required in lieu of sampling for TRPH because the cleanup level for TRPH in Arizona has been rescinded. Because there are numerous VOC constituents reported by the analytical method used to test collected soil samples (i.e., EPA Method 8260B), the use of Arizona SRLs for VOCs rather than a single cleanup level for TRPH is considered more protective to human health and the environment.”

Similar language has also been added to Question B of Sections 5.10 and 5.11 for Sites D-20 and SD-38, respectively.

- 10. Section 3.2, ST-18 Former Liquid Waste Storage Facility (Facility 993), Page 3-3 and Section 5.2, Site ST-18 Former Liquid Waste Storage Facility, Page 5-2:** The text states that reporting results are pending for July 2016 and February 2017 soil and soil vapor sampling results for ST-18. Please explain when results are expected and whether they will be made available to reviewing agencies before the next Five-Year Review.

AECOM RESPONSE: Following significant delay by the laboratory, the analytical data from soil vapor sampling to evaluate the risk of potential vapor intrusion into indoor air at Site ST-18 has been obtained, and the data has been validated. Preparation of the initial draft results report is in process. It is anticipated that this report will be submitted to AFCEC for review comments by mid-August 2017. After responses to comments are prepared, reviewed, and addressed, it is expected that a draft-final report will be submitted for review to the ADEQ by mid-November 2017.

The text in Sections 3.2 and 5.2 has been revised to indicate that the anticipated submittal date of a draft-final results report to the ADEQ is by mid-November 2017.

- 11. Section 3.5, Site FT-07E North Fire Training Area - East Side, Page 3-9 and Section 5.5, Site FT-07E North Fire Training Area-East Side, Page 5-3:** The text states that results of soil boring investigations at FT-07E for VOCs will be reported to ADEQ during first quarter of 2017. Please update to explain whether these results have been received. If they have not yet been received, the review should indicate when they are expected, and whether they will be provided to reviewing agencies prior to the next Five-Year Review.

AECOM RESPONSE: The samples collected during the October 2016 soil boring sampling for VOCs were mishandled by the laboratory which caused the data to be unusable. Due to the delays in reaching an agreement with the laboratory, re-sampling was not completed until May 3, 2017. This information is has been added under a new sub-section of Section 3.5 titled “May 2017 Soil Boring Re-Sampling for VOCs.”

In addition, at the end of this sub-section and in Section 5.5, Question B, the following explanation also has been added: *“After a lengthy period associated with reaching an agreement with the laboratory, a field investigation involving drilling and re-sampling three soil borings for VOCs was implemented on May 3, 2017 at Site FT-07E. The analytical results are currently being validated. Following preparation and submittal of a draft results report to AFCEC, and after incorporating AFCEC’s review comments, URS anticipates that a results report will be provided to ADEQ for review by no later than mid-September 2017.”*

- 12. Section 3.9, RW-02 Wastewater Treatment Plant Annex Landfill, Page 3-10:** The text states that the gamma radiation report for RW-02 is pending. The Five-Year Review should indicate when this report is expected, and whether it will be provided to reviewing agencies prior to the next Five-Year Review.

AECOM RESPONSE: The text in the last sentence of Section 3.9 has been modified to reflect the current status of reporting and the anticipated month that a results report will be provided for review to ADEQ, as follows: *“A draft results report for annual radiological monitoring at Site RW-02 was provided to AFCEC for review in late June 2017. After review comments are received, responses to AFCEC’s comments are prepared, and comments are incorporated, URS anticipates that a draft results report will be submitted for review to ADEQ in early August 2017.”*

- 13. Section 3.10, SD-20 Oil/Water Separator Canal and Earth Fissure, Page 3-12:** The text states that VOC sample results are pending for SD-20. The Five-Year Review should indicate when these results are expected, and whether they will be provided to reviewing agencies prior to the next Five-Year Review.

AECOM RESPONSE: The following explanation has been added as the last sentence to Section 3.10: *“Sample analytical results have been received and the VOC data has been validated. The results of all detected VOCs indicate no concentration exceedances to the Arizona NR-SRLs. A draft RACR is being prepared for submittal to AFCEC by the end of July 2017. After review comments are received, responses to AFCEC’s comments are prepared, and comments are incorporated, URS anticipates that a draft results report will be sent to ADEQ for review by late August 2017.”*

- 14. Section 3.11, SD-38 Oil/Water Separator at the Old Auto Body Shop, Page 3-14:** The text states that resampling at SD-38 will be performed in the first quarter of 2017. The Five-Year Review should indicate whether this has occurred, and whether results will be provided to reviewing agencies prior to the next Five-Year Review.

AECOM RESPONSE: The following explanation has been added as the last sentence to Section 3.11: *“Therefore, re-sampling soil adjacent to SB-9 at that same depth was performed on May 3, 2017. Sample analytical results were*

received and the VOC data has been validated. The results of all detected VOCs indicate no concentration exceedances to the Arizona NR-SRLs. A draft results report is being prepared for submittal to AFCEC. After review comments are received, responses to AFCEC's comments are prepared, and comments are incorporated, URS anticipates that a draft results report will be sent to ADEQ for review by late August 2017."

15. **Section 3.12, SS-42 Bulk Fuels Storage Area, 2014 and 2015 Annual Groundwater Monitoring/Reporting, Page 3-14; Section 3.2, ST-18 Former Liquid Waste Storage Facility (Facility 993), Page 3-2; and Section 3.9, RW-02 Waste Water Treatment Plant Annex Landfill, Page 3-10:** Section 3.12 states that a final annual groundwater monitoring report was prepared and submitted on January 31, 2017 (URS, 2017) combining the results of monitoring activities from SS-42, ST-18, and RW-02; however, neither monitoring activities nor the final annual groundwater monitoring report are mentioned in sections discussing Sites ST-18 and RW-02, which includes Sections 3.2 and Section 3.9. Please revise Sections 3.2 and 3.9 to include the final annual groundwater monitoring report discussion submitted on January 31, 2017 in the discussion of monitoring activities for Sites ST-18 and RW-02.

AECOM RESPONSE: The requested information has been added in Section 3.2 pertaining to monitoring at Site ST-18, as follows:

"2014 and 2015 Annual Groundwater Monitoring/Reporting

A final annual groundwater monitoring report associated with sampling activities performed on October 21, 2014 and December 2-3, 2015 was prepared by URS and submitted to Luke AFB and the ADEQ on January 31, 2017 (URS, 2017). The report combined the results of monitoring activities from three sites: SS-42, ST-18, and RW-02. Prior to this, the draft final annual LTM report for Sites SS-42, ST-18, and RW-02 had been submitted to the ADEQ for review comments. The ADEQ provided comments to the draft final report in a letter dated September 13, 2016 (ADEQ, 2016f). On January 10, 2017, the ADEQ provided concurrence that the responses to comments were acceptable to finalize the report (ADEQ, 2017).

Analytical results for both the October 2014 and December 2015 groundwater sampling events showed that that there were no detectable concentrations of VOCs present above established Arizona AWQS or Tier 1 guidance levels."

It should be noted that because it is outside the scope of authorized work, no groundwater monitoring has been performed at Site RW-02 since the PBR contract for Luke AFB was executed on September 20, 2013. The monitoring referred to in the FYR report is solely for annual radiological monitoring of soil at the low-level radioactive waste burial pit. To provide and clarify this information, the following has been added as the first sub-section/paragraph to Section 3.9:

"2014 and 2015 Annual Radiological Monitoring/Reporting

Annual radiological monitoring at Site RW-002, as required by the OU-1 ROD, was conducted on December 8, 2014 and on December 17, 2015. The procedures involving gamma radiation monitoring were conducted in accordance with the Luke AFB LTM Work Plan (Malcolm Pirnie, 2009). For both the December 2014 and 2015 monitoring events, gamma radiation measurements collected at monitoring locations MP-1 to MP-4 were consistent with the gamma radiation measurements collected from the background location BG-1 (see Figure 10a). No measurements over the action level of 24,122 counts per minute were recorded, therefore no notifications were made. The 2014 and 2015 data were consistent with the historical data, indicating there was no change in the subsurface gamma radiation levels. Additionally, exposure rate measurements collected during 2014 and 2015 monitoring at the site, were within background levels. Therefore, it was determined that in 2014 and 2015 that Site RW-02 did not present a gamma radiation exposure hazard to the public.”

