

**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**

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

**Prepared for:**

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

**and**

**Luke Air Force Base, Arizona**

**Prepared by:**

**HydroGeoLogic, Inc.  
8245 Nieman Road; Suite 101  
Lenexa, KS 66214**

**June 22, 2007**

|  |   |  |  |
|--|---|--|--|
| <b>REPORT DOCUMENTATION PAGE</b>   |   | Form Approved<br>QMB No. 0704-0188                               |  |
| Public reporting for this collection of information is estimated to average 1 hour per response, including the time for reviewing instruction, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1024, Arlington, VA 2220201302, and to the Office of Management and Budget, Paperwork Reduction Project (070400188), Washington, DC 20503. |   |  |  |
| 1. AGENCY USE ONLY (Leave blank)   |   | 2. REPORT DATE<br><br>February 19, 2007                          | 3. REPORT TYPE AND DATES COVERED<br><br>Final Second Five-Year Review/<br>2002 to 2006 |
| 4. TITLE AND SUBTITLE<br>Final Second Five-Year Review Report<br>Project Numbers: NUEX20067026 and NUEX20067041  |   | 5. Funding Numbers<br><br>F41624-03-D-8602<br>Task Order 0057    |  |
| 6. AUTHOR(S)<br>HydroGeoLogic, Inc   |   | 8. PERFORMANCE ORGANIZATION REPORT NUMBER<br><br>AFC002          |  |
| 7. PERFORMANCE ORGANIZATION NAME(S) AND ADDRESS(S)<br><br>HydroGeoLogic, Inc.<br>1155 Herndon Parkway, Suite 900<br>Herndon, VA 20170  |   | 10. SPONSORING/MONITORING AGENCY REPORT NUMBER<br><br>CDRL A001E |  |
| 9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(S)<br><br>AFCEE<br>3300 Sydney Brooks<br>Brooks City-Base, Texas 78235-5112  |   | 11. SUPPLEMENTARY NOTES  |  |
| 12a. DISTRIBUTION/AVAILABILITY STATEMENT<br><br>Unlimited  |   | 12b. DISTRIBUTION CODE   |  |
| 13. ABSTRACT (Maximum 200 words)<br>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.   |   |  |  |
| 14. SUBJECT TERMS  |   | 15. NUMBER OF PAGES  |  |
|  |   | 16. PRICE CODE   |  |
| 17. SECURITY CLASSIFICATION OF REPORT  | 18. SECURITY CLASSIFICATION OF THIS PAGE. | 19. SECURITY CLASSIFICATION OF ABSTRACT.                         |  |

## TABLE OF CONTENTS

| Page    |   | Page |
|---------|---|------|
| 1.0     | INTRODUCTION .....  | 1-1  |
| 2.0     | SITE CHRONOLOGY.....  | 2-1  |
| 3.0     | BACKGROUND.....   | 3-1  |
| 3.1     | PHYSICAL CHARACTERISTICS.....                                     | 3-1  |
| 3.1.1   | Installation Description .....                                    | 3-1  |
| 3.1.1.1 | Physiography .....  | 3-1  |
| 3.1.1.2 | Regional Geology.....   | 3-2  |
| 3.1.1.3 | Regional Hydrogeology .....                                       | 3-2  |
| 3.1.1.4 | Historical Trends in Water Levels.....                            | 3-3  |
| 3.2     | LAND AND RESOURCE USE.....  | 3-4  |
| 3.3     | PSC HISTORY OF CONTAMINATION AND INITIAL RESPONSE<br>ACTIONS..... | 3-4  |
| 3.3.1   | DP-13: Drainage Ditch Disposal Area.....                          | 3-4  |
| 3.3.1.1 | Site Description .....  | 3-4  |
| 3.3.1.2 | History of Contamination .....                                    | 3-5  |
| 3.3.1.3 | Initial Response Actions.....                                     | 3-5  |
| 3.3.2   | FT-07E: Eastern Portion of North Fire Training Area.....          | 3-5  |
| 3.3.2.1 | Site Description .....  | 3-5  |
| 3.3.2.2 | History of Contamination .....                                    | 3-6  |
| 3.3.2.3 | Initial Response Actions.....                                     | 3-6  |
| 3.3.3   | LF-03: Outboard Runway Landfill .....                             | 3-6  |
| 3.3.3.1 | Site Description .....  | 3-6  |
| 3.3.3.2 | History of Contamination .....                                    | 3-6  |
| 3.3.3.3 | Initial Response Actions.....                                     | 3-7  |
| 3.3.4   | LF-14: Old Salvage Yard Burial Site.....                          | 3-7  |
| 3.3.4.1 | Site Description .....  | 3-7  |
| 3.3.4.2 | History of Contamination .....                                    | 3-7  |
| 3.3.4.3 | Initial Response Actions.....                                     | 3-8  |
| 3.3.5   | LF-25: Northwest Landfill .....                                   | 3-8  |
| 3.3.5.1 | Site Description .....  | 3-8  |
| 3.3.5.2 | History of Contamination .....                                    | 3-8  |
| 3.3.5.3 | Initial Remedial Actions.....                                     | 3-8  |
| 3.3.6   | RW-02: Wastewater Treatment Annex Landfill.....                   | 3-9  |
| 3.3.6.1 | Site Description .....  | 3-9  |
| 3.3.6.2 | History of Contamination .....                                    | 3-9  |
| 3.3.6.3 | Initial Response Actions.....                                     | 3-9  |
| 3.3.7   | SD-20: Oil/Water Separator Canal and Earth Fissure.....           | 3-9  |
| 3.3.7.1 | Site Description .....  | 3-9  |
| 3.3.7.2 | History of Contamination .....                                    | 3-10 |

