FINAL
SECOND FIVE-YEAR REVIEW REPORT
FOR
LUKE AIR FORCE BASE
GLENDALE, ARIZONA

PROJECT NUMBERS:
NUEX20067026
NUEX20067041

Prepared for:

Air Force Center for Engineering and the Environment
Brooks-City Base, Texas

and

Luke Air Force Base, Arizona

Contract Number F41624-03-D-8602
Task Order 0057

June 22, 2007

HGL
HydroGeoLogic, Inc

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

September 19, 2007

Henry M. Reed III, Colonel, USAF
Vice Commander, 56th Fighter Wing
13970 W. Lightning Street
Luke AFB, Arizona 85309-1149

Re: Second Five Year Review, Luke Air Force Base, Arizona, June 2007

Dear Colonel Reed:

The U.S. Environmental Protection Agency (EPA) Region 9 has received the Final Second Five Year Review of Luke Air Force Base (AFB), Arizona, dated June 22, 2007. We have reviewed the aforementioned document. Based on this review, EPA agrees with the findings, conclusions, and recommendations provided in the Report, and concurs with the Air Force that the remedies at Luke AFB remain protective of human health and the environment under the current land use and exposure pathways that could result in unacceptable risks are being controlled through implementation of institutional controls and monitoring.

Enclosed is the signature page for the Final Second Five-Year Review Report. If you have any questions, please contact Xuan-Mai Tran, Remedial Project Manager, at (415) 972-3002.

Sincerely,

Michael M. Montgomery, Chief
Federal Facilities and Site Cleanup Branch

cc: Brian Stonebrink, ADEQ
Alan Thomas, Luke AFB
Jeff Rothrock, Luke AFB
John Chesnutt, EPA R9
Emily Johnson, EPA-HQ
Katherine Garufi, EPA-HQ
Daniel Salzler (CAB Co-Chair)
Ronald McRobbie, Air Force Regional Environmental Office

SIGNATURE SHEET

Signature sheet for the Second Five-Year Review of Comprehensive Environmental Response, Compensation, and Liability Act response actions at Luke Air Force Base, Glendale, Arizona.

Protectiveness Determination

The remedies at OU-1 and OU-2 currently protect human health and the environment because the exposure pathways that could result in unacceptable risks are being controlled and institutional controls are preventing exposure to contaminated soil. Soil concentrations are below levels that could impact groundwater, and groundwater results verify that the groundwater is no longer impacted by soil contamination. Some monitoring wells will need to be replaced to verify that the remedy continues to protect groundwater.

Because the remedial actions at all OUs are protective, the site is protective of human health and the environment.

Approved by: Date:

HENRY M. REED III, Colonel, USAF — 13 SEP 07
Vice Commander, 56th Fighter Wing

U.S. Environmental Protection Agency — 9/19/07
Kathleen Johnson, Chief
Federal Facilities and Site Cleanup Branch

Julie Remenaschneider for Samantha Roberts — 9/24/07
Samantha L. Roberts
Remedial Projects Section Manager
Arizona Department of Environmental Quality

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SECOND FIVE-YEAR REVIEW REPORT
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Prepared for:

Air Force Center for Engineering and the Environment
Brooks-City Base, Texas

and

Luke Air Force Base, Arizona

Prepared by:

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June 22, 2007

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13. ABSTRACT (Maximum 200 words) This report is the Second Five-year Review for the Luke AFB OU-1 and OU-2 sites. This Review describes the Five-Year Review process as it relates to Luke Air Force Base and the sites under consideration, lists the chronology of the sites, discusses the background of the sites, chronicles the remedial actions implemented, conveys the progress since the last Five-Year Review, provides a technical assessment addressing the three questions listed in the Environmental Protection Agency guidance document, and lists issues.		
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TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

LIST OF APPENDICES

LIST OF TABLES

Table **Page**

LIST OF TABLES (continued)

Table **Page**

LIST OF FIGURES

LIST OF ACRONYMS AND ABBREVIATIONS

amsl	above mean sea level
AF	Air Force
AFB	Air Force Base
ARARs	Applicable or Relevant and Appropriate Requirements
ADEQ	Arizona Department of Environmental Quality
BGP	Base General Plan
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and total xylenes
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CAB	Community Advisory Board
COC	contaminant of concern
cpm	counts per minute
FS	feasibility study
FTP	fire-training pits
GRAs	general response actions
HGL	HydroGeoLogic Inc.
IRP	Installation Restoration Program
IC	institutional control
ICP	Institutional Control Plan
LUST	leaking underground storage tank
LTM	long-term monitoring
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
mg/kg	milligrams per kilogram
µg/L	micrograms per liter
NCP	National Contingency Plan
NEPA	National Environmental Policy Act
NPL	National Priorities List
OU	operable unit

PPE	personal protective equipment
PCB	polychlorinated biphenyl
PSC	potential source of contamination
PRG	Preliminary Remediation Goal
PCE	tetrachloroethene
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
ROD	Record of Decision
SRL	Soil Remediation Level
SVOC	semivolatile organic compound
SSL	soil screening level
SVE	soil vapor extraction
TCE	trichloroethene
TPH	total petroleum hydrocarbons
TRPH	total recoverable petroleum hydrocarbons
USEPA	U.S. Environmental Protection Agency
VOC	volatile organic compound
VEMUR	Voluntary Environmental Mitigation Use Restriction
WQS	Water Quality Standards
WWTP	wastewater treatment plant

EXECUTIVE SUMMARY

Luke Air Force Base (AFB) is located 20 miles west of Phoenix, Arizona. The U.S. Environmental Protection Agency (USEPA) placed Luke AFB on the National Priorities List (NPL) as a result of past hazardous material handling and disposal practices. This action was taken pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986.

After being listed on the NPL, Luke AFB conducted remedial investigation/feasibility study (RI/FS) activities to determine the nature and extent of contamination at several identified sites throughout the Base. Thirty-three potential sources of contamination (PSCs) were initially identified for investigation purposes. To aid in the management of the investigations, the PSCs were divided into two operable units (OU): OU-1 and OU-2. OU-1 consists of 25 sites and OU-2 is composed of the remaining 8 sites. The OU-2 sites, which were the first sites to be investigated, focused on areas where petroleum-related wastes could have impacted soil. Investigation activities completed for the OU-1 sites were not limited to potential petroleum contamination and involved sampling air, groundwater, soil, and surface water.

In addition to the investigations of the identified PSCs, a Resource Conservation and Recovery Act (RCRA) facility assessment and RCRA facility investigation (RFI) were conducted to determine whether any of the current operational facilities at Luke AFB should be included as PSCs in the CERCLA program. Of the 25 sites investigated under OU-1, 8 sites were determined to require further action. Therefore, remedial alternatives were identified and selected for each and detailed in the OU-1 Record of Decision (ROD). Of the eight sites investigated under OU-2, only two sites were determined to warrant remedial action. Remedial alternatives were therefore developed for the two OU-2 sites determined to warrant remediation. The remedies implemented for the 10 sites in the OU-1 and OU-2 RODs consisted of soil treatment, source capping, groundwater monitoring, and institutional controls (ICs). ICs were emplaced in the form of a Voluntary Environmental Mitigation Use Restrictions (VEMURs) or internal land-use restrictions for the sites where ICs were part of the selected remedy.

This Five-Year Review report discusses the 10 sites that required a remedy, as determined from the results of the RI/FS: DP-13, FT-07E, LF-03, LF-14, LF-25, RW-02, SD-38, SS-42, ST-18, and DP-23. The sites classified as No Further Action sites in their respective RODs are not evaluated. However, during the First Five-Year Review, the Arizona Department of Environmental Quality (ADEQ) requested that several wells be added to the long-term monitoring. In response to this ADEQ comment, Luke AFB added sampling of additional monitoring wells at sites FT-07E, RW-02, and added sampling of wells at OU-1 site SD-20 to the groundwater monitoring program. SD-20 was considered a No Further Action site in the OU-1 ROD; however, because it was added to the LTM program by ADEQ, this report also discusses site SD-20. The five-year review process primarily consisted of site inspections, interviews, and a review of relevant documents and data. Alan Thomas, P.E., of Luke AFB

led the Second Five-Year Review effort for the site. The team members listed below assisted with the review:

- Alan Thomas, P.E., Luke AFB
- Xuan-Mai Tran, USEPA Region 9
- Brian Stonebrink, ADEQ
- Jeff Hodge, HydroGeoLogic, Inc. (HGL)
- Mary Knowles, HGL

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site name *(from WasteLAN)*: Luke Air Force Base		
EPA ID *(from WasteLAN)*: AZ0570024133		
Region: 9	**State:** AZ	**City/County:** Glendale/Maricopa

SITE STATUS	
NPL status: Final X Deleted Other (specify)	
Remediation status (choose all that apply): Under Construction Operating X Complete	
Multiple OUs?* X YES NO	**Construction completion date:** 09/25/2000
Has site been put into reuse? YES X NO	

REVIEW STATUS	
Lead agency: EPA State Tribe X Other Federal Agency Luke Air Force Base	
Author name: Jeff Hodge	
Author title: Project Scientist	**Author affiliation:** Luke AFB Contractor
Review period:** 07 / 2006 to 12 / 2006	
Date(s) of site inspection: 08 / 2005, 10 / 2005, and 08 / 2006	
Type of review: X Post-SARA Pre-SARA NPL-Removal only Non-NPL Remedial Action Site NPL State/Tribe-lead Regional Discretion	
Review number: 1 (first) X 2 (second) 3 (third) Other (specify) _____	
Triggering action: Actual RA Onsite Construction at OU #____ Actual RA Start at OU#____ Construction Completion X Previous Five-Year Review Report Other (specify)	
Triggering action date *(from WasteLAN)*: 01 / 21 / 2002	
Due date *(five years after triggering action date)*: 01 / 21 / 2007	

* ["OU" refers to operable unit.]

** [Review period should correspond to the actual start and end dates of the Five-Year Review in WasteLAN

Five-Year Review Summary Form (continued)

Issues:

Two monitoring wells were documented as being collapsed during the August 2006 sampling event: MW-124 and MW-123. MW-124 is located at OU-1 site RW-02 and is the only monitoring well at the site. Because this well cannot be sampled, groundwater conditions below site RW-02 are not known. Analytical data for samples collected from December 1994 to June 1996 indicate that the groundwater beneath site RW-02 has not been impacted. MW-123 is associated with OU-1 site FT-07E. There is another monitoring well at FT-07E: MW-118. MW-118 is located approximately 325 feet east/ northeast of the collapsed monitoring well MW-123 and the top of the screen is 13 feet deeper than the top of the screen at MW-123. Though MW-123 cannot be sampled, groundwater data from MW-118 samples can be reviewed to partially determine current groundwater conditions at FT-07E.

Monitoring well MW-114 is located at OU-2 site ST-18. This well is blocked at approximately 15 feet above the top of screen and the blockage prevents the proper collection of a low-flow groundwater sample. This well was sampled from the lowest possible point.

The well screens in monitoring wells MW-113, MW-114, MW-118, MW-121, and MW-125R are submerged and no longer bracket the water table. The static water level at these wells is above the top of the screen. Recent water level measurements indicate that water levels across the Base and in the vicinity of Luke AFB are rising five to seven feet per year as a result of increased housing development, which has lead to decreased agricultural aquifer pumping. Therefore, the distance between the sample zone (screened interval) and point of contact (vadose zone) where contaminants move from the vadose zone into groundwater is greater. As the distance between the sample zone and point of contact increases, the diffusion of the potential contaminants also increases, which decreases the effectiveness of the monitoring program. The table below summarizes the screen intervals and depths to water recorded for the wells sampled during the LTM activities conducted from 2002 to 2006.

Well Screen Interval and Depth to Water Summary

Well ID	Screen Interval	Depth to Water				
		2002	2003	2004	2005	2006
MW-112D	260-340	NR	NR	NR	NR	274.90
MW-112S	270-430	NR	NR	NR	NR	271.31
MW-113	300-400	NR	NR	NR	NR	291.50
MW-114	305-385	290.78	284.20	280.73	271.53	266.11
MW-118	293-393	NR	NR	NR	NR	280.81
MW-121	267-367	284.45	279.68	275.76	270.80	263.92
MW-122	266-366	290.80	285.02	280.74	273.98	268.72
MW-125R	260-360	280.47	275.83	271.77	266.83	259.64

Notes:
- Screen intervals and depths to water are listed in feet below ground surface.
- Shaded cells indicate that the screen is submerged.
NR not recorded

The last round of sampling in 1994 at MW-119 at SS-42 reported nickel results that exceeded Arizona Drinking Water standards.

The Institutional Control Plan (ICP) does not include OU-2 site DP-23. ICs are part of the specified remedy for DP-23. OU-1 site SS-42 is included in the ICP, though there is no requirement for ICs specified in the remedy for site SS-42.

The Base General Plan (BGP) does not list or illustrate sites DP-23 and ST-18.

Recommendations and Follow-up Actions:

Replace the collapsed monitoring wells at sites FT-07E (MW-123) and RW-02 (MW-124).

Remove the blockage in MW-114 at site ST-18 or reinstall the monitoring well.

Install monitoring wells with shallower screens to supplant the monitoring wells with submerged screens. Because the well screens no longer bracket the water table, groundwater samples collected from these wells are not representative of true groundwater conditions. Any new wells installed should be designed to accommodate future, anticipated fluctuating water levels.

Collect unfiltered and filtered groundwater samples from MW-121 at SS-42 for metals analysis. SS-42 is in the Luke AFB LTM program, but MW-119 is not included in the sampling regime. Therefore, it is recommended that samples for metals analysis be collected from MW-121 instead of MW-119, this well is the most proximal well to MW-119. It is located approximately 200 feet south southwest of the well.

Update the ICP: remove site SS-42 and add site DP-23.

Append the BGP to list and illustrate the environmental constraints at DP-23 and ST-18.

Continue groundwater monitoring program at sites SS-42, ST-18, FT-07E, RW-02, and SD-20 to comply with the guidelines established in the LTM plan and following the response to comments letter issued to the ADEQ for the Draft Final First Five-Year review on January 25, 2002.

Protectiveness Statement(s):

The remedies at OU-1 and OU-2 currently protect human health and the environment because the exposure pathways that could result in unacceptable risks are being controlled and institutional controls are preventing exposure to contaminated soil. Soil concentrations are below levels that could impact groundwater, and groundwater results verify that the groundwater is no longer impacted by soil contamination. Some monitoring wells will need to be replaced to verify that the remedy continues to protect groundwater.

Five-Year Review Summary Form (continued)

Because the remedial actions at all OUs are protective, the site is protective of human health and the envitonment.

Long-term Protectiveness:

Long-term protectiveness of the remedial action will be verified by obtaining groundwater samples every five years to evaluate current groundwater conditions and after the replacement wells are installed, inspecting the cap at ST-18, and reviewing pertinent documents to insure the sites and their respective contaminants are properly documented. The current data indicate that the contamination existing in the vadose zone beneath the sites has not migrated to groundwater.

Other Comments:

None

SIGNATURE SHEET

Signature sheet for the Second Five-Year Review of Comprehensive Environmental Response, Compensation, and Liability Act response actions at Luke Air Force Base, Glendale, Arizona.

Protectiveness Determination

The remedies at OU-1 and OU-2 currently protect human health and the environment because the exposure pathways that could result in unacceptable risks are being controlled and institutional controls are preventing exposure to contaminated soil. Soil concentrations are below levels that could impact groundwater, and groundwater results verify that the groundwater is no longer impacted by soil contamination. Some monitoring wells will need to be replaced to verify that the remedy continues to protect groundwater.

Because the remedial actions at all OUs are protective, the site is protective of human health and the environment.

Approved by: Date:

Henry M. Reed, Colonel, USAF
Vice Commander

U.S. Environmental Protection Agency
Kathleen Johnson, Chief
Federal Facilities and Site Cleanup Branch

Samantha L. Roberts
Remedial Projects Section Manager
Arizona Department of Environmental Quality

FINAL
SECOND FIVE-YEAR REVIEW REPORT
LUKE AIR FORCE BASE
GLENDALE, ARIZONA

1.0 INTRODUCTION

Luke Air Force Base (AFB) is located 20 miles west of Phoenix, Arizona. In 1990, the U.S. Environmental Protection Agency (USEPA) placed Luke AFB (Base) on the National Priorities List (NPL) pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986. Luke AFB was added to the NPL as a result of past hazardous material handling and disposal practices.

After being listed on the NPL, several remedial investigation/feasibility study (RI/FS) activities were performed to determine the nature and extent of contamination at numerous sites throughout the Base. Thirty-three potential sources of contamination (PSCs) were initially identified for investigation purposes. To aid in the management of the investigations, the PSCs were divided into two operable units (OUs): OU-1 and OU-2. OU-1 consists of 8 sites and OU-2 is composed of the remaining 25 sites. The OU-2 sites, which were the first sites to be investigated, focused on areas where petroleum-related wastes could have impacted soil. Investigation activities completed for the OU-1 sites were not limited to potential petroleum contamination and involved sampling air, groundwater, soil, and surface water.

In addition to the investigations of the identified PSCs, a Resource Conservation and Recovery Act (RCRA) facility assessment and RCRA Facility Investigation (RFI) were conducted to determine whether any of the current operational facilities at Luke AFB should be included as PSCs in the CERCLA program. Of the eight sites included in OU-1, remedial alternatives were identified and selected for each and detailed in the OU-1 Record of Decision (ROD). Of the 25 sites included in OU-2, only 2 sites were determined to warrant remedial action. The remaining 23 OU-2 sites were deemed No Further Action. Remedial alternatives were developed for the two OU-2 sites determined to warrant remediation. The remedies implemented for the 10 sites in the OU-1 and OU-2 RODs consisted of soil treatment, source capping, groundwater monitoring, and institutional controls (ICs). ICs were emplaced in the form of a Voluntary Environmental Mitigation Use Restrictions (VEMURs). VEMURs were filed for each site where ICs were part of the selected remedy.

This Second Five-Year Review was prepared by HydroGeoLogic, Inc. (HGL) for Luke AFB under Air Force Center for Engineering and the Environment (AFCEE) contract number F41624-03-D-8602, task order 0057. The purpose of the five-year review process is to determine whether the remedy at a site is protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in Five-Year Review reports. In addition, Five-Year Review reports detail any technical or administrative issues

identified during the review, if any, and make recommendations to address them. This is the Second Five-Year Review for the subject sites. The First Five-Year Review was conducted in 2002.

HGL prepared this Second Five-Year Review report for Luke AFB pursuant to CERCLA §121 and the National Contingency Plan (NCP). CERCLA §121 states:

> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

The USEPA interpreted this requirement further in the NCP; 40 CFR §300.430(f)(4)(ii) states:

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

Luke AFB, with assistance from HGL, conducted the Second Five-Year Review of the remedies implemented at OU-1 and OU-2 sites at the Base. The five-year review process primarily consisted of site inspections, interviews, and a review of relevant documents and data. This review was lead by the Luke AFB Restoration Program Manager from July 2006 through December 2006. This report documents the results of the review. The site inspection forms completed for each site are included in Appendix A. The interview records are provided in Appendix B.

The triggering action for this statutory review is the completion of the First Five-Year Review on January 18, 2002. The five-year review is required because hazardous substances, pollutants, or contaminants remain at the sites above levels that allow for unlimited use and unrestricted exposure.

2.0 SITE CHRONOLOGY

Twenty-five PSCs were investigated during the RI/FS phase of OU-1. The results of the OU-1 RI and Basewide risk assessment indicated that the air, surface water, and groundwater resources of Luke AFB did not represent conditions that would pose an imminent and substantial endangerment to public health, welfare, or the environment. However, the soils at eight of the OU-1 PSCs were found to have conditions that could either cause unacceptable human health risks under certain types of land use scenarios or could impact the underlying groundwater. Remedial alternatives were developed for the soils at those eight sites. A remedy selection process was not required for the soils at the remaining 17 PSCs investigated under OU-1 or for the air, surface water, and groundwater resources of the Base. The OU-1 sites are:

- DP-13: Drainage Ditch Disposal Area
- FT-07E: Eastern Portion of North Fire Training Area
- LF-03: Outboard Runway Landfill
- LF-14: Old Salvage Yard Burial Site
- LF-25: Northwest Landfill
- RW-02: Wastewater Treatment Annex Landfill
- SD-20: Oil/Water Separator Canal and Earth Fissure (added after First Five-Year Review)
- SD-38: Oil/Water Separator at Auto Body Shop
- SS-42: Bulk Fuels Storage Area

Eight sites where only petroleum-related wastes were disposed were evaluated during the RI/FS of OU-2. The results of the OU-2 RI and Basewide risk assessment indicated that the petroleum-impacted soils at six of the eight PSCs evaluated did not represent conditions that would pose an imminent and substantial endangerment to public health, welfare, or the environment. Remedial alternatives were developed for the remaining two OU-2 sites: DP-23: Old Surface Impoundment West of Facility 993, and ST-18: Former Liquid Waste Storage Facility (Facility 993).

This section contains site chronology tables that summarize the investigative activities and other actions for each of the sites that required a remedy in the OU-1 ROD signed in 1999 and the OU-2 ROD signed in 1994. OU-1 site SD-20 also is included in this review as it is in the Luke AFB groundwater monitoring program. The tables are presented alphabetically by operable unit.

Table 2.1
Chronology of Events
DP-13: Drainage Ditch Disposal Area
Operable Unit 1 – Luke AFB, Arizona

Date	Event
Past Activities/Investigations	
1940s	The site was the location of a drainage ditch reportedly used for refuse disposal. No reported disposal of hazardous or industrial-type wastes. Site was filled and covered in 1946.
July 14, 1989	Site was proposed to the NPL (Basewide proposal)
August 30, 1990	Site was added to the NPL (Basewide addition)
September 1990	Federal Facilities Agreement signed
1992/1994	An RI was conducted to determine boundaries of the former landfill and characterize its contents. The RI included the following: geophysical survey, soil-gas sampling, and excavation of 15 test pits. Ten soil borings also were advanced. Chromium and lead were detected at depth.
August 1996	Three additional soil borings were advanced to collect supplemental volatile organic compound and semivolatile organic compound data for risk assessment purposes.
August 1997	Luke AFB conducted a final inspection of the potential sources of contamination areas.
September 7, 1999	OU-1 ROD signed. The selected remedy for DP-13 was ICs, based on risk assessment determination that wastes were buried and there was no exposure threat based on current land use scenarios.
January 5, 2000	BGP revised to reflect land use restrictions placed on the site. Institutional control plan was prepared to facilitate enforcement of institutional controls and incorporated into base general plan. BGP is reviewed and updated as needed.
April 2000	The USEPA and ADEQ conducted a final site inspection and determined that the Air Force has constructed the remedy in accordance with the requirements of the ROD and remedial action work plan.
June 15, 2000	VEMUR filed with ADEQ to restrict future development of the site.
April 26, 2001	The USEPA concurred with the Final Close Out Report for the Base.
January 2002	First Five-Year Review completed.
April 22, 2002	Site delisted from the NPL (Basewide delisting)
October 5, 2005	Site Inspection Completed
Ongoing Activities	
Five Year Review	Required at 5-year intervals after final closeout process. Site inspection conducted to determine adequacy of surface controls and current land use.

Table 2.2
Chronology of Events
FT-07E: Eastern Portion of North Fire Training Area
Operable Unit 1 – Luke AFB, Arizona

Date	Event
Past Activities/Investigations	
1973 to 1989	Site was used by the base for fire training. Sprinkler systems were in place to dispense petroleum, oil, and lubricant waste onto mock aircraft carcasses for fire training purposes. FT-07E consisted of 5 fire training pits. Pits #3, #4, and #6 were the largest.
1984 to 1988	Soil and groundwater sampling was conducted at pits #3 and #4 under the Installation Restoration Program investigation. Four soil borings were advanced and 3 monitoring wells were installed. No data available.
July 14, 1989	Site was proposed to the NPL (Basewide proposal)
August 30, 1990	Site was added to the NPL (Basewide addition)
September 1990	Federal Facilities Agreement signed
1992	After the Installation Restoration Program study was completed the United States Air Force retained EA Engineering Science and Technology to conduct additional soil sampling at pits #3, #4, and #6. Three additional borings were emplaced at each of the 3 pits.
January 1992	Luke AFB decided to address soil contamination at FT-07E under a removal action. A pilot study was conducted to test the effectiveness of soil vapor extraction in mitigating the soil source at FT-07E and support the design of a full scale system.
March 1992	A soil vapor extraction system was installed at pits #3 and #4 and brought online.
March 1992 to December 1992	A soil vapor extraction system with thermal oxidizer off-gas treatment operated for 10 months, removing over 14,000 pounds of total petroleum hydrocarbons and BTEX constituents.
1992/1994	Multi-phase RI was conducted throughout OU-1, including FT-07E. The remedial investigation focused on evaluating the effectiveness of the soil vapor extraction treatment and assessing groundwater quality. Two monitoring wells were installed to supplement those installed during the Installation Restoration Program investigation.
August 1996	Two additional soil borings were advanced to 150 feet below ground surface at pit #3 and one boring was advanced to the same depth at pit #4. Contamination was negligible: concentrations were at the laboratory reporting limit at 140 feet below ground surface.
August 1997	Luke AFB conducted a final inspection of the potential sources of contamination areas.
September 7, 1999	OU-1 ROD signed. Selected remedy for FT-07E was ICs, based on risk assessment model indicating that soil contamination was not present at high enough levels to present an unacceptable risk, and would not migrate to groundwater.
January 5, 2000	The BGP was revised to reflect land use restrictions placed on the site. Institutional control plan was prepared to facilitate enforcement of ICs and

Table 2.2 (continued)
Chronology of Events
FT-07E: Eastern Portion of North Fire Training Area
Operable Unit 1 – Luke AFB, Arizona

Date	Event
Past Activities/Investigations	
	incorporated into BGP. BGP is reviewed and updated as needed.
April 2000	The USEPA and ADEQ conducted a final site inspection and determined that the Air Force has constructed the remedy in accordance with the requirements of the ROD and remedial action work plan.
May 12, 2000	Groundwater LTM plan for FT-07E submitted.
June 15, 2000	VEMUR filed with ADEQ to restrict future development of the site.
April 26, 2001	The USEPA concurred with the Final Close Out Report for the Base.
January 2002	First Five-Year Review conducted.
January 2002	Based on the recommendation of ADEQ in the First Five-Year Review, wells 118 and 123 will be sampled at every 5-year review cycle. Site was subsequently added to Luke AFB LTM program.
April 22, 2002	Site delisted from the NPL (Basewide delisting)
August 2006	Groundwater samples collected from monitoring well 118 under LTM program. Monitoring well MW-123 was documented to be collapsed.
August 21, 2006	Site Inspection Completed
Ongoing Activities	
Five Year Review	Required at 5-year intervals after final closeout process. Site inspection conducted to determine adequacy of ICs and document current land use and condition. Groundwater monitoring of wells MW-118 and MW-123 under Luke AFB LTM program.

Table 2.3
Chronology of Events
LF-03: Outboard Runway Landfill
Operable Unit 1 – Luke AFB, Arizona

Date	Event
Past Activities/Investigations	
1951 to 1953	Site was used by the base for limited disposal of general refuse. No known or suspected industrial type or hazardous wastes were disposed at LF-03.
July 14, 1989	Site was proposed to the NPL (Basewide proposal)
August 30, 1990	Site was added to the NPL (Basewide addition)
September 1990	Federal Facilities Agreement signed
1992/1994	RI conducted to determine boundaries of the former landfill and characterize its contents. RI included geophysical survey, soil-gas sampling, and excavation of 67 test pits. Soil borings also were advanced.
August 1996	Additional soil sampling conducted to support risk assessment.
August 1997	Luke AFB conducted a final inspection of the potential sources of contamination areas.
September 7, 1999	OU-1 ROD signed. Selected remedy for LF-03 was ICs, based on risk assessment model indicating that soil contamination was not present at high enough levels to present an unacceptable risk, and would not migrate to groundwater. Over 60% of the site is covered by the outboard runway.
January 5, 2000	BGP revised to reflect land use restrictions placed on the site. Institutional control plan prepared to facilitate enforcement of institutional controls and incorporated into base general plan. BGP is reviewed and updated as needed.
April 2000	The USEPA and ADEQ conducted a final site inspection and determined that the Air Force has constructed the remedy in accordance with the requirements of the ROD and remedial action work plan.
June 15, 2000	Voluntary Environmental Mitigation Use Restrictions filed with ADEQ to restrict future development of the site.
April 26, 2001	The USEPA concurred with the Final Close Out Report for the Base.
January 2002	First Five-Year Review conducted.
April 22, 2002	Site delisted from the NPL (Basewide delisting)
October 5, 2005	Site Inspection Completed
Ongoing Activities	
Five Year Review	Required at 5-year intervals after final closeout process. Site inspection conducted to determine adequacy of surface controls and current land use.

Table 2.4
Chronology of Events
LF-14: Old Salvage Yard Burial Site
Operable Unit 1 – Luke AFB, Arizona

Date	Event
Past Activities/Investigations	
1950s to 1962	In the 1940s, the site was part of main drainage canal for the northeastern corner of the base. The canal was abandoned when the path of the drainage was changed in the 1950s. According to base personnel, the abandoned canal may have been used as a disposal site for spent transformer fluids containing polychlorinated biphenyls.
July 14, 1989	Site was proposed to the NPL (Basewide proposal)
August 30, 1990	Site was added to the NPL (Basewide addition)
September 1990	Federal Facilities Agreement signed
1992/1994	RI conducted to determine boundaries of the former landfill and characterize its contents. RI included geophysical survey, soil-gas sampling, and excavation of 10 test pits. Twelve soil borings also were advanced.
August 1996	Additional soil sampling conducted to support risk assessment.
August 1997	Luke AFB conducted a final inspection of the potential sources of contamination areas.
September 7, 1999	OU-1 ROD signed. Selected remedy for LF-14 was ICs, based on risk assessment model indicating that soil contamination was not present at high enough levels to present an unacceptable risk, and would not migrate to groundwater.
January 5, 2000	BGP revised to reflect land use restrictions placed on the site. Institutional control plan prepared to facilitate enforcement of ICs and incorporated into base general plan. BGP is reviewed and updated as needed.
April 2000	The USEPA and ADEQ conducted a final site inspection and determined that the Air Force has constructed the remedy in accordance with the requirements of the ROD and remedial action work plan.
June 15, 2000	VEMUR filed with ADEQ to restrict future development of the site.
April 26, 2001	The USEPA concurred with the Final Close Out Report for the Base.
January 2002	First Five-Year Review conducted.
April 22, 2002	Site delisted from the NPL (Basewide delisting)
October 5, 2005	Site Inspection Completed
Ongoing Activities	
Five Year Review	Required at 5-year intervals after final closeout process. Site inspection conducted to determine adequacy of surface controls and current land use.

Table 2.5
Chronology of Events
LF-25: Northwest Landfill
Operable Unit 1 – Luke AFB, Arizona

Date	Event
Past Activities/Investigations	
Pre 1989	Site was used by the base as a landfill. Small portions were used for disposing of construction debris. All disposal ceased in 1989. Portions of LF-25 are immediately downrange of the base skeet shooting range (OT-41).
July 14, 1989	Site was proposed to the NPL (Basewide proposal)
January 1990	Geophysical and organic vapor survey conducted in the southern portion of the site. In this area 80 subsurface metallic objects were identified using geophysics and catalogued. U.S. Air Force subsequently removed the construction debris in preparation for the OU-1 RI. Contents were sifted as they were excavated and the majority of waste was determined to be concrete rubble. Site is currently a grassy swale.
August 30, 1990	Site was added to the NPL (Basewide addition)
September 1990	Federal Facilities Agreement signed
1992/1994	Multi-phased RI conducted throughout OU-1, including LF-25. RI focused on determining the boundaries of the former landfill and characterizing its contents. RI included geophysical survey, soil-gas sampling, and excavation of 15 test pits. No monitoring wells were installed.
August 1996	Soil borings were advanced to support the risk assessment.
August 1997	Luke AFB conducted a final inspection of the potential sources of contamination areas.
September 7, 1999	OU-1 ROD signed. Selected remedy for LF-25 was ex situ mechanical removal of lead shot from soils adjacent to the skeet range and institutional controls. Based on risk assessment model the low levels of total recoverable petroleum hydrocarbons and xylenes, soil contamination in other areas of the site was not present at high enough levels to present an unacceptable risk, and would not migrate to groundwater.
December 16 to 19, 1999	Surficial soils were removed from an area 375 feet square. Excavated soil was fed into a metals recovery unit, where about 2,800 pound of lead shot was removed. Confirmation sampling was conducted of remaining soil and lead and antimony levels were below the Soil Remediation Levels. Treated soils were returned to the excavated area.
January 5, 2000	BGP revised to reflect land use restrictions placed on the site. Institutional control plan prepared to facilitate enforcement of institutional controls and incorporated into base general plan. BGP is reviewed and updated as needed.
April 2000	The USEPA and ADEQ conducted a final site inspection and determined that the Air Force has constructed the remedy in accordance with the requirements of the ROD and remedial action work plan.

Table 2.5 (continued)
Chronology of Events
LF-25: Northwest Landfill
Operable Unit 1 – Luke AFB, Arizona

Date	Event
Past Activities/Investigations	
June 15, 2000	VEMUR filed with ADEQ to restrict future development of the site.
April 26, 2001	The USEPA concurred with the Final Close Out Report for the Base.
January 2002	First Five-Year Review conducted.
April 22, 2002	Site delisted from the NPL (Basewide delisting)
October 5, 2005	Site Inspection Completed
Ongoing Activities	
Five Year Review	Required at 5-year intervals after final closeout process. Site inspection conducted to determine adequacy of institutional controls and current land use.

Table 2.6
Chronology of Events
RW-02: Wastewater Treatment Annex Landfill
Operable Unit 1 – Luke AFB, Arizona

Date	Event
Past Activities/Investigations	
1953 to 1970	Site served as the primary base landfill, accepting general refuse
1956	Small quantity of low-level radioactive tubes and dials was buried at the landfill. The waste was encased in a concrete coffin, buried in a 12-foot deep pit, covered with 6 feet of concrete, then topped with 4 feet of soil cover. The entire site area is topped with concrete and is within the maintenance yard.
July 14, 1989	Site was proposed to the NPL (Basewide proposal)
August 30, 1990	Site was added to the NPL (Basewide addition)
September 1990	Federal Facilities Agreement signed
1991	Two soil borings were advanced near the radiological waste contaminant structure. Soil samples were collected from 10 to 12 feet below ground surface and from 15 to 17 feet below ground surface. Samples were analyzed for total alpha and beta radiation. No contamination was detected.
1992	Background soil boring installed and sampled during the remedial investigation. Samples were analyzed for total alpha and beta radiation. No contamination was detected. Soil samples also were collected from a nearby monitoring well boring (MW-115). The borehole was logged for natural gamma radiation and found to be within the range of naturally occurring levels.
August 1997	Luke AFB conducted a final inspection of the potential sources of contamination areas.
September 7, 1999	OU-1 ROD signed. Remedy for RW-02 was ICs in the form of a VEMUR to restrict land use/development, annual downhole radiological monitoring, and perimeter fencing.
December 1999	Radiological monitoring points (dry wells) installed to depth of 20 feet below ground surface. Four monitoring point intended to evaluate whether radiation is emanating from the source; one is background location.
January 5, 2000	Base general plan revised to reflect land use restrictions placed on the site. Institutional control plan prepared to facilitate enforcement of ICs and incorporated into BGP. BGP is reviewed and updated as needed.
April 2000	The USEPA and ADEQ conducted a final site inspection and determined that the Air Force has constructed the remedy in accordance with the requirements of the ROD and remedial action work plan.
June 15, 2000	VEMUR filed with ADEQ to restrict future development of the site.
November 14, 2000	Long Term Radiological Monitoring Plan developed.
April 26, 2001	The USEPA concurred with the Final Close Out Report for the Base.
August 8, 2002	Radiological monitoring event conducted.

Table 2.6 (continued)
Chronology of Events
RW-02: Wastewater Treatment Annex Landfill
Operable Unit 1 – Luke AFB, Arizona

Date	Event
Past Activities/Investigations	
January 2002	First Five-Year Review conducted.
January 2002	Based on the recommendation of ADEQ in the First Five-Year Review, MW-124 will be sampled at every 5-year review cycle. Site was subsequently added to Luke AFB LTM program.
April 22, 2002	Site delisted from the NPL (Basewide delisting)
August 26, 2003	Radiological monitoring event conducted.
July 12, 2004	Radiological monitoring event conducted.
July 21, 2005	Radiological monitoring event conducted.
August 2006	Radiological monitoring event conducted. Attempted to collect groundwater samples from MW-124 under long-term monitoring program; however, it was collapsed.
August 21, 2006	Site Inspection Completed
Ongoing Activities	
Annually	Radiological monitoring is conducted each year at established monitoring points. During the monitoring, the security fencing is inspected to assure that it is in good condition and that placarding is in place.
Five year review	Required at 5-year intervals after final closeout process. Site inspection conducted to determine adequacy of surface controls and current land use. Groundwater samples are scheduled to be collected from monitoring well 124 under Luke AFB LTM program.