16. **Section 3.13, Site TU-44 Waterdog Recreation Annex, Page 3-17 and Figure 14a, Site TU-44 Map:** Section 3.13 states that seven new monitoring wells (MW) were constructed (MW-17 through MW-23); however, these wells are not presented on Figure 14a. Figure 14a should include all of the monitoring wells installed at TU-44. Moreover, the text states that existing wells MW-5 and MW-12 were over-drilled and replaced, but Figure 14a does not identify replacement wells and wells that have been abandoned. Please revise Figure 14a to include all newly constructed monitoring wells, in addition to wells that have been abandoned and/or replaced.

AECOM RESPONSE: A revised Figure 14a has been prepared that shows the requested information.

17. **Section 4.0, Five-Year Review Process, Page 4-1:** While Section 4.0 contains information regarding community notification, involvement, and site interviews, it does not contain information regarding administrative components of the Five-Year Review process such as the identification of members of the review team or outline of components and Five-Year Review schedule. The EPA Comprehensive Five-Year Review Guidance (Guidance) dated June 2001 indicates that members of the review team and a review schedule should be included in the Five-Year Review. Please revise Section 4.0 to include additional details on the administrative components of the Five-Year Review.

AECOM RESPONSE: Section 1.0 identifies the FYR team members, which was expanded to include all personnel reviewing the report. In section 4.0 a table (Table 4.1) was added to present the administrative components and the review schedule.

18. **Section 4.3, Site Inspection, Page 4-3:** Section 4.3 presents the attendees of the site inspection, but it is unclear if the Regulatory Agencies were invited to participate or if they attended. Please revise the text to clarify whether the Regulatory Agencies were invited to participate in the site inspection.

AECOM RESPONSE: The first paragraph of referenced has been modified to include the following statement: *“There were no invitations or notifications sent to members of Regulatory Agencies to attend the fourth FYR site inspections.”*

19. **Section 5.1, Site DP-23 Old Surface Impoundment West of Facility 993, Page 5-1:** The text states “The physical conditions in conjunction with the ICs at the site are believed to be adequately protective.” Please elaborate on what is meant by “physical conditions,” and how those relate to protectiveness for DP-23.

AECOM RESPONSE: The first paragraph of Section 5.1, Question A has been modified as follows to include information on the physical conditions observed at the site and how these relate to protectiveness: *“The concrete and asphalt pavement that encompass a large portion of the site were observed to be good, as there was no pavement settlement or spalling observed, and only a limited amount of small/ insignificant cracks noticed. The unpaved landscape areas of the site were observed to be well-maintained with little to no surface erosion, and no pits, open excavations, or surface stains were observed. Consequently, the ability of storm water to infiltrate ground excessively through surface disturbance potentially mobilizing contaminants from the vadose zone to groundwater is considered improbable. Based on the aforementioned information, and in conjunction with ICs at the site, it is believed that the existing physical conditions at Site DP-23 are adequately protective.”*

20. **Section 5.5, Site FT-07E North Fire Training Area - East Side, Page 5-4:** The text states that, “as described for Site ST-07 above, PFAS compounds” This is the first and only reference to “ST-07”. Is this a separate site or is it supposed to be FT-07? In addition, there is no preceding discussion of PFAS compounds for any sites. The Five-Year Review should elaborate on any new information regarding PFAS compounds at the facility, and any plans for addressing PFAS compounds.

AECOM RESPONSE: The reference to “ST-07” is a typographical error and has been deleted.

21. **Section 5.11, Site SD-38 - Oil/Water Separator at Old Auto Body Hobby Shop, Page 5-6 and Section 5.12 Site SS-42 Bulk Fuels Storage Area, Page 5-7:** The texts state that “Changes in soil and groundwater ARARs or toxicity values would not affect the protectiveness of the remedy.” and “Changes in soil and groundwater toxicity values do not affect the protectiveness of the remedy.” respectively. These require additional explanation/support. For these sites, and for any other where the same statement is used, please explain first whether there have been any changes in soil and groundwater ARARs or toxicity values. If there have been such changes, the Five-Year Review should elaborate on why these are not expected to affect the protectiveness of the remedy.

AECOM RESPONSE: The two sentences specific to the above comment have been removed from the responses to Question B within Section 5.0.

22. **Section 5.13, Site TU-44 Waterdog Recreational Annex, Page 5-8:** The answer to Question B is somewhat misleading because there were no RAOs or remedies selected for this site through the RODs.

AECOM RESPONSE: The “Yes” response has been changed to the following: *“Not applicable. Site TU-44 is not listed in either of the Luke AFB OU-1 or OU-2 RODs.”*

23. **Section 6.0, Issues and Recommendations/Follow-Up Actions, Page 6-1 and Section 5.10, Site SD-20, Oil/Water Separator Canal and Earth Fissure, Page 5-6:** The text of the fourth bullet in Section 6.0 states that Section 5.10 discusses the discovery, initial response actions, and the intent to conduct characterization due to the discovery of oil on surface water and oil staining on soil at Site SD-20, but Section 5.10 does not include this information. Please revise Section 5.10 to include this information; alternatively, provide a reference to where this information can be found.

AECOM RESPONSE: Information was added into Section 5.10, Question C, describing the oil-related release to surface water and Luke AFB’s response actions.

24. **Section 6.0, Issues and Recommendations/Follow-Up Actions, Page 6-1:** It is unclear whether groundwater monitoring was performed at RW-02 after the third Five-Year Review. The fifth bullet point of Section 6.0, LTM [Long Term Monitoring] Status at Site FT-07E, RW-02, and SD-20, states that groundwater monitoring has not been performed at Sites FT-07E, RW-02, and SD-20 since the third Five-Year Review period ended in May 2011. However, Section 3.12, SS-42 Bulk Fuels Storage Area, states that a final annual groundwater monitoring report combined the monitoring activities from sites SS-42, ST-18, and RW-02. Please revise the text to clarify whether groundwater monitoring activities occurred at Site RW-02 after the Third Five-Year Review.

AECOM RESPONSE: Because it is outside the scope of authorized PBR contract work, no groundwater monitoring has been performed at Sites RW-02, FT-070E, and SD-20 since the contract for Luke AFB was executed on September 20, 2013. The monitoring at Site RW-02 referred to in the FYR report is solely annual radiological monitoring of soil at the low-level radioactive waste burial pit. To clarify this, the word “Groundwater” has been removed from title of the last sub-section in Section 3.12 which is now called *“2014 and 2015 Annual Monitoring/Reporting”*. In addition, a new footnote #2 has been added that is referenced at the end of the second sentence in the sub-section. The footnote states: *“The monitoring work at Site RW-02 consisted of radiological monitoring at the low-level radioactive waste burial pit area and no groundwater monitoring.”*

25. **Section 6.0, Issues and Recommendation/Follow-up Actions, Sites DP-23 and FT-07E, Page 6-1:** The Five-Year Review should discuss the Air Force’s proposed follow-up actions regarding VOC-related investigations, data evaluation, and results reporting, rather than discussing URS’s recommendations.

AECOM RESPONSE: We concur. The last statement in the third bullet of Section 6.0 has been modified to: “In an effort to realize the objective of attaining SC with UU/UE, *the Air Force intends to complete* the VOC-related investigations, data evaluation, and results reporting.”

Note: In the third bullet of Section 6.0, AECOM has identified and corrected a mistake in the underlined identification of one of the sites: Site “DP-23” has been corrected to Site “SD-38”. In addition, Site “SD-20” was added to the bullet. The underlined phrase at the beginning of the third bullet has been corrected to “Sites SD-20, SD-38 and FT-07E.”

26. **Section 6.0, Issues and Recommendations/Follow-Up Actions, Page 6-2 and Section 3.8, LF-25 Northwest Landfill, Page 3-10:** The first bullet on Page 6-2 states that the re-evaluation of surface conditions at LF-25 was not conducted, but this information was not included in the discussion of the progress since the last review section for this site. Specifically, this information should be presented earlier in the text in Section 3.8, LF-25 Northwest Landfill. Please revise Section 3.8 to include text stating that the re-evaluation of surface conditions at LF-25 was not conducted. However, if re-evaluating surface conditions at Site LF-25 is necessary to determine protectiveness, please provide proposed course of action.