**TABLE OF CONTENTS (continued)**

| <u>Page</u> |  | <u>Page</u> |
|-------------|--|-------------|
|             | 3.3.7.3 Initial Response Actions.....                                  | 3-10        |
| 3.3.8       | SD-38: Oil/Water Separator at Auto Body Shop.....                      | 3-10        |
|             | 3.3.8.1 Site Description.....  | 3-10        |
|             | 3.3.8.2 History of Contamination.....                                  | 3-10        |
|             | 3.3.8.3 Initial Response Actions.....                                  | 3-11        |
| 3.3.9       | SS-42: Bulk Fuels Storage Area.....                                    | 3-11        |
|             | 3.3.9.1 Site Description.....  | 3-11        |
|             | 3.3.9.2 History of Contamination.....                                  | 3-11        |
|             | 3.3.9.3 Initial Response Actions.....                                  | 3-11        |
| 3.3.10      | DP-23: Old Surface Impoundment West of Facility 993.....               | 3-12        |
|             | 3.3.10.1 Site Description.....   | 3-12        |
|             | 3.3.10.2 History of Contamination.....                                 | 3-12        |
|             | 3.3.10.3 Initial Response Actions.....                                 | 3-13        |
| 3.3.11      | ST-18: Former Liquid Waste Storage Facility (Facility 993).....        | 3-13        |
|             | 3.3.11.1 Site Description.....   | 3-13        |
|             | 3.3.11.2 History of Contamination.....                                 | 3-13        |
|             | 3.3.11.3 Initial Response Actions.....                                 | 3-14        |
| 3.4         | BASIS FOR TAKING ACTION.....   | 3-14        |
| 4.0         | REMEDIAL ACTIONS.....  | 4-1         |
| 4.1         | REMEDY SELECTION.....  | 4-1         |
|             | 4.1.1 Operable Unit 1.....   | 4-1         |
|             | 4.1.2 Operable Unit 2.....   | 4-2         |
| 4.2         | REMEDY IMPLEMENTATION.....   | 4-3         |
|             | 4.2.1 DP-13: Drainage Ditch Disposal Area.....                         | 4-3         |
|             | 4.2.2 FT-07E: Eastern Portion of North Fire Training Area.....         | 4-4         |
|             | 4.2.3 LF-03: Outboard Runway Landfill.....                             | 4-4         |
|             | 4.2.4 LF-14: Old Salvage Yard Burial Site.....                         | 4-5         |
|             | 4.2.5 LF-25: Northwest Landfill.....                                   | 4-5         |
|             | 4.2.6 RW-02: Wastewater Treatment Annex Landfill.....                  | 4-6         |
|             | 4.2.7 SD-38: Oil/Water Separator at Auto Body Shop.....                | 4-8         |
|             | 4.2.8 SS-42: Bulk Fuels Storage Area.....                              | 4-8         |
|             | 4.2.9 SD-20 Oil/Water Separator Canal and Earth Fissure.....           | 4-9         |
|             | 4.2.10 ST-18: Former Liquid Waste Storage Facility (Facility 993)..... | 4-9         |
|             | 4.2.11 DP-23: Old Surface Impoundment West of Facility 993.....        | 4-9         |
| 4.3         | SYSTEM OPERATION/OPERATION AND MAINTENANCE.....                        | 4-10        |
| 4.4         | LONG-TERM GROUNDWATER MONITORING PROGRAM.....                          | 4-10        |
| 5.0         | PROGRESS SINCE THE LAST FIVE-YEAR REVIEW.....                          | 5-1         |
| 6.0         | FIVE-YEAR REVIEW PROCESS.....  | 6-1         |