Table 2.7
Chronology of Events
SD-20: Oil/Water Separator Canal and Earth Fissure
Operable Unit 1 – Luke AFB, Arizona

Date	Event
Past Activities/Investigations	
1988	Site investigated during Phase II Installation Restoration Program investigation. Soil-gas samples were collected from regular interval along the canal from its origin to where it crossed the Base boundary. Sediment and surface water samples were collected. Soil borings were advanced and two monitoring wells were installed. Three rounds of groundwater sampling was conducted.
July 14, 1989	Site was proposed to the NPL (Basewide proposal)
August 30, 1990	Site was added to the NPL (Basewide addition)
September 1990	Federal Facilities Agreement signed
1992/1994	Multi-phased RI conducted at OU-1, including SD-20. During the RI, soil borings were advanced and soil, sediment, and groundwater samples were collected. Three new monitoring wells were installed to augment the two existing wells. Studies also targeted the earth fissures and the effect of the nearby Luke Salt Body on contaminant migration and transport. Based on the results of the RI, soil contamination was not present at high enough levels to present an unacceptable risk, and would not migrate to groundwater. Based on this conclusion, no remedial alternatives for SD-20 were developed in the OU-1 FS
August 1997	Luke AFB conducted a final inspection of the potential sources of contamination areas.
September 7, 1999	OU-1 ROD signed.
April 2000	The USEPA and ADEQ conducted a final site inspection and determined that the Air Force remedy was in accordance with the requirements of the ROD.
April 26, 2001	The USEPA concurred with the Final Close Out Report for the Base.
January 2002	First Five-Year Review conducted.
January 2002	Based on the recommendation of ADEQ in the First Five-Year Review, wells 112S, 112D, and 113 will be sampled at every 5-year review cycle. Site was subsequently added to Luke AFB LTM program.
April 22, 2002	Site delisted from the NPL (Basewide delisting)
August 2006	Groundwater samples collected from wells 112S, 112D, and 113 under long-term monitoring program.
August 26, 2006	Site Inspection Completed
Ongoing Activities	
Five Year Review	Required at 5-year review cycle.

Table 2.8
Chronology of Events
SD-38: Oil/Water Separator at Auto Body Shop
Operable Unit 1 – Luke AFB, Arizona

Past Activities/Investigations	
Date	**Event**
July 14, 1989	Site was proposed to the NPL (Basewide proposal)
August 30, 1990	Site was added to the NPL (Basewide addition)
September 1990	Federal Facilities Agreement signed
March 1991	Site was inspected as part of RCRA Facilities Assessment. It was discovered that the oil/water separator did not have a concrete bottom. Sludge samples were collected for analysis. No results available.
1992	Site was originally classified as an OU-2 PSC. The results of two soil borings indicated deep soil impacts (and thus a potential threat to groundwater); therefore, the site was reclassified as an OU-1 PSC.
1992/1994	A multi-phase RI was conducted for OU-1, including Site SD-38. Total recoverable petroleum hydrocarbons and VOCs were reported in at-depth soil samples. The highest total recoverable petroleum hydrocarbons contamination was reported in the sample collected from 8 feet below ground surface directly below the former separator. Though volatile organic compounds were detected at depth up to 200 feet below ground surface and semivolatile organic compounds were detected at 100 feet below ground surface, these data were not used as they did not meet QC requirements. The separator was removed.
August 1996	Additional soil sampling was conducted because of concerns about the data quality of the first sampling event. Two soil borings were advanced (depth unknown) and no VOCs or semivolatile organic compounds were reported. It was assumed at this time that the impacted soils had been excavated when the separator was removed. One monitoring well was installed and it was dry. The Basewide risk assessment determined that the detected contaminants were not present at levels high enough to cause adverse health effects under current land use scenarios. Modeling indicated that soil contamination posed no threat to groundwater.
August 1997	Luke AFB conducted a final inspection of the PSC.
September 7, 1999	OU-1 ROD signed. Selected remedy for SD-38 was ICs.
January 5, 2000	BGP revised to reflect land use restrictions placed on the site. Institutional Control Plan prepared to facilitate enforcement of institutional controls and incorporated into base general plan. BGP reviewed and updated as needed.
April 2000	The USEPA and ADEQ conducted a final site inspection and determined that the Air Force remedy was in accordance with the requirements of the ROD.
April 26, 2001	The USEPA concurred with the Final Close Out Report for the Base.
June 15, 2002	VEMUR filed with ADEQ to restrict future development of the site.
January 2002	First Five-Year Review conducted.
April 22, 2002	Site delisted from the NPL (Basewide delisting)
August 2005	Site Inspection Completed
Ongoing Activities	
Five Year Review	Required at 5-year intervals after final closeout process. Site inspection conducted to determine adequacy of surface controls and current land use.

Table 2.9
Chronology of Events
SS-42: Bulk Fuels Storage Area
Operable Unit 1 – Luke AFB, Arizona

Past Activities/Investigations	
Date	**Event**
July 14, 1989	Site was proposed to the NPL (Basewide proposal)
August 30, 1990	Site was added to the NPL (Basewide addition)
September 1990	Federal Facilities Agreement signed
March 1993	A leak occurred from subsurface piping when settlement of the underground storage tank caused the fill line to dislodge from the tank. The underground storage tank was part of an oil/water separator system.
March through July 1993	Investigation commenced to determine extent of contamination: 7 soil borings were advanced from 70 feet to 160 feet below ground surface. BTEX (benzene, toluene, ethylbenzene, and total xylenes) constituents were detected in the deepest samples at 160 feet below ground surface, so the vertical extent was not defined. The site was subsequently added to the Federal Facilities Agreement as a potential source of contamination.
1992/1994	A multi-phase remedial investigation/feasibility study was conducted for OU-1, including Site SS-42. Total petroleum hydrocarbons and BTEX constituents were reported in at-depth soil samples collected from as deep as 160 feet below ground surface. The highest total petroleum hydrocarbon contamination was reported in the sample collected from 70 feet below ground surface. The Basewide risk assessment determined that the detected contaminants were not present at levels high enough to cause adverse health effects under current land use scenarios. However, because of the depth of soil contamination, remedial alternatives were developed for the site.
May 1995	Luke AFB initiated a source removal by implementing a bioventing treatability study to reduce the contaminant mass and concentrations of contaminants in subsurface soils.
August 6, 1996	Operation of the full scale soil vapor extraction system commenced. The extracted vapors were reused to fuel a modified internal combustion engine that vented the wells. Thus the extracted soil vapors were treated.
June 1997	Soil boring CB-1 was advanced to monitor the effectiveness of the soil vapor extraction system in mitigating the soil source.
August 1997	Luke AFB conducted a final inspection of the PSC.
November 2, 1998	The soil vapor extraction system was shutdown.
January 7, 1999	Second boring advanced to determine effectiveness of soil vapor extraction. Based on analytical results, the soil vapor extraction system removed nearly 400,000 pounds of volatile hydrocarbons from the soil. Though total petroleum hydrocarbons and BTEX were detected in at-depth soil samples, levels were substantially reduced. Results of modeling indicated that residual total petroleum hydrocarbons and BTEX would not impact groundwater at concentrations above Arizona Water Quality Standards.

Table 2.9 (continued)
Chronology of Events
SS-42: Bulk Fuels Storage Area
Operable Unit 1 – Luke AFB, Arizona

Past Activities/Investigations	
Date	**Event**
September 7, 1999	OU-1 ROD signed. Selected remedy for SS-42 was soil vapor extraction, and LTM to monitor the groundwater quality. Because the soil vapor extraction component of the remedy had already been conducted under a removal action before the ROD was signed, this component of the remedy was not implemented under the ROD.
April 2000	The USEPA and ADEQ conducted a final site inspection and determined that the Air Force has constructed the remedy in accordance with the requirements of the ROD and remedial action work plan.
May 12, 2000	Groundwater LTM plan for SS-42 submitted.
May 16, 2000	First groundwater sampling event of five-year monitoring completed.
May 22, 2000	Soil vapor extraction and confirmation sampling summary report submitted.
April 26, 2001	The USEPA concurred with the Final Close Out Report for the Base.
January 2002	First Five-Year Review conducted.
April 22, 2002	Site delisted from the NPL (Basewide delisting)
August 2003	Completed annual LTM groundwater sampling.
June 2004	Completed annual LTM groundwater sampling.
April 2005	Completed annual LTM groundwater sampling.
August 2006	Completed annual LTM groundwater sampling.
August 23, 2006	Site Inspection Completed
Ongoing Activities	
Five Year Review	Required at 5-year intervals after final closeout process. Site inspection conducted to determine adequacy of surface controls and current land use. Groundwater monitoring of wells 121 and 125R under Luke AFB LTM program.

Table 2.10
Chronology of Events
DP-23: Old Surface Impoundment West of Facility 993
Operable Unit 2 – Luke AFB, Arizona

Date	Event
Past Activities/Investigations	
July 14, 1989	Site was proposed to the NPL (Basewide proposal)
August 30, 1990	Site was added to the NPL (Basewide addition)
September 1990	Federal Facilities Agreement signed
December 1991 to June 1992	OU-2 RI conducted to characterize soil contamination and determine threat to groundwater.
May 12, 1993	Proposed Plan presented to the public and accepted.
January 28, 1994	OU-2 ROD signed. DP-23 was divided into the southern portion and the northern portion. The remedy for the southern portion was excavation, ex situ soil treatment via composting, on-site disposal of treated soils, then subsequent monitoring. Based on the findings of the risk assessment, the remedy for the northern portion of DP-23 was ICs.
May 1994	Remedial design report was prepared and approved for composting operation to be conducted in on-site treatment cell. Report included recommendations for soil amendments to be added to form compost as determined from computer modeling.
April 11, 1995	Preliminary soil sampling conducted to further characterize the extent of soil contamination at the site. Contaminants of concern in excess of Preliminary Remediation Goals were determined to be four polynuclear aromatic hydrocarbon constituents. Based on preliminary results, the site was recommended for more extensive investigation.
July 1995	On-site treatment cell was constructed by emplacing berms and lining the bermed area with 40-milliliter high density polyethylene liner, topped with 6 inches of native fill. In all 625 cubic yards of soil contaminated with benzo(a)pyrene at levels above the Preliminary Remediation Goal 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, and moisture levels.
October 1995	After 120 days, interim samples were collected at baseline locations to determine the effectiveness of the composting: 25% remained above the Preliminary Remediation Goal for benzo(a)pyrene.
April 3, 1997	An optimized soil amendment mix was added to the compost and soil composting continued for an additional 60 days.
June to August 1997	Final sampling was conducted. All samples were stated to be below the Preliminary Remediation Goal for benzo(a)pyrene. The treated soils were used as fill to restore the site to its original grade and the site was hydro-seeded. The high density polyethylene liner was disposed at a local landfill.
August 1997	Final site inspection conducted.

Table 2.10 (continued)
Chronology of Events
DP-23: Old Surface Impoundment West of Facility 993
Operable Unit 2 – Luke AFB, Arizona

Date	Event
Past Activities/Investigations	
August 27, 1997	Final closure report submitted based on remediation complete status.
April 2000	The USEPA and ADEQ conducted a final site inspection and determined that the Air Force has constructed the remedy in accordance with the requirements of the ROD and remedial action work plan.
2001	Filed internal land use restriction.
April 26, 2001	The USEPA concurred with the Final Close Out Report for the Base.
January 2002	First Five-Year Review conducted.
April 22, 2002	Site delisted from the NPL (Basewide delisting)
August 22, 2006	Site Inspection Completed
Ongoing Activities	
N/A	ICs in place as site is located within confines of fenced AFB with controlled access. No groundwater monitoring required.
Five Year Review	Required at 5-year intervals after final closeout process. Site inspection conducted to determine adequacy of surface controls and current land use.

Table 2.11
Chronology of Events
ST-18: Former Liquid Waste Storage Facility (Facility 993)
Operable Unit 2 – Luke AFB, Arizona

Date	Event
Past Activities/Investigations	
1979	Site is classified as a RCRA interim status treatment, storage, and disposal facility.
1980	RCRA Part A Hazardous Waste permit submitted.
1982	RCRA closure activities commenced to allow construction of a new taxiway and U.S. Air Force reserve maintenance building.
July/August 1983	Soil borings were advanced to 50 feet below ground surface. No contamination was reported in subsurface soil samples. Based on these results, a partial closure plan was submitted to Arizona Department of Health Services.
October 4, 1983	Arizona Department of Health Services approves partial closure plan.
October 19, 1983	The three underground storage tanks in place at Facility 993 are removed. Visual evidence of contamination was evident during excavation.
November 1985 to February 1986	Site characterization activities conducted under Installation Restoration Program Phase I. Five soil borings were advanced over 100 to 145 feet below ground surface. Five monitoring wells were installed through the borings. Contaminated soil was detected in at-depth samples, with the deepest contamination occurring at 56.5 feet below ground surface.
May 1987	Site is capped with concrete runway, which satisfies part of the RCRA post-closure requirements for the site.
May 13, 1988	Letter prepared by ADEQ stated that they had conducted a final inspection of the cap and that is was adequate.
July 14, 1989	Site was proposed to the NPL (Basewide proposal)
August 30, 1990	Site was added to the NPL (Basewide addition)
September 27, 1990	The federal facilities agreement for Luke AFB was signed, transferring regulatory authority of ST-18 to CERCLA as part of RCRA/CERCLA integration efforts.
December 1991 to June 1992	Multi-phase RI/FS conducted throughout OU-2, including ST-18. Subsurface soil samples and groundwater samples were collected. Soil samples were reported to contain total recoverable petroleum hydrocarbons, VOCs, and semivolatile organic compounds. The highest levels of VOCs were reported at 20 to 22 feet below ground surface. Two VOCs were reported in groundwater in the first round of sampling in 1992, but were noted as common lab contaminants. Subsequent groundwater samples showed no contamination.
May 12, 1993	Proposed Plan presented to the public and accepted.

Table 2.11 (continued)
Chronology of Events
ST-18: Former Liquid Waste Storage Facility (Facility 993)
Operable Unit 2 – Luke AFB, Arizona

Date	Event
Past Activities/Investigations	
January 28, 1994	OU-2 ROD signed. Selected remedy for ST-18 specified as capping, surface controls, and groundwater monitoring.
August 1996	Additional sampling was conducted because of concerns about the quality/usability of data evaluated for the ROD and used to derive the relative risk posed by site conditions. Nine borings were emplaced and 36 samples collected. Total petroleum hydrocarbons were detected in several at-depth samples, with the highest concentration reported at 18,000 milligrams/kilogram in a sample collected from 18 to 20 feet below ground surface. The risk assessment was recalculated using the new data and the selected remedial alternative identified in the ROD was determined to be adequate and protective.
August 1997	Luke AFB conducted a final inspection of the PSC.
January 5, 2000	BGP revised to reflect land use restrictions placed on the site. Institutional control plan prepared to facilitate enforcement of institutional controls and incorporated into base general plan. BGP is reviewed and updated as needed.
April 2000	The USEPA and ADEQ conducted a final site inspection and determined that the Air Force has constructed the remedy in accordance with the requirements of the Record of Decision and remedial action work plan.
May 12, 2000	Groundwater LTM plan submitted for ST-18.
2001	Filed internal land use restriction.
April 26, 2001	The USEPA concurred with the Final Close Out Report for the Base.
January 2002	First Five-Year Review conducted.
April 22, 2002	Site delisted from the NPL (Basewide delisting)
August 2003	Completed annual LTM groundwater sampling.
June 2004	Completed annual LTM groundwater sampling.
April 2005	Completed annual LTM groundwater sampling.
August 2006	Completed annual LTM groundwater sampling.
August 22, 2006	Site Inspection Completed
Ongoing Activities	
Five year review	Required at 5-year intervals after final closeout process. Site inspection conducted to determine adequacy of ICs and current land use. Cap inspection and maintenance as needed. Groundwater sampling of monitoring wells 114 and 122 under the Luke AFB LTM program.

3.0 BACKGROUND

Section 3.0 provides an overview of the physical characteristics, land and resource use, history of contamination, initial response actions, and basis for taking action at the site.

3.1 PHYSICAL CHARACTERISTICS

This section briefly describes the Base and its environmental setting. Information was primarily derived from the following site documents:

Final Closeout Report, Luke AFB, Arizona, April 2001, prepared by ARCADIS
Base General Plan, Luke AFB, Arizona, April 2002
Final RI Report, Luke AFB, Arizona, Vol. I and II, October 1997, prepared by ARCADIS
First Five-Year Review Report, Luke AFB, Arizona, January 2002, prepared by ARCADIS

3.1.1 Installation Description

Luke AFB is located in the city of Glendale, Maricopa County, Arizona, approximately 20 miles northwest of downtown Phoenix in south-central Arizona (Figure 3.1). The city of Glendale, Arizona, is located approximately nine miles west of Luke AFB. The Base property encompasses approximately 4,000 acres.

The Maricopa Association of Government describes the area surrounding the AFB as rural (MAG, 1993). Agricultural land and scattered single family homes exist within ½ mile of the Base boundary. Several large residential communities also have been developed near the Base. It is unlikely that residential development will occur near the Base perimeter because land use restrictions imposed by local, city, and county governments are in place. The Base and its easements are illustrated on Figure 3.2.

Physiography

The installation is located in the Basin and Range Physiographic province, which is characterized by mountains that extend in a northwest-southeast direction. The mountain ranges are separated by broad, alluvial valleys. The Base is located in a basin approximately six miles east of the White Tank Mountains in the Lower Colorado River Valley Subdivision of the Sonoran Desert. The White Tank Mountains are remnants of faulted blocks of the earth's crust. Erosion of these mountains has deposited volumes of sand and gravel on the valley floors. The thickness of the deposits is not easily estimated. Gravel-sized fragments of metamorphic gneiss and igneous granite are found at Luke AFB. The fragments are randomly dispersed in the soil matrix, which consists of loam or mixtures of sand, silt, and clay.

Luke AFB is generally flat; however, there is a gentle slope from the north to south. The elevation of the Base ranges from 1,075 to 1,105 to feet above mean sea level (amsl) and there are two naturally-occurring hills at the site (Luke AFB, 2002).

Regional Geology

Eight soils and one soil complex occur at the Base as described below (Luke AFB, 2002). The distribution of the soils and the soil complex is illustrated on Figure 3.3.

Antho Series- permeable sandy loams

Calciorthid Soils- typically sandy loam to clay loam, gravel, and cobble materials

Estrella Series- loam of slow to moderate permeability on broad alluvial fans and low terraces. This series is found on grades of less than 1% at elevations of 800 feet to 1,400 feet AMSL.

Gilman Series- the predominant soil type and consists of loam and sandy loam of moderately permeable soils occurring on valley plains and low terraces at slopes from 0 to 3% at elevations from 800 feet to 1,400 feet AMSL.

Glenbar Series- loam of moderate permeability. This series is found on grades less than 1% at elevations ranging from 700 feet to 1,250 feet AMSL.

Laveen Series- sandy loam, loam and saline-alkali loam of moderate permeability. These soils are found at elevations from 800 feet to 1,400 feet AMSL

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Mohall Series- consists of loam and clay loam of slow to moderate permeability. This series occurs at elevations from 1,000 feet to 1,450 feet AMSL.

Pinal Series- consists of loams of moderate permeability deposited over a silica-lime cemented hard pan that is nearly impermeable. This series is found on grades less than 3% at elevations ranging from 800 feet to 1,400 feet AMSL.

Rillito-Perryville Complex- consists of gravelly and sandy loams formed on remnant stream terraces and alluvial fans. This series occurs at elevations that are 10 feet to 75 feet above surrounding soils.

The soils at Luke AFB are underlain by alluvial and basin fill consisting of sand, silt, gravel, clay, and salt, which are approximately 10,000 feet thick.

Regional Hydrogeology

This section discusses the aquifer units, regional recharge, regional discharge, and historical trends associated with the Luke AFB area. The hydrogeology information summarized below is from the First Five Year Review (ARCADIS, 2002a) and field measurements collected during the most recent round of LTM sampling.

Aquifer Units

The occurrence and movement of groundwater at Luke AFB is affected by hydraulic characteristics of the aquifer units, and the magnitude and distribution of groundwater recharge

and discharge for agriculture and other uses. Aquifer units are the upper alluvial unit, middle fine unit and lower conglomerate unit. Historically, withdrawals in excess of recharge have created declines in groundwater levels in the Luke AFB area of 300 feet. However, recent changes in groundwater use and increased recharge have caused groundwater levels to recover as described below in Section 3.1.1.4. Structural changes associated with the Luke Salt Body significantly affect local groundwater conditions south and east of the Luke AFB.

Interpolation of data from the regional study of Brown and Pool (USGS, 1998) indicates that the upper alluvial aquifer has been completely dewatered in the Luke AFB area, except for localized areas along the Agua Fria River, near the Luke AFB waste water treatment plant. Partial dewatering of the middle fine unit has also occurred in the Luke AFB area. This aquifer is now the uppermost aquifer.

Regional Recharge

Groundwater recharge in the West Salt River Valley is affected by natural as well as artificial sources. Groundwater is naturally recharged by infiltration through the beds of river channels during storm water events or releases from upstream impoundments. Artificial sources of groundwater recharge include infiltration of excess irrigation water applied to fields and seepage losses from irrigation ditches and canals. Infiltration of treated effluent from the Luke AFB wastewater treatment plant (WWTP) may also provide recharge in the immediate area of the releases to the Aqua Fria River floodplain.

Regional Discharge

Groundwater discharge from the regional aquifer in the Luke AFB area occurs primarily from cultural uses. There is no natural discharge due to evapotranspiration or discharge to surface water bodies. Discharge of groundwater occurs principally from pumping numerous wells for irrigation and for municipal, military, and light industrial consumption.

The amount of groundwater discharge for municipal usage is anticipated to increase dramatically in response to the growing population of the area; however, as the population increases in the area it is anticipated that groundwater discharged for agricultural uses will decrease. Comparison of the increased withdrawals for municipal uses and decreased withdrawals for irrigation uses shows that the demand for groundwater in the area will remain generally the same into the foreseeable future.

Historical Trends in Water Levels

Groundwater levels declined more than 300 feet in the vicinity of Luke AFB from 1923 to the late 1970s, primarily because of significant depletion in response to pumpage for irrigation requirements. The greatest declines occurred west, north, and south of Luke AFB. A large cone of depression has existed southwest of the Luke AFB since sometime before 1964. The regional groundwater flow direction, which is modified by the cone of depression, is to the south-southwest.

Water levels from selected wells, for which data were adequate, were plotted to show groundwater declines over time at a given location. Analysis of these hydrographs suggests that

water levels have declined substantially over most of the study area through at least 1980. After 1980, many of the hydrographs show a leveling off of the decline trend, or a groundwater rise of up to 40 to 60 feet. Groundwater table elevations in the study area have continued to rise as a result of reduction in agricultural pumpage. The agricultural pumpage has decreased because the farmland near the Base is being converted to residential properties. Also, the availability of Colorado River water via the Central Arizona Project canal (especially for agricultural irrigation) has greatly lessened the demands on groundwater in the Phoenix area.

Water level data for the period from 1991 to 1995 documents a continued rise in the groundwater table throughout the study area. Elevations had increased up to 20 feet, in large part due to above average precipitation for 1992 and 1993. Depth to water readings collected from monitoring wells during the August 2006 investigation documented a rise in static water level of 12.2 feet below ground surface (bgs) from August 2003 and 7.19 feet bgs from April 2005.

3.2 LAND AND RESOURCE USE

The eastern portion of Luke AFB currently consists of a variety of light industrial facilities, office buildings occupied by administrative and community services, base barracks, and outdoor recreation centers. The central and western portions of Luke AFB include the runways, open spaces, and aircraft operations, training and maintenance facilities. Base residential housing and commercial areas are located east of the fenced areas of the main portions Luke AFB. Aircraft maintenance and light industrial operations in support of training missions have been in existence at Luke AFB since its inception in 1941. The results of these activities generated potentially hazardous wastes including, petroleum residues and degreasing solvents (ARCADIS, 2002). The areas where the hazardous waste was stored or used (or suspected to have been used) are known as potential sources of contamination (PSCs). The site layout illustrating the PSCs that required a remedy or long-term monitoring (LTM) is included as Figure 3.4.

3.3 PSC HISTORY OF CONTAMINATION AND INITIAL RESPONSE ACTIONS

This section describes the history of contamination for the 11 sites that required a remedy or are included in the LTM plan. The initial responses for the PSCs also are described in this section. Initial responses were considered to be significant activities (for example: investigations, removals, etc.) completed before the signing of the ROD. The site, which includes the PSCs listed below, was proposed for the NPL on July 14, 1989, and placed on the list on August 30, 1990. The section is sorted by OU then alphabetically by site name.

3.3.1 DP-13: Drainage Ditch Disposal Area

Site Description

PSC DP-13 is located in the northwest corner of the Base. During the 1940s, this site was the location of a drainage ditch that was reportedly used for refuse disposal. The ditch was filled and covered when the Base was deactivated in 1946. Asphalt and concrete rubble stored in the northwest corner of the site was disposed in a burial pit in 1974. No known or suspected industrial-type wastes or hazardous wastes were disposed at this site. Currently, a majority of

the site is covered with bare ground. The northern portion of the site is used as a bivouac area for preparedness training.

History of Contamination

During the OU-1 RI, geophysical and soil gas surveys were conducted to define the landfill boundaries and to select locations for test pits. Fifteen test pits were excavated to characterize the extent and contents of the landfill. Ten soil borings were advanced to further define the vertical and lateral extent of constituents of potential concern detected in the test pit samples. In August 1996, three additional soil borings were advanced to collect supplemental volatile organic compound (VOC) and semivolatile organic compound (SVOC) data for risk assessment purposes.

The test pit located near the side of a maintained road within the bivouac area intercepted an inactive underground utility line. A paint pail and dried paint residue were also observed in this test pit. Wastes collected from that test pit at a depth of 5 feet bgs contained chromium at 15,900 milligrams per kilogram (mg/kg) and lead at 36,000 mg/kg. Because these wastes are buried and the surface area is maintained, direct exposure is not likely under current land use scenarios. However, exposure to these buried wastes could result if excavation were to occur or if the site were developed for residential purposes. For this reason, remedial alternatives were developed for PSC DP-13 as a protective measure (Geraghty & Miller [ARCADIS], 1997).

Initial Response Actions

From 1992 through 1996, investigations were completed to define the contents of the alleged disposal site. One sample collected during the investigation contained levels of metals contamination that would be hazardous to human health or the environment. However, this sample was collected from five feet bgs and because the surface of this area is maintained, direct exposure was not likely considering current land use scenarios. Thus, no time critical removal action (TCRA) was conducted.

3.3.2 FT-07E: Eastern Portion of North Fire Training Area

Site Description

PSC FT-07E is situated in the northern portion of the Luke AFB, west of Fire Department Training Facility 1355. Fire training activities in the eastern portion of PSC FT-07E began in 1973 when the Base constructed three fire-training pits (FTPs). According to Luke AFB records, the three FTPs were active from 1973 until 1989. The two largest FTPs were constructed with sprinkler systems to dispense off-spec petroleum oil lubricant onto mock aircraft or similar structures. The two largest FTPs were designated Fire Training Pit #3 (FTP-3) and Fire Training Pit #4 (FTP-4). The third FTP was identified as Fire Training Pit #6 (FTP-6).

History of Contamination

Luke AFB operated a soil vapor extraction (SVE) system at FTP-3 and FTP-4 from April 1992 through December 1992. Mass calculations indicate that over 14,000 pounds of contaminants were removed from the soil and destroyed by a thermal oxidizer treatment system.

Soil sample results indicated that residual hydrocarbon contamination was effectively reduced at depths greater than 16 feet bgs. Groundwater sample results provide evidence that the underlying groundwater resources have not been impacted and vadose zone transport modeling suggests that residual petroleum hydrocarbon contaminants in the soil will not leach to the underlying groundwater. However, relatively high concentrations (27,000 mg/kg) of total petroleum hydrocarbons (TPHs) remained in the soils near the surface, so remedial alternatives were developed (Geraghty & Miller, 1997). The remedial alternatives evaluated for this site are summarized in Table 3.1.

Initial Response Actions

Investigations were conducted at the PSC from 1984 to 1996. The investigations documented extensive VOC and TPH contamination. Luke AFB installed an SVE system in early 1992. The system was operated from April of 1992 to December of 1992. Investigations conducted after the SVE system ceased operations provided analytical data for the vadose transport model, which suggested that the overlying contamination would not leach to the groundwater.

3.3.3 LF-03: Outboard Runway Landfill

Site Description

PSC LF-03 consists of a former construction debris landfill located on the western side of the Base near the central part of the outboard runway, south of Taxiway F. The site occupies approximately 21 acres. The outboard runway currently covers 60 percent of the site. The remainder of the site consists of a bare low-lying area with sparse vegetation. The Base reportedly used the site for limited disposal of refuse from 1951 to 1953. Landfilling operations at this site ceased when the outboard runway was constructed.

History of Contamination

During the OU-1 RI, geophysical and soil gas surveys were conducted to define the landfill boundaries and to select locations for test pits. Six test pits were excavated and sampled to characterize its extent and contents. Two additional soil borings were advanced and sampled in August 1996 to collect additional VOC and SVOC data for risk assessment purposes.

Numerous metallic wastes were unearthed at the central portion of this site during test pit excavation. Samples of the wastes collected from test pit TP-5 at depths of 7-8 feet bgs contained chromium at a concentration of 386 mg/kg. Because the metallic wastes containing

elevated chromium concentrations are buried and extend below the outboard runway, direct exposure is not likely under current land use scenarios.

The risk assessment concluded that the site does not present unacceptable health risks given its current land uses. However, long-term exposure and unacceptable health risks could result if the runways were removed and the site was developed for residential purposes. As a result, remedial alternatives were developed for the site (Geraghty & Miller, 1997). The remedial alternatives evaluated for this site are summarized in Table 3.1.

Initial Response Actions

The landfill was characterized from 1992 to 1996. During the investigation, subsurface samples were collected that contained levels of contamination that would be hazardous to human health or the environment. The contaminants did not appear to pose an immediate threat; therefore, no TCRA was conducted.

3.3.4 LF-14: Old Salvage Yard Burial Site

Site Description

PSC LF-14 consists of a former landfill site located in the northeastern corner of the Base. In the 1940s, this site was part of the main drainage canal for the north end of the Base. The canal was abandoned when the drainage was changed in the 1950s. The abandoned canal may have been used as a landfill and was completely filled and covered by 1962. According to interviews with Base personnel, polychlorinated biphenyl (PCB)-containing transformer fluids may have been disposed in the ditch in the northern portion of this site. The site is currently unpaved and covered with bare ground.

History of Contamination

An RI was completed to define the boundaries of the former drainage ditch landfill and to characterize its content. Geophysical and soil gas surveys were conducted to define the landfill boundaries and to select locations for test pits. Phase II activities consisted of excavating 4 test pits and sampling 10 soil borings. Two additional soil borings were advanced in August 1996 to collect supplemental VOC and SVOC data for risk assessment purposes.

Relatively high PCB concentrations (2,300 mg/kg) were detected at the site; however, the depth at which this concentration was detected was greater than 16 feet bgs and exposure is unlikely. Based on the results of the Basewide risk assessment, contaminants identified at PSC LF-14 were not present at areas of potential exposure at concentrations high enough to cause adverse health effects under current land use scenarios. However, the concentrations of PCBs and chromium present in soils 0 to 16 feet bgs could theoretically cause adverse health affects in unlikely event that PSC LF-14 were developed for residential purposes in the future. For

this reason, remedial alternatives were developed for the site (Geraghty & Miller, 1997). The remedial alternatives evaluated for this site are summarized in Table 3.1.

Initial Response Actions

From 1992 through 1996, investigations were completed to define the contents of the former disposal site. The investigations documented PCB and metals contamination at relatively high levels. Based on the results of the Base-wide risk assessment, contaminants identified at PSC LF-14 were not present at areas of potential exposure at concentrations high enough to cause adverse health effects under current land use scenarios. Considering the risk assessment information, it was determined that a TCRA was not warranted.

3.3.5 LF-25: Northwest Landfill

Site Description

PSC LF-25 consists of an area formerly used for landfilling and is located along the southwest boundary of the Base, between the west perimeter and the northwest runway. This narrow site occupies approximately 43 acres. Portions of PSC LF-25 are located immediately downrange of the Base skeet shooting range. Small, localized sections of the site were used as a landfill for construction debris in the past for an undetermined length of time, but it has not been used since 1989.

History of Contamination

An RI was completed to define the boundaries of any former landfills and to characterize their content. During the OU-1 RI investigations, geophysical and soil gas surveys were conducted to define landfill boundaries and to select locations for test pits and soil borings.

Lead and antimony were detected in the surface soils adjacent to the skeet range at concentrations that could cause adverse health effects if prolonged exposure, such as excavation work or residential occupation, were to occur. The lead and antimony were present in the form of metal shot that was fired from the adjacent Base skeet shooting range. As a protective measure, remedial alternatives were developed for the site (Geraghty & Miller, 1997). The remedial alternatives evaluated for this site are summarized in Table 3.1.

Initial Remedial Actions

Investigations were conducted at the PSC from 1990 to 1996. The investigations concluded that metals contamination was present at levels that would pose a threat to human health or the environment in surface soil. Because the site is located in a relatively remote location and because there is no on-site activity that would expose Base personnel to the contamination, a TCRA was not conducted. Instead the contamination was addressed as a remedial action. In

December 1999, shot recovery activities were conducted to reduce the concentrations of antimony and lead below their clean-up goals of 31.0 mg/kg and 400 mg/kg, respectively.

3.3.6 RW-02: Wastewater Treatment Annex Landfill

Site Description

PSC RW-02 was previously a 28-acre landfill at the Luke AFB WWTP annex. The WWTP annex is located north of Glendale Avenue, approximately two miles east of Luke AFB. The landfill is located in the northwestern portion of the WWTP annex adjacent to the western bank of the Agua Fria River. PSC RW-02 served as the primary base landfill for the disposal of refuse from 1953 to 1970. The river bank bordering the landfill was stabilized by the U.S. Army Corps of Engineers in 1990 to prevent erosion.

In 1956, a small quantity of low-level radioactive tubes and dials were buried at the landfill. The radioactive material was reportedly encased in concrete and buried in a 12-foot deep pit with 6 feet of concrete cover and 4 feet of earth cover. The radioactive material burial site is located within the boundaries of the former Defense Reutilization Marketing Office storage yard. This area is surrounded by a fence placarded as a radioactive waste burial site and the burial site is designated with a permanent concrete marker (Geraghty & Miller, 1997).

History of Contamination

Two investigations were completed at this PSC. The investigations indicated that the soil near the alleged buried radioactive waste had not been impacted. Because the human and environmental threats were considered to be minimal, the PSC was addressed as a remedial action.

Initial Response Actions

No response actions have been conducted at RW-02.

3.3.7 SD-20: Oil/Water Separator Canal and Earth Fissure

Site Description

PSC SD-20 consists of a drainage canal located on the southern side of Luke AFB. This unlined canal originates at oil/water separator 912, approximately 100 feet north of Super Sabre Street, and extends southward. The oil/water separator 912 system serves two drainage systems: a 30-inch diameter system for the areas to the northwest, and a 43-inch diameter system for an area to the northeast. During past storm events, stagnant, oily water in the 30-inch diameter system occasionally overflowed into the oil/water separator canal. Upgrades to the Luke AFB sewer system have eliminated the potential for additional discharges to the canal. Two earth fissures, apparently resulting from differential land subsidence, are present at the end of the drainage canal.

History of Contamination

SD-20 was investigated during the RI. During the RI, soil borings were advanced and soil, sediment, and groundwater samples were collected. Studies also targeted the earth fissures and the effect of the nearby Luke Salt Body on contaminant migration and transport. The soils at PSC SD-20 were found to contain total recoverable petroleum hydrocarbons (TRPHs), benzo(a)pyrene, arsenic, and beryllium at low concentrations. Based on the results of the RI, soil contamination was not present at high enough levels to present an unacceptable risk, and would not migrate to groundwater. Based on this conclusion, despite the fact that groundwater samples collected at the site were found to contain trichloroethene (TCE), arsenic, and lead no remedial alternatives for SD-20 were developed in the OU-1 FS (Geraghty & Miller, 1997).

Initial Response Actions

As detailed above, based on the results of the RI, soil contamination was not present at high enough levels to present an unacceptable risk, and would not migrate to groundwater. Based on this conclusion, no remedial alternatives for SD-20 were developed in the OU-1 FS. Based on the recommendation of ADEQ in the First Five-Year Review wells 112S, 112D, and 113 will be sampled at every 5-year review cycle. Site was subsequently added to Luke AFB LTM program.

3.3.8 SD-38: Oil/Water Separator at Auto Body Shop

Site Description

PSC SD-38 is located near the middle of the Base at the northwest corner of "D" Street and 3rd Street. The site consists of the former oil/water separator serving Building 248, the old Base Auto Hobby Shop. In March 1991, the SD-38 oil/water separator was inspected as part of the RCRA Facilities Assessment. It was discovered that this oil/water separator did not have a concrete bottom. This separator has since been removed. The Base submitted samples of the sludge from the bottom of the oil/water separator for laboratory analysis. Other than the sludge sampling, no previous investigations or environmental sampling was performed at this site prior to the OU-1 RI.

History of Contamination

PSC SD-38 was originally assigned to the OU-2 investigation. Because OU-2 data indicated a deep soil impact and thus, a potential threat to groundwater, the site was reclassified as an OU-1 PSC. In May 1992, during the OU-1 investigation, three soil borings were advanced and sampled to further evaluate the nature of any impacts to the site and assess the vertical and horizontal extent of those impacts. A groundwater monitoring well (MW-117) was also installed and sampled at this time to evaluate groundwater quality at the site. In August 1996, one additional boring was advanced and sampled to collect supplemental VOC and SVOC data for use in the risk assessment.

Soil samples collected directly beneath the former oil/water separator at a depth of 8 feet bgs contained TRPH at a concentration of 58,000 mg/kg. Based on the results of the Basewide

risk assessment, prolonged exposure to this concentration of TRPH could potentially cause adverse health affects. Because the soils containing elevated concentrations of TRPH are located at depth, direct exposure is not likely under current land use scenarios. However, prolonged exposure to the TRPH in the subsurface soils could result if the site were developed for residential purposes in the future. For this reason, remedial alternatives were developed for PSC SD-38 (Geraghty & Miller, 1997). The remedial alternatives evaluated for this site are summarized in Table 3.1.