AECOM RESPONSE: Section 3.8 has been revised to include the following a statement: “*The third FYR report indicates that during the subsequent five year period, Luke AFB would re-evaluate surface conditions at LF-25. This was reportedly an oversight by Luke AFB and not performed. Funding for this effort is not likely to be available until fiscal year 2020, as allocations for Fiscal Year 2018 and 2019 have been solidified/locked. However, Luke AFB plans to secure funding for fiscal year 2020 to re-evaluate surface conditions that will include sampling at Site LF-25 to assess the concentrations and extent of lead in soil.*”

27. **Section 7.0, Protectiveness Statement, Page 7-1:** There should be a separate protectiveness statement for each OU, as well as a site-wide protectiveness statement per 2012 Guidance: “Clarifying the Use of Protectiveness Determinations for CERCLA Five Year Reviews”. Protectiveness statements should follow language and format specified in that guidance. Specifically, the Air Force should determine that the remedy is protective, short-term protective, will be protective, protectiveness deferred, or not protective (“adequately protective” is not an option provided in the guidance).

AECOM RESPONSE: The adjective “adequately” has been removed to describe the word “protective” in Section 7.0.

28. **Section 7.0, Protectiveness Statement, Page 7-1:** Additional explanation would be helpful to explain how the network of groundwater monitoring wells at Site TU-44 relates (or doesn't relate) to the protectiveness of the remedies.

AECOM RESPONSE: We believe that the last two sentences of the last paragraph of Section 7.0 do provide an adequate explanation of how use of the monitoring wells relate to site protectiveness, particularly which is associated with the BOS[®] 200 product injections. However to enhance this explanation, the following additional sentence has been added as the final sentence in the paragraph: *“Going forward, regardless of the ultimate remedy or remedies used to complete groundwater remediation at Site TU-044, the network of monitoring wells will be used to assess the on-going protectiveness of the remedies by providing a means to evaluate the hydrogeologic conditions at the site including the stability, nature, and extent of the contaminant plume.”*

29. **Attachment A, Site Inspection Forms and Section 6.0, Issues and Recommendations/Follow-Up Actions, Page 6-1:** The TU-44 Site Inspection Form notes that drums containing soil cuttings and well development water require removal but this recommendation was not included in Section 6.0. Please revise Section 6.0 to include text regarding a recommendation to remove drums containing soil cuttings and well development water.

AECOM RESPONSE: As requested, a description has been provided in a new bulleted paragraph that states the following:

“Removal of Drums Containing IDW at Site TU-44. During the site inspection on October 5, 2016, a total of 36 labeled drums containing both soil cuttings (26 drums) and well development/groundwater (11 drums) were observed at the site. These 55-gallon drums were used to contain wastes generated during the time period of the BOS 200[®] pilot test when injection boreholes and seven new monitoring wells were installed. Collection of composite samples from the drums for laboratory analysis was performed on October 13, 2017 to characterize the wastes to obtain approval for proper off-site treatment and/or disposal of the wastes. AECOM recommends that the drums be removed by a qualified and waste contractor and transported to an appropriate licensed disposal facility or facilities.”

30. **Appendix B, Site Inspection Photographic Log, Page 4 of 11 and Section 6.0, Issues and Recommendations/Follow-Up Actions, Page 6-1:** Photograph 23 shows multiple animal burrow holes but Section 6.0 does not recommend that the animal burrows be filled. Moreover, Photograph 23 appears to be mislabeled and should likely be Photograph 13, as another Photograph 23 is presented on Page 6 of 11. Please revise Section 6.0 to include a recommendation regarding filling the animal burrows shown in the Photograph 23 and resolve the apparent numbering discrepancy.

AECOM RESPONSE: The photograph number has been corrected from “23” to “13.” An additional bulleted paragraph has been added to Section 6.0 that states the following:

“Filling Animal Burrow Holes at Site LF-14. During the September 27, 2017 FYR inspection of Site LF-14, a considerable number of small animal burrow holes (presumably from rodents) were observed along the northern portion of the site. To mitigate enhanced infiltration of storm water into the waste materials below, the Air Force intends to fill the burrow holes with clean soil and/or re-grade the affected area in a manner that fills the holes.”

MINOR COMMENTS

- 1-7** These are primarily associated with correcting typographical errors, formatting, and incorrect references within the text

AECOM RESPONSE: AECOM has incorporated changes that address the EPA’s minor Comments 1-7.

- 8. Figures.** While Section 2.1 Basis for Taking Action (Pages 2-1 through 2-4), includes tables providing a summary of COCs detected in soil or groundwater exceeding applicable screening levels, adding the most relevant values and/or exceedances to figures would be helpful to clarify the extent of contamination at each site. Please revise the figures to include this information.

AECOM RESPONSE: We believe that the information in the tables and text adequately communicate the necessary information, and that the detailed information can be found on figures included in the major reports listed at the beginning of Section 2.0. Therefore, we respectfully decline to make the suggested additions.

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Douglas A. Ducey
Governor

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY



Misael Cabrera
Director

EMAIL AND U.S. MAIL
August 4, 2017
FPU 18-017

Stephanie McCary
Environmental Restoration
5960 Swaab Boulevard
Nellis AFB, NV 89191

Re: LAFB – ADEQ Review of RTC on Draft Final Fourth Five-Year Review Report OU1, OU2 and TU-44, received July 10, 2017

Dear Ms. McCary:

The Arizona Department of Environmental Quality (ADEQ) has reviewed the above referenced document for Luke Air Force Base and generally finds the responses acceptable with the exception of one minor comment.

Specific Comment:

- 1) **Page 2-11, Section 2.2.4, First paragraph, Third sentence;** AECOMs' response to the original comment was generally acceptable, however, it is requested, if known, the actual name of the model used be added rather than referring to "a vadose zone transport model".

Should you have any comments or questions regarding this matter, please do not hesitate to contact me at (602) 771-0200 or lf4@azdeq.gov.

Sincerely,

Laura Fischer
Project Manager
Federal Projects Unit
Waste Programs Division, ADEQ

Cc: Chad Coker – Matrix (electronic)

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From: MCCARY, STEPHANIE D GS-12 USAF AFCEC 99 MSG/CZO <stephanie.mccary@us.af.mil>
Sent: Friday, August 04, 2017 12:16 PM
To: Kim, John (Phoenix); FICKLEN, HOLMES D GS-13 USAF AFMC AFCEC/CZRW
Cc: ROTHROCK, CHARLES J GS-13 USAF AETC 56 CES/CEIE; TARLETON, KEVIN A CTR USAF AFMC AFCEC/CZR
Subject: FW: LAFB - ADEQ Comments on Draft Final Fourth Five Year Review
Attachments: Luke AFB Fourth FYR Report RTCs and Redline Version - June 2017.pdf
Signed By: stephanie.mccary@us.af.mil

John,
Attached are the EPAs comments on the RTCs.
Thanks,

Stephanie McCary
AFCEC/CZOW
Nellis IST
COM (702)652-9365
DSN 682-9365

-----Original Message-----

From: Tran, Xuan-Mai [<mailto:Tran.Xuan-Mai@epa.gov>]
Sent: Thursday, August 03, 2017 3:46 PM
To: MCCARY, STEPHANIE D GS-12 USAF AFCEC 99 MSG/CZO
<stephanie.mccary@us.af.mil>; Chad Coker <chad_coker@matrixdesigngroup.com>;
Laura Fischer <Fischer.Laura@azdeg.gov>
Cc: ROTHROCK, CHARLES J GS-13 USAF AETC 56 CES/CEIE
<charles.rothrock@us.af.mil>; Chesnutt, John <Chesnutt.John@epa.gov>
Subject: [Non-DoD Source] RE: LAFB - ADEQ Comments on Draft Final Fourth
Five Year Review

Hi Stephanie,

Thank you for the RTCs and the redline version of Luke AFB Fourth FYR
Report, dated June 2017. EPA has reviewed the RTCs and the redline version
and have a few remaining comments. These remaining comments are straight
forward. Please let me know when we can expect the responses to these
remaining comments.