**TABLE OF CONTENTS (continued)**

| <b>Page</b> |   | <b>Page</b> |
|-------------|---|-------------|
| 6.1         | ADMINISTRATIVE COMPONENTS .....                                 | 6-1         |
| 6.1.1       | Community Involvement .....                                     | 6-1         |
| 6.1.2       | Document Review .....   | 6-2         |
| 6.1.3       | Data Review .....   | 6-3         |
| 6.1.3.1     | Groundwater.....  | 6-3         |
| 6.1.3.2     | Soil.....   | 6-5         |
| 6.1.3.3     | Applicable or Relevant and Appropriate Requirements.....        | 6-5         |
| 6.1.4       | Site Inspections.....   | 6-6         |
| 6.1.5       | Interviews .....  | 6-7         |
| 7.0         | TECHNICAL ASSESSMENT.....                                       | 7-1         |
| 7.1         | ASSESSMENT OF SITE-SPECIFIC REMEDIES .....                      | 7-1         |
| 7.1.1       | DP-13: Drainage Ditch Disposal Area.....                        | 7-1         |
| 7.1.2       | FTE-07E: Eastern Portion of North Fire Training Area.....       | 7-3         |
| 7.1.3       | LF-03: Outboard Runway Landfill .....                           | 7-5         |
| 7.1.4       | LF-14: Old Salvage Yard Burial Site.....                        | 7-6         |
| 7.1.5       | LF-25: Northwest Landfill .....                                 | 7-8         |
| 7.1.6       | RW-02: Wastewater Treatment Annex Landfill.....                 | 7-9         |
| 7.1.7       | SD-38: Oil/Water Separator at Auto Body Shop.....               | 7-12        |
| 7.1.8       | SS-42: Bulk Fuels Storage Area.....                             | 7-14        |
| 7.1.9       | SD-20: Oil/Water Separator and Earth Fissure.....               | 7-16        |
| 7.1.10      | ST-18: Former Liquid Waste Storage Facility (Facility 993)..... | 7-16        |
| 7.1.11      | DP-23: Old Surface Impoundment West of Facility 993 .....       | 7-19        |
| 7.2         | SUMMARY OF FINDINGS .....                                       | 7-21        |
| 7.2.1       | Operable Unit 1 Sites .....                                     | 7-21        |
| 7.2.2       | Operable Unit 2 Sites .....                                     | 7-21        |
| 8.0         | ISSUES .....  | 8-1         |
| 9.0         | RECOMMENDATIONS/FOLLOW-UP ACTIONS .....                         | 9-1         |
| 10.0        | PROTECTIVENESS STATEMENT .....                                  | 10-1        |
| 11.0        | NEXT REVIEW .....   | 11-1        |
| 12.0        | REFERENCES .....  | 12-1        |

## LIST OF APPENDICES

---

|            |   |
|------------|---|
| Appendix A | Site Inspection Forms   |
| Appendix B | Interview Questionnaire   |
| Appendix C | Affidavit for Public Notice                                       |
| Appendix D | Groundwater Remedial Investigation Analytical Data Summary Tables |
| Appendix E | Soil Remedial Investigation Analytical Data Summary Tables        |
| Appendix F | Voluntary Environmental Use Restrictions                          |
| Appendix G | Cap Inspection Reports  |
| Appendix H | Response to Comments  |