Initial Response Actions

No initial response actions have been conducted at SD-38.

3.3.9 SS-42: Bulk Fuels Storage Area

Site Description

PSC SS-42 consists of a former leaking underground storage tank (LUST) site located within the eastern portion of the bulk fuels storage area of Luke AFB. The LUST was part of an oil/water separator system that received condensate from the two large aboveground fuel tanks.

History of Contamination

Environmental investigations were completed in response to the release from the oil/water separator UST. Seven soil borings were advanced adjacent to the oil/water separator and leaking UST. Several of the borings, advanced to define the horizontal and vertical extent of the impact, contained detections of BTEX and TRPH. Samples collected from as deep as 160 feet bgs reported detections. Because of these unexpected detections, the horizontal extent of the impact was not defined by the seven borings advanced.

A RI was conducted to determine the nature and extent of soil contamination and determine whether there was the potential for soil contaminants to migrate to groundwater. During the RI, TPH and BTEX concentrations were detected in samples collected at depths ranging from 10 feet to 160 feet bgs. The highest detected concentration of TPH was 33,900 mg/kg reported at a depth of 70 feet bgs. BTEX compounds also were detected at their highest concentrations at this depth. Based on the results of the Basewide risk assessment, contaminants identified at PSC SS-42 were not present at areas of potential exposure at concentrations high enough to cause adverse health effects under current land use scenarios, or even under residential land use scenarios. However, results of the vadose zone transport modeling indicated that petroleum related contaminants (TPH and BTEX) detected in the soil could migrate to the underlying groundwater resources. For this reason, remedial alternatives were developed for the site.

Initial Response Actions

Initial investigations conducted in response to the leak from the UST documented extensive VOC and TPH contamination. Luke AFB completed a bioventing treatment study in 1995 and

installed an SVE system in 1996. The system was operated from August of 1996 to November of 1998. Confirmation soil borings were emplaced to determine the effectiveness of the SVE system in mitigating the soil source. Based on analytical results, the SVE system removed nearly 400,000 pounds of volatile hydrocarbons from the soil. Though TPHs and BTEX were detected in at-depth soil samples, levels were substantially reduced. Results of modeling indicated that residual TPHs and BTEX would not impact groundwater at concentrations above Arizona Water Quality Standards (WQSs).

3.3.10 DP-23: Old Surface Impoundment West of Facility 993

Site Description

PSC DP-23 consists of the old surface impoundment and associated drainage swale located west of Building 999 and adjacent to the former south fire training area. The old surface impoundment portion of the site is a rectangular-shaped area that occupies approximately 3.3 acres. Currently, 80 percent of this area is either paved with asphalt, under tarmac, or under concrete, which includes the AGE equipment yard. In the late 1940s, an impoundment dam was constructed along an old natural drainage system, which flowed south off of the Base. This area may have been used for the disposal site for petroleum oil lubricant waste until construction covered the site in 1969. The dam used to create the surface impoundment was buried, but not removed. The swale portion of the site is located to the south of the impoundment area and occupies approximately 19.4 acres. The swale flows south to an area of earth fissures off Base.

History of Contamination

In February 1992, two 150-foot deep borings and four 40-foot deep soil borings were drilled and sampled during the OU-2 investigation. Sediment samples were collected from ten locations in December of 1991 and February of 1992. A total of 26 soil samples and 21 sediment samples were collected and submitted for laboratory analysis.

The highest detected concentration of TRPH was 2,000 mg/kg in the 2 to 4 foot bgs sample collected from a soil boring. The only detected VOC compounds (trace concentrations of toluene and ethyl benzene) were also detected in this sample. TRPH was generally confined to shallow soils. The deepest sample with detectable TRPH concentrations was collected from 8 to 10 feet bgs.

Six soil and five sediment samples collected during the OU-2 investigation contained detectable concentrations of SVOC compounds. Four samples contained concentrations of benzo(a)pyrene in excess of its stated Preliminary Remediation Goal (PRG) of 0.78 mg/kg. These four samples include the two surface samples, a two-to-four-foot bgs sample, and a duplicate sample. None of the other samples contained SVOC compounds at concentrations in excess of their respective PRGs.

The data collected during the OU-2 field investigation were evaluated to determine the appropriate remedial alternative for this site.

Initial Response Actions

In July 1995, the Base constructed an on-site treatment cell in which to compost PAH-contaminated soils by emplacing berms and lining the bermed area with 40-milliliter high density polyethylene (HDPE) liner, topped with 6 inches of native fill. In all 625 cubic yards of soil contaminated 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, and moisture levels. After 120 days, interim samples were collected at baseline locations to determine the effectiveness of the composting: 25% remained above the PRG for benzo(a)pyrene. An optimized soil amendment mix was added to the compost and soil composting continued for an additional 60 days. Final sampling was conducted and all samples were stated to be below the PRG for benzo(a)pyrene. The treated soils were used as fill to restore the site to its original grade and the site was hydro-seeded. The high density polyethylene (HDPE) liner was disposed at a local landfill. A site closure report was prepared and approved in 1997.

3.3.11 ST-18: Former Liquid Waste Storage Facility (Facility 993)

Site Description

PSC ST-18 consists of a former liquid waste storage facility (Facility 993) located in the southern part of the Base. Facility 993 originally consisted of a single 5,000-gallon refueling tank truck that was coated and buried in 1968. This UST was used for the temporary storage of all liquid petroleum, oil, lubricant waste, and solvent wastes generated at the Base. Before 1972, liquid wastes stored at this facility were disposed by spraying them on the road during road oiling and dust suppression activities, pouring the waste into narrow trenches, and using the waste as an incendiary during fire training activities. In 1972, two 10,000-gallon USTs were installed at the facility, and the area around all three USTs, approximately 0.2 acres, was enclosed with a fence. Also at this time, the Base began selling the liquid wastes to private contractors for off-base recycling. This facility was classified as an interim status treatment, storage, and disposal facility under the Resource Conservation and Recovery Act (RCRA) in 1979. Part A of a Hazardous Waste Permit application was submitted in 1980. However, closure of this facility began in 1982 to facilitate the construction of a new U.S. Air Force (AF) Reserve maintenance building.

History of Contamination

The three USTs were removed on October 19, 1983. The soil samples collected from directly beneath the 5,000-gallon buried tanker truck and one of the 10,000-gallon USTs showed signs of impact from past waste releases. The tank pit was excavated to a depth of 16 feet 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, and the minimally contaminated soils were placed directly back into the pit.

Because this site was an active facility in 1981, it was not identified during the Installation Restoration Program (IRP) Phase I investigation, which focused on historic waste disposal activities. However, the Base decided to include this site in the IRP Phase II investigation because of the sampling results of the UST closure activities. Between November 4, 1985, and February 6, 1986, the activities at the site continued during the IRP, Phase II, Stage 1 investigation. During this investigation, five soil borings were advanced in and around Facility 993. The depths of the soil borings ranged from 100 to 145 feet bgs. In addition, five groundwater monitoring wells were installed. The results indicated that the soil beneath the former USTs had been impacted by fuel and organic solvents, and that the impacted soil extended to 56.5 feet bgs.

Initial Response Actions

The site was capped with concrete in 1987 as part of the RCRA post-closure requirements for the site. In a letter dated May 13, 1988, the ADEQ stated that they had inspected the concrete cap covering the facility and it was satisfactory. Currently, the Base continues to inspect and maintain the cap to ensure the integrity of the concrete and sealed joints. Also, the groundwater beneath ST-18 is monitored in accordance with the LTM plan (Geraghty & Miller, 1997).

3.4 BASIS FOR TAKING ACTION

The contaminants of concern (COCs) that were identified during the RI/FS for the 11 PSCs discussed in this Five-Year Review are summarized in Table 3.2 by PSC and by sample media.

Remedial actions taken focused on eliminating exposures to soil associated with significant human health risks, which are defined as those sites where EPA or ADEQ risk management criteria had been exceeded.

Table 3.1
Remedial Alternative Matrix
for
Potential Sources of Contamination
Sites: FT-07E, LF-03, LF-14, LF-25, and SD-23
Luke AFB, Arizona

Remedial Alternative ROD ID	Remedial Alternative Description	Potential Source of Contamination				
		FT-07E	LF-03	LF-14	LF-25	SD-38
S-1	No action	X	X	X		X
S-2	Institutional Controls	X^R	X^R	X^R		X^R
S-3	Asphalt Cap and Institutional Controls					
S-4	Institutional Controls and Ex Situ Physical Treatment/Metals Recovery				X^R	
S-5	Excavation and Off-Site Disposal	X	X	X		X
S-6	Excavation, Off-Site Incineration, and Disposal			X		
S-7	Excavation, Off-Site Thermal/Chemical Treatment, and Disposal	X	X		X	X
S-8	Excavation, On-Site Thermal/Chemical Treatment, and Disposal	X	X	X	X	X
S-9	Excavation, On-Site Biological Treatment, and Disposal	X				X
S-10	Excavation, On-Site Thermoplastic Solidification, and Reuse			X		
S-11	In-Situ Soil Vapor Extraction		X			
S-12	In-Situ Aerobic Biodegradation		X			

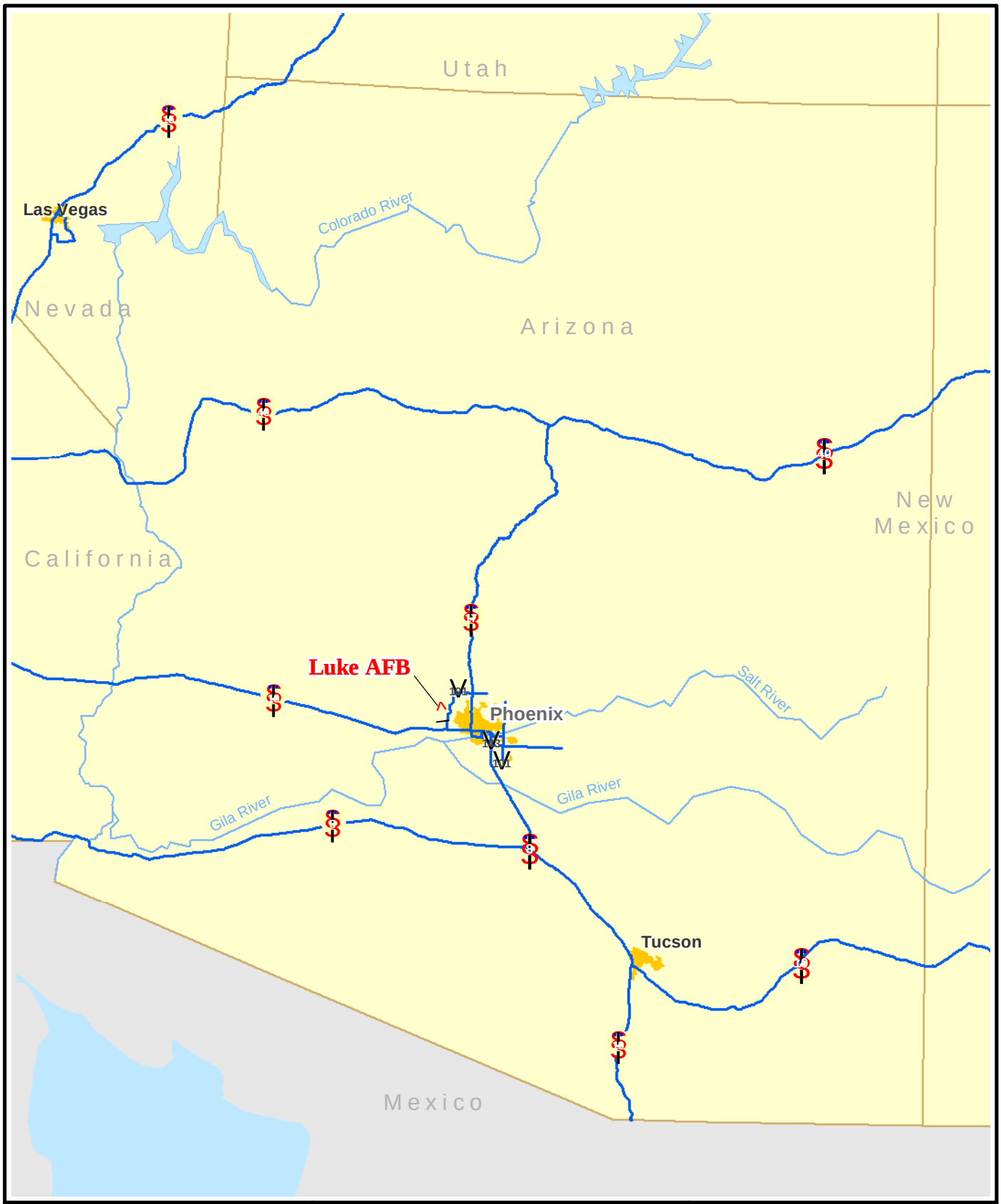
Notes
R Recommended Alternative
ID identification
ROD Record of Decision

Table 3.2
Basis for Taking Action
Luke AFB, Arizona

Potential Source of Contamination		Contaminants of Concern
Operable Unit 1	DP-13	acenaphthene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, bis(2-ethylhexyl)phthalate, carbazole, chrysene, dibenz(a,h)anthracene, dibenzofuran, fluoranthene, fluorine, indeno(1,2,3-cd)pyrene, phenanthrene, pyrene, TRPH, antimony, arsenic, barium, beryllium, cadmium, chromium, copper, lead, mercury, nickel, zinc, and cyanide
	FT-07E	acetone, ethylbenzene, toluene, xylenes, TRPH, arsenic, barium chromium, copper, lead, nickel, and zinc
	LF-03	TRPH, arsenic, barium, beryllium, cadmium, chromium, copper, lead, nickel, silver, and zinc
	LF-14	xylenes, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, butyl benzyl phthalate, chrysene, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, pyrene, PCBs, TRPH, arsenic, barium, beryllium, cadmium, chromium, copper, lead, nickel, silver, zinc, and cyanide
	LF-25	xylenes, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, fluoranthene, pyrene, TRPH, antimony, arsenic, barium, beryllium, cadmium, chromium, copper, lead, nickel, silver, zinc, and cyanide
	RW-02	2-methylnaphthalene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, bis(2-ethylhexyl)phthalate, chrysene, di-n-butyl phthalate, di-n-octyl phthalate, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, pyrene, TRPH, arsenic, barium, beryllium, cadmium, chromium, copper, lead, mercury, nickel, silver, uranium, zinc, gross alpha, gross beta, radium-226, and radium-228
	SD-20	toluene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, bis(2-ethylhexyl)phthalate, chrysene, di-n-octylphthalate, fluoranthene, indeno(1,2,3-c,d)pyrene, phenanthrene, pyrene, TRPH, antimony, arsenic, barium, beryllium, cadmium, chromium, copper, lead, nickel, and zinc
	SD-38	TRPH, antimony, arsenic, barium, beryllium, cadmium, chromium, copper, lead, nickel, and zinc
	SS-42	benzo(a)anthracene, benzo(b)fluoranthene, bis(2-ethylhexyl)phthalate, chrysene, di-n-butylphalate, fluoranthene, pyrene, TPH, and lead
Operable Unit 2	DP-23	ethylbenzene, toluene, anthracene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, benzo(a)pyrene, bis(2-ethylhexyl)phthalate, chrysene, dibenzo(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, pyrene, TRPH, copper, and lead
	ST-18	benzene, 1,1 dichloroethene, ethylbenzene, 1,1,2,2-tetrachlorethane, tetrachloroethene, toluene, trichloroethene, xylenes, benzo(a)anthracene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(a)pyrene, benzyl alcohol, bis(2-ethylhexyl)phthalate, chrysene, fluoranthene, indeno(1,2,3-cd)pyrene, 2-methylnaphthalene, naphthalene, phenanthrene, pyrene, TRPH, copper, and lead

Notes:
No elevated levels of radionuclides were detected in any samples, but the alleged buried waste qualifies the radionuclides as contaminants of concern.
TRPH total recoverable petroleum hydrocarbons

FIGURES

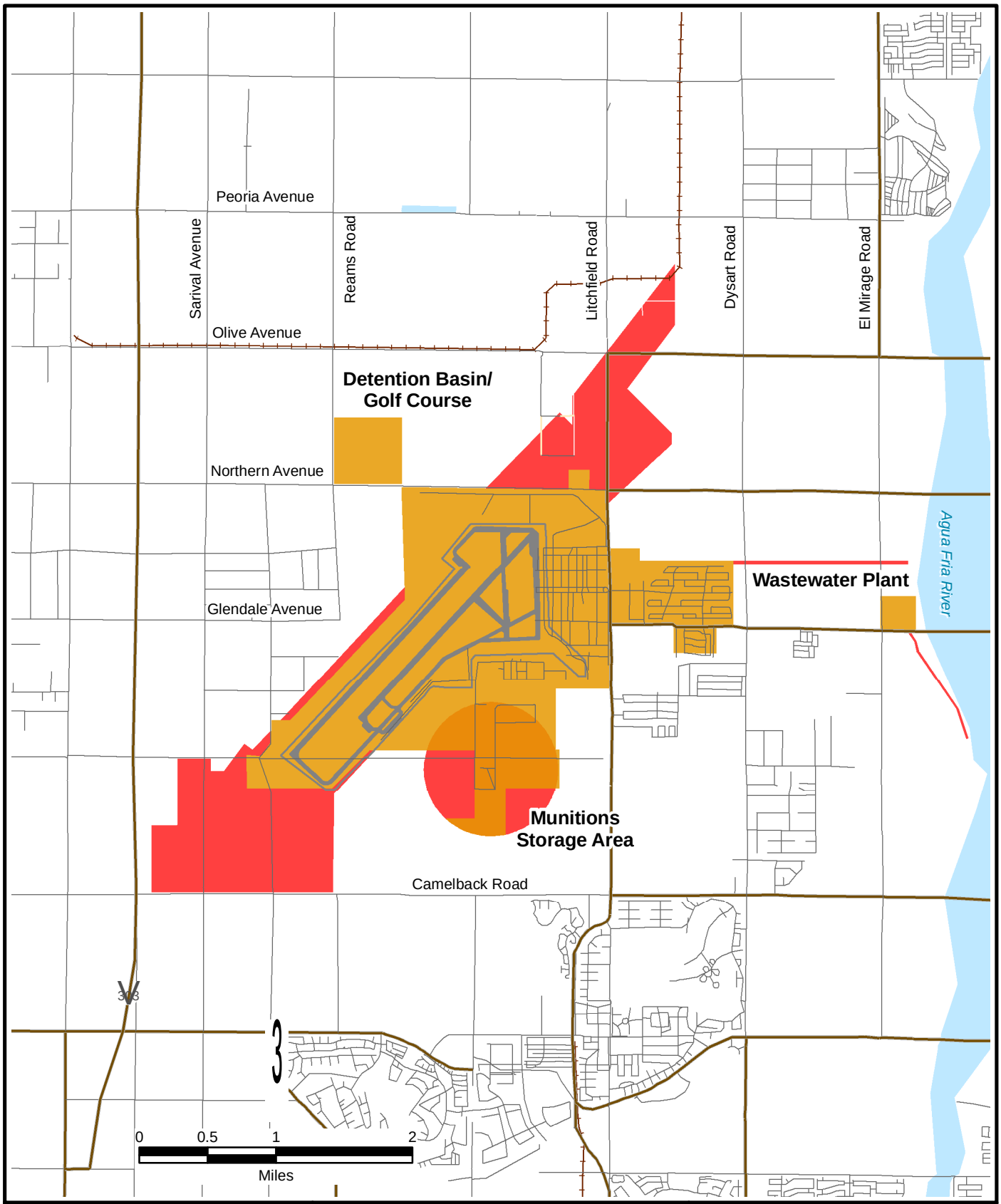


Filename: X:/AFC002/Luke_AFB/TO_57/MAPS/ 2nd 5 Year Review/Site_Location_Map.mxd
Project: AFC002-057-02-05
Created: 10/26/06 CV
Source: HGL GIS Database, 2006

0 20 40 80
Miles

3

Figure 3.1
Site Location Map



Filename: X:/AFC002/Luke_AFB/TO_57/MAPS/ 2nd 5 Year Review/Land_Ownership_Easement.mxd
Project: AFC002-057-02-05
Revised: 02/15/07 CV
Source: HGL GIS Database, 2006
ESRI StreetMap USA

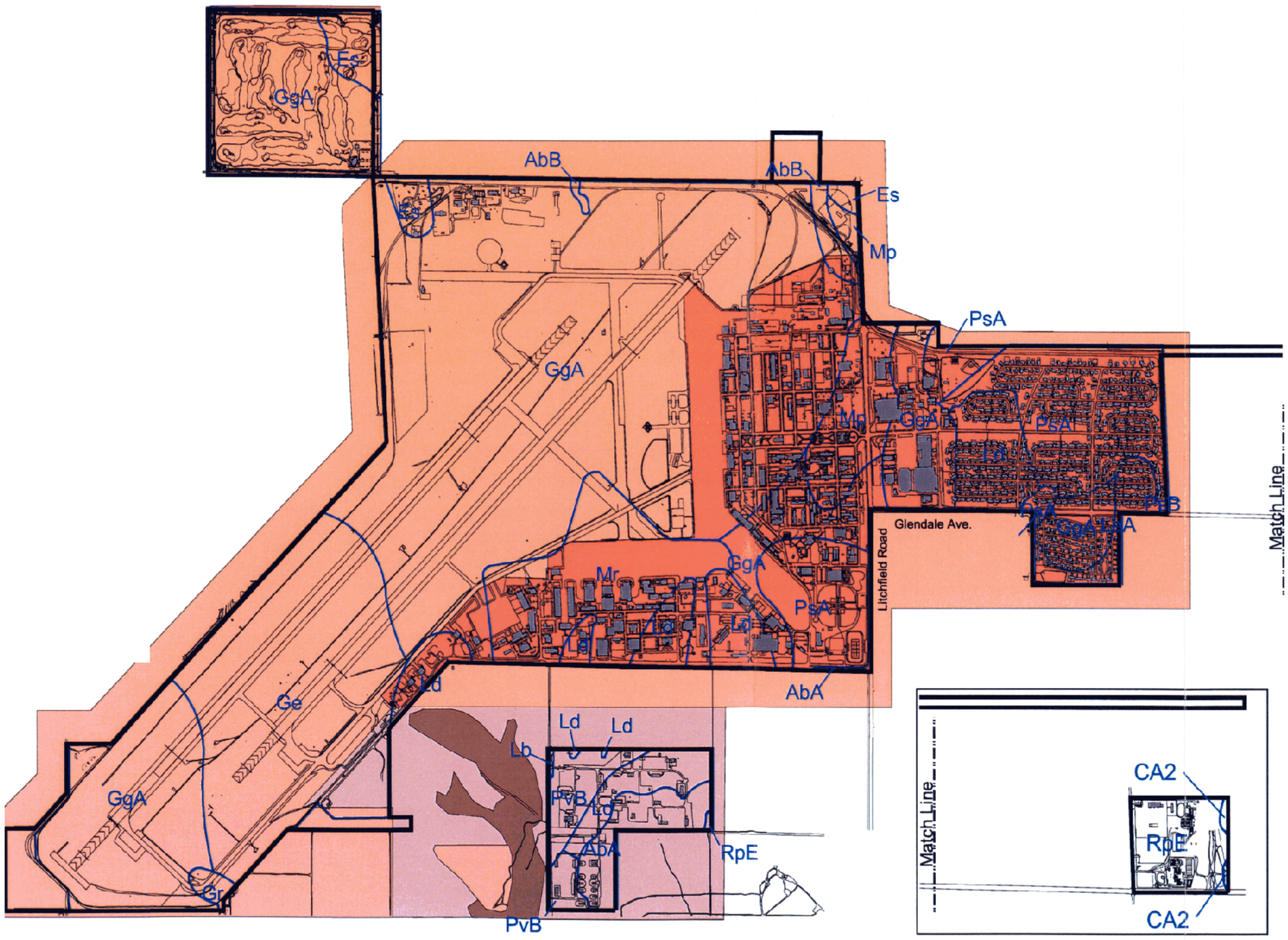
Land Owned

Easement

Figure 3.2
Land Ownerships and Easements

Figure 3.3
Soils and Vegetation

U.S. Air Force Center for Environmental Excellence



Base Boundary
Soil Boundry

Soil Types

AbA	Antho Sandy Loam 0-1 Percent Slopes
AbB	Antho Sandy Loam 1-3 Percent Slopes
CA2	Calciorthids
Es	Estrella Loam
Ge	Gilman Fine Sandy Loam
GgA	Gilman Loam 0-1 Percent Slopes
Gr	Glenbar Loam
Lb	Laveen Sandy Loam
Ld	Laveen Loam, Saline-Alkali
LeA	Laveen Loam 0-1 Percent Slopes
Mp	Mohall Loam
Mr	Mohall Clay Loam
PsA	Pinal Loam 0-1 Percent Slopes
PsB	Pinal Loam 1-3 Percent Slopes
PvB	Pinal-LaPalma Loams 1-3 Percent Slopes
RpE	Rillito-Perryville Complex

Vegetation Areas

- Microphyllous Desert Scrub Area
- Microphyll Woodlands
- Disturbed Sites
- Landscape Vegetation Areas

Date: 02/13/2002

N W E S

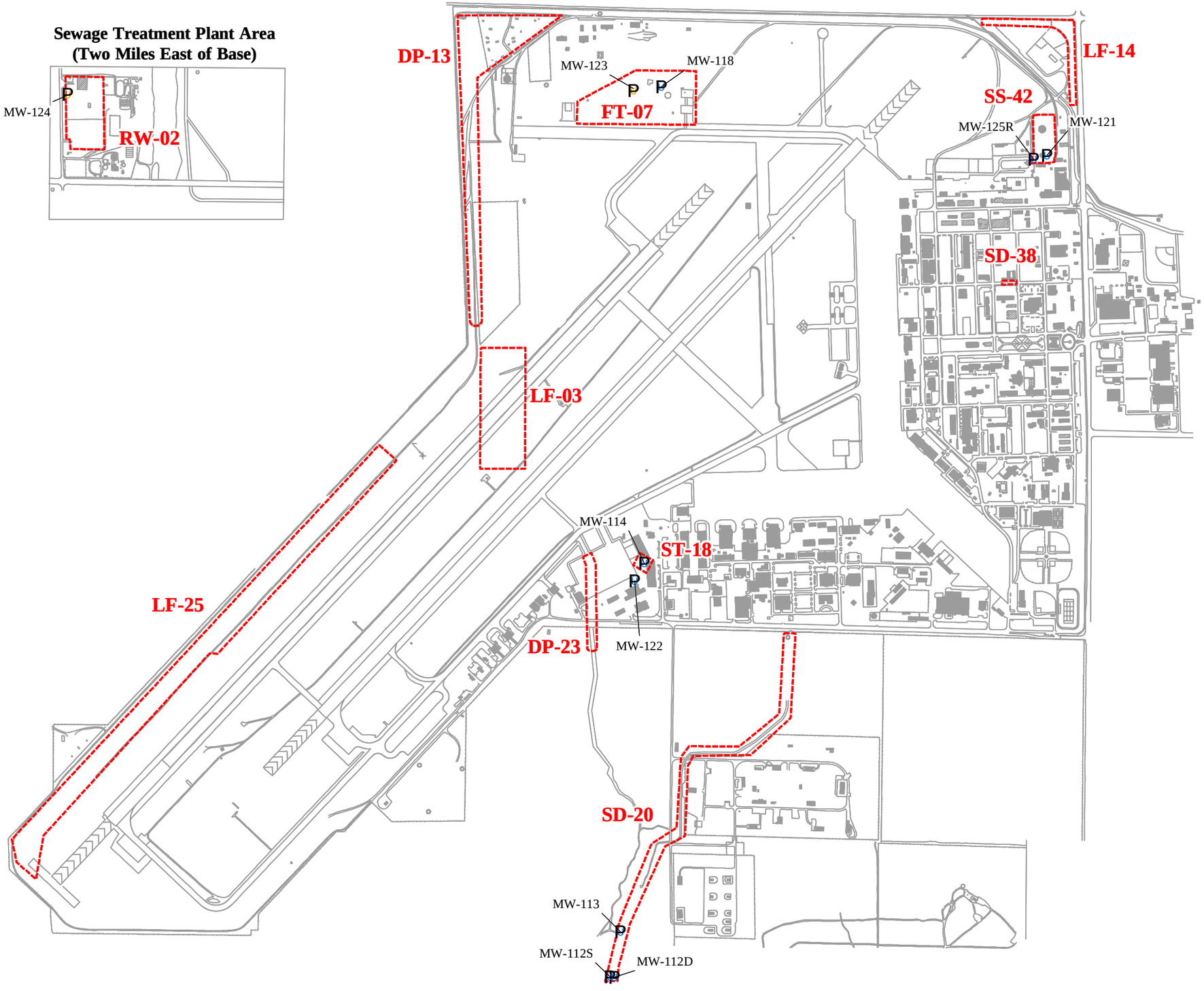
1000 0 1000 2000 Feet

Filename: X:/AFC002/Luke_AFB/TO_57/MAPS/
2nd 5 Year Review/Land_Ownership_Easement.mxd
Project: AFC002-057-02-05 Created: 10/26/06 CV
Source: Luke AFB Base General Plan
K:\81321001\Luke General Plan\gis
General Plan Phase II\gp_phase2.apr

HGL HydroGeoLogic, Inc

Figure 3.4
Site Layout Map

U.S. Air Force Center for Environmental Excellence



Legend

- Existing Structure
- Fence Line
- Miscellaneous Basemap Feature
- Monitoring Well
- Collapsed Well
- Project Potential Sources of Contamination (PSCs)

3

0 650 1,300 2,600
Feet

Filename: X:/AFC002/Luke_AFB/TO_57/MAPS/
2nd 5 Year Review/Site_Layout_Map.mxd
Project: AFC002-057-02-05
Revised: 02/15/07 CV
Source: Luke AFB Base General Plan

HGL HydroGeoLogic, Inc

4.0 REMEDIAL ACTIONS

This Second Five-Year Review covers remedial actions at both OU-1 and OU-2 sites. OU-1 includes the soils at eight PSCs, and Basewide air, surface water and groundwater. OU-2 includes those sites where only petroleum-related wastes were disposed. Remedial (cleanup) alternatives were developed for any site not deemed suitable for unrestricted land use, based on the results of the RI. Remedial alternatives also were developed for any site that could potentially impact the underlying groundwater resources in the future. The remedy selection and implementation at each OU are detailed in the following subsections.

4.1 REMEDY SELECTION

The remedy selections are summarized by OU.

4.1.1 Operable Unit 1

Twenty-five PSCs were investigated during the RI/FS phase. As part of the OU-1 RI, a Basewide risk assessment was conducted to evaluate the potential risks to human health and the environment that could result from exposure to the air, soil, surface water, and groundwater at Luke AFB. The results of the OU-1 RI and Basewide risk assessment indicated that the air, surface water, and groundwater resources of Luke AFB did not represent conditions that would pose an imminent and substantial endangerment to public health, welfare, or the environment. However, the soils at eight of the OU-1 PSCs were found to have conditions that could either cause unacceptable human health risks under certain types of land use scenarios or could impact the underlying groundwater. Remedial alternatives were developed for the soils at those eight sites. A remedy selection process was not required for the soils at the remaining 17 PSCs or for the air, surface water, and groundwater resources of the Base.

Based on the results of the RI, remedial action objectives (RAOs) were developed to aid in the development and screening of alternatives for the eight PSCs found to warrant remediation. All remedial alternatives considered for implementation (except no action) were required to satisfy the RAOs. The RAOs for OU-1 were divided into the following groups:

- Exposure Prevention. Prevent incidental ingestion, dermal contact, and inhalation by an at-risk receptor of soil that contains unacceptable concentrations of contaminants, as determined by the Basewide risk assessment.
- Protection of Groundwater. Prevent the migration of contaminants of concern (COCs) from unsaturated soils into groundwater or surface water to ensure that groundwater or surface water is protective of human health and the environment.

These RAOs are considered to be protective of human health and the environment by preventing human contact with impacted material and by eliminating, reducing, or controlling the possible migration of COCs to other environmental media.

General response actions (GRAs) for soils also were established. GRAs are general measures that could be implemented to achieve the RAOs. GRAs are developed to aid in the identification of remedial technologies that can minimize releases, threats of releases, or pathways of exposure to the soils. Although GRAs are not detailed, they categorize technologies that may be pertinent for remediation of soils. GRAs were developed for two soil units: soils to a depth of 16 feet bgs, and soils with the potential to leach COCs to groundwater. The depth limit was established because exposure to soils deeper than 16 feet bgs is unlikely, even during construction activities. This depth is greater than the maximum standard depth of excavation for a residential development and exceeds most depths of trenching for utility lines. The following GRAs were identified:

- No action. The site would remain as it currently exists. Monitoring may be conducted.
- ICs. Institutional action would be implemented to limit site access and land uses. Personal protective equipment (PPE) may also be required during certain site activities.
- Containment. The relevant area would be physically contained.
- Excavation and Disposal. Selected soil volumes would be excavated for subsequent disposal off-site without treatment.
- Excavation, Treatment, and Disposal. Selected soil volumes would be removed for subsequent treatment and disposal either on or off-site.
- In-situ Extraction. Constituents would be removed from the subsurface soils and discharged at the surface for treatment.
- In-situ Treatment. Selected soil volumes would be treated using appropriate technologies applied in-situ.

It should be noted that GRAs were not developed for groundwater because the groundwater resources beneath the OU-1 PSCs were not impacted with COCs at concentrations above Applicable or Relevant and Appropriate Requirements (ARARs). GRAs developed for the soils also ensure that future impacts to groundwater would not occur at sites that showed the potential for COCs to leach to the groundwater.

Remedial alternatives were developed for the soils at the eight sites as part of the OU-1 FS. The OU-1 FS report prepared by ARCADIS Geraghty & Miller, Inc. in 1998 provided recommendations for the most appropriate remedial alternative for each site based on the nine selection criteria. As required under Superfund, the recommendations were presented to the public and regulatory agencies for review and comment in the OU-1 Proposed Plan.

The selected remedies for the eight OU-1 sites that required action are summarized in Table 4.1

4.1.2 Operable Unit 2

Eight sites where only petroleum-related wastes were disposed were evaluated during the RI/FS of OU-2. The results of the OU-2 RI and Basewide risk assessment indicated that the petroleum-impacted soils at six of the eight PSCs evaluated did not represent conditions that would pose an imminent and substantial endangerment to public health, welfare, or the

environment. Remedial alternatives were developed for the remaining two OU-2 sites: ST-18 and DP-23.

The RAOs for OU-2 were the same as for OU-1. Twelve potential remedial alternatives were screened; of these 12 alternatives, the 5 alternatives listed below were retained for a more detailed analysis:

- No Action
- Capping, surface controls, and monitoring
- Excavation, ex situ biological treatment, and on-site disposal
- In situ extraction and monitoring
- In situ biological treatment and monitoring

All these alternatives were considered to be viable and meet the requirements of the RAOs. The selected remedy for ST-18: Former Liquid Waste Storage Facility (Facility 993) was capping, surface controls, and monitoring. The selected remedy for DP-23: Old Surface Impoundment West of Facility 993 was excavation, ex situ biological treatment, and on-site disposal.

4.2 REMEDY IMPLEMENTATION

The manner in which the selected remedies for each of the OU-1 and OU-2 sites under consideration in this Second Five-Year Review were implemented are summarized in the following subsections.

4.2.1 DP-13: Drainage Ditch Disposal Area

The selected remedy for DP-13 was ICs, based on the determination made in the risk assessment that wastes were buried and posed no exposure threat based on current land use scenarios. The remedy was implemented by revising the Base General Plan (BGP) in January 2000 to reflect that land use restrictions had been placed on the site. The BGP serves as the primary mechanism that ensures the institutional and engineering controls are established and maintained. The BGP's constraints against residential development and construction are enforced through procedures already in place at Luke AFB, including the use of AF Form 332, which controls development and construction projects on Base. An AF Form 332 must be submitted before beginning any building project at the Base. The final approval of any building project resides with the Base Chief of Operations, who is required to review the BGP and sign all AF Form 332s. In compliance with the restrictions of the BGP, the Chief of Operations for Luke AFB will not approve any AF Form 332 that plans for the residential development of the site. The BGP is reviewed and updated annually as needed. The process for obtaining a permit for construction is also detailed in the institutional control plan (ICP).

Another IC in place as part of the remedy is the use of personal protective equipment (PPE) during all future excavation activities at the site. All dig permits issued for the site must include a provision for the use of PPE. The Base Chief of Environmental Engineering must ensure that PPE is used during any future excavation work at the site.

DP-13 was added to the Luke AFB ICP to facilitate enforcement of ICs and incorporated into the BGP. Luke AFB filed a Voluntary Environmental Mitigation Use Restriction (VEMUR) with ADEQ on June 15, 2000 stating that Luke AFB agrees to restrict the site to nonresidential usage.

Site inspections are required at 5-year intervals after signing of the ROD to determine the adequacy of ICs and current land use.

4.2.2 FT-07E: Eastern Portion of North Fire Training Area

The selected remedy for FT-07E was ICs, based on the determination made in the risk assessment that impacted soils remain in place and pose no exposure threat based on current land use scenarios. The remedy was implemented by revising the BGP in January 2000 to reflect that land use restrictions had been placed on the site. The BGP serves as the primary mechanism that ensures the institutional and engineering controls are established and maintained. The BGP's constraints against residential development are enforced through procedures already in place at Luke AFB. An AF Form 332 must be submitted before beginning any building project at the Base. The final approval of any building project resides with the Base Chief of Operations, who is required to review the BGP and sign all AF Form 332s. In compliance with the restrictions of the BGP, the Chief of Operations for Luke AFB will not approve any AF Form 332 that plans for the residential development of the site. The BGP is reviewed and updated annually as needed. The process for obtaining a permit for construction is also detailed in the ICP.