Thanks,
XM

-----Original Message-----

From: MCCARY, STEPHANIE D GS-12 USAF AFCEC 99 MSG/CZO
[<mailto:stephanie.mccary@us.af.mil>]
Sent: Monday, July 10, 2017 12:22 PM
To: Chad Coker <chad_coker@matrixdesigngroup.com>; Laura Fischer
<Fischer.Laura@azdeg.gov>; Tran, Xuan-Mai <Tran.Xuan-Mai@epa.gov>
Subject: RE: LAFB - ADEQ Comments on Draft Final Fourth Five Year Review

Attached are the RTCs for the Luke 5 year review. Sorry for not sending
these earlier.
Let me know if you have any concerns with the RTCs.
Thank you,

Stephanie McCary
AFCEC/CZOW
Nellis IST
COM (702)652-9365
DSN 682-9365

Review of the Responses to Comments on the Draft-Final Fourth Five-Year Review Report, OU1, OU2 and TU-44, Luke Air Force Base, Arizona, and the Redline Draft-Final Fourth Five-Year Review Report OU1, OU2 and TU-44, Luke Air Force Base, Arizona, June 2017

Evaluation of the Response to General Comment (GC) 3: The response partially addresses the comment. Since vapor intrusion (VI) risk was not calculated for most sites with shallow contamination (e.g., DP-13, SD-20, TU-44, etc.), it is recommended that if structures are built on those sites in the future, the Redline Draft-Final Fourth Five-Year Review Report OU1, OU2 and TU-44, Luke Air Force Base, Arizona (Redline FYR) should assess VI risk in a manner similar to the approach used for SS-042. Please revise the Redline FYR to state that in the case that future structures will be built on sites with shallow contamination, VI risk will be assessed accordingly.

Evaluation of the Response to Specific Comment (SC) 4: The response addresses the comment; however, the range for background levels of arsenic should be included to clarify why it is no longer a contaminant of concern (COC). Please revise Section 2.2.5, Site FT-07E North Fire Training Area – East Side, to include the background level for arsenic at Luke Air Force Base.

Evaluation of the Response to SC 8: The response partially addresses the comment. While updates were provided for Site ST-18, SS-42, and LF-25, it is unclear whether the recommendation from the 2012 Third Five-Year Review Report for Site RW-02 was addressed, based on the note to Air Force Civil Engineering Center (AFCEC) included in the response. Additionally, the update for Site ST-18 states that site closure (SC) would negate the need to replace the cap. However, according to Section 3.2, ST-18 Former Liquid Waste Storage Facility, the cap is a required part of the remedy. If the site were to achieve closure, the cap must continually be maintained unless there is a Record of Decision Amendment (RODA) or an Explanation of Significant Differences (ESD) document generated that removes the cap as a required remedy component for this site or if it can be demonstrated that no hazardous wastes or contaminants remain at this site. Please revise Section 3.9, RW-02 Wastewater Treatment Plant Annex Landfill, to include a more detailed status of recommendations from the previous Five-Year Review for Site RW-02. Additionally, please revise Section 3.2 to state that a RODA or ESD would be required to negate the need to replace the cap upon SC.

Evaluation of the Response to SC 16: The response partially addresses the comment. While monitoring wells (MW) were added to the figure, existing wells MW-5 and MW-12 were not differentiated as being over-drilled and replaced. It is unclear from the figure that MW-5 and MW-12 were replaced. Please revise Figure 14a, Site TU-44 Map, to include a legend icon for wells that have been replaced.

Evaluation of the Response to SC 27: The response partially addresses the comment. While the language for site-wide protectiveness was modified to address the comment, a separate protectiveness statement was not generated for each operable unit (OU) as specified in the original comment. Please revise Section 7.0, Protectiveness Statement, to include a separate protectiveness statement for each OU.

Minor Comments:

1. In the “RTC – EPA Review of Luke AFB FYR Report” document, on Page 17 of 17, the paragraph that begins “Filling Animal Burrow Holes...” says that “during the September 27, **2017** FYR inspection...”, this should probably be **2016**. The same error is repeated on Page 6-3 of the redline version of the Draft Final Fourth Five-Year Review Report.
2. In the redline version of the Draft Final Fourth Five-Year Review Report, Page 2-11, second to last sentence in second to last paragraph, “predictions” should be “predicted.”
3. In the redline version of the Draft Final Fourth Five-Year Review Report, Page 3-13, the heading just below the middle of the page is “September 2015 Soil Boring Sampling Results,” but then the section actually talks about soil borings done in February 2016. Is one of these dates wrong? Also, there is a typo in that first sentence, which should read “to advance” rather than “to advanced.”

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15 August 2017

MEMORANDUM – Final

TO: Don Ficklen, AFCEC/CZRW
Stephanie McCary, AFCEC/CZOW
Jeff Rothrock, USAF AETC 56 CES/CEIE

FROM: John Kim, AECOM Project Manager

CC: Jeff Rackow, AECOM Task Manager

Re: 2nd Response to the ADEQ Review of RTCs to Draft-Final Fourth Five-Year Review Report, OU1, OU2 and TU-44 Luke Air Force Base, Glendale, Arizona, Contract FA8903-16-D-0029 Task Order 0004, Subtask 3.3, CDRL A001e

The following provides URS Group, Inc. (an AECOM company) response to the Arizona Department of Environmental Quality's (ADEQ) letter date August 4, 2017 regarding; *ADEQ Review of RTC on Draft Final Fourth Five-Year Review Report OU1, OU2, and TU-44, received July 10, 2017.*

SPECIFIC COMMENT

1. Page 2-11, Section 2.2.4, First paragraph, Third sentence; AECOM's response to the original comment was generally acceptable, however, it is requested, if known, the actual name of the model used be added rather than referring to "a vadose zone transport model:.

AECOM RESPONSE: We have added the name of the document in which the Vadose Zone Transport Model is contained, and the computer code utilized for the model. The text in Section 2.2.4, third paragraph has been modified as follows:

".....In addition, a vadose zone transport model was used to evaluate the current potential for COCs in soil at OU-2 to leach from the soil and cause impact to groundwater. *Details about the model, which utilized a computer code known as MULTIMED to simulate one-dimensional vertical flow and solute transport in the unsaturated zone, is provided in the 1993 Final Feasibility Study Report, Appendix A, Vadose Zone Transport Model, OU-2, Luke AFB, Arizona.....*"

Please contact John Kim at 602-648-2523 if you have any questions or need additional information.

Sincerely,

AECOM

A handwritten signature in black ink, appearing to read "J. Kim", written in a cursive style.

John Kim
Project Manager

15 August 2017

MEMORANDUM – Final

TO: Don Ficklen, AFCEC/CZRW
Stephanie McCary, AFCEC/CZOW
Jeff Rothrock, USAF AETC 56 CES/CEIE

FROM: John Kim, AECOM Project Manager

CC: Jeff Rackow, AECOM Task Manager

Re: 2ND Response to USEPA Review of RTCs to Draft-Final Fourth Five-Year Review Report, OU1, OU2 and TU-44, Luke Air Force Base, Glendale, Arizona, Contract FA8903-16-D-0029 Task Order 0004, CDRL A001e

The following provides URS Group, Inc. (an AECOM company) response to the Environmental Protection Agency's (EPA) email date August 3, 2017 regarding; *EPA Review of RTC on Draft Final Fourth Five-Year Review Report OU1, OU2, and TU-44.*

EPA'S SUBSTANTIVE COMMENTS:

1. **Evaluation of the Response to General Comment (GC) 3:** The response partially addresses the comment. Since vapor intrusion (VI) risk was not calculated for most sites with shallow contamination (i.e., DP-13, SD-20, TU-44, etc.), it is recommended that if structures are built on those sites in the future, the Redline Draft-Final Fourth Five-Year Review Report OU-1, OU-2, and TU-44, Luke Air Force Base, Arizona (Redline FYR) should assess VI risk in a manner similar to the approach used for SS-042. Please revise the Redline FYR to state that in the case that future structures will be built on sites with shallow contamination, VI risk will be assessed accordingly.