## LIST OF TABLES

| Table      |   | Page |
|------------|---|------|
| Table 2.1  | Chronology of Events DP-13: Drainage Ditch Disposal Area .....                          | 2-2  |
| Table 2.2  | Chronology of Events FT-07E: Eastern Portion of North Fire Training Area ..             | 2-3  |
| Table 2.3  | Chronology of Events LF-03: Outboard. Runway Landfill .....                             | 2-5  |
| Table 2.4  | Chronology of Events LF-14: Old Salvage Yard Burial Site .....                          | 2-6  |
| Table 2.5  | Chronology of Events LF-25: Northwest landfill.....                                     | 2-7  |
| Table 2.6  | Chronology of Events RW-02: Wastewater Treatment Annex Landfill .....                   | 2-9  |
| Table 2.7  | Chronology of Events SD-20: Oil/Water Separator Canal and Earth Fissure .               | 2-11 |
| Table 2.8  | Chronology of Events SD-38: Oil/Water Separator at Auto Body Shop .....                 | 2-12 |
| Table 2.9  | Chronology of Events SS-42: Bulk Fuels Storage Area.....                                | 2-13 |
| Table.2.10 | Chronology of Events DP-23: Old Surface Impoundment West of<br>Facility 993.....        | 2-15 |
| Table 2.11 | Chronology of Events ST-18: Former Liquid Waste Storage Facility<br>(Facility 993)..... | 2-17 |
| Table 3.1  | Remedial Alternative Matrix .....   | 3-15 |
| Table 3.2  | Basis for Taking Action.....  | 3-16 |
| Table 4.1  | Summary of Selected Remedies .....  | 4-10 |
| Table 4.2  | Summary of OU-2 and OU-2 Site Inspection Requirements.....                              | 4-11 |
| Table 6.1  | Administrative Components Summary .....   | 6-7  |
| Table 6.2  | Applicable or Relevant and Appropriate Requirements .....                               | 6-8  |
| Table 6.3  | Groundwater Organic Analytical Data Exceedences for PSC FT-07E.....                     | 6-10 |
| Table 6.4  | Groundwater Organic Analytical Data for PSC RW-02.....                                  | 6-11 |
| Table 6.5  | Groundwater Organic Analytical Data Exceedences for PSC SD-20 .....                     | 6-12 |
| Table 6.6  | Groundwater Organic Analytical Data Exceedences for PSC SS-42.....                      | 6-13 |
| Table 6.7  | Groundwater Organic Analytical Data Exceedences for PSC ST-18.....                      | 6-14 |
| Table 6.8  | Groundwater Inorganic Analytical Data Exceedences for PSC FT-07E.....                   | 6-14 |
| Table 6.9  | Groundwater Inorganic Analytical Data Exceedences for PSC RW-02 .....                   | 6-15 |
| Table 6.10 | Groundwater Inorganic Analytical Data Exceedences for PSC SD-20 .....                   | 6-16 |
| Table 6.11 | Groundwater Inorganic Analytical Data Exceedences for PSC SD-38 .....                   | 6-20 |
| Table 6.12 | Groundwater Inorganic Analytical Data Exceedences for PSC SS-42 .....                   | 6-20 |
| Table 6.13 | Groundwater Inorganic Analytical Data Exceedences for PSC ST-18.....                    | 6-21 |
| Table 6.14 | Soil Organic Analytical Data Exceedences for PSC DP-13.....                             | 6-22 |
| Table 6.15 | Soil Organic Analytical Data Exceedences for PSC DP-23.....                             | 6-23 |
| Table 6.16 | Soil Organic Analytical Data Exceedences for PSC FT-07E.....                            | 6-24 |
| Table 6.17 | Soil Organic Analytical Data Exceedences for PSC LF-14.....                             | 6-25 |
| Table 6.18 | Soil Organic Analytical Data Exceedences for PSC LF-25.....                             | 6-26 |
| Table 6.19 | Soil Organic Analytical Data Exceedences for PSC RW-02.....                             | 6-27 |
| Table 6.20 | Soil Organic Analytical Data Exceedences for PSC SD-20.....                             | 6-27 |
| Table 6.21 | Soil Organic Analytical Data Exceedences for PSC SD-38.....                             | 6-28 |