FT-07E was added to the Luke AFB ICP to facilitate enforcement of ICs and incorporated into the BGP. Luke AFB filed a VEMUR with ADEQ on June 15, 2000 stating that Luke AFB agrees to restrict the site to nonresidential usage.

Site inspections are required at 5-year intervals after signing of the ROD to determine the adequacy of ICs and current land use.

4.2.3 LF-03: Outboard Runway Landfill

The selected remedy for LF-03 was ICs, based on the determination made in the risk assessment that wastes were buried and posed no exposure threat based on current land use scenarios. The remedy was implemented by revising the BGP in January 2000 to reflect that land use restrictions had been placed on the site. The BGP serves as the primary mechanism that ensures the institutional and engineering controls are established and maintained. The BGP's constraints against residential development are enforced through procedures already in place at Luke AFB. An AF Form 332 must be submitted before beginning any building project at the Base. The final approval of any building project resides with the Base Chief of Operations, who is required to review the BGP and sign all AF Form 332s. In compliance with the restrictions of the BGP, the Chief of Operations for Luke AFB will not approve any AF Form 332 that plans for the residential development of the site. The BGP is reviewed and

updated annually as needed. The process for obtaining a permit for construction is also detailed in the ICP.

LF-03 was added to the Luke AFB ICP to facilitate enforcement of ICs and incorporated into the BGP. Luke AFB filed a VEMUR with ADEQ on June 15, 2000 stating that Luke AFB agrees to restrict the site to nonresidential usage.

Site inspections are required at 5-year intervals after signing of the ROD to determine the adequacy of ICs and current land use.

4.2.4 LF-14: Old Salvage Yard Burial Site

The selected remedy for LF-14 was ICs, based on the determination made in the risk assessment determination that wastes were buried and posed no exposure threat based on current land use scenarios. The remedy was implemented by revising the BGP in January 2000 to reflect that land use restrictions had been placed on the site. The BGP serves as the primary mechanism that ensures the institutional and engineering controls are established and maintained. The BGP's constraints against residential development are enforced through procedures already in place at Luke AFB. An AF Form 332 must be submitted before beginning any building project at the Base. The final approval of any building project resides with the Base Chief of Operations, who is required to review the BGP and sign all AF Form 332s. In compliance with the restrictions of the BGP, the Chief of Operations for Luke AFB will not approve any AF Form 332 that plans for the residential development of the site. The BGP is reviewed and updated annually as needed. The process for obtaining a permit for construction is also detailed in the ICP.

LF-14 was added to the Luke AFB ICP to facilitate enforcement of ICs and incorporated into the BGP. Luke AFB filed a VEMUR with ADEQ on June 15, 2000, stating that Luke AFB agrees to restrict the site to nonresidential usage.

Site inspections are required at 5-year intervals after signing of the ROD to determine the adequacy of surface controls and current land use.

4.2.5 LF-25: Northwest Landfill

The selected remedy for LF-25 was excavation of contaminated soils, ex situ mechanical treatment of contaminated soils, on-site disposal of treated soils, and ICs. Surficial soils were removed from an area 375 feet square that is adjacent to the skeet range. Excavated soil was fed into a metals recovery unit, where about 2,800 pound of lead shot was removed. Confirmation sampling was conducted of remaining soil and lead and antimony levels were below the Arizona Soil Remediation Levels (SRLs). Treated soils were returned to the excavated area, and the site was restored to grade.

ICs were established to restrict future development of the site. ICs were implemented by revising the BGP in January 2000 to reflect that land use restrictions had been placed on the site. The BGP serves as the primary mechanism that ensures the institutional and engineering controls are established and maintained. The BGP's constraints against residential development are enforced through procedures already in place at Luke AFB. An AF Form 332 must be submitted before beginning any building project at the Base. The final approval of any building project resides with the Base Chief of Operations, who is required to review the BGP and sign all AF Form 332s. In compliance with the restrictions of the BGP, the Chief of Operations for Luke AFB will not approve any AF Form that plans for the residential development of the site. The BGP is reviewed and updated annually as needed. The process for obtaining a permit for construction is also detailed in the ICP.

Another IC in place as part of the remedy at LF-25 is the use of PPE during all future excavation activities at the site. All dig permits issued for the site must include a provision for the use of PPE. The Chief of Environmental Engineering must ensure that PPE is used during any future excavation work at the site.

LF-25 was added to the Luke AFB ICP to facilitate enforcement of ICs and incorporated into the BGP. Luke AFB filed a VEMUR with ADEQ on June 15, 2000 stating that Luke AFB agrees to restrict the site to nonresidential usage.

4.2.6 RW-02: Wastewater Treatment Annex Landfill

The selected remedy for RW-02 was ICs to prevent exposure to low-level radioactive wastes buried at the site, and monitoring to assure that the integrity of the concrete burial vault has not been compromised and that groundwater has not been impacted. In November 2000, the Long Term Radiological Monitoring Plan was developed, detailing the procedures and schedule for conducting downhole radiological monitoring. The monitoring program consists of using portable field instrumentation to monitor gamma ray concentrations at four monitoring points and one background location that were installed at the site. The action level was established at twice background. Downhole radiological monitoring is conducted annually and monitoring must be conducted for 30 years.

4.2.6.1 Institutional Controls

Several ICs were implemented and are maintained at RW-02. The site is within the confines of the former Defense Reutilization Marketing Office maintenance yard and is fenced. A second fence was emplaced immediately around the site area and this fence carries a placard that identifies it as a radiological waste site. The fencing and placard are inspected during the annual monitoring events. The photo below illustrates the fence and placarding documented during the 2006 annual monitoring event.

Fence surrounding the permanent concrete monument, placarding, and protective tires at RW-02.

RW-02 was added to the Luke AFB ICP to facilitate enforcement of ICs and incorporated into BGP. Luke AFB filed a VEMUR with ADEQ on June 15, 2000 stating that Luke AFB agrees to restrict the site to nonresidential usage. The BGP serves as the primary mechanism that ensures the institutional and engineering controls are established and maintained. The BGP's constraints against residential development are enforced through procedures already in place at Luke AFB. An AF Form 332 must be submitted before beginning any building project at the Base. The final approval of any building project resides with the Chief of Operations, who is required to review the BGP and sign all AF Form 332s. In compliance with the restrictions of the BGP, the Chief of Operations for Luke AFB will not approve any AF Form 332 that plans for the residential development of the site. The BGP is reviewed and updated annually as needed. The process for obtaining a permit for construction is also detailed in the ICP.

4.2.6.2 Monitoring Program

From 2000 through 2005, a Ludlum Measurements Inc. Model 2221 analyzer was used in combination with a Model 44-10 scintillator probe to record radiation levels. In 2006, a Model 44-20 scintillator probe was used instead of the 44-10 scintillator probe. The 44-20 scintillator probe produces counts per minute (cpm) readings that are three times higher than the Model 44-10 scintillator probe because the surface area is three times greater than the surface area of the 44-10 probe.

The readings obtained from the monitoring locations have never exceeded an action level and were comparable to background levels. The list below provides additional details pertaining to each sampling event.

- 2000 – Readings ranged from 10,546 cpm to 20,695 cpm
- 2001 – Readings ranged from 10,310 cpm to 20,434 cpm
- 2002 – Readings ranged from 8,480 cpm to 16,886 cpm
- 2003 – Readings ranged from 9,124 cpm to 17,570 cpm
- 2004 – Readings ranged from 9,742 cpm to 20,221 cpm
- 2005 – Readings ranged from 9,537 cpm to 19,357 cpm
- 2006 – Readings ranged from 25,869 cpm to 53,302 cpm

The readings collected from 2000 to 2006 are summarized in Tables 4.2 through 4.6. Figures 4.1 through 4.5 graphically display these readings. The readings were normalized by multiplying the 2000 through 2005 readings by three.

Groundwater samples are scheduled to be collected every five years at this site.

4.2.7 SD-38: Oil/Water Separator at Auto Body Shop

The selected remedy for SD-38 was ICs, based on the determination made in the risk assessment that impacted soils remain in place and posed no exposure threat based on current land use scenarios. The remedy was implemented by revising the BGP in January 2000 to reflect that land use restrictions had been placed on the site. The BGP serves as the primary mechanism that ensures the institutional and engineering controls are established and maintained. The BGP's constraints against residential development are enforced through procedures already in place at Luke AFB. An AF Form 332 must be submitted before beginning any building project at the Base. The final approval of any building project resides with the Base Chief of Operations, who is required to review the BGP and sign all AF Form 332s. In compliance with the restrictions of the BGP, the Chief of Operations for Luke AFB will not approve any AF Form that plans for the residential development of the site. The BGP is reviewed and updated annually as needed. The process for obtaining a permit for construction is also detailed in the ICP.

SD-38 was added to the Luke AFB ICP to facilitate enforcement of ICs and incorporated into the BGP. Luke AFB filed a VEMUR with ADEQ on June 15, 2000 stating that Luke AFB agrees to restrict the site to nonresidential usage.

Site inspections are required at 5-year intervals after signing of the ROD to determine the adequacy of ICs and current land use.

4.2.8 SS-42: Bulk Fuels Storage Area

The selected remedy for SS-42 was the installation and operation of an SVE system to remediate the contaminated soil source, then monitoring the groundwater to confirm the effectiveness of the SVE system and groundwater quality. In May 1995, Luke AFB initiated an interim removal action to reduce the contaminant mass and concentrations of contaminants in subsurface soils. A pilot-scale study was conducted to determine the effectiveness of SVE in remediating the contaminated soil source. Based on the results of the pilot study, operation of the full scale SVE system commenced in August of 1996. The extracted vapors were treated by using them to fuel a modified internal combustion engine that vented the wells. The SVE system operated until November 2, 1998, when it was shut down. Soil borings were advanced to determine the effectiveness of the SVE system in reducing the contaminant mass in subsurface soils. Based on analytical results, the SVE system removed nearly 400,000 pounds

of volatile hydrocarbons from the soil. Though TPH and BTEX were still present in at-depth soil samples, levels were substantially reduced. Results of modeling indicated that residual TPH and BTEX would not impact groundwater at concentrations above Arizona WQSs. Because the SVE component of the remedy had already been conducted under a removal action before the ROD was signed in September 1999, this component of the remedy was not implemented under the ROD.

Groundwater samples are collected at 5-year intervals at SS-42 under the Luke AFB LTM program.

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

No remedial alternatives were developed for the SD-20 site during the FS because it was concluded from data collected during the RI that COCs at SD-20 were not present at levels high enough to cause adverse health effects under current land use scenarios. Further, the result of vadose zone transport modeling indicated that any contaminants present in site soils would not migrate to underlying groundwater. However, after the First Five-Year Review was conducted, ADEQ requested that Luke AFB sample monitoring wells MW-112S, MW-112D, and MW-113 because low levels (near the laboratory detection limit) of TCE, tetrachloroethene (PCE), and toluene had been reported during past sampling events. Based on ADEQ's request, Luke AFB samples these three SD-20 wells at every five-year review.

4.2.10 ST-18: Former Liquid Waste Storage Facility (Facility 993)

The selected remedy for ST-18 in the OU-2 ROD was specified as capping, surface controls (ICs), and groundwater monitoring. The USTs once present at the site had been removed in the early 1980s under RCRA closure activities conducted to allow construction of a new taxiway and USAF reserve maintenance building. The site was capped with a concrete runway in 1987 to satisfy part of the RCRA post-closure requirements for the site. This component of the ROD was already in place before the ROD was signed. Post-ROD actions consisted of LTM to monitoring groundwater quality. Internal land use restrictions are in place to restrict future land use.

4.2.11 DP-23: Old Surface Impoundment West of Facility 993

DP-23 was divided into the southern portion and the northern portion. The remedy for the southern portion was excavation, ex situ soil treatment via composting, on-site disposal of treated soils, then subsequent monitoring. Based on the findings of the risk assessment, the remedy for the northern portion of DP-23 was ICs.

At the southern portion of DP-23, an on-site treatment cell was constructed by emplacing berms and lining the bermed area with 40-mL HDPE liner, topped with 6 inches of native fill. In all, 625 cubic yards of soil contaminated 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, and moisture levels. After 120 days, interim samples were collected at baseline locations to determine the effectiveness of the composting: 25% remained above the PRG for benzo(a)pyrene. An optimized soil amendment mix was added to the compost and soil composting continued for an additional 60 days. Final sampling was conducted, and all samples were stated to be below the PRG for benzo(a)pyrene. The treated soils were used as fill to restore the site to its original grade and the site was hydro-seeded. The HDPE liner was disposed at a local landfill.

Internal land use restrictions are in place to restrict future land use. It is unclear what 'monitoring' is required by the ROD. No groundwater samples are required and the contaminated soils were treated and disposed on site.

4.3 SYSTEM OPERATION/OPERATION AND MAINTENANCE

There are no active remedial systems in place at any of the subject sites. Therefore, there are no associated operating costs other than routine inspections. The frequency of inspections depends on the selected remedy for the site. The inspection schedules for the OU-1 and OU-2 sites under consideration in this Five-Year Review are summarized in Table 4.7. The results of the site inspections are discussed in Section 6.

4.4 LONG-TERM GROUNDWATER MONITORING PROGRAM

The selected remedies for sites ST-18 and SS-42 require annual groundwater sampling to monitor groundwater quality in the site vicinity. Based on the recommendation of ADEQ in the First Five-Year Review, PSCs FT-07E, SD-20, and RW-02 were added to the LTM program. The results of the routine groundwater sampling conducted under the Luke AFB LTM program are discussed in Section 6.

Table 4.1
Summary of Selected Remedies
Luke AFB, Arizona

Operable Unit 1	
Site	**Summary of Selected Remedy**
DP-13: Drainage Ditch Disposal Area	ICs to prevent exposure to subsurface soil contamination and restrict land use.
FT-07E: Eastern Portion of North Fire Training Area	ICs to prevent exposure to subsurface soil contamination and restrict land use.
LF-03: Outboard Runway Landfill	ICs to prevent exposure to subsurface soil contamination and restrict land use.
LF-14: Old Salvage Yard Burial Site	ICs to prevent exposure to subsurface soil contamination and restrict land use.
LF-25: Northwest Landfill	• Excavation of contaminated surface soils • Ex situ mechanical treatment (removal of lead shot) • On-site disposal of treated soils • ICs
RW-02: Wastewater Treatment Annex Landfill	• ICs • Annual downhole radiological monitoring for a period of 30 years • Security fencing with radiation waste placarding
SD-38: Oil/Water Separator at Auto Body Shop	ICs to prevent exposure to subsurface soil contamination and restrict land use.
SS-42: Bulk Fuels Storage Area	• Soil vapor extraction to mitigate contaminated soil source • LTM to monitor groundwater quality
Operable Unit 2	
DP-23: Old Surface Impoundment West of Facility 993	DP-23 was divided into the southern portion and the northern portion. The remedy for the southern portion was: • Excavation • Ex situ soil treatment via composting • On-site disposal of treated soils • Monitoring The remedy for the northern portion of DP-23 was ICs to restrict land use.
ST-18: Former Liquid Waste Storage Facility (Facility 993)	• Capping • ICs • LTM to monitor groundwater quality

Table 4.2
Summary of BG-1 Gamma Radiation Monitoring
Luke AFB, Arizona

Depth (ft bgs)	Gamma Ray Readings (cpm)						
	5/23/2000	8/8/2001	9/10/2002	8/26/2003	7/12/2004	7/21/2005	8/21/2006
1	16,354	16,304	13,920	14,470	16,215	15,148	43,327
2	19,959	19,618	16,292	17,129	19,149	18,520	48,808
3	14,453	14,795	12,780	14,082	14,849	14,486	36,339
4	14,057	13,749	12,105	12,565	13,968	13,375	36,257
5	14,844	14,056	12,488	13,001	14,268	13,625	34,703
6	13,444	13,030	11,771	12,664	13,377	13,105	33,713
7	13,393	13,219	11,458	12,273	13,223	12,793	33,672
8	12,859	12,492	10,759	11,552	12,473	12,186	33,321
9	12,980	13,085	11,334	11,924	13,035	12,436	32,921
10	12,549	12,070	10,656	11,141	12,208	11,864	31,727
11	12,762	12,177	10,714	11,398	12,319	12,049	31,558
12	11,647	11,558	10,298	10,825	11,474	11,131	30,982
13	12,920	12,115	11,340	11,493	12,759	12,170	32,889
14	13,915	13,049	11,871	12,605	13,242	12,610	32,674
15	13,807	12,920	11,628	12,408	13,765	12,823	34,014
16	14,343	13,536	12,425	12,895	14,141	13,585	34,777
17	15,300	14,823	13,297	13,825	15,328	14,533	37,543
18	15,495	14,459	13,350	14,359	14,873	14,366	38,130
19	16,041	15,613	13,953	14,833	15,557	14,654	39,299

Notes:
- Sample results before 2006 were obtained using a Ludlum 44-10 probe instead of a 44-20 probe, which accounts for the sudden increase.

cpm counts per minute
ft bgs feet below ground surface

Table 4.3
Summary of MP-1 Gamma Radiation Monitoring
Luke AFB, Arizona

Depth (ft bgs)	Gamma Ray Readings (cpm)						
	5/23/2000	8/8/2001	9/10/2002	8/26/2003	7/12/2004	7/21/2005	8/21/2006
1	16,279	16,673	14,021	14,989	16,541	15,476	41,379
2	18,972	18,994	12,724	16,484	18,346	17,951	48,560
3	14,705	14,287	9,367	13,792	14,632	13,242	36,887
4	11,559	11,612	10,765	10,240	11,104	11,539	28,247
5	12,978	13,231	9,588	11,100	12,622	10,624	32,449
6	11,558	11,377	8,589	10,905	10,867	12,470	27,813
7	10,546	10,310	8,480	9,197	9,742	9,537	25,971
8	10,764	10,565	10,463	9,124	10,044	9,913	25,869
9	13,208	13,113	10,086	10,631	12,654	11,998	32,252
10	12,532	11,917	9,482	11,213	11,325	11,051	31,152
11	11,819	11,623	8,977	10,364	10,872	10,467	27,146
12	11,322	11,334	9,763	10,107	10,552	10,024	27,384
13	11,867	11,863	9,545	10,430	11,081	10,989	29,399
14	13,687	14,054	10,936	12,066	12,694	12,270	33,478
15	13,042	13,370	11,408	12,204	12,104	11,771	32,228
16	12,659	12,775	10,265	11,188	12,221	11,334	31,420
17	15,471	15,589	13,110	13,843	14,911	14,041	37,532
18	14,230	14,038	11,567	12,508	12,993	12,529	34,690
19	14,024	14,954	11,208	12,199	12,987	12,560	35,020

Notes:
- Sample results before 2006 were obtained using a Ludlum 44-10 probe instead of a 44-20 probe, which accounts for the sudden increase.

cpm counts per minute
ft bgs feet below ground surface

Table 4.4
Summary of MP-2 Gamma Radiation Monitoring
Luke AFB, Arizona

Depth (ft bgs)	Gamma Ray Readings (cpm)						
	5/23/2000	8/8/2001	9/10/2002	8/26/2003	7/12/2004	7/21/2005	8/21/2006
1	16,160	16,366	13,609	15,214	16,171	15,360	41,729
2	19,238	19,923	15,708	16,706	19,080	18,362	50,390
3	16,069	16,008	12,620	15,059	16,485	15,227	40,845
4	12,227	12,368	10,090	11,880	12,443	11,477	30,450
5	11,747	11,637	9,355	9,923	11,363	10,655	28,500
6	11,027	11,158	8,904	9,530	10,514	10,096	26,557
7	11,132	10,982	9,127	9,356	10,251	9,761	26,271
8	11,703	11,526	9,485	9,194	10,908	10,680	28,018
9	11,245	11,077	9,269	9,955	10,259	9,981	27,418
10	12,434	12,613	10,801	11,537	11,771	11,528	31,433
11	13,720	13,404	11,485	11,629	12,851	12,246	33,314
12	13,368	13,100	11,246	11,706	12,764	12,460	32,411
13	13,539	13,401	11,327	11,552	13,119	12,246	34,305
14	14,152	14,095	12,024	12,237	13,153	12,768	35,236
15	12,956	13,222	10,854	11,368	12,261	11,535	31,889
16	12,100	12,404	10,205	10,509	11,634	11,082	30,376
17	12,896	12,487	11,045	10,381	12,043	11,309	31,581
18	15,835	16,242	13,982	13,915	14,963	14,731	39,680
19	16,023	16,125	13,845	13,951	15,107	14,361	38,878
20	16,541	16,566	13,450	14,307	15,680	14,297	38,391

Notes:
- Sample results before 2006 were obtained using a Ludlum 44-10 probe instead of a 44-20 probe, which accounts for the sudden increase.

cpm counts per minute
ft bgs feet below ground surface

Table 4.5
Summary of MP-3 Gamma Radiation Monitoring
Luke AFB, Arizona

Depth (ft bgs)	Gamma Ray Readings (cpm)						
	5/23/2000	8/8/2001	9/10/2002	8/26/2003	7/12/2004	7/21/2005	8/21/2006
1	18,801	18,390	15,181	16,312	17,929	17,163	49,751
2	20,695	20,434	16,886	17,270	20,221	19,357	53,302
3	19,100	19,016	15,428	16,598	18,436	17,643	48,204
4	13,134	14,530	11,832	12,969	14,029	13,388	35,240
5	13,174	13,270	11,129	11,710	13,175	12,376	31,740
6	13,155	13,181	11,249	11,838	12,862	12,318	32,340
7	13,140	13,168	10,982	11,422	12,662	12,348	32,284
8	12,892	12,413	10,659	10,816	11,837	11,475	30,635
9	12,841	12,962	11,046	11,198	12,682	12,193	33,060
10	14,010	14,086	12,006	12,110	13,490	13,318	34,871
11	13,808	13,516	11,643	11,706	13,597	12,402	33,845
12	14,060	13,961	11,829	11,927	12,954	13,258	33,487
13	14,798	14,554	12,616	12,175	13,294	15,209	37,363
14	16,657	16,851	14,375	14,466	14,214	14,598	40,607
15	15,494	15,811	13,549	13,711	15,780	14,120	37,770
16	14,897	15,048	12,793	12,948	14,343	14,517	36,241
17	15,248	15,396	13,136	13,231	14,660	15,704	39,495
18	16,864	16,637	14,377	14,595	15,875	15,693	41,200
19	16,470	16,518	14,507	14,552	15,768	15,371	37,705
20	15,599	15,453	13,015	13,507	14,510	13,707	37,828

Notes:
- Sample results before 2006 were obtained using a Ludlum 44-10 probe instead of a 44-20 probe, which accounts for the sudden increase.

cpm counts per minute
ft bgs feet below ground surface

Table 4.6
Summary of MP-4 Gamma Radiation Monitoring
Luke AFB, Arizona

Depth (ft bgs)	Gamma Ray Readings (cpm)						
	5/23/2000	8/8/2001	9/10/2002	8/26/2003	7/12/2004	7/21/2005	8/21/2006
1	19,932	19,656	16,734	17,570	19,783	18,209	47,277
2	19,891	20,021	16,464	13,169	18,958	18,395	51,568
3	14,725	14,602	12,621	12,628	14,327	13,193	38,352
4	14,303	14,289	11,757	12,106	13,706	13,182	34,161
5	13,985	13,957	11,310	11,967	13,263	12,822	32,409
6	13,836	14,016	11,519	12,007	13,139	12,594	33,563
7	15,839	13,776	11,534	11,718	13,253	12,310	33,235
8	13,662	13,682	11,813	12,271	13,207	12,166	32,430
9	13,856	14,095	11,926	11,687	13,376	12,662	33,299
10	13,697	13,558	11,351	11,334	12,973	12,169	32,036
11	13,144	13,252	11,314	11,767	12,431	11,623	31,878
12	13,878	13,729	11,870	12,781	13,051	12,405	31,448
13	14,967	14,960	12,830	13,088	14,080	13,367	35,142
14	15,077	15,399	12,814	13,125	14,535	13,554	36,867
15	15,606	15,389	13,016	13,072	14,506	13,711	37,779
16	15,803	15,313	13,076	13,314	14,485	13,683	37,143
17	15,183	15,450	13,128	13,207	14,741	14,062	38,015
18	16,035	16,258	14,279	14,328	15,443	14,725	38,767
19	15,031	14,947	12,632	13,363	14,231	13,511	36,375

Notes:
- Sample results before 2006 were obtained using a Ludlum 44-10 probe instead of a 44-20 probe, which accounts for the sudden increase.

cpm counts per minute
ft bgs feet below ground surface

Table 4.7
Summary of OU-1 and OU-2 Site Inspection Requirements
Luke AFB, Arizona

Operable Unit 1	
Site	**Inspection Schedule**
DP-13: Drainage Ditch Disposal Area	At every 5-year review cycle and as needed in the event that construction/excavation is proposed in the site vicinity
FT-07E: Eastern Portion of North Fire Training Area	At every 5-year review cycle and as needed in the event that construction/excavation is proposed in the site vicinity
LF-03: Outboard Runway Landfill	At every 5-year review cycle and as needed in the event that construction/excavation is proposed in the site vicinity
LF-14: Old Salvage Yard Burial Site	At every 5-year review cycle and as needed in the event that construction/excavation is proposed in the site vicinity
LF-25: Northwest Landfill	At every 5-year review cycle and as needed in the event that construction/excavation is proposed in the site vicinity
RW-02: Wastewater Treatment Annex Landfill	At every 5-year review cycle
SD-38: Oil/Water Separator at Auto Body Shop	At every 5-year review cycle and as needed in the event that construction/excavation is proposed in the site vicinity
SS-42: Bulk Fuels Storage Area	Annually and as needed in the event that construction/excavation is proposed in the site vicinity
SD-20: Oil/Water Separator Canal and Earth Fissure	At every 5-year review cycle and as needed in the event that construction/excavation is proposed in the site vicinity
Operable Unit 2	
DP-23: Old Surface Impoundment West of Facility 993	In the event that construction/excavation is proposed in the site vicinity and at every 5-year review cycle
ST-18: Former Liquid Waste Storage Facility (Facility 993)	Annually and as needed in the event that construction/excavation is proposed in the site vicinity

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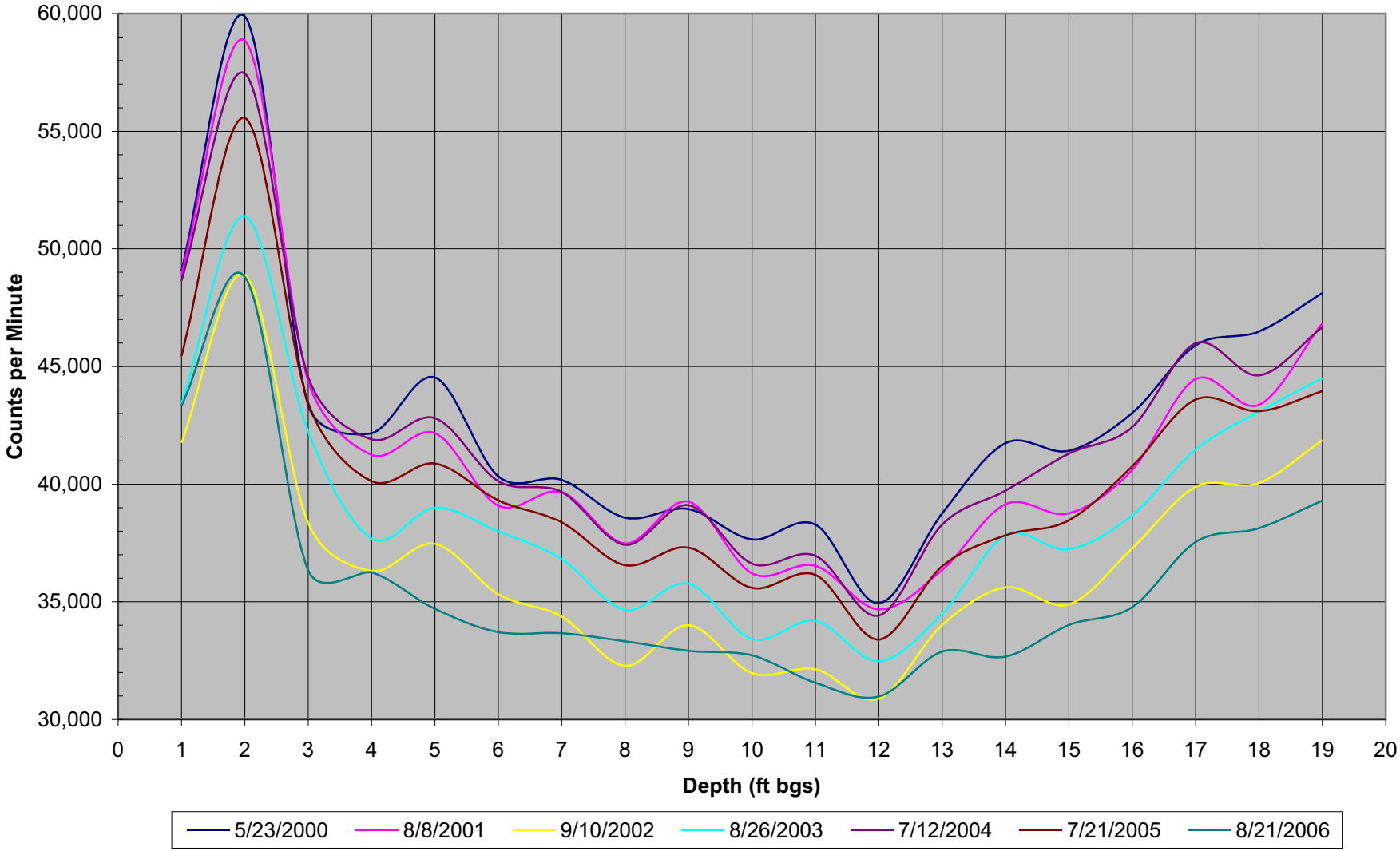
FIGURES



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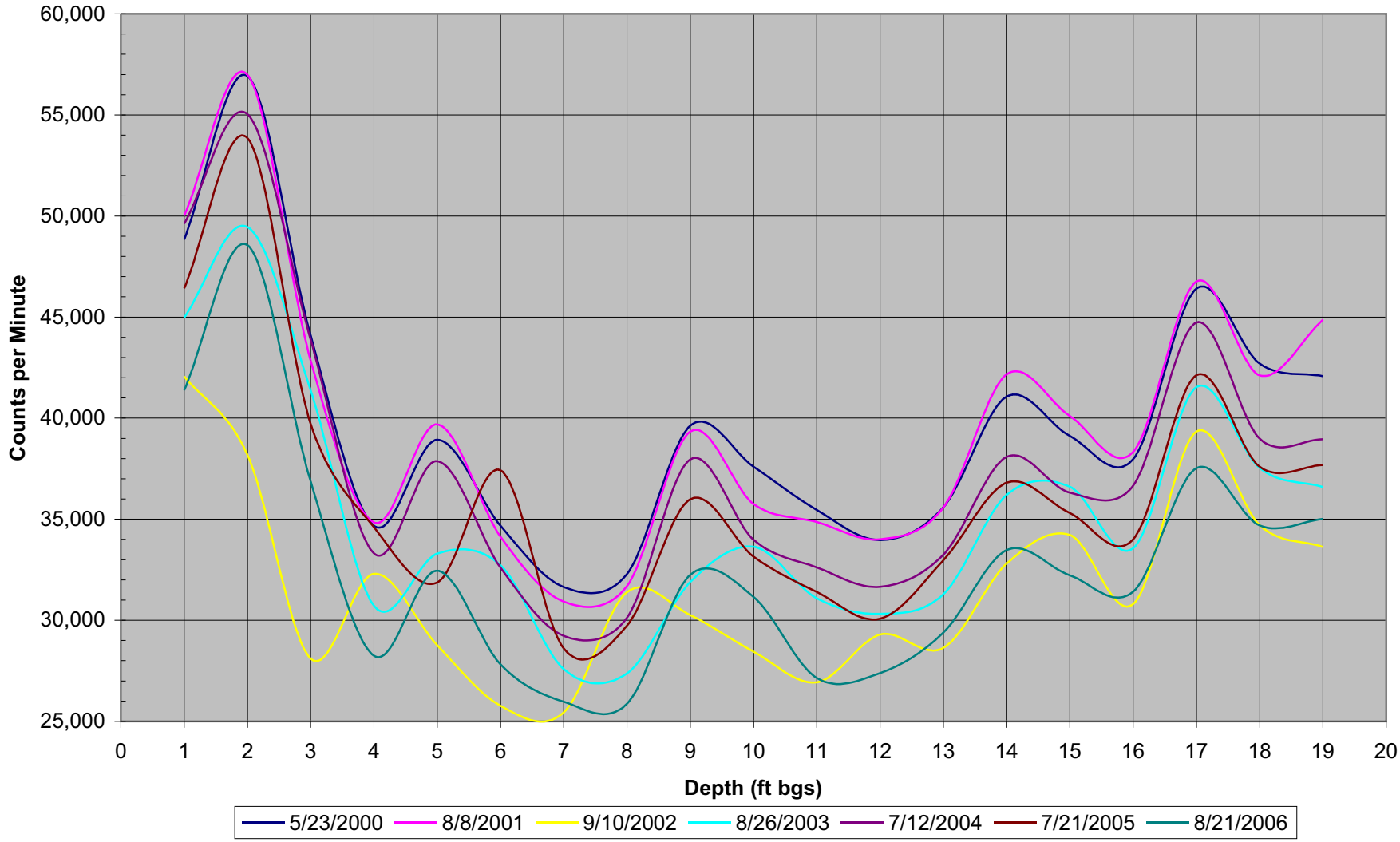
Revised:05/31/07 CV
Source: HGL GIS Database, 2001

HGL HydroGeoLogic, Inc

Note: The readings collected before 2006 were normalized by multiplying them by three. The readings collected from 2000 to 2005 were collected utilizing a 44-10 scintillator probe. The 2006 readings were obtained with a 44-20 scintillator probe. The statement of work stipulated that HGL use the 44-20 scintillator probe. The Model 44-20 scintillator probe produces counts per minute (cpm) readings that are three times higher than the Model 44-10 scintillator probe. The 44-20 scintillator probe has three times the surface area that the 44-10 probe has; thus, the readings, when measuring using cpm, are three times higher.

Figure 4.1
BG-1 Gamma Radiation Trend Analysis
Second Five-Year Review



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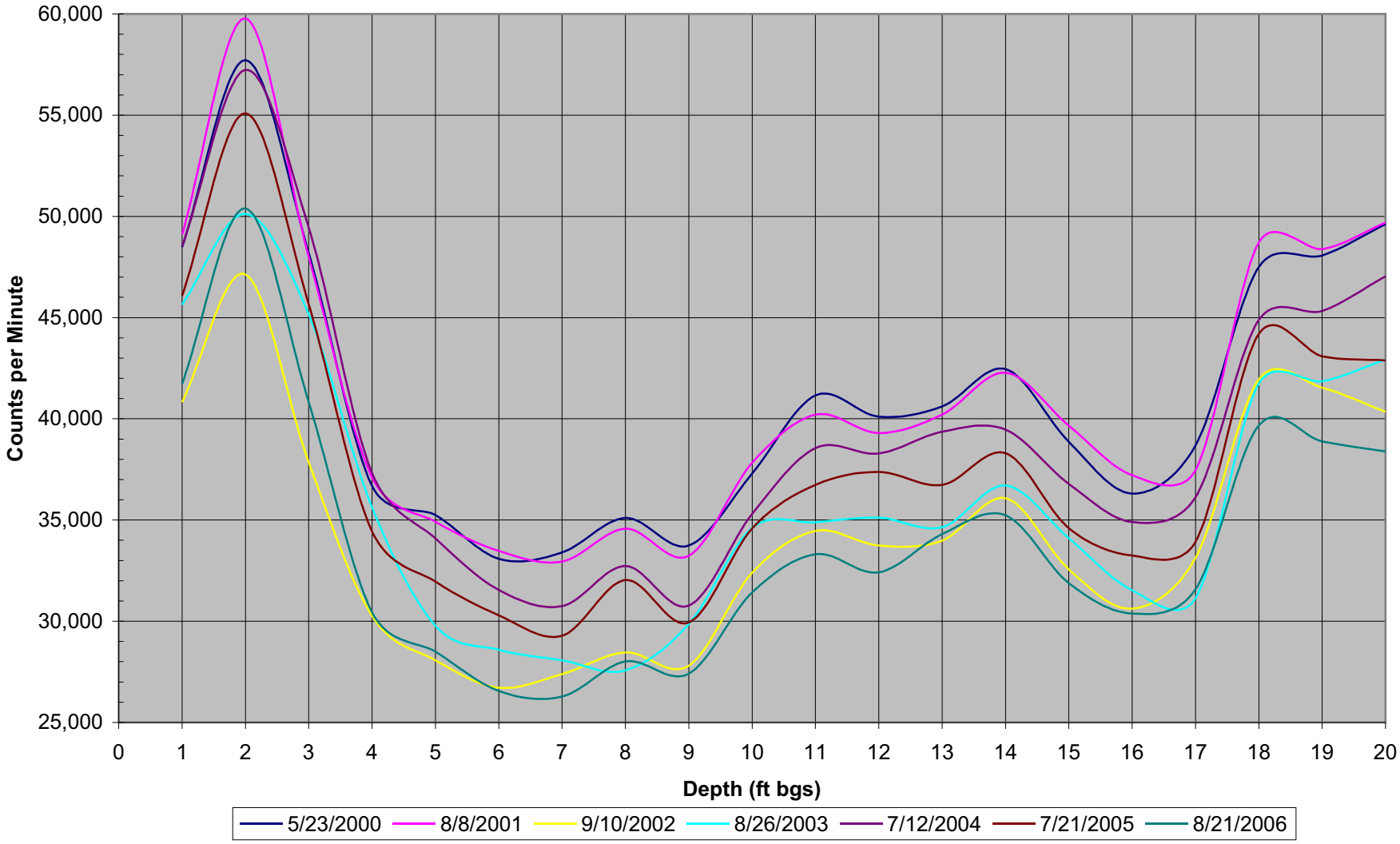
Revised:05/31/07 CV
Source: HGL GIS Database, 2001

HGL HydroGeoLogic, Inc

Note: The readings collected before 2006 were normalized by multiplying them by three. The readings collected from 2000 to 2005 were collected utilizing a 44-10 scintillator probe. The 2006 readings were obtained with a 44-20 scintillator probe. The statement of work stipulated that HGL use the 44-20 scintillator probe. The Model 44-20 scintillator probe produces counts per minute (cpm) readings that are three times higher than the Model 44-10 scintillator probe. The 44-20 scintillator probe has three times the surface area that the 44-10 probe has; thus, the readings, when measuring using cpm, are three times higher.