AECOM RESPONSE: We concur. The following text has been added to Section 6.0, Issues and Recommendations/Follow-Up Actions:

Vapor intrusion risks do not presently exist at Sites DP-13, FT-07, FT-07E, LF-03, LF-14, LF-25, RW-02, SD-20, and TU-44 due to the absence of any enclosed structures within or near the contaminant source area(s) that could be occupied by personnel. However, if plans are made in the future to construct new enclosed buildings or other structures on any of these sites, the vapor intrusion risk to human health should be evaluated. Considerations for the evaluation may include the proximity of planned structure(s) to the soil contamination area(s); the

inclusion of engineering controls in construction of the structure(s) to protect against vapor intrusion; whether or not the site has achieved SC, etc.

2. **Evaluation of the Response to Specific Comment (SC) 4:** The response addresses the comment; however, the range for background levels of arsenic should be included to clarify why it is no longer a contaminant of concern (COC). Please revise Section 2.2.5. Site FT-07E North Fire Training Area – East Side, to include the background level for arsenic at Luke Air Force Base.

AECOM RESPONSE: Section 2.2.5 has been revised to the following:

Arsenic was considered a COC due to detectable concentrations exceeding the EPA Region IX PRG of 0.38 mg/Kg. However, detectable concentrations of arsenic in soil were below the current Arizona SRL of 10 mg/Kg and within the range of naturally occurring concentrations included within the background data set for metals in soil at Luke AFB (Geraghty & Miller, 1997). *More specifically, the October 31, 1997 Final Appendix B Baseline Basewide Risk Assessment Risk Assessment report (Volume II of II) for Luke AFB states the following for arsenic detections in background soils:*

“Arsenic was reported above the PQLs in 33 of the total 190 results (17 percent prevalence) for background Luke AFB samples; the maximum value was 26 mg/kg. The PQLs for arsenic were generally < 5 mg/kg. The detections distribution was 8 detections in surficial samples and 22 detections in soils between 0 and 16 feet bgs. Mean arsenic concentrations were similar (3.7 mg/kg for surface soils; 3.5 mg/kg in soils from 0 to 16 feet bgs). The tolerance level for arsenic at Luke AFB is 8 mg/kg for surficial soils and 9 mg/kg for soils between 0 to 16 feet bgs and for all soils.”

In addition, arsenic is not expected to be related to past activities at Site ST-70E. Therefore, arsenic was no longer considered a COC.

3. **Evaluation of Response to SC 8:** The response partially addresses the comment. While updates were provided for Site ST-18, SS-42, and LF-25, it is unclear whether the recommendation from the 2012 Third Five-Year Review Report for RW-02 was addressed, based on the note to Air Force Civil Engineering Center (AFCEC) included in the response. Additionally, the update for Site ST-18 states that site closure (SC) would negate the need to replace the cap. However, according to Section 3.2, ST-18 Former Liquid Waste Storage Facility, the cap is a required part of the remedy. If the site were to achieve closure, the cap must continually be maintained unless there is a Record of Decision Amendment (RODA) or an Explanation of Significant Differences (ESD) document generated that removes the cap as a required remedy component for this site or if it can be demonstrated that there are no hazardous wastes or contaminants remain at the site. Please revise Section 3.9, RW-02 Wastewater Treatment Plant Annex Landfill, to include a more detailed status of recommendations from the previous Five

Year Review for Site RW-02. Additionally, please revise Section 3.2 to state that a RODA or ESD would be required to negate the need to replace the cap upon SC.

AECOM RESPONSE: The text in the last paragraph of Section 3.2 has been expanded/modified to address the comment as follows (the changes are shown with italicized font).

The cap has been annually inspected and maintained. Applying for funding to perform a cost/benefit analysis was not done because the objective under the PBR contract has been to achieve SC which was considered possible. *If SC is achieved, continuing to maintain the cap and/or potentially replacing it would still be necessary because the cap is a required part of the remedy as specified in the January 1994 ROD for OU-2. Assuming SC is achieved, the air force intends to submit an ESD document to remove the cap as a required remedy component of ST-18, so that continued cap maintenance no longer would be required.*

In response to EPA's comment about the gamma radiation action level for monitoring at Site RW-02, additional information in the last paragraph of Section 3.9 has been prepared as follows:

The 2012 Third FYR Report provided a recommendation that Luke AFB work with ADEQ prior to the May 2012 monitoring event to assess the appropriateness of the current action level for gamma radiation monitoring. *As written in the LTM Plan, the current action level is based on two-times the value of the lowest measured concentration of gamma radiation in the background monitoring point (BG-1). The Air Force engaged in conversations with the ADEQ about the action level; ADEQ was interested in establishing a firm action level rather than a "floating" level. The Air Force evaluated the historical action levels derived from annual monitoring and determined that the levels have been relatively steady over time. A copy of the historical gamma radiation action levels is included in Attachment F. The Air Force has indicated that it cannot recall if the data table was sent out to the agencies for comments, and documentation as such by the Air Force is not available. A recommendation to revisit this matter has been provided in Section 7.0.*

In addition, a recommendation to follow-up with ADEQ on this matter has been added as the last bullet of Section 6.0 as follows.

- Gamma Radiation Action Level for Site RW-02. The 2012 Third FYR Report provided a recommendation that Luke AFB work with ADEQ prior to the May 2012 monitoring event to assess the appropriateness of the current action level for gamma radiation monitoring. The matter was discussed with the ADEQ and the Air Force had compiled and evaluated the action level data (see Section 3.9 and Attachment F). It is recommended that prior to the next Site RW-02 annual monitoring event in December 2107, that the action level issue be revisited between the Air Force, EPA,

and/or ADEQ.

4. **Evaluation of Response to SC 16:** The response partially addresses the comment. While monitoring wells were added to the figure, existing wells MW-5 and MW-12 were not differentiated as being over-drilled or replaced. It is unclear from the figure that MW-5 and MW-12 were replaced. Please revise Figure 14a, Site TU-44 Map, to include a legend icon for wells that have been replaced.

AECOM RESPONSE: Figure 14a has been revised to include a unique symbol for wells MW-5 and MW-12 to designate that they were replaced. The symbol is defined in the Legend as “Replaced Well,” and a note has been added to the lower left corner on the aerial photograph portion of the figure that indicates the month/year that wells MW-5 and MW-12 were replaced.

5. **Evaluation of Response to SC 27.** The response partially addresses the comment. While the language for site-wide protectiveness was modified to address the comment, a separate protectiveness statement was not generated for each operable unit (OU) as specified in the original comment. Please revise Section 7.0, Protectiveness Statement, to include a separate protectiveness statement for each OU.

AECOM RESPONSE: Section 7.0 has been expanded and reorganized to provide both a listing of the applicable sites and separate protectiveness statements for the OU-1 and OU-2 sites, as well as Site TU-044.

EPA’S MINOR COMMENTS:

1. In the “RTC-EPA Review of Luke AFB FYR Report” document, on page 17 of 17, the paragraph that begins “Filling Animal Burrow Holes...” says that during September 27, **2017** inspection...”, this should probably be **2016**. The same error is repeated on Page 6-3 of the redline version of the Draft-Final Fourth Five-Year Review Report.

AECOM RESPONSE: The error has been corrected from year 2017 to year 2016 in the redline version of the report.

2. In the redline version of the Draft-Final Fourth Five-Year Review Report, page 2-11, the second to last sentence in the second to last paragraph, “predictions” should be “predicted.”

AECOM RESPONSE: The word has been corrected in the described portion of the paragraph of Section 2.2.4 from “predictions” to “predicted.”

3. In the redline version of the Draft-Final Fourth Five-Year Review Report, Page 3-13, the heading just below the middle of the page is “September 2015 Soil Boring Sampling Results,” but then the section actually talks about soil borings done in February 2016. Is

one of these dates wrong? Also, there is a typo in that first sentence, which should read “to advance” rather than “to advanced.”

AECOM RESPONSE: The subject heading on page 3-13 has been corrected to “February 2016 Soil boring Sampling Results.”

Please contact John Kim at 602-648-2523 if you have any questions or need additional information.

Sincerely,
AECOM

A handwritten signature in black ink, appearing to read "John Kim", with a stylized, cursive script.

John Kim
Project Manager

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Douglas A. Ducey
Governor

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY



Misael Cabrera
Director

EMAIL AND U.S. MAIL
August 30, 2017
FPU 18-035

Stephanie McCary
Environmental Restoration
5960 Swaab Boulevard
Nellis AFB, NV 89191

Re: LAFB – ADEQ Review of 2nd RTC on RTC on Draft Final Fourth Five-Year Review Report OU1, OU2 and TU-44, received July 10, 2017

Dear Ms. McCary:

The Arizona Department of Environmental Quality (ADEQ) has reviewed the above referenced document for Luke Air Force Base and generally finds the response acceptable. ADEQ has no further comments.

Should you have any comments or questions regarding this matter, please do not hesitate to contact me at (602) 771-0200 or lf4@azdeq.gov.

Sincerely,

Laura Fischer
Project Manager
Federal Projects Unit
Waste Programs Division, ADEQ

Cc: Chad Coker – Matrix (electronic)

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From: MCCARY, STEPHANIE D GS-12 USAF AFCEC 99 MSG/CZO <stephanie.mccary@us.af.mil>
Sent: Friday, September 01, 2017 8:16 AM
To: Kim, John (Phoenix)
Cc: FICKLEN, HOLMES D GS-14 USAF AFMC AFCEC/CZRW; ROTHROCK, CHARLES J GS-13 USAF AETC 56 CES/CEIE
Subject: FW: Notification of Transmittal: Final-2nd RTCs to EPA and ADEQ Reviews of RTCs to Draft-Final FYR Report, Luke AFB
Signed By: stephanie.mccary@us.af.mil

John, 1 of 2 emails on the RTCs from XM.

Thanks,

Stephanie McCary
AFCEC/CZOW
Nellis ISS
COM (702)652-9365
DSN 682-9365

-----Original Message-----

From: Tran, Xuan-Mai [<mailto:Tran.Xuan-Mai@epa.gov>]
Sent: Tuesday, August 29, 2017 6:17 PM
To: MCCARY, STEPHANIE D GS-12 USAF AFCEC 99 MSG/CZO
<stephanie.mccary@us.af.mil>; Laura Fischer <Fischer.Laura@azdeg.gov>
Cc: FICKLEN, HOLMES D GS-14 USAF AFMC AFCEC/CZRW <holmes.ficklen@us.af.mil>;
ROTHROCK, CHARLES J GS-13 USAF AETC 56 CES/CEIE <charles.rothrocks@us.af.mil>
Subject: [Non-DoD Source] RE: Notification of Transmittal: Final-2nd RTCs to EPA and ADEQ Reviews of RTCs to Draft-Final FYR Report, Luke AFB

Hi Stephanie,

My apologies for sending you too many emails on the same review. In addition to the minor comments that I sent in the email below on the latest redline version of the Luke AFB 2017 FYR Report, I just found a few more:

5. Section 3.0, Progress Since Last Review: In the first paragraph, the text mentioned that the updated IDP and ICP were approved by EPA in 2014. Since Luke AFB has been deleted from the NPL, ADEQ is the lead regulatory agency. ADEQ might have approved the updated IDP and ICP, but not the EPA. Could you please check the records and make the correction? [Laura: Could you please confirm whether ADEQ approved these two updated documents?]

6. Section 4.1, Review Team and Schedule: Please update the dates under the column "Time Period"

7. Section 8.0, Next Review: In addition to OU-1 and OU-2, please include TU-44 in the next FYR.

Thanks,
XM

-----Original Message-----

From: Tran, Xuan-Mai
Sent: Monday, August 28, 2017 3:26 PM
To: 'MCCARY, STEPHANIE D GS-12 USAF AFCEC 99 MSG/CZO'
<stephanie.mccary@us.af.mil>; Laura Fischer <Fischer.Laura@azdeg.gov>
Cc: FICKLEN, HOLMES D GS-13 USAF AFMC AFCEC/CZRW <holmes.ficklen@us.af.mil>;
ROTHROCK, CHARLES J GS-13 USAF AETC 56 CES/CEIE <charles.rothrocks@us.af.mil>
Subject: RE: Notification of Transmittal: Final-2nd RTCs to EPA and ADEQ Reviews of RTCs to Draft-Final FYR Report, Luke AFB

Hi Stephanie,

Thank you for the opportunity to review the revised RTCs and the updated redline version to address EPA's outstanding comments on the Luke AFB 2017 FYR Report. The majority of EPA's comments have been addressed adequately, except for a few minor ones below:

1. Section 1.1, Site Background, second to the last paragraph: The last sentence states that "The SI work plan was approved by EPA and ADEQ and fieldwork began on 26 June 2017." EPA deferred the review of this SI work plan to ADEQ, so technically EPA didn't review/approve this document. Please delete the words "EPA and"; so the statement will read "The SI work plan was approved by ADEQ and fieldwork began on 26 June 2017."
2. Luke AFB 2017 FYR Report mentions ESDs will be submitted for several sites in the future. However, depending on the change in remedy, an ESD or a ROD Amendment would be required. At this point, a decision on whether an ESD or a ROD Amendment would be required for change in remedy (i.e., removal of the cap at ST-18 or adopt the Arizona SRLs for Arsenic instead of EPA residential PRG, etc.) has not been made. Therefore, it'd be appropriate to replace "ESD" with the phrase "appropriate CERCLA decision document" in the Luke AFB 2017 FYR Report. Please do a global search and make replacement where it's appropriate.
3. Section 3.5, FT-07E North Fire Training Area - East Side: The text under the sub-heading "August 2015 Closure Justification Memorandum" mentions a decision was made in February 2016 about an ESD for FT-07E North Fire Training Area. My apologies, I can't recall this determination in February 2016. However, I believe a conference call took place in March 2016 to discuss whether an ESD or a ROD Amendment would be required for sites that contained TPH applying the change in ADEQ's soil rule. The outcome of this conference call was that individual petroleum constituents in soil will need to be looked at prior to decision [Laura: Please correct me if I'm wrong].
4. Figure 14a has not been revised as indicated in the response. The response states that "Figure 14a has been revised to include a unique symbol for wells MW-5 and MW-12 to designate that they were replaced. The symbol is defined in the Legend as "Replaced Well," and a notes has been added to the lower left corner on the aerial photograph portion of the figure that indicate the month/year that wells MW-5 and MW-12 were replaced." However, the attached Fig 14a is the same as the last version that was provided via email on 7/10/17. Please revise Fig 14a as stated in the response.

Please give me a call if you would like to discuss any of the above minor comments. On the other hand, if you agree, please make the changes and I think we can proceed to preparing the final version. Please note that it will take some time to get the signature packet to go up the chain, and EPA management's schedule during the last two weeks of September is very tight. Therefore, please submit the final version of the Luke AFB 2017 FYR Report in the first two weeks of September.

Thanks,
XM

-----Original Message-----

From: MCCARY, STEPHANIE D GS-12 USAF AFCEC 99 MSG/CZO

[<mailto:stephanie.mccary@us.af.mil>]

Sent: Friday, August 18, 2017 2:26 PM

To: Tran, Xuan-Mai <Tran.Xuan-Mai@epa.gov>; Laura Fischer

<Fischer.Laura@azdeq.gov>

Cc: FICKLEN, HOLMES D GS-13 USAF AFMC AFCEC/CZRW <holmes.ficklen@us.af.mil>;

ROTHROCK, CHARLES J GS-13 USAF AETC 56 CES/CEIE <charles.rothrock@us.af.mil>

Subject: Notification of Transmittal: Final-2nd RTCs to EPA and ADEQ Reviews of RTCs to Draft-Final FYR Report, Luke AFB

Transmitted herein for your review are two memorandums from AECOM providing responses to regulatory agencies' review of the RTCs to the subject draft-final report. In addition, also included with this transmittal are the redline version of the revised report that incorporate changes based on AECOM's responses, revised Figure 14a, and new Attachment F. This is an electronic email transmittal only; no hard copies will be distributed. Please provide written comments to me by 1 September 2017.