Figure 4.2
MP-1 Gamma Radiation Trend Analysis
Second Five-Year Review



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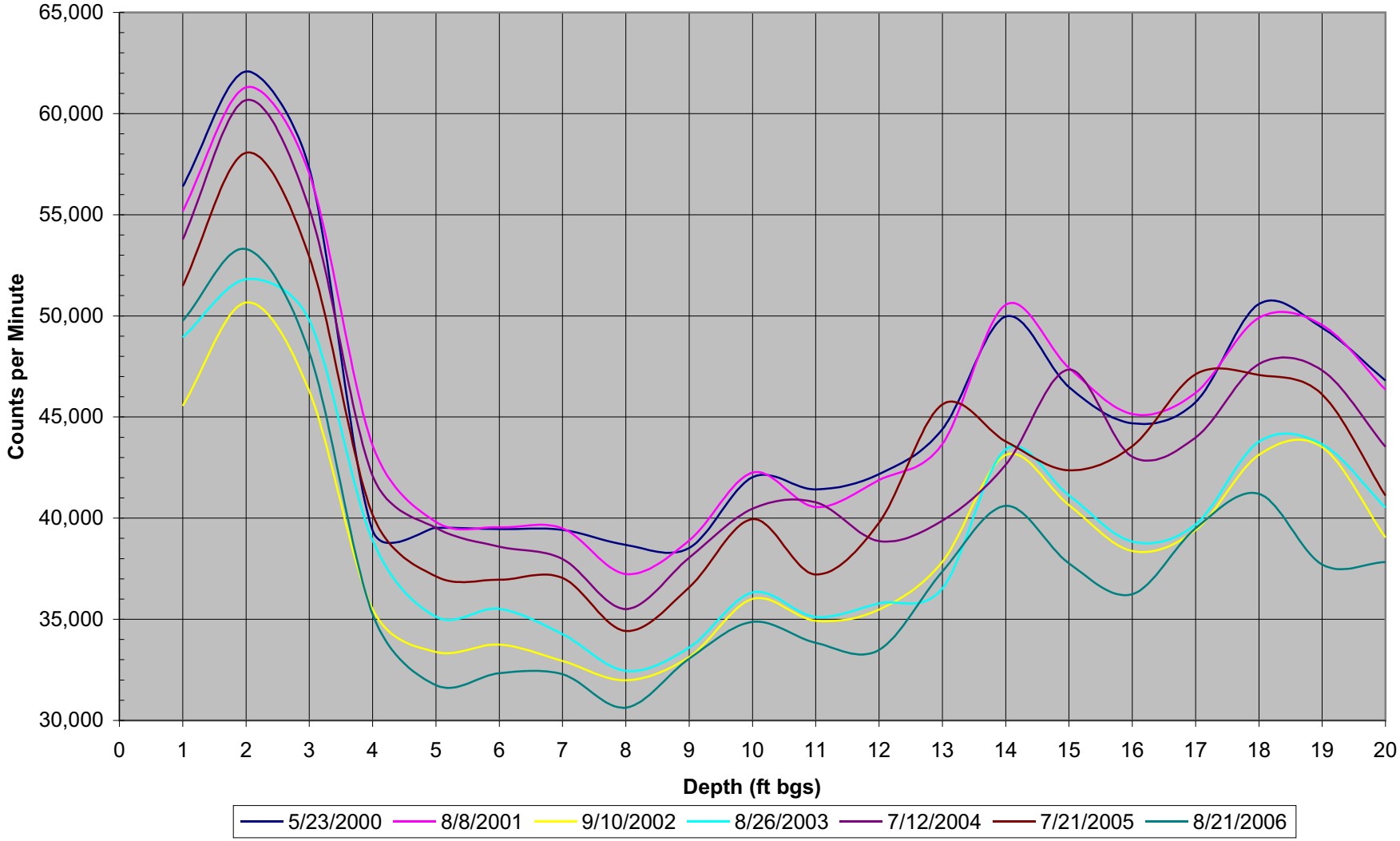
Source: HGL GIS Database, 2001

HGL HydroGeoLogic, Inc

Note: The readings collected before 2006 were normalized by multiplying them by three. The readings collected from 2000 to 2005 were collected utilizing a 44-10 scintillator probe. The 2006 readings were obtained with a 44-20 scintillator probe. The statement of work stipulated that HGL use the 44-20 scintillator probe. The Model 44-20 scintillator probe produces counts per minute (cpm) readings that are three times higher than the Model 44-10 scintillator probe. The 44-20 scintillator probe has three times the surface area that the 44-10 probe has; thus, the readings, when measuring using cpm, are three times higher.

Figure 4.3
MP-2 Gamma Radiation Trend Analysis
Second Five-Year Review



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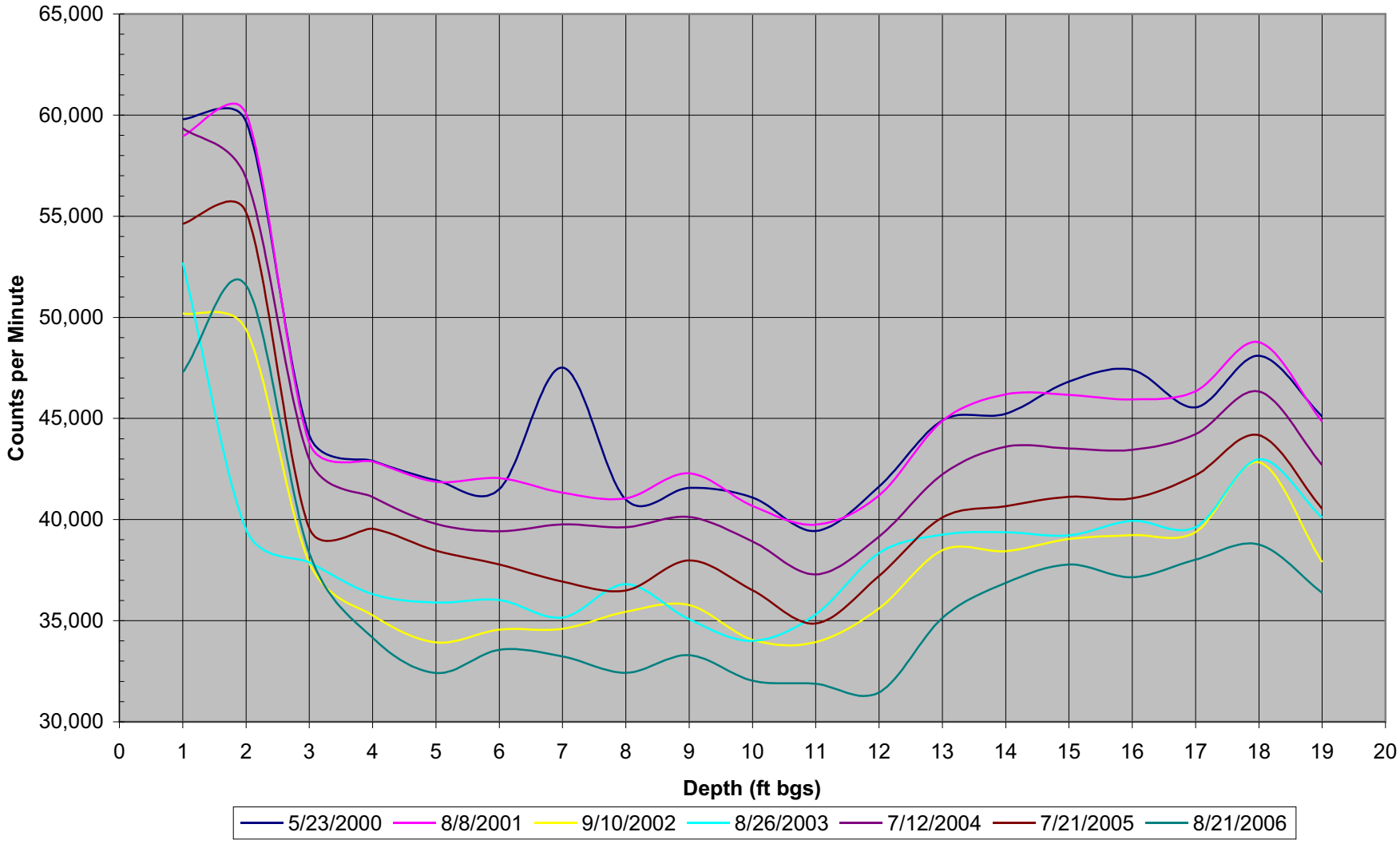
Source: HGL GIS Database, 2001

HGL HydroGeoLogic, Inc

Note: The readings collected before 2006 were normalized by multiplying them by three. The readings collected from 2000 to 2005 were collected utilizing a 44-10 scintillator probe. The 2006 readings were obtained with a 44-20 scintillator probe. The statement of work stipulated that HGL use the 44-20 scintillator probe. The Model 44-20 scintillator probe produces counts per minute (cpm) readings that are three times higher than the Model 44-10 scintillator probe. The 44-20 scintillator probe has three times the surface area that the 44-10 probe has; thus, the readings, when measuring using cpm, are three times higher.

Figure 4.4
MP-3 Gamma Radiation Trend Analysis
Second Five-Year Review



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Revised:05/31/07 CV
Source: HGL GIS Database, 2001

HGL HydroGeoLogic, Inc

Note: The readings collected before 2006 were normalized by multiplying them by three. The readings collected from 2000 to 2005 were collected utilizing a 44-10 scintillator probe. The 2006 readings were obtained with a 44-20 scintillator probe. The statement of work stipulated that HGL use the 44-20 scintillator probe. The Model 44-20 scintillator probe produces counts per minute (cpm) readings that are three times higher than the Model 44-10 scintillator probe. The 44-20 scintillator probe has three times the surface area that the 44-10 probe has; thus, the readings, when measuring using cpm, are three times higher.

Figure 4.5
MP-4 Gamma Radiation Trend Analysis
Second Five-Year Review

5.0 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

The issues listed below from the First Five-Year Review were addressed before the Second Five-Year Review was completed:

- Internal land use restrictions were filed for PSCs SS-42 and ST-18
- Radiological monitoring continued annually at PSC RW-02
- Annual groundwater monitoring was conducted at PSCs SS-42 and ST-18
- Based on the recommendation of ADEQ in the First Five-Year Review, routine groundwater sampling was conducted at three additional PSCs: SD-20, FT-07E, and RW-02. As requested by ADEQ, groundwater sampling was completed at SD-20 and FT-07E during the annual sampling event conducted before the preparation of this Second Five-Year Review. An attempt was made to collect samples from MW-124 at site RW-02, but the well was discovered to be collapsed; therefore, no sample could be retrieved.

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6.0 FIVE-YEAR REVIEW PROCESS

This section discusses the administrative components of this Five-Year Review.

6.1 ADMINISTRATIVE COMPONENTS

This review was led by Mr. Alan Thomas, P.E. Mr. Thomas is the Restoration Program Manager at Luke AFB. Others that assisted with the review are:

- Xuan-Mai Tran, USEPA Region 9
- Stacy L. Duffy, ADEQ
- Jeff Hodge, HGL
- Mary Knowles, HGL

Table 6.1 summarizes the administrative components of this Five-Year Review and the start and finish dates for the administrative components.

6.1.1 Community Involvement

Members of the community advisory board (CAB) were notified of the Second Five-Year Review via telephone on October 16, 2006. CAB members Joyce Clark and Dan Salzler were contacted. An attempt was made to contact a third member of the CAB (Martin Jefferies). However, Mr. Jefferies has moved from the area and could not be reached.

A public notice announcing the start of the five-year review process was published as a legal notification in three local newspapers on the dates listed below.

- *Arizona Republic* – October 21, 2006
- *Glendale Star* – October 26, 2006
- *Northwest Valley* – October 21, 2006

The public notice is provided below in italicized text. The affidavits for the notices are provided in Appendix C.

> *A Five-Year Review is in the process of being completed for environmental sites located within Luke AFB just west of Phoenix, Arizona. The review is scheduled to be completed in early 2007. Information about the site may be viewed at http://cfpub.epa.gov/supercpad/cursites/csitinfo.cfm?id=0900884. The Luke AFB Environmental Flight is leading the effort to complete the review. The contaminants of concern for the base are volatile organic compounds, semivolatile organic compounds (formerly known as BNAs), and metals. Environmental issues at the base are being or have been addressed by deed restrictions, plan modifications, soil capping, and various forms of contaminant removal. Interested parties may submit comments to Alan Thomas, Restoration Program Manager at 56 CES/CEVQR; 13970 W. Lightning St.; Luke AFB, AZ 85309-1149 or at alan1.thomas@luke.af.mil.*

A second public notice will be placed in the same local newspapers listed above after the Second Five-Year Review has been approved by regulatory authorities. The results of the review will be will be made available to the public at the Glendale Public Library, Peoria Public Library, and the USEPA Region 9 office.

6.1.2 Document Review

The following regulatory guidance documents and publications were reviewed during preparation of this Second Five-Year Review:

- Arizona Numeric Water Quality Criteria (Arizona, 1996a)
- Arizona Soil Remediation Levels (Arizona, 1996b)
- Comprehensive Five-Year Review Guidance (EPA, 2001)
- Environmental Protection Agency Region 9 Preliminary Remediation Goals (EPA, 1996)
- Environmental Protection Agency Region 9 Preliminary Remediation Goals (EPA, 2000)
- Environmental Protection Agency Region 9 Preliminary Remediation Goals (EPA, 2004)
- National Primary and Secondary Drinking Water Standards (EPA, 2003)
- Supplement to the Comprehensive Five-Year Review Guidance: Evaluation of Institutional Controls (EPA, 2005)

The following historical site documents and reports were reviewed during preparation of this Second Five-Year Review. The documents were provided by Luke AFB:

- Draft Groundwater Long-Term Monitoring Report, August 2006 Sampling Event (HGL, 2006a)
- Final Close-Out Report (ARCADIS, 2001a)
- Final First Five-Year Review (ARCADIS, 2002a)
- Final Remedial Action Report, Luke AFB, Arizona (ARCADIS, 2001b)
- Final Remedial Investigation Report, Volumes I and II (Geraghty & Miller, 1997)
- Groundwater Sampling Event Results for PSC SS-42, PCS ST-18, and RW-02 at Luke Air Force Base, Arizona (ARCADIS, 2002b)
- Inspection of Concrete Cap and Cost Estimate for Recommended Repairs Site ST-18, Building 993, Luke AFB, AZ (ERMS, 2000)
- Inspection of Concrete Cap at Site ST-18, Building 993, Luke AFB, AZ (ERMS, 1999)
- Inspection of Concrete Cap Site ST-18, Building 993, Luke AFB, AZ (ERMS, 2001)
- Inspection of Concrete Cap Site ST-18, Building 993, Luke AFB, AZ (ERMS, 2002)
- Inspection of Concrete Cap Site ST-18, Building 993, Luke AFB, AZ (ERMS, 2003)
- Inspection of Concrete Cap Site ST-18, Building 993, Luke AFB, AZ (ERMS, 2004)
- Inspection of Concrete Cap Site ST-18, Building 993, Luke AFB, AZ (Luke AFB, 2006)
- Institutional Control Plan (ARCADIS, 2000)
- July 2004 Radiological Monitoring Summary at PSC RW-02, Luke Air Force Base, AZ (ARCADIS, 2004a)

- July 2005 Radiological Monitoring Summary at PSC RW-02, Luke Air Force Base, AZ (ARCADIS, 2005a)
- Letter Report Summarizing the April 2005 Groundwater Sampling Event for PSC SS-42 and PSC ST-18 at Luke Air Force Base, Arizona (ARCADIS, 2006)
- Letter Report Summarizing the August 2003 Groundwater Sampling Event Results for PSC SS-42 and PCS ST-18 at Luke Air Force Base (AFB), Arizona (ARCADIS, 2003a)
- Letter Report Summarizing the June 2004 Groundwater Sampling Event for PSC SS-42 and PSC ST-18 at Luke Air Force Base, Arizona (ARCADIS, 2004b)
- Long-Term Monitoring Plan (ARCADIS, 2004c)
- Luke Air Force Base General Plan (Luke AFB, 2002)
- Radiological Long-Term Monitoring, August 2006 Annual Event at Luke Air Force Base, Arizona (HGL, 2006b)
- Radiological Monitoring Summary at PSC RW-02, Luke Air Force Base, AZ (ARCADIS, 2003b)
- Record of Decision Operable Unit 1 (EPA, 1994)
- Record of Decision Operable Unit 2 (EPA, 1999)
- Site DP-23, Soil Composting at Luke Air Force Base, Arizona (ECC, 1997)
- Soil Vapor Extraction and Conformation Sampling Summary Report, SS-42 (ARCADIS, 2000b)

Additional information pertaining to the groundwater and soil cleanup standards listed above is summarized in Table 6.2.

6.1.3 Data Review

This section describes the groundwater and soil analytical data collected at the 11 PSCs from 1988 to 2006. The RI and LTM analytical data for both matrices was reviewed to develop a comprehensive list of contaminants that have been detected at the PSCs. Analytical results are summarized on data tables 6.2 through 6.33. Only results reported as detected are shown on the summary tables; therefore, if the data from an LTM event are not shown on the tables, this indicates that all analytical results were reported as nondetect.

The data was compared to the current ARARs (health-based standards) to determine whether the remedies implemented remain protective. Current and past ARARs used in this Second Five-Year Review are summarized below.

Groundwater and soil analytical data summary tables from the RI are included as Appendices D and E, respectively. It should be noted that for those samples collected prior to 1988, the analytical data is not available.

6.1.3.1 Groundwater

Organic Data Summary- No VOCs have been detected at any of the 11 PSCs at a level greater than an ARAR since 2003. From 1991 to 2003, 10 VOCs, 1 SVOC, Gasoline Range Organics

(GRO), and Diesel Range Organics (DRO) were detected in groundwater samples at levels that exceed an ARAR. Four of the ten VOCs (chloroform, dibromochloromethane, bromodichloromethane, and methylene chloride) and the SVOC (bis[2-ethylhexyl]phthalate) that were detected at concentration that exceeded a standard are likely not attributable to the PSCs. Tables 6.3 through 6.7 summarize by PSC the sample dates, monitoring wells sampled, and analytical data for the samples that exceeded an ARAR.

The list below summarizes the analytical data obtained from the samples collected during this Five-Year Review period.

- In 2002, there were no reported detections in the samples collected from the monitoring wells. The samples were analyzed by Del Mar Analytical of Phoenix, Arizona.
- In 2003, 1,2-dichloropropane was the only reported detection in the sample collected from the monitoring wells. It was reported at 1.6 µg/L in the sample collected from MW-125R at SS-42. No Maximum Contaminant Level (MCL) has been established for 1,2-dichloropropane; the Arizona Water Quality Standard (AWQS) is 5.0 µg/L, and the EPA Region 9 tap water Preliminary Remediation Goal (PRG) is 0.16 µg/L. The laboratory analysis was performed by Precision Analytical Laboratories of Phoenix, Arizona (a division of Aerotech Environmental Laboratories [AEL]).
- In 2004, toluene was detected at 1.5 µg/L in the sample collected from MW-114 at ST-18. The MCL and AWQS for toluene is 1,000 µg/L. The EPA Region 9 tap water standard is 720 µg/L. No other detections were reported. AEL performed the analysis of the samples.
- In 2005, there were no reported detections in the samples collected from the monitoring wells. The laboratory analysis was performed by AEL.
- In 2006, the only reported detection for the samples collected during this event is suspected to not be attributed to the site. Acetone was detected at 60 µg/L in the sample collected from MW-112D at SD-20. Neither, an MCL or AWQS has been established for Acetone. The EPA Region 9 tap water PRG is 5,500 µg/L. AEL performed the analysis of the samples. Acetone is a common laboratory contaminant.

Inorganic Data Summary- A metals sample has not been collected from a monitoring well located within a PSC since 1994. Samples ceased to be collected because the reported concentrations were: less than their respective health-based standard, not attributable to the PSCs, or within expected background concentrations. Nearly all of the reported detections that exceeded a standard were arsenic. The reported arsenic detections ranged from 5.00 µg/L to 28.0 µg/L. The arsenic concentrations are likely from Arizona's abundant sulfide mineral deposits. Naturally occurring concentrations of arsenic in the state of Arizona range from less than 0.10 mg/kg to 97.0 mg/kg (USGS, 1981). Sample dates, locations, analysis, and analytical data for the samples that exceeded an ARAR are summarized by PSC in Tables 6.8 through 6.13.

6.1.3.2 Soil

The remedial alternatives described in the ROD have been implemented with the exception of the issues noted in Section 8.0. The implementation of these remedies has reduced the levels of contamination and/or limited human exposure to the point that the USEPA approved the final closeout of the PSCs on April 26, 2001. The information below describes the tables that summarize the analytical data collected from the PSCs before the remedies were carried out.

Organics- Tables 6.14 through 6.23 summarize the sample dates, locations, depths, and analytical data for the samples that exceeded an ARAR by PSC.

Inorganic- Sample dates, locations, depths, and analytical data for the samples that exceeded an ARAR are summarized by PSC in Tables 6.24 through 6.33.

6.1.3.3 Applicable or Relevant and Appropriate Requirements

Groundwater

Current groundwater standards were compared to the 1999 chemical-specific ARARs summarized in the OU-1 ROD (which were used for the Base Wide Risk Assessment) and used to evaluate the historical data. The current standards are listed below:

- MCLs (revised 2006)
- PRGs (revised 2004)
- Arizona WQS (revised 1996)

Only one of the levels listed in the 1999 ROD decreased when compared to the current standards. The MCL and Arizona WQSs for lead decreased from 50.0 µg/L to 15.0 µg/L.

The PRGs for the following contaminants decreased:

- PCE decreased from 1.10 µg/L to 0.10 µg/L
- TCE decreased from 1.60 µg/L to 0.028 µg/L
- Total xylenes decreased from 1,400 µg/L to 210 µg/L

Tables 6.34 (organic) and 6.35 (inorganic) provide a summary of the ARARs compiled for groundwater.

Soil

There have been no decreases in Arizona SRLs documented from the First Five-Year Review for the contaminants detected at the PSCs. The Arizona SRLs are scheduled to be revised in May 2007. However, industrial PRGs for all but two of the metals detected, 10 SVOCs, and 4 VOCs have decreased. The subsequent lists summarize the reduced PRGs:

<u>Metals</u>

- Antimony (820 mg/kg to 410 mg/kg)
- Barium (100,000 mg/kg to 67,000 mg/kg)
- Beryllium (2,200 mg/kg to 1,900 mg/kg)

- Cadmium (810 mg/kg to 450 mg/kg)
- Copper (76,000 mg/kg to 41,000 mg/kg)
- Lead (7,500 mg/kg to 800 mg/kg)
- Mercury (610 mg/kg to 310 mg/kg)
- Nickel (41,000 mg/kg to 20,000 mg/kg)
- Selenium (10,000 mg/kg to 5,100 mg/kg)
- Silver (10,000 mg/kg to 5,100 mg/kg)
- Thallium (130 mg/kg to 67.0 mg/kg)

SVOCs

- Benzo(a)pyrene (0.29 mg/kg to 0.21 mg/kg)
- Benzo(a)anthracene (2.90 mg/kg to 2.10 mg/kg)
- Benzo(b)fluoranthene (2.90 mg/kg to 2.10 mg/kg)
- Benzo(k)fluoranthene (29.0 mg/kg to 1.30 mg/kg)
- Bis(2-ethylhexyl)phthalate (180 mg/kg to 120 mg/kg)
- Chrysene (290 mg/kg to 210 mg/kg)
- Fluoranthene (27,000 mg/kg to 22,000 mg/kg)
- Indeno(1,2,3-cd)pyrene (2.90 mg/kg to 2.10 mg/kg)
- Naphthalene (2,400 mg/kg to 190 mg/kg)
- PCBs (1.00 mg/kg to 0.74 mg/kg)
- Pyrene (54,000 mg/kg to 29,000 mg/kg)

VOCs

- Benzene (1.50 mg/kg to 1.40 mg/kg)
- PCE (19.0 mg/kg to 1.30 mg/kg)
- Toluene (880 mg/kg to 520 mg/kg)
- TCE (7.00 mg/kg to 0.11 mg/kg)

Tables 6.36 and 6.37 provide a summary of the ARARs compiled for organic and inorganic constituents in soil, respectively.

6.1.4 Site Inspections

Inspections at the PSCs were conducted in August 2005, October 2005, and August 2006, by Alan Thomas (Restoration Program Manager, Luke AFB Environmental Flight) and HGL. The site inspection checklists from the Second Five-Year Review are provided as Appendix A. The purpose of the inspections is to assess the protectiveness of the remedy, including the presence of fencing to restrict access, the integrity of the cap at ST-18, the status of the land use restrictions, and the condition of the restricted areas.

No significant issues have been identified at any time regarding the fence, the cap at ST-18, or the restricted areas. The fencing at RW-02 was intact and well maintained. The annual ST-18 cap inspection reports are provided as Appendix E. ICs were evaluated during the site visit and by accessing the county website to review VEMURS. A copy of the VEMURs is included as Appendix D. Luke AFB did not file a VEMUR for PSCs DP-23 and ST-18 as was

recommended in the First Five-Year Review. They opted instead to file internal land use restrictions, which have the same practical effect as VEMURs.

The ICs that are in place include prohibitions on the use or disturbance of soil, excavation activities, disturbance of the cap, and any other activities or actions that might interfere with the implemented remedy. No activities were observed that would have violated the ICs. The cap at ST-18 and restricted areas were undisturbed, and no new land use was observed at any of the PSCs inspected.

6.1.5 Interviews

Interviews were conducted with various parties connected to the site. Joyce Clark, owner of nearby property and CAB member, was interviewed on October 16, 2006. Ms. Clark stated that the CAB's interaction with Luke AFB was successful. Two other nearby residents, Dan Salzler and Martin Jefferies, were attempted to be interviewed on October 17, 2006. Mr. Salzler did not return telephone or electronic mail messages. Mr. Jefferies has moved from the area and could not be reached. Stacy Duffy, a representative of the ADEQ, was interviewed, and stated that she was satisfied with the progress of the environmental restoration program at Luke AFB, and that communication between ADEQ and Luke AFB as it related to the project was successful. Ms. Duffy indicated that ADEQ needed at least 60 days to review deliverables. Alan Thomas, the Luke AFB Restoration Program Manager, was interviewed on October 17, 2006. Mr. Thomas deemed the five-year review process at Luke AFB to be highly successful. He also noted that some of the monitoring wells may have to be replaced to address the fact that some well screens are submerged and two have collapsed. Jeff Rothrock, the Base point of contact, completed his interview questionnaire on November 6, 2006 and also noted that the project was a success citing the history of events. Mr. Rothrock specifically noted that Luke AFB was the first active duty Air Force installation to be de-listed from the EPA's National Priorities List.

Table 6.1
Administrative Components Summary
Luke AFB, Arizona

Administrative Component	Start Date	Finish Date
Community Involvement	October 16, 2006	November 15, 2006
Document Review	July 11, 2006	October 27, 2006
Data Review	July 11, 2006	October 27, 2006
Site Inspection	August 2005	August 2006
Interviews	October 16, 2006	November 15, 2006
Report Development and Review	August 28, 2006	January 15, 2007

Table 6.2
Applicable or Relevant and Appropriate Requirements
Luke AFB, Arizona

Medium/Authority	ARAR	Status	Requirement Synopsis	Action to Achieve ARAR
Groundwater/SDWA	Federal – SDWA - MCLs (40 CFR Part 141.11-141.16) and non-zero MCLGs.	Relevant and Appropriate	MCLs have been adopted as enforceable standards for public drinking water systems: MCLGs are non-enforceable levels for such systems.	None (see Section 6.1.3).
Groundwater/USEPA	Federal – SDWA – Region 9 PRGs Table 2002 Update.	To be considered	PRGs are generic and based on direct contact exposures which may not address site specific conditions or indirect exposure pathways.	None (see Section 6.1.3).
Groundwater/State	State – SDWA - Title 18, Environmental Quality. Chapter 11, DEQ WQSs. Supplement 03-01. Article 1, Numeric WQSs, Appendix A - Numeric WQSs, Table 1 – Human Health and Agricultural Designated Uses.	Relevant and Appropriate	MCLs are established for contaminants under Arizona administrative code title 18, chapter 11. All public water systems must comply with the levels of contaminants.	None (see Section 6.1.3).
Soil/RCRA	Federal - RCRA - Criteria for Classification of Solid Waste Disposal and Practices (40 CFR Part 257).	Relevant and Appropriate	Solid wastes containing contaminants greater than the health-based standards established during the completion of the site specific risk assessment were addressed during removal and remedial activities to meet the goals calculated.	None (see Section 6.1.3).
Soil/USEPA	Federal – RCRA – Region 9 PRGs Table 2002 Update.	To be considered	PRGs are generic and based on direct contact exposures which may not address site specific conditions or indirect exposure pathways.	None (see Section 6.1.3).

Table 6.2 (continued)
Applicable or Relevant and Appropriate Requirements
Luke AFB, Arizona

Medium/Authority	ARAR	Status	Requirement Synopsis	Action to Achieve ARAR
Soil/RCRA	State – RCRA - Title 18, Environmental Quality. Chapter 7, DEQ RA. Supplement 06-01. Article 2, Soil Remediation Standards, Appendix A – Soil Remediation Levels.	Relevant and Appropriate	Solid wastes containing contaminants greater than the health-based standards established during the completion of the site specific risk assessment were addressed during removal and remedial activities to meet the goals calculated.	None (see Section 6.1.3).

Notes:

DEQ	Department of Environmental Quality	WQS	water quality standard
MCL	maximum contaminant level	RCRA	resource conservation and recovery act
MCLG	maximum contaminant level goal	SDWA	safe drinking water act
PRG	preliminary remediation goal	USEPA	United States Environmental Protection Agency
RA	remedial action		

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Table 6.3
Groundwater Organic Analytical Data
Exceedences for PSC FT-07E
Luke AFB, Arizona

		VOCs														SVOC		
		1,2-Dibromo-3-chloropropane			Chloroform			1,2-Dichloroethane			Dibromo-chloromethane			Bromo-dichloromethene			Bis(2-ethylhexyl)phthalate		
		AWQS	PRG	MCL	AWQS	PRG	MCL	AWQS	PRG	MCL	AWQS	PRG	MCL	AWQS	PRG	MCL	AWQS	PRG	MCL
Sample Date	**Location**	**0.20**	**0.048**	**NE**	**5.00**	**0.17**	**7.00**	**5.00**	**0.12**	**NE**	**100**	**0.13**	**80.0**	**100**	**0.18**	**80.0**	**NE**	**4.80**	**NE**
01/23/92	MW-110	NA			**1.00**			ND			ND			ND			ND		
01/23/92	MW-110	NA			**1.00**			ND			ND			ND			ND		
07/15/92	MW-110	NA			**2.00**			**3.00**			ND			ND			ND		
12/08/92	MW-110	**110**			ND			ND			ND			ND			ND		
03/16/93	MW-110	NA			**1.00**			ND			ND			ND			ND		
03/16/93	MW-110	NA			**1.00**			ND			ND			ND			ND		
06/10/93	MW-110	NA			**1.00**			ND			ND			ND			**33.0**		
06/10/93	MW-110	NA			**1.00**			ND			ND			ND			ND		
11/09/93	MW-110	NA			**1.00**			ND			ND			ND			ND		
11/09/93	MW-110	NA			**1.00**			ND			ND			ND			ND		
05/12/94	MW-110	NA			**2.00**			ND			ND			ND			ND		
07/15/92	MW-111	NA			ND			**1.00**			**1.00**			ND			ND		
06/16/93	MW-111	NA			ND			ND			ND			ND			**15.0**		
07/14/94	MW-123	NA			**7.90**			ND			**11.0**			**2.30**			ND		
12/07/94	MW-123	NA			**1.40**			ND			ND			ND			ND		
		NA			**1.60**			ND			ND			ND			ND		
02/23/95	MW-123	NA			**2.00**			ND			ND			ND			NA		
11/11/97	MW-123	NA			**2.70 J**			ND			ND			ND			NA		
05/13/98	MW-123	NA			**2.40 J**			ND			ND			ND			NA		
11/05/98	MW-123	NA			**1.60 J**			ND			ND			ND			NA		

Notes:
- Sample results are reported in micrograms per liter
- Shaded results exceed a standard
- Bold results indicate compound was detected
- Prior to 1994 tentatively identified compounds (TIC) were reported in unknown quantities
- Data prior to 1996 sampling was determined to be of unknown quality; therefore, it cannot be used for decision-making purposes

AWQS	Arizona water quality standards
J	estimated concentration
MCL	Environmental Protection Agency maximum contaminant level
NA	not analyzed
NE	not established
ND	not detected
PRG	Environmental Protection Agency Region 9 preliminary remediation goal
SVOC	semivolatile organic compound
VOC	volatile organic compounds

Table 6.4
Groundwater Organic Analytical Data for PSC RW-02
Luke AFB, Arizona

Sample Date	Location	SVOC		
		Bis(2-ethylhexyl)phthalate		
		AWQS	PRG	MCL
		NE	4.80	NE
06/17/93	MW-115	**63.0**		
05/19/94	MW-115	**5.00 J**		
05/19/94	MW-116	**8.00 J**		

Notes:
- Sample results are reported in micrograms per liter
- Bold results indicate compound was detected
- Prior to 1994 tentatively identified compounds (TIC) were reported in unknown quantities
- Data prior to 1996 sampling was determined to be of unknown quality; therefore, it cannot be used for decision making purposes

AWQS	Arizona water quality standards
J	estimated concentration
MCL	Environmental Protection Agency maximum contaminant level
ND	not detected
NE	not established
PRG	Environmental Protection Agency Region 9 preliminary remediation goal
SVOC	semivolatile organic compound

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Table 6.5
Groundwater Organic Analytical Data
Exceedences for PSC SD-20
Luke AFB, Arizona

Sample Date	Location	VOCs																	SVOC		
		1,2-Dichloroethane			1,2-Dichloropropane			Bromodichloro-methane			Chloroform			Tetrachloroethene			Trichloroethene			Bis(2-ethylhexyl) phthalate		
		AWQS	PRG	MCL	AWQS	PRG	MCL	AWQS	PRG	MCL	AWQS	PRG	MCL	AWQS	PRG	MCL	AWQS	PRG	MCL	AWQS	PRG	MCL
		5.00	0.12	NE	5.00	0.16	NE	100	0.18	80.0	5.00	0.17	7.00	5.00	0.10	5.00	5.00	0.028	5.00	NE	4.80	NE
12/12/91	MW-102	ND			ND			ND			ND			ND			ND			**14.0**		
12/09/91	MW-103	ND			ND			ND			ND			ND			ND			**32.0**		
12/01/92	MW-112S	ND			ND			ND			ND			ND			**1.00**			ND		
03/19/93	MW-112S	ND			ND			ND			ND			ND			**1.00**			ND		
06/08/93	MW-112S	ND			ND			ND			ND			ND			**1.00**			ND		
07/21/92	MW-113	ND			ND			ND			ND			ND			**1.00**			ND		
12/17/92	MW-113	**1.00**			ND			ND			ND			ND			**2.00**			ND		
03/18/93	MW-113	**1.00**			ND			ND			ND			ND			**2.00**			ND		
03/18/93	MW-113	**1.00**			ND			ND			ND			ND			**2.00**			ND		
03/18/93	MW-113	**1.00**			ND			ND			ND			ND			**2.00**			ND		
06/07/93	MW-113	**1.00**			ND			ND			ND			ND			**2.00**			ND		
06/07/93	MW-113	**1.00**			ND			ND			ND			ND			**2.00**			ND		
11/02/93	MW-113	**1.00**			ND			ND			ND			ND			**2.00**			ND		
05/09/94	MW-113	ND			ND			ND			ND			ND			**2.00**			ND		
02/11/95	MW-113	ND			ND			ND			ND			ND			**2.00**			ND		
05/03/95	MW-113	ND			**4.00**			ND			ND			ND			ND			ND		
11/03/98	MW-113	**0.30 J**			ND			ND			ND			**0.18 J**			ND			ND		
05/11/98	MW-112S	ND			ND			ND			ND			ND			**1.50 J**			ND		
12/22/98	MW-112S	**0.28 J**			ND			ND			ND			**0.35 J**			**1.20 J**			ND		
05/19/99	MW-113	ND			ND			**6.00**			**5.00**			ND			ND			ND		

Notes:
- Sample results are reported in micrograms per liter
- Shaded results exceed a standard
- Bold results indicate compound was detected
- Prior to 1994 tentatively identified compounds (TIC) were reported in unknown quantities
- Data prior to 1996 sampling was determined to be of unknown quality; therefore, it cannot be used for decision-making purposes