If you have any questions or comments, please contact me.
Thank you,

Stephanie McCary
AFCEC/CZOW
Nellis IST
COM (702)652-9365
DSN 682-9365

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From: MCCARY, STEPHANIE D GS-12 USAF AFCEC 99 MSG/CZO <stephanie.mccary@us.af.mil>
Sent: Tuesday, September 12, 2017 2:12 PM
To: Tran, Xuan-Mai
Cc: Kim, John (Phoenix); FICKLEN, HOLMES D GS-14 USAF AFMC AFCEC/CZRW
Subject: Notification of Transmittal: Final-2nd RTCs to EPA and ADEQ Reviews of RTCs to Draft-Final FYR Report, Luke AFB
Attachments: 090817-Proposed Final 4th 5YR Rpt_Luke AFB Redline.docx; Fig 14a Waterdog_SiteMap(rev).pdf
Signed By: stephanie.mccary@us.af.mil

Xuan-Mai,
I apologize for the delay in getting this document to you. Please see the below RTCs on your comments on the five year review for Luke and let me know if you have any further questions or concerns with this document. If you approve of the RTCs we can provide you with an electronic copy of the document in a day or two.

1. Section 1.1, Site Background, second to the last paragraph: The last sentence states that "The SI work plan was approved by EPA and ADEQ and fieldwork began on 26 June 2017." EPA deferred the review of this SI work plan to ADEQ, so technically EPA didn't review/approve this document. Please delete the words "EPA and"; so the statement will read "The SI work plan was approved by ADEQ and fieldwork began on 26 June 2017."

URS Response: The change has been made.

2. Luke AFB 2017 FYR Report mentions ESDs will be submitted for several sites in the future. However, depending on the change in remedy, an ESD or a ROD Amendment would be required. At this point, a decision on whether an ESD or a ROD Amendment would be required for change in remedy (i.e., removal of the cap at ST-18 or adopt the Arizona SRLs for Arsenic instead of EPA residential PRG, etc.) has not been made. Therefore, it'd be appropriate to replace "ESD" with the phrase "appropriate CERCLA decision document" in the Luke AFB 2017 FYR Report. Please do a global search and make replacement where it's appropriate.

URS Response: With the exception of the third subsection in Section 3.5 where it is not considered applicable to do so, this global change has been made.

3. Section 3.5, FT-07E North Fire Training Area - East Side: The text under the sub-heading "August 2015 Closure Justification Memorandum"

mentions a decision was made in February 2016 about an ESD for FT-07E North Fire Training Area. My apologies, I can't recall this determination in February 2016. However, I believe a conference call took place in March

2016 to discuss whether an ESD or a ROD Amendment would be required for sites that contained TPH applying the change in ADEQ's soil rule. The outcome of this conference call was that individual petroleum constituents in soil will need to be looked at prior to decision [Laura: Please correct me if I'm wrong].

URS Response: We concur that during the conference call it was understood that the presence or absence of individual petroleum constituents (i.e., VOCs) needed to be investigated as a condition of pursuing the CERCLA decision document. However, based on communications earlier with EPA as well as on the conference call, URS understands that the decision document would be an ESD rather than a ROD Amendment, contingent on the results of VOC investigation. We propose to make several minor revisions to the last statement of the paragraph to:

"After discussions with EPA and ADEQ, the parties it was agreed determined that an ESD would be an appropriate mechanism to close the Site. However, before the EPA would concur that the site was eligible for closure, updated VOC data for soil in lieu of TRPH analysis would be required for evaluation of petroleum constituents."

4. Figure 14a has not been revised as indicated in the response. The response states that "Figure 14a has been revised to include a unique symbol for wells MW-5 and MW-12 to designate that they were replaced. The symbol is defined in the Legend as "Replaced Well," and a notes has been added to the lower left corner on the aerial photograph portion of the figure that indicate the month/year that wells MW-5 and MW-12 were replaced." However, the attached Fig 14a is the same as the last version that was provided via email on 7/10/17. Please revise Fig 14a as stated in the response.

URS Response: We apologize for our mistake of inadvertently attaching the original figure. The correct revised Figure 14a is now attached for your review and our proposed inclusion with the final report.

5. Section 3.0, Progress Since Last Review: In the first paragraph, the text mentioned that the updated IDP and ICP were approved by EPA in 2014.

Since Luke AFB has been deleted from the NPL, ADEQ is the lead regulatory agency. ADEQ might have approved the updated IDP and ICP, but not the EPA.

Could you please check the records and make the correction? [Laura: Could you please confirm whether ADEQ approved these two updated documents?]

URS Response: Luke AFB has confirmed that the IDP and ICP documents were finalized in April 2014 and September 2014, respectively. However, upon further review, documentation that the plans were submitted to and approved by ADEQ is absent from Luke AFB's files. Therefore, we have assumed that ADEQ did not have an opportunity to review, comment on, and ultimately approve the IDP and ICP documents. Based on this information, the text in the first paragraph has been modified to remove the sentence: "Both of the documents were updated and approved by the EPA." Note that Luke AFB is willing to submit the documents at this time to the ADEQ for review.

6. Section 4.1, Review Team and Schedule: Please update the dates under the column "Time Period"

URS Response: The Time Period column of the table has been updated per your request.

7. Section 8.0, Next Review: In addition to OU-1 and OU-2, please include TU-44 in the next FYR.

URS Response: The sentence in Section 8.0 has been revised to: "The next FYR for the OU-1 and OU-2 sites at Luke AFB, and for Site TU-44 located off the base, will be performed in year 2022."

Thank you,

Stephanie McCary
AFCEC/CZOW
Nellis ISS
COM (702)652-9365
DSN 682-9365

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From: Tran, Xuan-Mai <Tran.Xuan-Mai@epa.gov>
Sent: Tuesday, September 12, 2017 3:40 PM
To: MCCARY, STEPHANIE D GS-12 USAF AFCEC 99 MSG/CZO
Cc: Kim, John (Phoenix); FICKLEN, HOLMES D GS-14 USAF AFMC AFCEC/CZRW; Laura Fischer
Subject: RE: Notification of Transmittal: Final-2nd RTCs to EPA and ADEQ Reviews of RTCs to Draft-Final FYR Report, Luke AFB
Signed By: Tran.Xuan-Mai@epa.gov

Hi Stephanie,

Thank you VERY MUCH for addressing all of EPA's outstanding comments on Luke AFB 2017 FYR Report. When I first read the proposed text in the quotes in response to comment 3 below, it didn't sound right. It says, "After discussions with EPA and ADEQ, the parties it was agreed determined that an ESD ...". But when I checked the text in the revised version, it's fine, where it says, "After discussions with EPA and ADEQ, the parties agreed that an ESD ..."

In Section 3.0, Progress Since Last Review, in the first paragraph, please replace the "Institutional Control Plan (ICP)" with just "ICP" and "Base General Plan" with "BGP", since they have been abbreviated in previous text. Also, there is an extra period at the end of the second to the last sentence in this paragraph.

Please make those last minor changes in Section 3.0 and go ahead to finalize the document. I'd appreciate it very much if I can get a clean copy by tomorrow.

Best regards,
XM

-----Original Message-----

From: MCCARY, STEPHANIE D GS-12 USAF AFCEC 99 MSG/CZO
[mailto:stephanie.mccary@us.af.mil]
Sent: Tuesday, September 12, 2017 2:12 PM
To: Tran, Xuan-Mai <Tran.Xuan-Mai@epa.gov>
Cc: Kim, John (Phoenix) <john.s.kim@aeacom.com>; FICKLEN, HOLMES D GS-14 USAF AFMC AFCEC/CZRW <holmes.ficklen@us.af.mil>
Subject: Notification of Transmittal: Final-2nd RTCs to EPA and ADEQ Reviews of RTCs to Draft-Final FYR Report, Luke AFB

Xuan-Mai,
I apologize for the delay in getting this document to you. Please see the below RTCs on your comments on the five year review for Luke and let me know if you have any further questions or concerns with this document. If you approve of the RTCs we can provide you with an electronic copy of the document in a day or two.

1. Section 1.1, Site Background, second to the last paragraph: The last sentence states that "The SI work plan was approved by EPA and ADEQ and fieldwork began on 26 June 2017." EPA deferred the review of this SI work plan to ADEQ, so technically EPA didn't review/approve this document. Please delete the words "EPA and"; so the statement will read "The SI work plan was approved by ADEQ and fieldwork began on 26 June 2017."

URS Response: The change has been made.