AWQS Arizona water quality standards
J estimated concentration
MCL Environmental Protection Agency maximum contaminant level
ND not detected
NE not established
PRG Environmental Protection Agency Region 9 preliminary remediation goal
SVOC semivolatile organic compound
VOC volatile organic compounds

Table 6.6
Groundwater Organic Analytical Data
Exceedences for PSC SS-42
Luke AFB, Arizona

Sample Date	Location	VOCs								
		1,2-Dichloropropane			Methylene Chloride			Benzene		
		AWQS	PRG	MCL	AWQS	PRG	MCL	AWQS	PRG	MCL
		5.00	0.16	NE	NE	4.30	NE	5.00	0.35	5.00
08/04/93	MW-119	**1.00**			ND			ND		
11/05/93	MW-119	**2.00**			ND			ND		
11/05/93	MW-119	**2.00**			ND			ND		
05/17/94	MW-119	**2.00**			ND			ND		
02/02/95	MW-119	**2.00**			ND			ND		
07/17/97	MW-119	**1.00 J**			ND			ND		
05/16/94	MW-120	**1.00**			ND			ND		
07/17/97	MW-120	**1.70 J**			ND			ND		
11/05/98	MW-120	**1.40 J**			**0.25 JB**			ND		
05/13/94	MW-121	**2.00**			ND			ND		
05/16/94	MW-121	**2.00**			ND			ND		
05/16/94	MW-121	**2.00**			ND			ND		
02/21/95	MW-121	**2.00**			ND			ND		
02/21/95	MW-121	**2.00**			ND			ND		
07/17/97	MW-121	**1.40 J**			ND			**1.80 J**		
11/13/97	MW-121	**1.70 J**			ND			ND		
05/14/98	MW-121	**1.80 J**			ND			**1.80**		
11/15/98	MW-121	ND			**34.0 JB**			**17.0**		
11/05/98	MW-121	ND			**0.04 JB**			**19.0**		
07/19/97	MW-125	**1.00 J**			ND			ND		
07/19/97	MW-125	**1.10 J**			ND			**3.40 J**		
11/13/97	MW-125	**1.20 J**			ND			ND		
11/13/97	MW-125	**1.30 J**			ND			ND		
05/14/98	MW-125	**1.60 J**			ND			ND		
11/05/98	MW-125	**1.20 J**			**0.21 JB**			ND		
08/21/03	MW-125	**1.60**			ND			ND		

Notes:
- Sample results are reported in micrograms per liter
- Shaded results exceed a standard
- Bold results indicate compound was detected
- Prior to 1994 tentatively identified compounds (TIC) were reported in unknown quantities
- Data prior to 1996 sampling was determined to be of unknown quality; therefore, it cannot be used for decision making purposes

AWQS	Arizona water quality standards
B	compound detected in blank
J	estimated concentration
MCL	Environmental Protection Agency maximum contaminant level
ND	not detected
NE	not established
PRG	Environmental Protection Agency Region 9 preliminary remediation goal
VOC	volatile organic compound

Table 6.7
Groundwater Organic Analytical Data
Exceedences for PSC ST-18
Luke AFB, Arizona

Sample Date	Location	VOCs											
		Toluene			Tetrachloroethene			Trichloroethene			1,2-Dibromo-3-chloropropane		
		AWQS	PRG	MCL	AWQS	PRG	MCL	AWQS	PRG	MCL	AWQS	PRG	MCL
		1,000	720	1,000	5.00	0.10	5.00	5.00	0.028	5.00	0.20	0.048	NE
11/24/92	MW-3	ND			ND			ND			**70.0**		
10/25/01	MW-114	ND			**0.95**			**2.00**			NA		
10/25/01	MW-114	ND			**0.90**			**2.00**			NA		
06/22/04	MW-114	**1.5**			ND			ND			NA		

Notes:
- Sample results are reported in micrograms per liter
- Shaded results exceed a standard
- Bold results indicate compound was detected
- Prior to 1994 tentatively identified compounds (TIC) were reported in unknown quantities
- Data prior to 1996 sampling was determined to be of unknown quality; therefore, it cannot be used for decision-making purposes

AWQS Arizona water quality standards
MCL Environmental Protection Agency maximum contaminant level
NA not analyzed
ND not detected
NE not established
PRG Environmental Protection Agency Region 9 preliminary remediation goal
VOC volatile organic compound

Table 6.8
Groundwater Inorganic Analytical Data
Exceedences for PSC FT-07E
Luke AFB, Arizona

Sample Date	Location	Analysis	Inorganic Constituents		
			Arsenic		
			AWQS	PRG	MCL
			50.0	0.045	10.0
12/07/94	MW-123	Total	**22.0**		
		Dissolved	**21.0**		
	Duplicate	Total	**23.0**		
		Dissolved	**19.0**		

Notes:
- Sample results are reported in micrograms per liter
- Shaded results exceed a standard
- Bold results indicate compound was detected

AWQS Arizona water quality standards
MCL Environmental Protection Agency maximum contaminant level
PRG Environmental Protection Agency Region 9 preliminary remediation goal

Table 6.9
Groundwater Inorganic Analytical Data
Exceedences for PSC RW-02
Luke AFB, Arizona

Sample Date	Location	Analysis	Inorganic Constituents					
			Arsenic			Lead		
			AWQS	PRG	MCL	AWQS	PRG	MCL
			50.0	0.045	10.0	15.0	NE	15.0
07/23/92	MW-115	Total	**8.00**			**4.00 J**		
		Dissolved	**6.00**			< 2.00		
	Duplicate	Total	**7.00**			**0.018 J**		
		Dissolved	**6.00**			< 2.00		
11/17/92	MW-115	Total	**6.00**			**8.00**		
		Dissolved	**6.00**			**8.00**		
03/25/93	MW-115	Total	**7.00**			**3.00**		
		Dissolved	**5.00**			< 2.00		
11/08/93	MW-115	Total	**6.00**			< 2.00		
		Dissolved	**6.00**			< 2.00		
05/19/94	MW-115	Total	**7.00**			**3.00**		
		Dissolved	**6.00**			< 2.00		
07/23/92	MW-116	Total	**16.0**			**17.0**		
		Dissolved	**15.0**			< 2.00		
11/18/92	MW-116	Total	**17.0**			**4.00**		
		Dissolved	**14.0**			**4.00**		
03/23/93	MW-116	Total	**15.0**			< 2.00		
		Dissolved	**14.0**			< 2.00		
06/17/93	MW-116	Total	**12.0**			< 2.00		
		Dissolved	**5.00**			< 2.00		
11/08/93	MW-116	Total	**14.0**			< 2.00		
		Dissolved	**14.0**			< 2.00		
05/19/94	MW-116	Total	**16.0**			< 2.00		
		Dissolved	**16.0**			< 2.00		
12/07/94	MW-124	Total	**6.80**			**1.30**		
		Dissolved	**6.50**			< 1.00		

Notes:
- Sample results are reported in micrograms per liter
- Shaded results exceed a standard
- Bold results indicate compound was detected

<	less than
AWQS	Arizona water quality standards
J	estimated concentration
MCL	Environmental Protection Agency maximum contaminant level
NE	not established
PRG	Environmental Protection Agency Region 9 preliminary remediation goal

Table 6.10
Groundwater Inorganic Analytical Data
Exceedences for PSC SD-20
Luke AFB, Arizona

Sample Date	Location	Analysis	Inorganic Constituents								
			Arsenic			Chromium			Lead		
			AWQS	PRG	MCL	AWQS	PRG	MCL	AWQS	PRG	MCL
			50.0	0.045	10.0	100	NE	100	15.0	NE	15.0
12/12/91	MW-102	Total	**26.0**			**26.0**			**4.00**		
		Dissolved	**28.0**			**20.0**			< 2.00		
07/18/92	MW-102	Total	**16.0**			**27.0**			< 2.00		
		Dissolved	**16.0**			**21.0**			< 2.00		
11/23/92	MW-102	Total	**15.0**			**24.0**			**6.00**		
		Dissolved	**15.0**			**22.0**			< 2.00		
03/11/93	MW-102	Total	**20.0**			**23.0**			< 2.00		
		Dissolved	**19.0**			**12.0**			< 2.00		
06/11/93	MW-102	Total	**16.0**			**18.0**			**3.00**		
		Dissolved	**15.0**			**16.0**			**2.00**		
11/11/93	MW-102	Total	**16.0**			**23.0**			< 2.00		
		Dissolved	**15.0**			**22.0**			< 2.00		
05/20/94	MW-102	Total	**16.0**			**27.0**			< 2.00		
		Dissolved	**16.0**			**26.0**			< 2.00		
12/09/91	MW-102	Total	**15.0**			**25.0**			**3.00**		
		Dissolved	**14.0**			**15.0**			< 2.00		
	Duplicate	Total	**14.0**			**24.0**			**4.00**		
		Dissolved	**14.0**			**15.0**			< 2.00		
07/18/92	MW-103	Total	**16.0**			**21.0**			< 2.00		
		Dissolved	**13.0**			**18.0**			< 2.00		
11/24/92	MW-103	Total	**19.0**			**24.0**			**4.00**		
		Dissolved	**16.0**			**11.0**			< 2.00		

Table 6.10 (continued)
Groundwater Inorganic Analytical Data
Exceedences for PSC SD-20
Luke AFB, Arizona

Sample Date	Location	Analysis	Inorganic Constituents								
			Arsenic			Chromium			Lead		
			AWQS	PRG	MCL	AWQS	PRG	MCL	AWQS	PRG	MCL
			50.0	0.045	10.0	100	NE	100	15.0	NE	15.0
03/11/93	MW-103	Total	**23.0**			**16.0**			< 2.00		
		Dissolved	**20.0**			**14.0**			< 2.00		
06/11/93	MW-103	Total	**18.0**			**14.0**			< 2.00		
		Dissolved	**15.0**			**14.0**			< 2.00		
11/06/93	MW-103	Total	**20.0**			**20.0**			< 2.00		
		Dissolved	**19.0**			**17.0**			< 2.00		
05/20/94	MW-103	Total	**25.0**			**26.0**			< 2.00		
		Dissolved	**23.0**			**22.0**			< 2.00		
12/09/91	MW-112S	Total	**11.0**			**62.0**			**48.0**		
		Dissolved	**8.00**			**11.0**			< 2.00		
07/22/92	MW-112S	Total	**10.0**			**20.0**			**11.0**		
		Dissolved	**8.00**			**14.0**			< 2.00		
12/01/92	MW-112S	Total	**7.00**			**11.0**			**2.00**		
		Dissolved	**7.00**			**10.0**			< 2.00		
03/19/93	MW-112S	Total	**10.0**			**26.0**			**4.00**		
		Dissolved	**8.00**			**13.0**			< 2.00		
06/08/93	MW-112S	Total	**9.00**			**13.0**			< 2.00		
		Dissolved	**7.00**			**10.0**			< 2.00		
11/03/93	MW-112S	Total	**10.0**			**16.0**			< 2.00		
		Dissolved	**7.00**			< 10.0			< 2.00		

Table 6.10 (continued)
Groundwater Inorganic Analytical Data
Exceedences for PSC SD-20
Luke AFB, Arizona

Sample Date	Location	Analysis	Inorganic Constituents								
			Arsenic			Chromium			Lead		
			AWQS	PRG	MCL	AWQS	PRG	MCL	AWQS	PRG	MCL
			50.0	0.045	10.0	100	NE	100	15.0	NE	15.0
05/10/94	MW-112S	Total	**26.0**			**53.0**			**8.00**		
		Dissolved	**9.00**			< 10.0			< 2.00		
12/10/91	MW-112D	Total	**9.00**			**10.0**			< 2.00		
		Dissolved	**9.00**			**10.0**			< 2.00		
07/22/92	MW-112D	Total	**16.0**			**32.0**			**9.00**		
		Dissolved	**7.00**			< 10.0			< 2.00		
12/01/92	MW-112D	Total	**17.0**			**32.0**			**3.00**		
		Dissolved	**6.00**			< 10.0			< 2.00		
03/19/93	MW-112D	Total	**13.0**			**27.0**			**5.00**		
		Dissolved	**8.00**			< 10.0			< 2.00		
06/08/93	MW-112D	Total	**16.0**			**30.0**			**3.00**		
		Dissolved	**7.00**			< 10.0			< 2.00		
11/03/93	MW-112D	Total	**23.0**			**49.0**			**4.00**		
		Dissolved	**9.00**			< 10.0			< 2.00		
05/10/94	MW-112D	Total	**9.00**			**18.0**			**10.0**		
		Dissolved	**6.00**			**12.0**			< 2.00		
	Duplicate	Total	**9.00**			**14.0**			**7.00**		
		Dissolved	**8.00**			**14.0**			< 2.00		
01/24/92	MW-113	Total	**9.00**			**27.0**			**4.00**		
		Dissolved	**9.00**			**13.0**			**4.00**		

Table 6.10 (continued)
Groundwater Inorganic Analytical Data
Exceedences for PSC SD-20
Luke AFB, Arizona

Sample Date	Location	Analysis	Inorganic Constituents								
			Arsenic			Chromium			Lead		
			AWQS	PRG	MCL	AWQS	PRG	MCL	AWQS	PRG	MCL
			50.0	0.045	10.0	100	NE	100	15.0	NE	15.0
07/21/92	MW-113	Total	**20.0**			**109**			**23.0**		
		Dissolved	**8.00**			**14.0**			< 2.00		
12/17/92	MW-113	Total	**12.0**			**41.0**			**5.00**		
		Dissolved	**11.0**			**12.0**			< 2.00		
03/18/93	MW-113 Time-series Initial Sample	Total	**10.0**			**19.0**			2.00		
		Dissolved	**10.0**			**14.0**			< 2.00		
	MW-114 Time-series Duplicate	Total	**10.0**			**17.0**			2.00		
		Dissolved	**10.0**			**16.0**			4.00		
	MW-113 Time-series 4hr-Sample	Total	**11.0**			**19.0**			< 2		
		Dissolved	**10.0**			**14.0**			< 2		
06/07/93	MW-113	Total	**10.0**			**20.0**			**2**		
		Dissolved	**10.0**			**10.0**			< 2		
	Duplicate	Total	**11.0**			**22.0**			< 2		
		Dissolved	**11.0**			**15.0**			< 2		
11/02/93	MW-113	Total	**11.0**			**121**			< 2		
		Dissolved	**8.00**			**14.0**			< 2		
05/09/94	MW-113	Total	**12.0**			**42.0**			< 2		
		Dissolved	**9.00**			< 10.0			< 2		

Notes:
- Sample results are reported in micrograms per liter
- Shaded results exceed a standard
- Bold results indicate compound was detected

< less than
AWQS Arizona water quality standards
J estimated concentration
MCL Environmental Protection Agency maximum contaminant level
NE not established
PRG Environmental Protection Agency Region 9 preliminary remediation goal

Table 6.11
Groundwater Inorganic Analytical Data
Exceedences for PSC SD-38
Luke AFB, Arizona

Sample Date	Location	Analysis	Inorganic Constituents		
			Arsenic		
			AWQS	PRG	MCL
			50.0	0.045	10.0
11/12/93	MW-117	Total	**6.00**		
		Dissolved	**5.00**		

Notes:
- Sample results are reported in micrograms per liter
- Shaded results exceed a standard
- Bold results indicate compound was detected

AWQS Arizona water quality standards
MCL Environmental Protection Agency maximum contaminant level
PRG Environmental Protection Agency Region 9 preliminary remediation goal

Table 6.12
Groundwater Inorganic Analytical Data
Exceedences for PSC SS-42
Luke AFB, Arizona

Sample Date	Location	Analysis	Inorganic Constituents								
			Arsenic			Chromium			Nickel		
			AWQS	PRG	MCL	AWQS	PRG	MCL	AWQS	PRG	MCL
			50.0	0.045	10.0	100	NE	100	140	730	NE
11/05/93	MW-119	Total	**7.00**			**384 J**			**103 J**		
	Duplicate	Total	< 5.00			**164 J**			**53.0 J**		
05/17/94	MW-119	Total	< 5.00			**73.0**			**254**		
		Dissolved	< 5.00			< 10.0			**250**		
01/05/94	MW-121	Total	< 5.00			**74.0**			**144**		
		Dissolved	< 5.00			< 10.0			**143**		

Notes:
- Sample results are reported in micrograms per liter
- Shaded results exceed a standard
- Bold results indicate compound was detected

< less than
AWQS Arizona water quality standards
J estimated concentration
MCL Environmental Protection Agency maximum contaminant level
PRG Environmental Protection Agency Region 9 preliminary remediation goal

Table 6.13
Groundwater Inorganic Analytical Data
Exceedences for PSC ST-18
Luke AFB, Arizona

Sample Date	Location	Analysis	Inorganic Constituents											
			Arsenic			Chromium			Lead			Zinc		
			AWQS	PRG	MCL	AWQS	PRG	MCL	AWQS	PRG	MCL	AWQS	PRG	MCL
			50.0	0.045	10.0	100	NE	100	15.0	NE	15.0	2,100	11,000	5,000
07/23/92	MW-4	Total	**5.00**			< 10.0			**4.00**			**204**		
07/18/92	MW-5	Total	**19.0**			**115**			**26.0**			**8,700**		
06/21/93	MW-5	Dissolved	< 5.00			< 10.0			**16.0**			**506**		
07/22/92	MW-114	Total	**7.00**			**22.0**			**11.0**			**407**		
		Dissolved	**6.00**			**13.0**			**3.00**			**370**		
11/30/92	MW-114	Total	**6.00**			**17.0**			**4.00**			**344**		
		Dissolved	**5.00**			**18.0**			**2.00**			**310**		
	Duplicate	Total	**6.00**			**23.0**			**3.00**			**337**		
		Dissolved	**6.00**			**15.0**			**2.00**			**348**		

Notes:
- Sample results are reported in micrograms per liter
- Shaded results exceed a standard
- Bold results indicate compound was detected

<	less than
AWQS	Arizona water quality standards
MCL	Environmental Protection Agency maximum contaminant level
PRG	Environmental Protection Agency Region 9 preliminary remediation goal

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Table 6.14
Soil Organic Analytical Data
Exceedences for PSC DP-13
Luke AFB, Arizona

Sample Date	Location	Depth (ft bgs)	SVOCs															
			Benzo(b) fluoranthene				Benzo(a) anthracene				Benzo(a) pyrene				Benzo(k) fluoranthene			
			ASRL		PRG		ASRL		PRG		ASRL		PRG		ASRL		PRG	
			Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.		Ind.	
			6.10	26.0	0.62	2.10	6.10	26.0	0.62	2.10	0.61	2.60	0.062	0.21	61.0	260	0.38	1.30
03/08/93	13-SB-2	8-10	**1.60**				ND				ND				ND			
		14-16	**2.60**				**1.10**				**0.89**				ND			
	13-SB-4	0-2	**1.40**				ND				ND				ND			
11/07/91	13-TP-12	3	ND				**0.21**				**0.18**				**0.37**			
		6	**0.42**				Tr				**0.20**				ND			
08/23/96	13-SB-11	8-10	**0.46**				**0.39**				**0.41**				**0.42**			
		15-17	**0.63**				**0.64**				**0.56**				**0.63**			

Notes:
- Sample results are reported in milligrams per kilogram
- Shaded results exceed a standard
- Bold results indicate compound was detected
- Prior to 1994 tentatively identified compounds (TIC) were reported in unknown quantities
- Data for VOC/SVOCs prior to 1996 sampling was determined to be of unknown quality; therefore, it cannot be used for decision-making purposes

ASRL	Arizona soil remediation level
ft bgs	feet below ground surface
Ind.	industrial
ND	not detected
PRG	Environmental Protection Agency Region 9 preliminary remediation goal
Res.	residential
SVOC	semivolatile organic compound
Tr	trace, unquantifiable amount detected

Table 6.15
Soil Organic Analytical Data
Exceedences for PSC DP-23
Luke AFB, Arizona

Sample Date	Location	Depth (ft bgs)	SVOCs																	
			Benzo(a) anthracene				Benzo(a) pyrene				Benzo(b) fluoranthene				Benzo(k) fluoranthene				Chrysene			
			ASRL		PRG		ASRL		PRG		ASRL		PRG		ASRL		PRG		ASRL		PRG	
			Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.
			6.10	26.0	0.62	2.10	0.61	2.60	0.062	0.21	6.10	26.0	0.62	2.10	61.0	260	0.38	1.30	610	2600	3.80	13.0
02/06/92	SB-2	0-2	**0.29**				**0.35**				**0.50**				ND				**0.35**			
04/14/92	SB-4	0-2	**2.50**				**2.80**				**5.50**				ND				**3.60**			
		0-2	**6.60**				**3.30**				**1.30**				**5.80**				**7.50**			
04/15/92	SB-5	0-2	**1.10**				**1.40**				**4.00**				ND				**1.60**			
12/09/91	SD-4	0-1	**0.20**				**0.21**				**0.48**				ND				**0.48**			
	SD-5	0-1	**0.52**				**0.42**				**0.79**				ND				**1.00**			

Notes:
- Sample results are reported in milligrams per kilogram
- Shaded results exceed a standard
- Bold results indicate compound was detected
- Prior to 1994 tentatively identified compounds (TIC) were reported in unknown quantities
- Data for VOC/SVOCs prior to 1996 sampling was determined to be of unknown quality; therefore, it cannot be used for decision-making purposes

< less than
ASRL Arizona soil remediation level
ft bgs feet below ground surface
Ind. industrial
ND not detected
PRG Environmental Protection Agency Region 9 preliminary remediation goal
Res. residential
SVOC semivolatile organic compound
Tr trace, unquantifiable amount detected

Table 6.16
Soil Organic Analytical Data
Exceedences for PSC FT-07E
Luke AFB, Arizona

Sample Date	Location	Depth (ft bgs)	VOCs			
			Xylenes (Total)			
			ASRL		PRG	
			Res.	Ind.	Res.	Ind.
			2,800	2,800	270	420
03/29/93	07-SB-6	8-10	**600**			
		18-20	**290**			
		28-30	**290**			

Notes:
- Sample results are reported in milligrams per kilogram
- Shaded results exceed a standard
- Bold results indicate compound was detected
- Prior to 1994 tentatively identified compounds (TIC) were reported in unknown quantities
- Data for VOC/SVOCs prior to 1996 sampling was determined to be of unknown quality; therefore, it cannot be used for decision-making purposes

ASRL Arizona soil remediation level
ft bgs feet below ground surface
Ind. industrial
PRG Environmental Protection Agency Region 9 preliminary remediation goal
Res. residential
VOC volatile organic compound

Table 6.17
Soil Organic Analytical Data
Exceedences for PSC LF-14
Luke AFB, Arizona

Sample Date	Location	Depth (ft bgs)	SVOCs							
			Polychlorinated Biphenyls				Benzo(a)pyrene			
			ASRL		PRG		ASRL		PRG	
			Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.
			2.50	13.0	0.22	0.74	0.61	2.60	0.062	0.21
10/28/91	14-SB-02	0-2	**0.74**				ND			
10/29/91	14-SB-03	0-2	**13.0**				**0.30**			
		5-15	**3.60**				< 0.17 Tr			
10/30/91	14-SB-04	0-2	**1.50**				ND			
04/06/93	14-SB-11	0-1	**0.70**				NA			
	14-SB-12	0-1	**0.67**				NA			
	14-SB-13	0-1	**0.30**				NA			
04/20/93	14-SB-08	0-2	**37.0**				NA			
		2-4	**0.40**				NA			
		8-10	**91.0**				NA			
		18-20	**2,300**				NA			
	14-SB-09	0-2	**0.57**				NA			
		8-10	**0.27**				NA			
08/11/93	14-SB-17	0-2	**1.20**				NA			
	14-SB-19	0-2	**0.41**				NA			

Notes:
- Sample results are reported in milligrams per kilogram
- Shaded results exceed a standard
- Bold results indicate compound was detected
- Prior to 1994 tentatively identified compounds (TIC) were reported in unknown quantities
- Data for SVOCs prior to 1996 sampling was determined to be of unknown quality; therefore, it cannot be used for decision-making purposes

ASRL Arizona soil remediation level
ft bgs feet below ground surface
Ind. industrial
NA not analyzed
ND not detected
PRG Environmental Protection Agency Region 9 preliminary remediation goal
Res. residential
Tr trace, unquantifiable amount detected
SVOC semivolatile organic compound

Table 6.18
Soil Organic Analytical Data
Exceedences for PSC LF-25
Luke AFB, Arizona

Sample Date	Location	Depth (ft bgs)	SVOCs																	
			Benzo(a) anthracene				Benzo(a) pyrene				Benzo(b) fluoranthene				Benzo(k) fluoranthene				Indeno (1,2,3-cd) pyrene			
			ASRL		PRG		ASRL		PRG		ASRL		PRG		ASRL		PRG		ASRL		PRG	
			Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.
			6.10	26.0	0.62	2.10	0.61	2.60	0.062	0.21	6.10	26.0	0.62	2.10	61.0	260	0.38	1.30	6.10	26.0	0.62	2.10
10/21/91	25-TP-10	2	**1.20**				**1.50**				**2.30**				ND				**0.90**			
10/23/91	25-TP-15	7	**0.57**				**0.42**				**0.75**				**0.63**				**0.25**			
08/23/96	25-SB-5	8-10	**0.12 J**				**0.10 J**				**0.21 J**				**0.15 J**				**ND**			

Notes:
- Sample results are reported in milligrams per kilogram
- Shaded results exceed a standard
- Bold results indicate compound was detected
- Prior to 1994 tentatively identified compounds (TIC) were reported in unknown quantities
- Data for SVOCs prior to 1996 sampling was determined to be of unknown quality; therefore, it cannot be used for decision-making purposes

ASRL Arizona soil remediation level
ft bgs feet below ground surface
Ind. industrial
J estimated concentration
ND not detected
PRG Environmental Protection Agency Region 9 preliminary remediation goal
Res. residential
SVOC semivolatile organic compound

Table 6.19
Soil Organic Analytical Data
Exceedences for PSC RW-02
Luke AFB, Arizona

Sample Date	Location	Depth (ft bgs)	SVOCs							
			Benzo(a)pyrene				Benzo(b)fluoranthene			
			ASRL		PRG		ASRL		PRG	
			Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.
			0.61	2.60	0.062	0.21	6.10	26.0	0.62	2.10
08/27/96	02-SB-14	0-2	**0.10 J**				**0.11 J**			
10/31/91	02-TP-01	1-3	**0.63**				**1.60**			

Notes:
- Sample results are reported in milligrams per kilogram
- Shaded results exceed a standard
- Bold results indicate compound was detected
- Prior to 1994 tentatively identified compounds (TIC) were reported in unknown quantities
- Data for SVOCs prior to 1996 sampling was determined to be of unknown quality; therefore, it cannot be used for decision-making purposes

ASRL Arizona soil remediation level
ft bgs feet below ground surface
Ind. industrial
J estimated concentration
PRG Environmental Protection Agency Region 9 preliminary remediation goal
Res. residential
SVOC semivolatile organic compound

Table 6.20
Soil Organic Analytical Data
Exceedences for PSC SD-20
Luke AFB, Arizona

Sample Date	Location	Depth (ft bgs)	SVOCs											
			Bis(2-ethylhexyl)phthalate				Benzo(a)pyrene				Benzo(b)fluoranthene			
			ASRL		PRG		ASRL		PRG		ASRL		PRG	
			Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.
			320	1,400	35.0	120	0.61	2.60	0.062	0.21	6.10	26.0	0.62	2.10
10/09/91	20-SB-01	0-2	ND				**0.18**				**0.32**			
11/13/91	20-SD-13	0-1	ND				**0.48**				**0.96**			
04/28/93	20-SD-16	0-0.25	**330**				ND				**64.0**			

Notes:
- Sample results are reported in milligrams per kilogram
- Shaded results exceed a standard
- Bold results indicate compound was detected
- Prior to 1994 tentatively identified compounds (TIC) were reported in unknown quantities
- Data for SVOCs prior to 1996 sampling was determined to be of unknown quality; therefore, it cannot be used for decision-making purposes

ASRL Arizona soil remediation level
ft bgs feet below ground surface
Ind. industrial
ND not detected
PRG Environmental Protection Agency Region 9 preliminary remediation goal
Res. residential
SVOC semivolatile organic compound

Table 6.21
Soil Organic Analytical Data
Exceedences for PSC SD-38
Luke AFB, Arizona

Sample Date	Location	Depth (ft bgs)	VOCs							
			Trichloroethene				Tetrachloroethene			
			ASRL		PRG		ASRL		PRG	
			Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.
			27.0	70.0	0.053	0.11	53.0	170	0.48	1.31
05/04/92	38-SB-3	6-8	**19.0**				**450**			
		8-10	**0.40**				**40.0**			
05/06/92	38-SB-3	8-10	ND				**20.0**			

Notes:
- Sample results are reported in milligrams per kilogram
- Shaded results exceed a standard
- Bold results indicate compound was detected
- Prior to 1994 tentatively identified compounds (TIC) were reported in unknown quantities
- Data for VOCs prior to 1996 sampling was determined to be of unknown quality; therefore, it cannot be used for decision-making purposes

ASRL Arizona soil remediation level
ft bgs feet below ground surface
Ind. industrial
ND not detected
PRG Environmental Protection Agency Region 9 preliminary remediation goal
Res. residential
VOC semivolatile organic compound

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Table 6.22
Soil Organic Analytical Data
Exceedences for PSC SS-42
Luke AFB, Arizona

Sample Date	Location	Depth (ft bgs)	VOCs											
			Benzene				Toluene				Xylenes (Total)			
			ASRL		PRG		ASRL		PRG		ASRL		PRG	
			Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.
			0.62	1.40	0.64	1.40	790	2,700	520	520	2,800	2,800	270	420
11/20/93	042-SB-02	19-21	**5.50**				**88.0**				**130**			
		49-51	**1.10**				**49.0**				**110**			
		59-61	**0.70**				**30.0**				**86.0**			
		69-71	**150**				**860**				**950**			
		79-81	**3.10**				**48.0**				**80.0**			
		89-91	**4.00**				**25.0**				**46.0**			
		109-111	**6.80**				**93.0**				NA			
		119-121	**14.0**				**86.0**				**120**			
		129-131	**48.0**				**310**				**380**			
		139-141	**54.0**				**300**				**330**			

Notes:
- Sample results are reported in milligrams per kilogram
- Shaded results exceed a standard
- Bold results indicate compound was detected
- Prior to 1994 tentatively identified compounds (TIC) were reported in unknown quantities
- Data for VOCs prior to 1996 sampling was determined to be of unknown quality; therefore, it cannot be used for decision-making purposes

ASRL	Arizona soil remediation level
ft bgs	feet below ground surface
Ind.	industrial
J	estimated concentrations
NA	not analyzed
ND	not detected
PRG	Environmental Protection Agency Region 9 preliminary remediation goal
Res.	residential
VOC	volatile organic compound

Table 6.23
Soil Organic Analytical Data
Exceedences for PSC ST-18
Luke AFB, Arizona

Sample Date	Location	Depth (ft bgs)	VOCs															
			1,1-Dichloroethene				1,1,2,2-Tetrachloroethane				Trichloroethene				Benzene			
			ASRL		PRG		ASRL		PRG		ASRL		PRG		ASRL		PRG	
			Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.
			0.36	0.80	120	410	4.40	11.0	0.41	0.93	27.0	70.0	0.053	0.11	0.62	1.40	0.64	1.40
12/13/91	SB-2	12-14	**1.00**				**3.00**				**1.00**				**2.00**			
		20-22	ND				ND				**3.00**				**6.40**			
08/22/96	SB-11	18-20	ND				ND				ND				**6.30 J**			
			ND				ND				**1.80 J**				**4.00 J**			
		28-30	ND				ND				**2.00 J**				ND			
		38-40	ND				ND				**2.70 J**				**1.40 J**			

Sample Date	Location	Depth (ft bgs)	VOCs								SVOCs							
			Tetrachlorethene				Xylenes (Total)				Benzo(a) pyrene				Benzo(b) fluoranthene			
			ASRL		PRG		ASRL		PRG		ASRL		PRG		ASRL		PRG	
			Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.
			53.0	170	0.48	1.31	2,800	2,800	210	210	0.61	2.60	0.062	0.21	6.10	26.0	0.62	2.10
12/13/91	SB-2	12-14	**3.00**				**280**				ND				ND			
		20-22	**2.40**				**380**				ND				ND			
02/03/92	SB-3	0-2	ND				ND				**0.43**				**0.77**			
	SB-4	0-2	ND				ND				**0.17**				ND			
08/21/96	SB-10	18-20	ND				**290**				ND				ND			
08/22/96	SB-11	18-20	ND				**800**				ND				ND			
		38-40	ND				**600**				ND				ND			

Notes:
- Sample results are reported in milligrams per kilogram
- Shaded results exceed a standard
- Bold results indicate compound was detected
- Prior to 1994 tentatively identified compounds (TIC) were reported in unknown quantities
- Data for VOCs/SVOCs prior to 1996 sampling was determined to be of unknown quality; therefore, it cannot be used for decision-making purposes

ASRL	Arizona soil remediation level
ft bgs	feet below ground surface
Ind.	industrial
J	estimated concentrations
ND	not detected
PRG	Environmental Protection Agency Region 9 preliminary remediation goal
Res.	residential
SVOC	semivolatile organic compound
VOC	volatile organic compound

Table 6.24
Soil Inorganic Analytical Data
Exceedences for PSC DP-13
Luke AFB, Arizona

Sample Date	Location	Depth (ft bgs)	Inorganic Constituents															
			Arsenic				Chromium				Copper				Lead			
			ASRL		PRG		ASRL		PRG		ASRL		PRG		ASRL		PRG	
			Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.
			10.0	10.0	0.39	1.60	2,100	4,500	210	450	2,800	63,000	3,100	41,000	400	2,000	400	800
03/09/93	13-SB-2	18-20	**5.00**				**16.3**				**14.9**				**17.0**			
			7.00				**8.40**				**9.90**				ND			
03/08/93	13-SB-3	0-2	**9.00**				**22.2**				**22.0**				**23.0**			
		8-10	**13.0**				**23.5**				**39.6**				**24.0**			
	13-SB-4	0-2	**17.0**				**23.6**				**21.1**				**28.0**			
		8-10	**13.0**				**14.4**				**14.4**				**14.0**			
03/09/93	13-SB-6	0-2	**9.00**				**14.6**				**14.9**				**8.00**			
		18-20	**6.00**				**13.8**				**14.4**				**12.9**			
	13-SB-7	0-2	**12.0**				**16.8**				**16.8**				**9.00**			
			8.00				**20.5**				**19.6**				**11.0**			
		8-10	**7.00**				**16.5**				**18.2**				**8.00**			
		18-20	**8.00**				**7.40**				**7.40**				**6.00**			
11/06/91	13-TP-07	2	**9.00**				**11.7**				**20.4**				**11.0**			
11/07/91	13-TP-12	6	**7.00**				**23.7**				**3,900**				**51.0**			
		5	**19.0**				**15,900**				**35.6**				**36,000**			

Notes:
- Sample results are reported in milligrams per kilogram
- Shaded results exceed a standard
- Bold results indicate compound was detected
- Total chromium standards listed

ASRL Arizona soil remediation level
ft bgs feet below ground surface
Ind. industrial
ND not detected
PRG Environmental Protection Agency Region 9 preliminary remediation goal
Res. residential

Table 6.25
Soil Inorganic Analytical Data
Exceedences for PSC DP-23
Luke AFB, Arizona

Sample Date	Location	Depth (ft bgs)	Inorganic Constituents			
			Arsenic			
			ASRL		PRG	
			Res.	Ind.	Res.	Ind.
			10.0	10.0	0.39	1.60
12/09/91	SD-2	0-1	**6.00**			
02/06/92	SD-6	0-1	**5.00**			
	SD-8	0-1	**5.70**			
	SD-9	0-1	**6.30**			
	SD-10	0-1	**6.90**			
		1-2	**5.10**			
02/03/92	SB-1	8-10	**6.20**			
		24-26	**8.80**			
02/06/92	SB-2	0-2	**5.60**			
		6-8	**5.30**			
04/14/92	SB-4	0-2	**6.00**			
04/15/92	SB-4	148-150	**6.00**			
	SB-5	0-2	**7.00**			
		10-12	**6.00**			
		38-40	**9.00**			

Notes:
- Sample results are reported in milligrams per kilogram
- Shaded results exceed a standard
- Bold results indicate compound was detected

ASRL Arizona soil remediation level
ft bgs feet below ground surface
Ind. industrial
PRG Environmental Protection Agency Region 9 preliminary remediation goal
Res. residential

Table 6.26
Soil Inorganic Analytical Data
Exceedences for PSC FT-07E
Luke AFB, Arizona

Sample Date	Location	Depth (ft bgs)	Inorganic Constituents			
			Arsenic			
			ASRL		PRG	
			Res.	Ind.	Res.	Ind.
			10.0	10.0	0.39	1.60
04/03/93	07-SB-1	0-2	**8.00**			
		88-90	**10.0**			
		98-100	**6.00**			
04/05/93	07-SB-2	0-2	**6.00**			
		0-2	**6.00**			
		28-30	**5.00**			
		38-40	**10.0**			
		48-50	**7.00**			
		58-60	**6.00**			
		68-70	**6.00**			
		88-90	**8.00**			
04/02/93	07-SB-3	88-90	**6.00**			
03/30/93	07-SB-4	0-2	**9.00**			
		0-2	**9.00**			
		28-30	**6.00**			
		38-40	**8.00**			
		78-80	**6.00**			
		88-90	**6.00**			
		98-100	**9.00**			
04/01/93	07-SB-5	68-70	**6.00**			
		78-80	**8.00**			
		98-100	**7.00**			
03/29/93	07-SB-6	0-2	**6.00**			
		4-6	**6.00**			

Notes:
- Sample results are reported in milligrams per kilogram
- Shaded results exceed a standard
- Bold results indicate compound was detected

ASRL Arizona soil remediation level
ft bgs feet below ground surface
Ind. industrial
PRG Environmental Protection Agency Region 9 preliminary remediation goal
Res. residential

Table 6.27
Soil Inorganic Analytical Data
Exceedences for PSC LF-03
Luke AFB, Arizona

Sample Date	Location	Depth (ft bgs)	Inorganic Constituents															
			Arsenic				Chromium				Copper				Lead			
			ASRL		PRG		ASRL		PRG		ASRL		PRG		ASRL		PRG	
			Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.
			10.0	10.0	0.39	1.60	2,100	4,500	210	450	2,800	63,000	3,100	41,000	400	2,000	400	800
10/26/91	03-TP-5	8	**5.90**				**386**				**4,700**				**796**			
		7-8	**9.50**				**349**				**387**				**721**			
	03-TP-6	2	**5.20**				**20.1**				**32.9**				**13.5**			
	03-TP-4	4	**15.9**				**26.6**				**123**				**568**			

Notes:
- Sample results are reported in milligrams per kilogram
- Shaded results exceed a standard
- Bold results indicate compound was detected
- Total Chromium standards are listed

ASRL Arizona soil remediation level
ft bgs feet below ground surface
Ind. industrial
PRG Environmental Protection Agency Region 9 preliminary remediation goal
Res. residential

Table 6.28
Soil Inorganic Analytical Data
Exceedences for PSC LF-14
Luke AFB, Arizona

Sample Date	Location	Depth (ft bgs)	Inorganic Constituents											
			Arsenic				Beryllium				Chromium			
			ASRL		PRG		ASRL		PRG		ASRL		PRG	
			Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.
			10.0	10.0	0.39	1.60	1.40	11.0	150	1,900	2,100	4,500	210	450
10/28/91	14-TP-2	1	ND				**1.50**				**18.6**			
		4	**8.70**				**0.50**				**16.1**			
10/29/91	14-TP-3	1-2	**5.40**				ND				**15.5**			
		10	**8.90**				ND				**12.1**			
			8.00				ND				**10.2**			
10/30/91	14-SB-4	5-15	**6.10**				**0.50**				**13.7**			
10/31/91	14-SB-5	0-2	ND				ND				**221**			
			ND				ND				**376**			
03/10/93	14-SB-6	0-2	**14.0**				**0.60**				**19.6**			
		8-10	**9.00**				**0.70**				**20.1**			
		28-30	**7.00**				ND				**17.5**			
	14-SB-7	0-2	**6.00**				**0.50**				**16.0**			
		8-10	**5.00**				**0.50**				**17.6**			
03/15/93	14-SB-8	0-2	**6.00**				ND				**17.6**			
	14-SB-9	8-10	**6.00**				ND				**21.8**			

Notes:
- Sample results are reported in milligrams per kilogram
- Shaded results exceed a standard
- Bold results indicate compound was detected
- Total Chromium standards are listed

ASRL Arizona soil remediation level
ft bgs feet below ground surface
Ind. industrial
ND not detected
PRG Environmental Protection Agency Region 9 preliminary remediation goal
Res. residential

Table 6.29
Soil Inorganic Analytical Data
Exceedences for PSC LF-25
Luke AFB, Arizona

Sample Date	Location	Depth (ft bgs)	Inorganic Constituents															
			Antimony				Arsenic				Beryllium				Lead			
			ASRL		PRG		ASRL		PRG		ASRL		PRG		ASRL		PRG	
			Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.
			31.0	680	31.0	410	10.0	10.0	0.39	1.60	1.40	11.0	150	1,900	400	2,000	400	800
10/18/91	25-TP-06	1	ND				ND				**1.50**				**15.0**			
		10	ND				ND				**1.70**				**13.0**			
	25-TP-07	2	ND				ND				**1.70**				**13.0**			
	25-TP-08	2	ND				ND				**2.00**				**12.0**			
	25-TP-09	0.5	ND				**6.00**				**7.60**				**66.0**			
10/21/91	25-TP-10	2	ND				ND				**4.40**				**19.0**			
	25-TP-11	2	**368 J**				**16.0**				**2.50**				**10,100**			
	25-TP-12	1-2	ND				ND				**2.00**				**24.0**			
		10	ND				ND				**3.50**				**15.0**			
10/22/91	25-TP-13	1-1.5	ND				**6.00**				ND				**26.0**			

Notes:
- Sample results are reported in milligrams per kilogram
- Shaded results exceed a standard
- Bold results indicate compound was detected

ASRL	Arizona soil remediation level
ft bgs	feet below ground surface
Ind.	industrial
J	estimated concentration
ND	not detected
PRG	Environmental Protection Agency Region 9 preliminary remediation goal
Res.	residential

Table 6.30
Soil Inorganic Analytical Data
Exceedences for PSC RW-02
Luke AFB, Arizona

Sample Date	Location	Depth (ft bgs)	Inorganic Constituents					
			Arsenic				Lead	
			ASRL		PRG		ASRL	PRG
			Res	Ind.	Res.	Ind.	Res.	Ind.
			10.0	10.0	0.39	1.60	400	2000
03/03/93	02-SB-03	18-20	**18.0**				**13.0**	
	02-SB-04	8-10	**9.00**				**16.0**	
		18-20	**30.0**				**13.0**	
03/02/93	02-SB-05	8-10	**7.00**				**33.0**	
		18-20	**12.0**				**14.0**	
03/04/93	02-SB-07	0-2	**7.00**				**8.00**	
		8-10	**19.0**				**9.00**	
		18-20	**10.0**				**11.0**	
	02-SB-08	0-2	**9.00**				**14.0**	
		8-10	**7.00**				**57.0**	
		18-20	**18.0**				**11.0**	
	02-SB-09	0-2	**8.00**				**14.0 J**	
			8.00				**30.0 J**	
		8-10	**13.0**				**14.0**	
		18-20	**12.0**				**8.0**	
10/31/91	02-TP-02	1-4	**15.0**				**414**	
		10	**6.00**				**15.0**	
	02-TP-03	1-2	**6.00**				**11.0**	
		10	**7.00**				**11.0**	
11/01/91	02-TP-05	10	**6.00**				**9.00**	
11/04/91	02-TP-08	4	**8.00**				**10.0**	
	02-TP-09	10	ND				**680**	

Notes:
- Sample results are reported in milligrams per kilogram
- Shaded results exceed a standard
- Bold results indicate compound was detected

ASRL	Arizona soil remediation level
ft bgs	feet below ground surface
Ind.	industrial
J	estimated concentration
ND	not detected
PRG	Environmental Protection Agency Region 9 preliminary remediation goal
Res.	residential

Table 6.31
Soil Inorganic Analytical Data Exceedences for PSC SD-20
Luke AFB, Arizona

Sample Date	Location	Depth (ft bgs)	Inorganic Constituents			
			Arsenic			
			ASRL		PRG	
			Res.	Ind.	Res.	Ind.
			10.0	10.0	0.39	1.60
10/09/91	20-MW-112D	0-2	**5.40**			
		130-132	**8.70**			
		280-282	**6.40**			
		380-382	**5.30**			
12/03/91	20-MW-113	0-2	**5.50**			
		320-322	**16.0**			
			13.0			
10/10/91	20-SB-02	38-40	**5.90**			
	20-SB-03	0-2	**5.00**			
		12-14	**7.40**			
	20-SB-04	0-2	**5.70**			
		30-32	**5.20**			
03/16/93	20-SB-05	16-18	**7.00**			
		26-28	**16.0**			
03/18/93	20-SB-06	8-10	**17.0**			
03/17/93	20-SB-07	26-28	**7.00**			
03/18/93	20-SB-08	16-18	**7.00**			
03/23/93	20-SB-09	6-8	**16.0**			
		14-16	**10.0**			
		24-26	**11.0**			
03/22/93	20-SB-10	6-8	**17.0**			
		14-16	**9.00**			
		24-26	**9.00**			
	20-SB-11	6-8	**9.00**			
		24-26	**12.0**			
	20-SB-12	6-8	**12.0**			
		14-16	**26.0**			
		24-26	**14.0**			
03/23/93	20-SB-13	4-6	**16.0**			
		12-14	**7.00**			
		22-24	**14.0**			
			16.0			
10/02/91	20-SD-08	0-1	**6.10**			
		1-2	**10.9**			
	20-SD-11	0-1	**5.00**			
		1-2	**8.50**			

Notes:
- Sample results are reported in milligrams per kilogram
- Shaded results exceed a standard
- Bold results indicate compound was detected

ASRL Arizona soil remediation level
ft bgs feet below ground surface
Ind. industrial
ND not detected
PRG EPA Region 9 preliminary remediation goal
Res. residential

Table 6.32
Soil Inorganic Analytical Data
Exceedences for PSC SD-38
Luke AFB, Arizona

Sample Date	Location	Depth (ft bgs)	Inorganic Constituents							
			Arsenic				Lead			
			ASRL		PRG		ASRL		PRG	
			Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.
			10.0	10.0	0.39	1.60	400	2,000	400	800
05/04/92	38-SB-1	0-2	**7.00**				**30.0**			
			11.0				**22.0**			
		2-4	**8.00**				**16.0**			
		48-50	**10.0**				**9.00**			
		98-100	**9.00**				**7.00**			
05/05/92	38-SB-2	0-2	**10.0**				**23.0**			
		2-4	**14.0**				**17.0**			
		98-100	**12.0**				**9.00**			
05/04/92	38-SB-3	6-8	**8.00**				**470**			
		10-12	**5.00**				**8.00**			
		198-200	**10.0**				**12.0**			
04/06/93	38-SB-5	34-36	**8.00**				**15.0**			
04/07/93	38-SB-5	44-46	**6.00**				**6.00**			
		154-156	**13.0**				**16.0**			
		204-206	**11.0**				**9.00**			
		254-256	**5.00**				ND			
04/08/93	38-SB-5	304-306	**8.00**				**11.0**			
04/09/93	38-SB-7	8-10	**5.00**				**8.00**			
		18-20	**6.00**				**11.0**			
		38-40	**5.00**				**9.00**			
04/13/93	38-MW-117	206-208	**8.00**				**18.0**			
		276-278	**10.0**				**13.0**			
		306-308	**12.0**				**10.0**			
		334-336	**6.00**				**8.00**			

Notes:
- Sample results are reported in milligrams per kilogram
- Shaded results exceed a standard
- Bold results indicate compound was detected

ASRL Arizona soil remediation level
ft bgs feet below ground surface
Ind. industrial
ND not detected
PRG Environmental Protection Agency Region 9 preliminary remediation goal
Res. residential

Table 6.33
Soil Inorganic Analytical Data
Exceedences for PSC ST-18
Luke AFB, Arizona

Sample Date	Location	Depth (ft bgs)	Inorganic Constituents			
			Arsenic			
			ASRL		PRG	
			Res.	Ind.	Res.	Ind.
			10.0	10.0	0.39	1.60
02/03/92	SB-3	18-20	**7.00**			
	SB-5	0-2	**5.00**			
	SB-6	0-2	**5.00**			
		4-6	**6.00**			
06/25/92	SB-8	62-64	**6.00**			

Notes:
- Sample results are reported in milligrams per kilogram
- Shaded results exceed a standard
- Bold results indicate compound was detected

ASRL Arizona soil remediation level
ft bgs feet below ground surface
Ind. industrial
PRG Environmental Protection Agency Region 9 preliminary remediation goal
Res. residential

Table 6.34
Groundwater Organic
Applicable or Relevant and Appropriate Requirements Values
Luke AFB, Arizona

Constituent	AWQS	PRG			MCL
		1996	2000	2004	
1,2-Dibromo-3-chloropropane	0.20	NL	0.0047	0.048	NE
1,2-Dichloroethane	5.00	NL	0.12	0.12	NE
1,2-Dichloropropane	5.00	0.16	0.16	0.16	NE
Acetone	NE	610	610	5,500	NE
Benzene	5.00	NL	0.35	0.35	5.00
Benzoic Acid	NE	NL	150,000	150,000	NE
Bis(2-ethylhexyl)phthalate	NE	NL	4.80	4.80	NE
Bromodichloromethane	TTHM (100)	NL	0.18	0.18	TTHM (80.0)
Chloroform	TTHM (100)	0.16	0.16	0.17	TTHM (80.0)
Dibromochloromethane	TTHM (100)	NL	0.13	0.13	TTHM (80.0)
cis-1,2-Dichloroethene	70.0	61.0	61.0	61.0	70.0
Ethylbenzene	700	NL	1,300	1,300	700
1,2-Dibromoethane	0.05	NL	0.00076	0.0056	0.05
Methyl Ethyl Ketone	NE	NL	1,900	7,000	NE
Methylene Chloride	NE	NL	4.30	4.30	NE
Tetrachloroethene	5.00	NL	1.10	0.10	5.00
Toluene	1,000	NL	720	720	1,000
Total Petroleum Hydrocarbons - Diesel Range	NE	NE	NE	NE	NE
Total Petroleum Hydrocarbons - Gasoline Range	NE	NE	NE	NE	NE
Trichloroethene	5.00	1.60	1.60	0.028	5.00
Xylenes (Total)	10,000	1,400	1,400	210	10,000

Notes:
- Standards are listed in micrograms per liter

AWQS Arizona water quality standard
MCL Environmental Protection Agency maximum contaminant level
NE not established
NL not located
PRG Environmental Protection Agency Region 9 preliminary remediation goal
TTHM total trihalomethanes

Table 6.35
Groundwater Inorganic
Applicable or Relevant and Appropriate Requirements Values
Luke AFB, Arizona

Constituent	AWQS	PRG			MCL
		1996	2000	2004	
Arsenic	50.0	0.045	0.045	0.045	10.0
Barium	2,000	2,600	2,600	2,600	2,000
Boron	630	NL	3,300	7,300	NE
Chromium	100	NE	NE	NE	100
Copper	1,300	1,400	1,400	1,500	1,300
Lead	15.0	NL	NE	NE	15.0
Nickel	140	730	730	730	NE
Selenium	50.0	180	180	180	50.0
Zinc	2,100	11,000	11,000	11,000	5,000[a]

Notes:
- Standards are listed in micrograms per liter
- Total Chromium standard listed

a	secondary water standard reported
AWQS	Arizona water quality standard
MCL	Environmental Protection Agency maximum contaminant level
NE	not established
NL	not located
PRG	Environmental Protection Agency Region 9 preliminary remediation goal
TTHM	total trihalomethanes

Table 6.36
Soil Organic
Applicable or Relevant and
Appropriate Requirements Values
Luke AFB, Arizona

Constituents	Arizona Soil Remediation Levels				EPA Region 9 Preliminary Remediation Goals					
	2000		2002		1996		2000		2004	
	Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.
1,1,2,2-Tetrachloroethane	NL	NL	4.40	11.0	NL	NL	0.38	0.90	0.41	0.93
1,1-Dichloroethene	NL	NL	0.36	0.80	NL	NL	0.054	0.12	120	410
2-Methylnaphthalene	NL	NL	NE	NE	NE	800	NE	190	NE	NE
Acetone	NL	NL	2,100	8,800	2,100	8,800	1,600	6,200	14,000	54,000
Anthracene	20,000	200,000	20,000	200,000	NE	NL	22,000	100,000	22,000	100,000
Benzene	0.62	1.40	0.62	1.40	1.40	NL	0.65	1.50	0.64	1.40
Benzo(a)anthracene	6.10	26.0	6.10	26.0	NE	2.60	0.62	2.90	0.62	2.10
Benzo(a)pyrene	0.61	2.60	0.61	2.60	0.061	0.26	0.062	0.29	0.062	0.21
Benzo(b)fluroanthene	6.10	26.0	6.10	26.0	8.00	2.60	0.62	2.90	0.62	2.10
Benzo(g,h,i)perylene	NL	NL	NE	NE	NE	NL	NE	NE	NE	NE
Benzo(k)fluoranthene	61.0	260	61.0	260	NL	26.0	0.61	29.0	0.38	1.30
Benzoic Acid	NE	NE	260,000	1,000,000	NL	NL	10,000	10,000	100,000	100,000
Bis(2-ehtylhexyl)phthalate	320	1,400	320	1,400	NL	140	35.0	180	35.0	120
Butylbenzylpthalate	NL	NL	13000	140,000	NL	NL	12,000	100,000	12,000	100,000
Carbon Disulfide	NL	NL	7.50	24.0	NL	NL	360	720	360	720
Chrysene	610	2,600	610	2,600	6.10	7.20	6.10	290	62.0	290
Cyanide	NE	NE	1,300	14,000	NL	NL	11.0	35.0	1,200	12,000
Di-n-butyl phthalate	2,600	27,000	NE	NE	NL	NL	6,100	88,000	6,100	62,000
Ethylbenzene	1,500	2,700	1,500	2,700	NL	NL	230	230	400	400
Fluoranthene	2,600	27,000	2,600	27,000	2,300	30,000	2,300	30,000	2,300	22,000
Indeno(1,2,3-cd)pyrene	NL	NL	6.10	26.0	0.61	2.60	0.62	2.90	0.62	2.10
Methylene Chloride	NL	NL	77.0	180	NL	NL	8.90	21.0	9.10	21.0
Naphthalene	2,600	27,000	2,600	27,000	2,400	2,400	56.0	190	56.0	190
Phenanthrene	NE	NE	NE	NE	NE	NE	NE	54,000	NE	NE
Polychlorinated Biphenyls	2.50	13.0	2.50	13.0	NE	NE	0.22	1.00	0.22	0.74
Pyrene	2,000	20,000	2,000	20,000	100	100	2,300	54,000	2,300	29,000
Tetrachloroethene	NL	NL	53.0	170	NL	NL	5.70	19.0	0.48	1.30
Toluene	790	2700	790	2,700	NL	NL	520	520	520	520
Total Petroleum Hydrocarbons	4,100	18,000	NE	NE	NL	NL	NE	NE	NE	NE
Total Recoverable Petroleum Hydrocarbons	4,100	18,000	NE	NE	NL	NL	NE	NE	NE	NE
Trichloroethene	NL	NL	27.0	70.0	3.20	7.00	2.80	6.10	0.053	0.11
Xylenes (Total)	2,800	2,800	2,800	2,800	320	320	210	210	270	420

Notes:
- The standards are reported in milligrams per kilogram
- Several organic compounds were reported as being detected by previous contractor, but were not identified. The acronyms are: 1,2-DCB, ACEN, AF, CAR, DOP and 1,2-DCE

EPA Environmental Protection Agency
Ind. industrial
NE not established
Res. residential
NL 1996 PRG or 2000 SRL not located for reporting

Table 6.37
Soil Inorganic
Applicable or Relevant and Appropriate Requirements Values
Luke AFB, Arizona

Constituent	Arizona Soil Remediation Levels				EPA Preliminary Remediation Goals					
	2000		2002		1996		2000		2004	
	Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.	Res.	Ind.
Antimony	NL	NL	31.0	680	31.0	680	31.0	820	31.0	410
Arsenic	10.0	10.0	10.0	10.0	0.38	2.40	0.39	2.70	0.39	1.60
Barium	NL	NL	5,300	110,000	5,300	100,000	5,400	100,000	5,400	67,000
Beryllium	1.40	11.0	1.4.0	11.0	NL	1.10	150	2,200	150	1,900
Cadmium	38.0	850	38.0	850	NL	NL	9.00	810	37.0	450
Chromium	2,100	4,500	2,100	4,500	210	450	210	450	210	450
Copper	2,800	63,000	2,800	63,000	2,800	63,000	2,900	76,000	3100	41,000
Lead	400	2,000	400	2,000	NL	NL	400	750	400	800
Mercury	NL	NL	6.70	180	NL	NL	23.0	610	23.0	310
Nickel	NL	NL	1,500	34,000	150	34,000	1,600	41,000	1600	20,000
Selenium	NL	NL	380	8,500	380	8,500	390	10,000	390	5,100
Silver	NL	NL	380	8,500	380	8,500	390	10,000	390	5,100
Thallium	NL	NL	NE	NE	NL	NL	5.20	130	5.20	67.0
Zinc	NL	NL	23,000	510,000	23,000	100,000	23,000	100,000	23000	100,000

Notes:
- The standards are reported in milligrams per kilogram
- Total Chromium standards listed

EPA Environmental Protection Agency
Ind. industrial
NE not established
NL 1996 PRG or 2000 SRL were not located for reporting
Res. residential

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7.0 TECHNICAL ASSESSMENT

This section discusses whether the remedy selected in the ROD and subsequently implemented for the sites under consideration in this Second Five-Year review remain effective in protecting human health and the environment. The RAOs for all OU-1 and OU-2 sites are the same: exposure prevention and protection of groundwater. In the discussion presented in the following subsections, the remedy for each site is evaluated to determine its continued effectiveness in achieving these RAOs, and determine whether new ARARs or other information has come to light since the last Five-Year Review that affects the protectiveness of the remedy. The evaluation was accomplished by reviewing relevant site documents and reports, revisiting the ARARs applied at the time of the remedy, evaluating risk assumptions, and considering the results of the site inspections.

The following discussion evaluates site-specific groundwater levels against MCLs, PRGs, and Arizona WQSs, whichever is the most conservative, in order to evaluate the protectiveness of the remedies. Soil levels are compared to PRGs and SRLs.

7.1 ASSESSMENT OF SITE-SPECIFIC REMEDIES

7.1.1 DP-13: Drainage Ditch Disposal Area

The selected remedy for DP-13 was institutional controls, based on the risk assessment determination that wastes were buried and there was no exposure threat based on current land use scenarios.

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

Yes. Land use restrictions are in place and land use has not changed. The BGP and ICP require that any development at the site be approved through AF Form 332 (also known as the Base Civil Engineer Work Request form). All new AF Form 332's are reviewed at the weekly work order review board meeting. The Environmental Flight National Environmental Policy Act (NEPA) Program Manager attends the weekly meeting. The project location identified on the Form 332 is compared to the BGP map of IRP sites with institutional controls. Residential development is not allowed for these areas. If non-residential construction is involved then the NEPA Manager annotates on the Form 332 that PPE should be worn when disturbing soil in the area and that the contractor should meet with the IRP Program Manager prior to the work to acquire additional information on the area. The NEPA Manager initials off on the Form 332, logs it into his database, and then it goes to the Chief of Operations for final approval/disapproval. A VEMUR is also in place.

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

There have been no changes in the physical conditions of the site that would affect the

protectiveness of the remedy.

Changes in Standards and To Be Considered (TBC)- The medium of concern at this site is soil. Soil ARARs are the RCRA – Criteria for Classification of Solid Waste Disposal and Practices (40 CFR 257), USEPA Region 9 PRGs, and Arizona SRLs (Title 18 – Environmental Quality, Chapter 7- Department of Environmental Quality Remedial Action, Article 2 – Soil Remediation Standards, Appendix A- SRLs). ARARs are listed in Tables 6.34 through 6.37. No new standards or TBCs affecting the protectiveness of the remedy have been discovered.

Changes in Exposure Pathways, Toxicity, and Other Contaminant Characteristics- The exposure assumptions used to develop the Human Health Risk Assessment have not changed. The industrial PRGs for the four SVOC contaminants and three of the five metals detected at this site have changed as follows:

- Benzo(a)pyrene (0.29 mg/kg to 0.21 mg/kg)
- Benzo(a)anthracene (2.90 mg/kg to 2.10 mg/kg)
- Benzo(b)fluoranthene (90 mg/kg to 2.10 mg/kg)
- Benzo(k)fluoranthene (29.0 mg/kg to 1.30 mg/kg)
- Cadmium (810 mg/kg to 450 mg/kg)
- Copper (76,000 mg/kg to 41,000 mg/kg)
- Lead (7,500 mg/kg to 800 mg/kg)

In addition to the four SVOCs detected, TRPH was reported in the RI soil samples at levels that exceeded the current most stringent standards. Five inorganic contaminants also were detected at levels above the most conservative ARAR. Of the 10 constituents detected, only arsenic and benzo[b]fluoranthene were detected in surface soils. Arsenic was detected in four surface soils at a concentration that exceeded its industrial PRG of 1.60 mg/kg. Only one of the arsenic detections in surface soil exceeded the Arizona SRL of 10.0 mg/kg. The reported arsenic detections are believed to be naturally occurring. Naturally occurring arsenic levels in the state of Arizona range from 1.40 mg/kg to 97.0 mg/kg (USGS, 1981). Benzo[b]fluoranthene was detected in one surface soil sample at a concentration of 0.63 mg/kg, which slightly exceeds the residential soil PRG of 0.62 mg/kg, but is significantly below the industrial PRG of 2.10 mg/kg.

This site is used for industrial purposes and future land use is not expected to change. The BGP precludes residential development on the site. Therefore, there is no direct contact exposure threat at this site. Based on the concentrations of contaminants detected in subsurface soil samples collected during the RI, and the depth to water it is highly unlikely that the contaminants associated with this site will ever migrate to groundwater.

The remedy is still considered to be protective and ICs are adequate.

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

No.

7.1.2 FTE-07E: Eastern Portion of North Fire Training Area

The selected remedy for FT-07E was institutional controls and LTM, based on the risk assessment determination that wastes were buried and posed no exposure threat based on current land use scenarios.

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

Yes. Land use restrictions are in place and land use has not changed. The BGP and ICP require that any development at the site be approved through AF Form 332. All new AF Form 332s are reviewed at the weekly work order review board meeting. The Environmental Flight NEPA Program Manager attends the weekly meeting. The project location identified on the Form 332 is compared to the BGP map of IRP sites with institutional controls. Residential development is not allowed for these areas. If non-residential construction is involved, then the NEPA Manager annotates on the Form 332 that PPE should be worn when disturbing soil in the area and that the contractor should meet with the IRP Program Manager prior to the work to obtain additional information regarding potential hazards in the area. The NEPA Manager initials the Form 332, logs it into the NEPA program database, then routes the form to the Chief of Operations for final approval/disapproval. A VEMUR is also in place.

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

There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy.

Changes in Standards and TBC- The media of concern at this site are soil and groundwater. For groundwater, the ARARs are the Safe Drinking Water Act (SDWA) (40 CFR 141.11-141.16) from which many of the groundwater cleanup levels were derived - MCLs and MCLGs, USEPA Region 9 PRGs, and Arizona WQSs (Title 18 – Environmental Quality, Chapter 11 – Department of Environmental Quality Water Quality Standards, Supplement 03-01 Article 1 – Numeric Water Quality Standards, Table 1 – Human Health and Agriculture Uses). The ARARs for soil are RCRA – Criteria for Classification of Solid Waste Disposal and Practices (40 CFR 257), USEPA Region 9 PRGs for industrial soils, and Arizona SRLs for industrial soils (Title 18 – Environmental Quality, Chapter 7- Department of Environmental Quality Remedial Action, Article 2 – Soil Remediation Standards, Appendix A- SRLs). ARARs are listed in Table 6.34 through 6.37. No new standards or TBCs affecting the protectiveness of the remedy have been discovered.

Changes in Exposure Pathways, Toxicity, and Other Contaminant Characteristics- The exposure assumptions used to develop the Human Health Risk Assessment have not changed. One ARAR has changed for the contaminants detected at this site. The MCL for arsenic

decreased from 50.0 µg/L to 10.0 µg/L.

Arsenic was the only metal that was reported in the soil samples collected during the RI at level that exceeded the industrial PRG of 1.60 mg/kg. The reported arsenic detections ranged from 5.00 mg/kg to 10.0 mg/kg and are believed to be naturally occurring. Concentrations of naturally occurring arsenic for the state of Arizona range from 1.40 mg/kg to 97.0 mg/kg (USGS, 1981).

Arsenic was also the only inorganic constituent detected in groundwater samples collected during the RI at a concentration that exceeded an ARAR. These reported detections ranged from 19.0 µg/L to 23.0 µg/L, which exceed the current MCL of 10.0 µg/L and PRG of 0.045 µg/L. These levels are consistent with expected background concentrations. None of the organic compounds detected in the groundwater samples collected from the site were reported at a concentration that exceeded an MCL or WQS. However, the concentrations reported for six compounds exceeded a PRG. None of these compounds are believed to be attributable to the site. The detections are summarized in Section 6.0.

FT-07E is in the Luke AFB LTM program. Groundwater is sampled routinely for VOCs. LTM data indicate that no VOCs have been detected at levels above an ARAR since 1998. This site is used for industrial purposes and future land use is not expected to change. ICs are in place and FT-07E is in the ICP, which precludes residential development on the site. Therefore, there is no direct contact exposure threat at this site. The arsenic reported in soil and groundwater were reported at naturally occurring levels and are not considered to be site related. The remedy is considered to be protective and the ICs adequate.

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

There are two monitoring wells at FT-07E included in the LTM program: MW-118 and MW-123. Well MW-123 has collapsed and, therefore, no groundwater samples can be collected. The well screen in MW-118 is submerged. Water levels across the base have been rising in recent years because the quantity of water withdrawn from the aquifer for irrigation purposes has decreased. Given that the static water level is above the well screen, the groundwater sample collected from this well may not be representative. However, the analytical data for the samples collected from well MW-118 is valid for the purpose of determining potential contaminant concentrations in the aquifer within the radius of influence of the pump inlet (sample zone), regardless of the whether the well screen is submerged. In the case of the wells with submerged screens, the distance between the sample zone and point of contact where contaminants move from the vadose zone into groundwater is greater than for those wells with screens that bracket the water table. A shorter distance between the water table and sample zone provides a more conservative and representative monitoring program.

Another issue associated with the well screens being submerged beneath the water table is that potential light non-aqueous phase liquids (LNAPLs) that float on the water would not be

observed in these wells. However, because LNAPLs have never been observed in these wells, the objective of the LTM program of monitoring for potential groundwater contamination has not been compromised by the rise in static water levels.

The ROD does not stipulate that the wells must be included in the LTM network. Luke AFB collected a sample from MW-118 and attempted to collect a sample from the MW-123 at the request of ADEQ. Luke AFB is currently pursing the funds to replace the wells at the site. The wells will be sampled once they are replaced.

7.1.3 LF-03: Outboard Runway Landfill

The selected remedy for LF-03 was ICs, based on the risk assessment determination that wastes were buried and there was no exposure threat based on current land use scenarios.

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

Yes. Land use restrictions are in place and land use has not changed. The BGP and ICP require that any development at the site be approved through AF Form 332. All new AF Form 332s are reviewed at the weekly work order review board meeting. The Environmental Flight NEPA Program Manager attends the weekly meeting. The project location identified on the Form 332 is compared to the BGP map of IRP sites with institutional controls. Residential development is not allowed for these areas. If non-residential construction is involved then the NEPA Manager annotates on the Form 332 that PPE should be worn when disturbing soil in the area and that the contractor should meet with the IRP Program Manager prior to the work to obtain additional information regarding potential hazards in the area. The NEPA Manager initials the Form 332, logs it into the NEPA program database, then routes the form to the Chief of Operations for final approval/disapproval. A VEMUR is also in place. The remedy appears to be adequate for achieving RAOs.

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

There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy.

Changes in Standards and TBC- The medium of concern at this site is soil. The soil ARARs are the RCRA – Criteria for Classification of Solid Waste Disposal and Practices (40 CFR 257), USEPA Region 9 PRGs for industrial soils, and Arizona SRLs for industrial soils (Title 18 – Environmental Quality, Chapter 7- Department of Environmental Quality Remedial Action, Article 2 – Soil Remediation Standards, Appendix A- SRLs). ARARs are listed in Tables 6.34 through 6.37. No new standards or TBCs affecting the protectiveness of the remedy have been discovered.

Changes in Exposure Pathways, Toxicity, and Other Contaminant Characteristics- The exposure assumptions used to develop the Human Health Risk Assessment have not changed.

The industrial PRGs for two of the four inorganic constituents detected in site soils have decreased as follows:

- Copper (76,000 mg/kg to 41,000 mg/kg)
- Lead (7,500 mg/kg to 800 mg/kg)

Four inorganic contaminants were detected in the RI soil samples at levels that exceeded the current most stringent ARAR. Only one of the contaminants (arsenic) was detected in a surface soil sample. Arsenic was detected in one surface soil sample at a concentration of 9.50 mg/kg, which exceeds the industrial PRG of 1.60 mg/kg. The reported detection did not exceed the Arizona SRL of 10.0 mg/kg. The reported arsenic detection is believed to be naturally occurring. Naturally occurring arsenic levels in the state of Arizona range from 1.40 mg/kg to 97.0 mg/kg (USGS, 1981).

This site is used for industrial purposes and future land use is not expected to change. ICs are in place and the BGP precludes residential development on the site. Therefore, there is no direct contact exposure threat at this site. The arsenic concentrations reported in soil were reported at naturally occurring levels and are not considered to be site related. The remedy is considered to be protective and the ICs adequate.

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

No.

7.1.4 LF-14: Old Salvage Yard Burial Site

The selected remedy for LF-14 was ICs, based on the risk assessment determination that wastes were buried and posed no exposure threat based on current land use scenarios.

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

Yes. Land use restrictions are in place and land use has not changed. The BGP and ICP require that any development at the site be approved through AF Form 332. All new AF Form 332s are reviewed at the weekly work order review board meeting. The Environmental Flight NEPA Program Manager attends the weekly meeting. The project location identified on the Form 332 is compared to the BGP map of IRP sites with institutional controls. Residential development is not allowed for these areas. If non-residential construction is involved then the NEPA Manager annotates on the Form 332 that PPE should be worn when disturbing soil in the area and that the contractor should meet with the IRP Program Manager prior to the work to obtain additional information regarding potential hazards in the area. The NEPA Manager initials the Form 332, logs it into the NEPA program database, then routes the form to the Chief of Operations for final approval/disapproval. A VEMUR is also in place. The remedy appears to be adequate for achieving RAOs.

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

There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy.

Changes in Standards and TBC- The medium of concern at this site is soil. The soil ARARs are the RCRA – Criteria for Classification of Solid Waste Disposal and Practices (40 CFR 257), USEPA Region 9 PRGs for industrial soils, and Arizona SRLs for industrial soils (Title 18 – Environmental Quality, Chapter 7- Department of Environmental Quality Remedial Action, Article 2 – Soil Remediation Standards, Appendix A- SRLs). ARARs are listed in Tables 6.34 through 6.37. No new standards or TBCs affecting the protectiveness of the remedy have been discovered.

Changes in Exposure Pathways, Toxicity, and Other Contaminant Characteristics- The exposure assumptions used to develop the Human Health Risk Assessment have not changed.

Industrial PRGs for some constituents detected at this site have changed as follows:

- PCBs (1.00 mg/kg to 0.74 mg/kg)
- Benzo(a)pyrene (0.29 mg/kg to 0.21 mg/kg)
  Beryllium (2,200 mg/kg to 1,900 mg/kg)

Three inorganic contaminants and two organic contaminants were detected in the RI soil samples at levels that exceeded the current most stringent ARAR. Only one of the inorganic contaminants (arsenic) was detected in a surface soil sample. Arsenic was detected in two surface soil samples at a concentration that exceeded its industrial PRG of 1.60 mg/kg. One sample was reported to contain arsenic at 14.0 mg/kg, which exceeds the Arizona SRL of 10.0 mg/kg. The reported arsenic detection is believed to be naturally occurring. Naturally occurring arsenic levels in the state of Arizona range from 1.40 mg/kg to 97.0 mg/kg (USGS, 1981). PCBs were detected in three surface soil samples at concentrations that exceeded the industrial PRG of 0.74 mg/kg. One surface soil sample contained benzo(a)pyrene at 0.30 mg/kg, which is greater than its industrial PRG of 0.21 mg/kg.

This site is used for industrial purposes and future land use is not expected to change. ICs are in place and LF-14 is in the ICP, which precludes residential development on the site. Therefore, there is no direct contact exposure threat at this site. The arsenic concentrations reported in soil were reported at naturally occurring levels and are not considered to be site related. The remedy is considered to be protective and the ICs adequate.

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

No.

7.1.5 LF-25: Northwest Landfill

The selected remedy for LF-25 was excavation of contaminated soils, ex situ mechanical treatment of contaminated soils, on-site disposal of treated soils, and ICs.

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

Yes. Lead shot was mechanically separated from the soil. The soil was tested before being returned to the site to assure that the action level of 400 mg/kg had been achieved. A VEMUR is in place to restrict future development. Land use has not changed. The BGP and ICP require that any development at the site be approved through AF Form 332. All new AF Form 332s are reviewed at the weekly work order review board meeting. The Environmental Flight NEPA Program Manager attends the weekly meeting. The project location identified on the Form 332 is compared to the BGP map of IRP sites with institutional controls. Residential development is not allowed for these areas. If non-residential construction is involved then the NEPA Manager annotates on the Form 332 that PPE should be worn when disturbing soil in the area and that the contractor should meet with the IRP Program Manager prior to the work to obtain additional information regarding potential hazards in the area. The NEPA Manager initials the Form 332, logs it into the NEPA program database, then routes the form to the Chief of Operations for final approval/disapproval. The remedy appears to be adequate for achieving RAOs.

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

There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy.

Changes in Standards and TBC- The medium of concern at this site is soil. The soil ARARs for this PSC are the RCRA – Criteria for Classification of Solid Waste Disposal and Practices (40 CFR 257), USEPA Region 9 PRGs for industrial soils, and Arizona SRLs for industrial soils (Title 18 – Environmental Quality, Chapter 7- Department of Environmental Quality Remedial Action, Article 2 – Soil Remediation Standards, Appendix A- SRLs). Soil ARARs are summarized in Tables 6.36 and 6.37. No new standards or TBCs affecting the protectiveness of the remedy have been discovered.

Changes in Exposure Pathways, Toxicity, and Other Contaminant Characteristics- The exposure assumptions used to develop the Human Health Risk Assessment have not changed.

The industrial PRGs for several constituents detected in site soils have changed as listed below.