2. Luke AFB 2017 FYR Report mentions ESDs will be submitted for several sites in the future. However, depending on the change in remedy, an ESD or a ROD Amendment would be required. At this point, a decision on whether an ESD or a ROD Amendment would be required for change in remedy (i.e., removal of the cap at ST-18 or adopt the Arizona SRLs for Arsenic instead of EPA residential PRG, etc.) has not been made. Therefore, it'd be appropriate to replace "ESD" with the phrase "appropriate CERCLA decision document" in the Luke AFB 2017 FYR Report. Please do a global search and make replacement where it's appropriate.

URS Response: With the exception of the third subsection in Section 3.5 where it is not considered applicable to do so, this global change has been made.

3. Section 3.5, FT-07E North Fire Training Area - East Side: The text under the sub-heading "August 2015 Closure Justification Memorandum"

mentions a decision was made in February 2016 about an ESD for FT-07E North Fire Training Area. My apologies, I can't recall this determination in February 2016. However, I believe a conference call took place in March

2016 to discuss whether an ESD or a ROD Amendment would be required for sites that contained TPH applying the change in ADEQ's soil rule. The outcome of this conference call was that individual petroleum constituents in soil will need to be looked at prior to decision [Laura: Please correct me if I'm wrong].

URS Response: We concur that during the conference call it was understood that the presence or absence of individual petroleum constituents (i.e., VOCs) needed to be investigated as a condition of pursuing the CERCLA decision document. However, based on communications earlier with EPA as well as on the conference call, URS understands that the decision document would be an ESD rather than a ROD Amendment, contingent on the results of VOC investigation. We propose to make several minor revisions to the last statement of the paragraph to:

"After discussions with EPA and ADEQ, the parties it was agreed determined that an ESD would be an appropriate mechanism to close the Site. However, before the EPA would concur that the site was eligible for closure, updated VOC data for soil in lieu of TRPH analysis would be required for evaluation of petroleum constituents."

4. Figure 14a has not been revised as indicated in the response. The response states that "Figure 14a has been revised to include a unique symbol for wells MW-5 and MW-12 to designate that they were replaced. The symbol is defined in the Legend as "Replaced Well," and a notes has been added to the lower left corner on the aerial photograph portion of the figure that indicate the month/year that wells MW-5 and MW-12 were replaced." However, the attached Fig 14a is the same as the last version that was provided via email on 7/10/17. Please revise Fig 14a as stated in the response.

URS Response: We apologize for our mistake of inadvertently attaching the original figure. The correct revised Figure 14a is now attached for your review and our proposed inclusion with the final report.

5. Section 3.0, Progress Since Last Review: In the first paragraph, the text mentioned that the updated IDP and ICP were approved by EPA in 2014.

Since Luke AFB has been deleted from the NPL, ADEQ is the lead regulatory agency. ADEQ might have approved the updated IDP and ICP, but not the EPA.

Could you please check the records and make the correction? [Laura: Could you please confirm whether ADEQ approved these two updated documents?]

URS Response: Luke AFB has confirmed that the IDP and ICP documents were finalized in April 2014 and September 2014, respectively. However, upon further review, documentation that the plans were submitted to and approved by ADEQ is absent from Luke AFB's files. Therefore, we have assumed that ADEQ did not have an opportunity to review, comment on, and ultimately approve the IDP and ICP documents. Based on this information, the text in the first paragraph has been modified to remove the sentence: "Both of the documents were updated and approved by the EPA." Note that Luke AFB is willing to submit the documents at this time to the ADEQ for review.

6. Section 4.1, Review Team and Schedule: Please update the dates under the column "Time Period"

URS Response: The Time Period column of the table has been updated per your request.

7. Section 8.0, Next Review: In addition to OU-1 and OU-2, please include TU-44 in the next FYR.

URS Response: The sentence in Section 8.0 has been revised to: "The next FYR for the OU-1 and OU-2 sites at Luke AFB, and for Site TU-44 located off the base, will be performed in year 2022."

Thank you,

Stephanie McCary
AFCEC/CZOW
Nellis ISS
COM (702)652-9365
DSN 682-9365

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From: Tran, Xuan-Mai <Tran.Xuan-Mai@epa.gov>
Sent: Thursday, December 21, 2017 5:44 PM
To: Kim, John (Phoenix)
Subject: RE: Revision to Section 7 of Final FYR Luke AFB

Thanks so much, John.
Happy Holidays!
XM

From: Kim, John (Phoenix) [<mailto:john.s.kim@aecom.com>]
Sent: Thursday, December 21, 2017 4:35 PM
To: Tran, Xuan-Mai <Tran.Xuan-Mai@epa.gov>
Cc: MCCARY, STEPHANIE D GS-12 USAF AFCEC 99 MSG/CZO <stephanie.mccary@us.af.mil>; FICKLEN, HOLMES D GS-14 USAF AFMC AFCEC/CZRW <holmes.ficklen@us.af.mil>; Laura Fischer <Fischer.Laura@azdeq.gov>
Subject: RE: Revision to Section 7 of Final FYR Luke AFB

Here is the revise report with added footnote in track change.

Best regards,

John Kim
Senior Project Manager and Principal Engineer
Design and Consulting Services, Environment
D +1-602-648-2523
M +1-480-318-2899
John.S.Kim@aecom.com

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From: Tran, Xuan-Mai [<mailto:Tran.Xuan-Mai@epa.gov>]
Sent: Thursday, December 21, 2017 5:15 PM
To: Kim, John (Phoenix)
Cc: MCCARY, STEPHANIE D GS-12 USAF AFCEC 99 MSG/CZO; FICKLEN, HOLMES D GS-14 USAF AFMC AFCEC/CZRW; Laura Fischer
Subject: RE: Revision to Section 7 of Final FYR Luke AFB

Thank you SO MUCH, John. You're too quick. I was trying to email Stephanie to let her know that I couldn't get a hold of her via phone so I had to contact you directly for revisions as I'm trying to extract the protectiveness statements to upload into the data base for EPA-HQ while waiting for the official signed copy from Luke AFB.

require remedial action per the ROD. It was added to the LTM at ADEQ's request after the first FYR (please see Section 2.4 OU-1 and OU-2 Sites, Table 1, Page 8 of the Luke AFB Third FYR Report).

Thanks so much,
XM

From: Kim, John (Phoenix) [<mailto:john.s.kim@aecom.com>]
Sent: Thursday, December 21, 2017 3:59 PM
To: Tran, Xuan-Mai <Tran.Xuan-Mai@epa.gov>
Cc: MCCARY, STEPHANIE D GS-12 USAF AFCEC 99 MSG/CZO <stephanie.mccary@us.af.mil>; FICKLEN, HOLMES D GS-14 USAF AFMC AFCEC/CZRW <holmes.ficklen@us.af.mil>
Subject: Revision to Section 7 of Final FYR Luke AFB

Hi XM;
Per our telephone conversation today, I've attached the FYR for Luke with proposed revisions in track change to the protectiveness statement in Section 7.0.

Stephanie and Don – The language in the protectiveness statement was not changed but was moved as shown in the track changed document so it would make more sense. There was also a typo that was corrected.

If you all concur with the change, I can finalize and PDF Section 7 so that we can replace it in the document that is being routed for signature.

Best regards,

John Kim
Senior Project Manager and Principal Engineer
Design and Consulting Services, Environment
D +1-602-648-2523
M +1-480-318-2899
John.S.Kim@aecom.com

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

SEP 25 2017

Michael S. Richardson, Colonel, USAF
Vice Commander, 56th Fighter Wing
14185 W Falcon Street
Luke AFB AZ 85309-1629

Re: Fourth Five-Year Review Report, Luke Air Force Base, Arizona, September 2017

Dear Colonel Richardson:

The U.S. Environmental Protection Agency (EPA) Region 9 has received the Fourth Five-Year Review Report for Luke Air Force Base (AFB), Arizona, dated September 2017 (the Report). Based on our review of the Report, EPA agrees with the Air Force that the remedies at Luke AFB remain protective of human health and the environment under the current land use and that exposure pathways that could result in unacceptable risks are being controlled through implementation of institutional controls and monitoring.

If there are any questions concerning this matter, please contact Xuan-Mai Tran of my staff at (415) 972-3002.

Sincerely,

A handwritten signature in blue ink, appearing to read "Angeles Herrera".

Angeles Herrera
Assistant Director, Superfund Division
Federal Facilities and Site Cleanup Branch

cc: Stephanie McCary, Nellis AFB
Laura Fischer, ADEQ

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