- Benzo(a)pyrene (0.29 mg/kg to 0.21 mg/kg)
- Benzo(a)anthracene (2.90 mg/kg to 2.10 mg/kg)
- Benzo(b)fluoranthene (2.90 mg/kg to 2.10 mg/kg)
- Benzo(k)fluoranthene (29.0 mg/kg to 1.30 mg/kg)
- Indeno(1,2,3-cd)pyrene (2.90 mg/kg to 2.10 mg/kg)

- Antimony (820 mg/kg to 410 mg/kg)
- Beryllium (2,200 mg/kg to 1,900 mg/kg)
- Lead (7,500 mg/kg to 800 mg/kg)

Four inorganic contaminants and five organic contaminants were detected in the RI soil samples at levels that exceeded the current most stringent ARARs. All four of the inorganic contaminants (antimony, arsenic, beryllium, and lead) were detected in a surface soil sample. The only inorganic constituent detected at a level that exceeded and ARAR was arsenic, which was detected in two surface soil samples at a concentration that exceeded its industrial soil PRG of 1.60 mg/kg. The reported arsenic detection is believed to be naturally occurring. Naturally occurring arsenic ranges from 1.40 mg/kg to 97.0 mg/kg in the state of Arizona (USGS, 1981). Lead was detected in one sample at 10,100 mg/kg, which exceeds the industrial PRG of 800 mg/kg and the SRL for industrial soils of 2,000 mg/kg. In December 1999, the antimony and lead contaminated area was delineated and remediated by mechanically removing lead shot from excavated soils. Treated soils were sampled before being returned to the site. Post-remediation concentrations of lead were less than all established standards. Four of the five organics were detected in one surface soil sample. The five organic compounds were PAHs: benzo(a)anthracene, benzo(a)pyrene, benzo(a)fluoranthene, and indeno(1,2,3-cd)pyrene.

This site is used for industrial purposes and future land use is not expected to change. ICs are in place and LF-25 is in the ICP, which precludes residential development on the site. Therefore, there is no direct contact exposure threat at this site. The arsenic concentrations reported in soil were reported at naturally occurring levels and are not considered to be site related. The one lead detection in a surface soil sample is likely attributable to a lead particle being collected with the sample and not indicative of pervasive lead contamination. The remedy is considered to be protective and the ICs adequate.

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

PAHs were detected in surface soil samples during the RI at levels that exceed their respective industrial PRGs (see Table 6.14). However, no soil samples have been collected at the site for over 10 years. The likelihood that PAH contamination is still present in near-surface soil samples is low. Moreover, the ICs described above ameliorate the threat of direct contact.

7.1.6 RW-02: Wastewater Treatment Annex Landfill

The selected remedy for RW-02 was ICs to prevent exposure to low-level radioactive wastes buried at the site, and monitoring for 30 years to assure that the integrity of the concrete burial vault has not been compromised and that groundwater has not been impacted.

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

Yes. Results of the downhole radiological monitoring indicate that the concrete vault is functioning to contain the radioactive waste. Radiological results indicate readings commensurate with background levels. Section 4 of this report contains a brief discussion of the readings documented over the last five years, tables that summarize those readings, and graphical illustrations of the readings. Although groundwater samples were not collected during the last sampling event at this site, it is unlikely that the groundwater has been impacted. Various monitoring wells were sampled frequently from 1992 to 1996 at this site and only one organic (bis[2-ethylhexyl]phthalate) and two inorganic (arsenic and lead) contaminants were reported at a concentration that exceeded a clean-up goal. Bis(2-ethylhexyl)phthalate was reported for 3 of the 16 samples submitted for SVOC analysis for this site. These detections are not believed to be site related because bis(2-ethylhexyl)phthalate is known as a common laboratory contaminant. Two of the three reported bis(2-ethylhexyl)phthalate concentrations were estimated at 5 µg/L and 8 µg/L. The third reported concentration was 63 µg/L. It should also be noted that these detections were randomly reported for wells and sample dates. Arsenic was detected in 26 of the 28 groundwater samples collected from the site. The reported concentrations ranged from 5 µg/L to 17 µg/L and averaged 9.9 µg/L. The laboratory reporting limit was 5 µg/L and it is suspected that the two samples that did not report a detection of arsenic contained arsenic at a concentration just below the reporting limit. It is also believed the reported arsenic detections are naturally occurring. Lead was detected in one unfiltered sample at a concentration of 17 µg/L, which exceeds it's MCL and AWQS of 15 µg/L. Lead was not detected (reporting limit 2 µg/L) in the filtered version of this same sample. In addition to the groundwater evidence presented above, the reported soil detections for this site do not indicate that the groundwater is threatened. Two organic contaminants were detected at a concentration that exceeded a clean-up goal. Benzo(a)pyrene was detected at an estimated concentration of 0.10 mg/kg and 0.63 mg/kg and benzo(b)fluoranthene was detected at an estimated concentration 0.11 mg/kg and 1.6 mg/kg. Considering these contaminants, the concentration of the contaminants, and the depth to water; it is highly unlikely the groundwater has been impacted by either. Arsenic and lead were also detected in soil samples at a concentration that exceeded a standard. The reported arsenic detections are believed to be naturally occurring and the lead detections are random and not considered a threat to groundwater. The ICs are in place and land use has not changed. The security fencing is in good condition and placarding is visible and adequate. ICs in place at RW-02 are detailed in the BGP. The BGP and ICP require that any development at the site be approved through AF Form 332. All new AF Form 332s are reviewed at the weekly work order review board meeting. The Environmental Flight NEPA Program Manager attends the weekly meeting. The project location identified on the Form 332 is compared to the BGP map of IRP sites with institutional controls. Residential development is not allowed for these areas. If non-residential construction is involved then the NEPA Manager annotates on the Form 332 that PPE should be worn when disturbing soil in the area and that the contractor should meet with the IRP Program Manager prior to the work to obtain additional information regarding potential hazards in the area. The NEPA Manager initials the Form 332, logs it into the NEPA program database, then routes the form to the Chief of Operations for final approval/disapproval.

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

There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy.

Changes in Standards and TBC- The media of concern at this site are soil and groundwater. Groundwater ARARs are the Safe Drinking Water Act (SDWA) (40 CFR 141.11-141.16) from which many of the groundwater cleanup levels were derived - MCLs and MCLGs, USEPA Region 9 PRGs, and Arizona WQSs (Title 18 – Environmental Quality, Chapter 11 – Department of Environmental Quality Water Quality Standards, Supplement 03-01 Article 1 – Numeric Water Quality Standards, Table 1 – Human Health and Agriculture Uses). Soil ARARs are RCRA – Criteria for Classification of Solid Waste Disposal and Practices (40 CFR 257), USEPA Region 9 PRGs for industrial soils, and Arizona SRLs for industrial soils (Title 18 – Environmental Quality, Chapter 7- Department of Environmental Quality Remedial Action, Article 2 – Soil Remediation Standards, Appendix A- SRLs). ARARs are listed in Tables 6.34 through 6.37.

Changes in Exposure Pathways, Toxicity, and Other Contaminant Characteristics- The exposure assumptions used to develop the Human Health Risk Assessment have not changed.

The industrial PRGs for the contaminants detected at this site have changed as follows:

- Benzo(a)pyrene (0.29 mg/kg to 0.21 mg/kg)
- Benzo(b)fluoranthene (2.90 mg/kg to 2.10 mg/kg)

Arsenic and lead were detected in soil samples collected at the site. The highest lead concentration was reported to be 680 mg/kg, which is below the PRG for industrial soil of 800 mg/kg and the industrial SRL of 2,000 mg/kg. The reported arsenic detections ranged from 6.00 mg/kg to 30.0 mg/kg, which exceeds the PRG of 1.60 mg/kg and the SRL of 10.0 mg/kg. The presence of arsenic at these levels is believed to be naturally occurring. Concentrations of naturally occurring arsenic for the state of Arizona range from 1.40 mg/kg to 97.0 mg/kg (USGS, 1981). Three organic constituents were detected in three samples at a concentration that was greater than a current standard. One of the three detections was reported in a surface soil sample. The surface soil sampled contained benzo(a)pyrene at an estimated concentration of 0.10 mg/kg, which is less than the industrial PRG of 0.21 mg/kg. Radiological monitoring is conducted annually to insure the soil has not been impacted. Generally, the radiological monitoring results have decreased slightly each year.

Arsenic and lead were also the only inorganic contaminants detected in the RI groundwater samples at a concentration that exceeded an ARAR. Though some detections exceeded the MCL of 10.0 µg/L, the reported range of 5.00 µg/L to 17.0 µg/L is consistent with expected background concentrations. All of the reported detections exceed the PRG of 0.045 µg/L. The sample collected from MW-116 in July of 1992 reported a detection of 17.0 µg/L for total lead, which exceeds its MCL and Arizona WQS of 15.0 µg/L. The filtered faction of this

sample did not contain lead. Lead was not detected in either the filtered or unfiltered samples collected during the subsequent six sampling events. Bis(2-ethylhexyl)phthalate was the only organic compound detected in a groundwater sample collected from this PSC that exceeded an ARAR. There is no MCL or WQS for bis(2-ethylhexyl)phthalate. The PRG is 4.80 µg/L. Three samples were reported to contain bis(2-ethylhexyl)phthalate at a level that exceeded the PRG. This compound is a common laboratory contaminant and the reported detections are believed to be attributable to laboratory contamination.

RW-02 is in the Luke AFB LTM program. Groundwater is sampled routinely for VOCs. LTM data indicate that no VOCs have been detected at levels above an ARAR. This site is used for industrial purposes and future land use is not expected to change. ICs are in place and RW-02 is in the ICP, which precludes residential development on the site. Therefore, there is no direct contact exposure threat at this site. The arsenic concentrations reported in soil were reported at naturally occurring levels and are not considered to be site related. The one historic reported lead concentration is attributable to lead particles sorbed to particulates suspended in groundwater and not groundwater contamination; the dissolved fraction was reported as nondetect. The remedy is considered to be protective and the ICs adequate.

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

The monitoring well in place at RW-02 (MW-124) has collapsed. Therefore, no groundwater samples can be retrieved. The ROD does not stipulate that MW-124 be included in the LTM network. However, Luke AFB attempted to collect a sample from the well as requested by ADEQ and is currently pursing funds to replace the well, which will be sampled upon replacement.

7.1.7 SD-38: Oil/Water Separator at Auto Body Shop

The selected remedy for SD-38 was ICs, based on the risk assessment determination that wastes were buried and there was no exposure threat based on current land use scenarios. The site is in the Luke AFB LTM program.

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

Yes. Land use restrictions are in place and land use has not changed. The BGP and ICP require that any development at the site be approved through AF Form 332. All new AF Form 332s are reviewed at the weekly work order review board meeting. The Environmental Flight NEPA Program Manager attends the weekly meeting. The project location identified on the Form 332 is compared to the BGP map of IRP sites with institutional controls. Residential development is not allowed for these areas. If non-residential construction is involved then the NEPA Manager annotates on the Form 332 that PPE should be worn when disturbing soil in the area and that the contractor should meet with the IRP Program Manager prior to the work to obtain additional information regarding potential hazards in the area. The NEPA Manager initials the Form 332, logs it into the NEPA program database, then routes the form to the

Chief of Operations for final approval/disapproval. A VEMUR is in place and SD-38 is included in the ICP. The remedy appears to be adequate for achieving RAOs.

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

There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy.

Changes in Standards and TBC- The media of concern at this site are groundwater and soil. The groundwater ARARs are the Safe Drinking Water Act (SDWA) (40 CFR 141.11-141.16) from which many of the groundwater cleanup levels were derived - MCLs and MCLGs, USEPA Region 9 PRGs, and Arizona WQSs (Title 18 – Environmental Quality, Chapter 11 – Department of Environmental Quality Water Quality Standards, Supplement 03-01 Article 1 – Numeric Water Quality Standards, Table 1 – Human Health and Agriculture Uses). Soil ARARs are RCRA – Criteria for Classification of Solid Waste Disposal and Practices (40 CFR 257), USEPA Region 9 PRGs for industrial soils, and Arizona SRLs for industrial soils (Title 18 – Environmental Quality, Chapter 7- Department of Environmental Quality Remedial Action, Article 2 – Soil Remediation Standards, Appendix A- SRLs). A list of ARARs is included in Section 6.0. No new standards or TBCs affecting the protectiveness of the remedy have been discovered.

Changes in Exposure Pathways, Toxicity, and Other Contaminant Characteristics- The exposure assumptions used to develop the Human Health Risk Assessment have not changed. There have been no changes to the industrial PRGs for the contaminants detected at this site.

Arsenic and lead were the only metals that were reported in the soil samples collected during the RI at level that exceeded the current most stringent soil standards. The reported arsenic detections ranged from 5.00 mg/kg to 14.0 mg/kg and are believed to be naturally occurring. Concentrations of naturally occurring arsenic for the state of Arizona range from 1.40 mg/kg to 97.0 mg/kg (USGS, 1981). One sample contained at lead at 470 mg/kg, which is below the industrial PRG of 800 mg/kg. Three organic constituents were detected in four samples at concentrations that are greater than a current ARAR. None of the reported detections were for surface soils.

Arsenic was detected in the filtered and unfiltered samples collected from MW-117 at concentrations of 5.00 µg/L and 6.00 µg/L, respectively. The reported detections were greater than the PRG but less than the MCL and WQS. Further, the reported detections are consistent with background concentrations.

This site is used for industrial purposes and future land use is not expected to change. ICs are in place and SD-38 is in the ICP, which precludes residential development on the site. Therefore, there is no direct contact exposure threat at this site. The arsenic concentrations detected in soil were reported at naturally occurring levels and are not considered to be site

related. The one arsenic concentration reported in groundwater exceeds only one ARAR (PRG) and is suspected to be naturally occurring. Though TRPH, TCE and PCE were detected on four soil samples, all were reported in samples collected from 6 feet to 8 feet bgs. ICs are in place to protect the hypothetical future construction that may contact subsurface soil during excavation. Groundwater modeling conducted during the RI concluded that subsurface soil contamination would not impact groundwater and the site is included in the Luke AFB LTM program. The remedy is considered to be protective and the ICs adequate.

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

No.

7.1.8 SS-42: Bulk Fuels Storage Area

The selected remedy for SS-42 was installation and operation of an SVE system to remediate the soil source, then monitoring the groundwater to confirm the effectiveness of the SVE system and groundwater quality.

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

The SVE system was installed and operated under an interim removal action before the OU-1 ROD was signed, thereby nullifying the need for further action. Routine groundwater monitoring is conducted under the LTM program and data indicate that groundwater in the site vicinity has not been impacted. The remedy appears to be adequate for achieving RAOs.

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

There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy.

Changes in Standards and TBC- The media of concern at this site are soil and groundwater. The groundwater ARARs for this site are the Safe Drinking Water Act (SDWA) (40 CFR 141.11-141.16) from which many of the groundwater cleanup levels were derived - MCLs and MCLGs, USEPA Region 9 PRGs, and Arizona WQSs (Title 18 – Environmental Quality, Chapter 11 – Department of Environmental Quality Water Quality Standards, Supplement 03-01 Article 1 – Numeric Water Quality Standards, Table 1 – Human Health and Agriculture Uses). Soil ARARs are RCRA – Criteria for Classification of Solid Waste Disposal and Practices (40 CFR 257), USEPA Region 9 PRGs, and Arizona SRLs (Title 18 – Environmental Quality, Chapter 7- Department of Environmental Quality Remedial Action, Article 2 – Soil Remediation Standards, Appendix A- SRLs). ARARs are summarized in Tables 6.34 through 6.37. No new standards or TBCs affecting the protectiveness of the remedy have been discovered.

Changes in Exposure Pathways, Toxicity, and Other Contaminant Characteristics- The exposure assumptions used to develop the Human Health Risk Assessment have not changed.

The industrial PRGs for the contaminants detected at this site have changed as follows:

- Benzene (1.50 mg/kg to 1.40 mg/kg)
- Toluene (880 mg/kg to 520 mg/kg)

Four organic constituents were detected in 15 soil samples at a level that exceeded an ARAR. Only 1 of the 15 samples was a surface soil sample. None of the constituents reported in this sample exceeded an ARAR. TRPH was detected at 9,000 mg/kg. There is no PRG established for TRPH. There is no current (2002) industrial SRL for TRPH; the 2000 SRL for TRPH in industrial soils was 18,000 mg/kg.

Three inorganic constituents were detected in RI groundwater samples at concentrations that exceeded an ARAR: arsenic, chromium, and nickel. Six samples contained metals contamination that exceeded an ARAR. Arsenic was detected at 7.00 µg/L and as noted above it is believed that the low level detection of arsenic is consistent with naturally occurring concentrations. In 1993, total chromium was detected in MW-119 at an estimated concentration of 384 µg/L. (Its duplicate sample was reported to contain total chromium at an estimated concentration of 164 µg/L.) Chromium was reported as nondetect in the filtered fractions of these samples. The chromium concentration in the unfiltered sample collected in 1994 from this well was 73.0 µg/L, which is below the MCL and Arizona WQS of 100 µg/L. In 1993 and 1994, nickel was detected in MW-119. The total nickel concentration in 1993 was 103 µg/L (estimated) and the dissolved nickel was 53.0 µg/L. In 1994, total nickel was detected at 254 µg/L and dissolved nickel was detected at 250 µg/L. Total nickel in MW-121 in 1994 was 144 µg/L and dissolved nickel was 143 µg/L. There is no MCL or MCLG for nickel. The Arizona WQS is 140 µg/L. Three organics were reported in SS-42 groundwater at a concentration that exceeded an ARAR: 1,2-dichloropropane, methylene chloride, and benzene. Benzene was detected in MW-121 in 1998 at 17.0 µg/L and 19.0 µg/L; both levels exceed the MCL and WQS of 5.00 µg/L. Three additional samples from MW-121 reported a detection that exceeded the PRG for benzene of 0.35 µg/L. The concentrations reported for 1,2-dichloropropane and methylene chloride ranged from 1.00 µg/L to 2.00 µg/L and 0.04 µg/L to 34.0 µg/L. The PRG for 1,2-dichloropropane is 0.16 µg/L and the PRG for methylene chloride is 4.30 µg/L, respectively. The reported detections of 1,2-dichloropropane and methylene chloride are not believed to be site related.

SS-42 is in the Luke AFB LTM program. Groundwater samples are collected routinely and sampled for VOCs. None of the reported detections have exceeded a groundwater ARAR. Metals are not analyzed, so more recent data on nickel levels in groundwater are not available.

This site is used for industrial purposes and future land use is not expected to change. ICs are in place and SS-42 is in the ICP, which precludes residential development on the site. Therefore, there is no direct contact exposure threat at this site. The remedy is considered to be protective and the ICs adequate.

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

Wells MW-121 and MW-125 are sampled at SS-42 under the LTM program. The well screens are submerged in both wells. The issues associated with sample representativeness that occur when well screens are submerged are discussed in detail in Section 7.1.2 above.

7.1.9 SD-20: Oil/Water Separator and Earth Fissure

As detailed in Section 4.2.9, no remedial alternatives were developed for the SD-20 site during the FS. It was assigned no further action status in the ROD. However, after the First Five-Year Review was conducted, ADEQ requested that Luke AFB sample monitoring wells 112S, 112D, and 113 every five years. SD-20 was subsequently added to the LTM program. Seven organic compounds have been detected in groundwater samples collected at SD-20 at a level that exceeds an ARAR. Of these detections, only two (PCE and TCE), are thought to be site related. PCE was reported for two samples at estimated concentrations of 0.18 µg/L and 0.35 µg/L. These reported detections exceed the PRG for PCE of 0.10 µg/L. TCE was reported in 15 samples at concentrations that ranged from 1.00 µg/L to 2.00 µg/L, which exceeds only one of its ARARs: the PRG of 0.028 µg/L. Numerous samples reported an arsenic detection; however, all of the reported detections were less than 28.0 µg/L. Thus, they are considered to naturally occurring and not site related. Chromium and lead each were detected in an unfiltered sample at a level that exceeded an ARAR. The filtered versions of these samples contained the analytes at a concentration less than their respective ARARs.

SD-20 is in the Luke AFB LTM program. Groundwater samples are collected routinely for VOCs. Recent sample results indicate that groundwater is no longer contaminated with PCE and TCE. PCE and TCE have not been detected in a sample since 1998. This site is used for industrial purposes and future land use is not expected to change. ICs are in place and the BGP precludes residential development on the site. Therefore, there is no direct contact exposure threat at this site. The well screens in all three SD-20 LTM wells are submerged. The issues associated with sample representativeness that occur when well screens are submerged are discussed in detail in Section 7.1.2 above. New wells may need to be installed to assure that samples are representative on site conditions. The remedy is considered to be protective and the ICs adequate.

7.1.10 ST-18: Former Liquid Waste Storage Facility (Facility 993)

The selected remedy for ST-18 in the OU-2 ROD was specified as capping, ICs, and groundwater monitoring.

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

Yes. The site was capped with a concrete runway in 1997 as part of RCRA closure requirements before the OU-2 ROD was signed. Because the cap recommended in the ROD was already in place, this component of the remedy was not implemented. The cap is inspected annually to assure its integrity and repairs are made as needed. The cap inspection reports for ST-18 since the last Five-Year Review are included in Appendix D. Groundwater monitoring is conducted under the LTM program and analytical results indicate that groundwater beneath the site is not impacted. Land use restrictions are in place and land use has not changed. The land use restrictions require that any development at the site be approved through AF Form 332. All new AF Form 332s are reviewed at the weekly work order review board meeting. The Environmental Flight NEPA Program Manager attends the weekly meeting. The project location identified on the Form 332 is compared to the BGP map of IRP sites with institutional controls. The BGP does not discuss this site; however, the plan is scheduled to be updated to include this area. Considering, this area is apart of the tarmac construction is very unlikely before the plan is updated. Additionally, the Environmental Flight NEPA Program Manager has immanent knowledge of this area. Residential development is not allowed for this area. If non-residential construction is involved then the NEPA Manager annotates on the Form 332 that PPE should be worn when disturbing soil in the area and that the contractor should meet with the IRP Program Manager prior to the work to obtain additional information regarding potential hazards in the area. The NEPA Manager initials the Form 332, logs it into the NEPA program database, then routes the form to the Chief of Operations for final approval/disapproval.

The remedy appears to be adequate for achieving RAOs.

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

There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy.

Changes in Standards and TBC- The media of concern at this site are soil and groundwater. The groundwater ARARs are the Safe Drinking Water Act (SDWA) (40 CFR 141.11-141.16) from which many of the groundwater cleanup levels were derived - MCLs and MCLGs, USEPA Region 9 PRGs, and Arizona WQSs (Title 18 – Environmental Quality, Chapter 11 – Department of Environmental Quality Water Quality Standards, Supplement 03-01 Article 1 – Numeric Water Quality Standards, Table 1 – Human Health and Agriculture Uses). Soil ARARs are RCRA – Criteria for Classification of Solid Waste Disposal and Practices (40 CFR 257), USEPA Region 9 PRGs for industrial soils, and Arizona SRLs for industrial soils (Title 18 – Environmental Quality, Chapter 7- Department of Environmental Quality Remedial Action, Article 2 – Soil Remediation Standards, Appendix A- SRLs). ARARs are listed in Tables 6.34 through 6.37. No new standards or TBCs affecting the protectiveness of the remedy have been discovered.

Changes in Exposure Pathways, Toxicity, and Other Contaminant Characteristics- The

exposure assumptions used to develop the Human Health Risk Assessment have not changed.

Industrial PRGs for the constituents detected at this site have changed as follows:

- Benzo(a)pyrene (0.29 mg/kg to 0.21 mg/kg)
- Benzo(b)fluoranthene (2.90 mg/kg to 2.10 mg/kg)
- Benzene (1.50 mg/kg to 1.40 mg/kg)
- TCE (7.00 mg/kg to 0.11 mg/kg)
- PCE (19.0 mg/kg to 1.30 mg/kg)

The only inorganic constituent detected was arsenic, which was reported in four soil samples. Only two of these samples were surface soils. Arsenic was detected in two surface soil samples at 5.00 mg/kg, which exceeds the industrial PRG of 1.60 mg/kg but is well below the Arizona SRL of 10.0 mg/kg. The reported arsenic detections are believed to be naturally occurring. Naturally occurring arsenic ranges from 1.40 mg/kg to 97.0 mg/kg in the state of Arizona (USGS, 1981).

Nine organic constituents were detected in 10 RI soil samples at levels that exceeded an ARAR: 1,1-dichloroethene; 1,1,2,2-tetrachloroethane; benzene; TCE; PCE; total xylenes; benzo[a]pyrene; benzo[b]fluoranthene; and TRPH. Two of these samples were surface soil samples. Benzo(a)pyrene was the only constituent that was reported in the surface soil samples at levels that exceeded an ARAR. Benzo(a)pyrene was detected in one sample at 0.43 mg/kg, which exceeds the industrial PRG of 0.21 mg/kg but below the SRL of 2.60 mg/kg.

Four inorganic constituents were detected in RI groundwater samples at a concentration that exceeded an ARAR: arsenic, chromium, lead, and zinc. Arsenic was detected at concentrations that ranged from 5.00 µg/L to 19.0 µg/L and as noted above it is believed that the low level detections of arsenic are consistent with background concentrations. The unfiltered sample collected from MW-114 reported arsenic, chromium, lead, and zinc at concentrations that exceeded the MCL and/or WQS. Only lead was reported at a level that exceeded a standard in the filtered fraction of this sample. No metals contaminants were reported at a level that exceeded a standard in the subsequent sampling events.

ST-18 is in the Luke AFB LTM program. Groundwater is sampled routinely for VOCs. Recent LTM data indicate that no VOCs have been detected at levels above an ARAR. PCE and TCE have not been detected since 2001 and 1,2-dibromo-3-chloropropane has not been detected since 1992. This site is used for industrial purposes and future land use is not expected to change. ICs are in place and ST-18 is in the ICP, which precludes residential development on the site. Therefore, there is no direct contact exposure threat at this site. The remedy is considered to be protective and the ICs adequate.

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

During the First Five-year Review, it was recommended that a VEMUR be filed for the site. Luke AFB opted instead to emplace internal land use restrictions because land use restrictions and restrictions on future development are managed under existing Luke AFB programs. Any development at the site must be approved through AF Form 332 by the Base Chief of Operations. These forms will not be approved at sites such as ST-18 where land use restrictions are in place.

Wells MW-114 and MW-122 are sampled at ST-18 under the LTM program. The well screens are submerged in both wells. The issues associated with sample representativeness that occur when well screens are submerged are discussed in detail in Section 7.1.2 above.

7.1.11 DP-23: Old Surface Impoundment West of Facility 993

DP-23 was divided into the southern portion and the northern portion. The remedy for the southern portion was excavation, ex situ soil treatment via composting, on-site disposal of treated soils, then subsequent monitoring. Based on the findings of the risk assessment, the remedy for the northern portion of DP-23 was ICs.

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

Internal land use restrictions are in place and land use has not changed. The land use restrictions require that any development at the site be approved through AF Form 332. All new AF Form 332s are reviewed at the weekly work order review board meeting. The Environmental Flight NEPA Program Manager attends the weekly meeting. The project location identified on the Form 332 is compared to the BGP map of IRP sites with institutional controls. The BGP and ICP do not discuss this site; however, the plans are scheduled to be updated to include this area. Considering, this area's remote location construction is very unlikely before the plan is updated. Additionally, the Environmental Flight NEPA Program Manager has immanent knowledge of this area. Residential development is not allowed for this area. If non-residential construction is involved then the NEPA Manager annotates on the Form 332 that PPE should be worn when disturbing soil in the area and that the contractor should meet with the IRP Program Manager prior to the work to obtain additional information regarding potential hazards in the area. The NEPA Manager initials the Form 332, logs it into the NEPA program database, then routes the form to the Chief of Operations for final approval/disapproval. See additional discussion in Question B below.

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

Changes in Standards and TBC - The medium of concern at this site is soil. Soil ARARs are RCRA – Criteria for Classification of Solid Waste Disposal and Practices (40 CFR 257), USEPA Region 9 PRGs for industrial soils, and Arizona SRLs for industrial soils (Title 18 – Environmental Quality, Chapter 7- Department of Environmental Quality Remedial Action, Article 2 – Soil Remediation Standards, Appendix A- SRLs). ARARs are listed in Tables 6.34

through 6.37. No new standards or TBCs affecting the protectiveness of the remedy have been discovered.

The primary COC at DP-23 is benzo(a)pyrene. When the OU-2 ROD was signed, the RAO for DP-23 was to reduce the concentrations of contaminants in soil to below PRGs through composting – this level was considered to be protective of groundwater resources as well. Based on site investigative data listed in the ROD, that the most significant reported detection of benzo(a)pyrene was 3.30 mg/kg. The ROD stated the PRG for the contaminant was 0.78 mg/kg. Based on this data, the composting process was estimated to take 120 days (4 months). However at 4 months verification sampling results indicated that the cleanup goals had not been achieved; thus, additional soil amendments were added to the compost mixture and the composting was continued for another 60 days to achieve the cleanup goal. The benzo(a)pyrene concentration documented at the end of the additional 60 days was 0.51 mg/kg. Since the completion of the composting, the PRG for benzo(a)pyrene has been reduced to 0.21 mg/kg. However, it should be noted that the impacted soils were moved to a remote location to be composted where they remain. The composting location is relatively remote, is situated on secure Base property, and is rarely visited by Base personnel. Therefore, the exposure risk is minimal and the current PRG is not applicable. The land use restriction implemented by the Base for DP-23 mitigates the remaining impacted soil.

The stated RAOs for soil were intended to be protective of groundwater resources. Despite the fact that near-surface soil levels of the primary COC benzo(a)pyrene may exceed the current PRG, it is not expected that groundwater resources would be impacted. The Soil Screening Level (SSL) PRGs for migration to groundwater are appropriate for evaluating soil concentrations of contaminants and their propensity to leach to groundwater. The SSL for benzo(a)pyrene in 1996, 2000, and 2004 was established at 800 mg/kg. Concentrations of benzo(a)pyrene in near-surface soils – even at their highest reported preremedial level–are well below the SSL.

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

During the First Five-year Review, it was recommended that a VEMUR be filed for the site. Luke AFB opted instead to emplace internal land use restrictions because land use restrictions and restrictions on future development are managed under existing Luke AFB programs. Any development at the site must be approved through AF Form 332 by the Base Chief of Operations. These forms will not be approved at sites such as DP-23 where land use restrictions are in place.

It is unclear what 'monitoring' is required by the ROD. No groundwater samples are required and the contaminated soils were treated and disposed on site.

7.2 SUMMARY OF FINDINGS

The findings of the technical review of each of the sites under consideration in this Five-Year Review are detailed in Section 7.1 and summarized under the OU-1 and OU-2 RODs.

7.2.1 Operable Unit 1 Sites

It can be determined from available information and data that the specified remedies for all sites within OU-1 remain protective of human health and the environment under current and future land use scenarios. The submerged screens mentioned above may be affecting the quality of the groundwater samples collected during the LTM events, but this issue is not expected to compromise the objective of the groundwater monitoring component of the ROD.

Though some of the ARARs for the COCs at the OU-1 sites have changed since the remedial action and since the last Five-Year Review, the cleanup accomplished under the 1996 PRGs are still protective under current land use scenarios. (Note: ARARs were not evaluated in the First Five- Year Review.) See the site-specific evaluations in Section 7.1.

7.2.2 Operable Unit 2 Sites

The remedy at ST-18 appears to remain protective under current and future land use scenarios. However, the screens at the two ST-18 monitoring wells (MW-114 and MW-122) are submerged. Therefore, the groundwater water samples collected from these wells under the LTM program as required by the ROD may not be truly representative of aquifer conditions in the immediate site vicinity. This problem with the submerged well screens is not expected to compromise the objective of the groundwater monitoring component of the ROD. As with the OU-1 sites, some of the ARARs have changed since the remedial action and since the First Five-Year Review. However, the cleanup accomplished under the 1996 PRGs are still protective under current land use scenarios.

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8.0 ISSUES

Table 8.1 summarizes the issues identified at the sites under consideration in this Five-Year Review during the data evaluation and assessment process. Identified issues are evaluated as to whether they affect the current protectiveness of the remedy, or may affect the protectiveness in the future.

Table 8.1
Issues Summary
Luke AFB, Arizona

Issue	Affects Protectiveness	
	Currently	Future
MW-123 at PSC FT-07E has collapsed.	No*	No*
MW-124 at PSC RW-02 has collapsed.	No	No
Sample zone was obstructed at MW-114 at PSC ST-18.	No*	No*
The screen of MW-118 at PSC FT-07 is submerged.	No*	No*
The screen of MW-114 at PSC ST-18 is submerged.	No*	No*
The screen of MW-113 at PSC SD-20 is submerged.	No*	No*
The screen of MW-121 at PSC SS-42 is submerged.	No*	No*
The screen of MW-125R at PSC SS-42 is submerged.	No*	No*
Metals groundwater data for MW-119 at PSC SS-42 is incomplete.	No	No
Institutional Control Plan does not discuss PSC DP-23.	No	No
Institutional Control Plan should not include PSC SS-42.	No	No
Base General Plan does not list or illustrate PSC DP-23	No	No
Base General Plan does not list or illustrate PSC ST-18	No	No

Notes:
* See the explanation provided in Section 7.1.2. Also, the Base is pursing funds to replace the wells with submerged screens and the replacement wells will be sampled shortly after they are installed
MW monitoring well
PSC potential source of contamination

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9.0 RECOMMENDATIONS/FOLLOW-UP ACTIONS

Table 9.1 summarizes the issues identified during the Second Five-Year Review and the recommended corrective action. The responsible party for all recommended follow-up actions is Luke AFB, and both ADEQ and EPA are the regulatory oversight/approval agencies.

Table 9.1
Recommendations/Follow-Up Actions Summary
Luke AFB, Arizona

Issue	Recommendations/ Follow-Up Actions	Milestone Date	Affects Protectiveness	
			Currently	Future
MW-123 at PSC FT-07E has collapsed and cannot be sampled. There is another well at this PSC (MW-118) but the screen is submerged (see below).	Replace well	TBD	No*	No*
The screen of MW-118 at PSC FT-07E is submerged. Therefore, groundwater samples collected from this well may not be representative of groundwater quality beneath the site. Given that the second well at FT-07E is collapsed and cannot be sampled, the evaluation of groundwater quality for this PSC is incomplete.	Replace well	TBD	No	No
MW-124 at PSC RW-02 has collapsed. This is the only monitoring well at this PSC. The groundwater monitoring requirement of the ROD cannot be met because this well cannot be sampled.	Replace well	TBD	No*	No*
MW-114 at PSC ST-18 contains blockage that extends to 15 feet above the screen. Because this well cannot be sampled at the proper depth, groundwater results obtained from MW-114 may not represent site conditions.	Replace well	TBD	No*	No*
The screen of MW-114 at PSC ST-18 is submerged. Therefore, groundwater samples collected from this well may not be representative of groundwater quality beneath the site.	Replace well	TBD	No*	No*
The screen of MW-121 at PSC SS-42 is submerged. Groundwater sample representativeness is discussed in the entry above.	Replace well	TBD	No*	No*
The screen of MW-113 at PSC SD-20 is submerged. Therefore, groundwater samples collected from this well may not be representative of groundwater quality beneath the site.	Replace well	TBD	No*	No*
The screen of MW-125R at PSC SS-42 is submerged. Therefore, groundwater samples collected from this well may not be representative of groundwater quality beneath the site.	Replace well	TBD	No*	No*

Table 9.1 (continued)
Recommendations/Follow-Up Actions Summary
Luke AFB, Arizona

Issue	Recommendations/ Follow-Up Actions	Milestone Date	Affects Protectiveness	
			Currently	Future
Metals groundwater data for MW-119 at PSC SS-42 is incomplete. In 1994, Nickel was detected in groundwater samples collected at a concentration that exceeded the Arizona drinking water standard.	Collect Samples	TBD	No	No
Institutional Control Plan does not discuss, list or illustrate PSC DP-23.	Revise ICP	TBD	No	No
Institutional Control Plan should not include PSC SS-42.	Revise ICP	TBD	No	No
Base General Plan does not list or illustrate PSC ST-28.	Revise BGP	TBD	No	No
Continue routine monitoring at PSCs ST-18, SS-42, FT-07E, RW-02, and SD-20.	Continue with past practices	TBD	No	No

Notes:

* See the explanation provided in Section 7.1.2. Also, the Base is pursing funds to replace the wells with submerged screens and the replacement wells will be sampled shortly after they are installed

ADEQ Arizona Department of Environmental Quality
AFB Air Force Base
EPA Environmental Protection Agency
MW monitoring well
PSC potential source of contamination
TBD to be determined

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10.0 PROTECTIVENESS STATEMENT

The remedies at OU-1 and OU-2 currently protect human health and the environment because the exposure pathways that could result in unacceptable risks are being controlled and institutional controls are preventing exposure to contaminated soil. Soil concentrations are below levels that could impact groundwater, and groundwater results verify that the groundwater is no longer impacted by soil contamination. Some monitoring wells will need to be replaced to verify that the remedy continues to protect groundwater.

Because the remedial actions at all OUs are protective, the site is protective of human health and the envitonment.

Long-term protectiveness of the removal and remedial actions will be verified by obtaining additional groundwater samples to fully evaluate the potential migration of contamination from the vadose zone to the water table. Current groundwater monitoring data indicate that the groundwater beneath the PSCs is not being impacted. Additional sampling and analysis will be completed annually at PSCs SS-42 and ST-18 and every fifth year at PSCs FT-07E, RW-02, and SD-20.

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11.0 NEXT REVIEW

The next Five-Year Review for the Luke AFB Superfund Site is required by January 2012, five years from the date of this review.

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Appendices for this Five-Year Review are available by placing a request using the Customized CERCLIS/RODS Report Order Form.

http://www.epa.gov/superfund/sites/phonefax/rods.htm