## LIST OF TABLES (continued)

| Table      |  | Page |
|------------|--|------|
| Table 6.22 | Soil Organic Analytical Data Exceedences for PSC SS-42 .....                         | 6-29 |
| Table 6.23 | Soil Inorganic Analytical Data Exceedences for PSC ST-18 .....                       | 6-30 |
| Table 6.24 | Soil Inorganic Analytical Data Exceedences for PSC DP-13.....                        | 6-31 |
| Table 6.25 | Soil Inorganic Analytical Data Exceedences for PSC DP-23.....                        | 6-32 |
| Table 6.26 | Soil Inorganic Analytical Data Exceedences for PSC FT-07E .....                      | 6-33 |
| Table 6.27 | Soil Inorganic Analytical Data Exceedences for PSC LF-03 .....                       | 6-34 |
| Table 6.28 | Soil Inorganic Analytical Data Exceedences for PSC LF-14 .....                       | 6-35 |
| Table 6.29 | Soil Inorganic Analytical Data Exceedences for PSC LF-25 .....                       | 6-36 |
| Table 6.30 | Soil Inorganic Analytical Data Exceedences for PSC RW-02.....                        | 6-37 |
| Table 6.31 | Soil Inorganic Analytical Data Exceedences for PSC SD-20.....                        | 6-38 |
| Table 6.32 | Soil Inorganic Analytical Data Exceedences for PSC SD-38.....                        | 6-39 |
| Table 6.33 | Soil Inorganic Analytical Data Exceedences for PSC ST-18 .....                       | 6-40 |
| Table 6.34 | Groundwater Organic Applicable or Relevant and Appropriate Requirements Values ..... | 6-41 |
| Table 6.35 | Groundwater Inorganic Applicable or Reasonable and Appropriate Requirements.....     | 6-42 |
| Table 6.36 | Soil Organic Applicable or Relevant and Appropriate Requirements Values...           | 6-43 |
| Table 6.37 | Soil Inorganic Applicable or Relevant and Appropriate Requirements Values.           | 6-44 |
| Table 8.1  | Issues Summary .....   | 8-1  |
| Table 9.1  | Recommendations/Follow-Up Actions Summary.....                                       | 9-2  |

## LIST OF FIGURES

|            |                                     |
|------------|-------------------------------------|
| Figure 3.1 | Site Location Map                   |
| Figure 3.2 | Land Ownerships and Easements       |
| Figure 3.3 | Soils and Vegetation                |
| Figure 3.4 | Site Layout Map                     |
| Figure 4.1 | BG-1 Gamma Radiation Trend Analysis |
| Figure 4.2 | MP-1 Gamma Radiation Trend Analysis |
| Figure 4.3 | MP-2 Gamma Radiation Trend Analysis |
| Figure 4.4 | MP-3 Gamma Radiation Trend Analysis |
| Figure 4.5 | MP-4 Gamma Radiation Trend Analysis |

## 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   |

## LIST OF ACRONYMS AND ABBREVIATIONS (continued)

---

|       |   |
|-------|---|
| 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<br>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 <input type="checkbox"/> Deleted <input checked="" type="checkbox"/> Other (specify)   |  |                                |
| Remediation status (choose all that apply): Under Construction <input type="checkbox"/> Operating <input type="checkbox"/> Complete <input checked="" type="checkbox"/>  |  |                                |
| Multiple OUs?* <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO   | Construction completion date: 09/25/2000 |                                |
| Has site been put into reuse? YES <input type="checkbox"/> NO <input checked="" type="checkbox"/>  |  |                                |
| REVIEW STATUS  |  |                                |
| Lead agency: EPA <input type="checkbox"/> State <input type="checkbox"/> Tribe <input type="checkbox"/> Other Federal Agency <input checked="" type="checkbox"/> 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  |  |                                |
| <b>Type of review:</b><br><input checked="" type="checkbox"/> Post-SARA <input type="checkbox"/> Pre-SARA <input type="checkbox"/> NPL-Removal only<br><input type="checkbox"/> Non-NPL Remedial Action Site <input type="checkbox"/> NPL State/Tribe-lead<br><input type="checkbox"/> Regional Discretion |  |                                |
| Review number: 1 (first) <input checked="" type="checkbox"/> 2 (second) <input type="checkbox"/> 3 (third) <input type="checkbox"/> Other (specify) _____  |  |                                |
| <b>Triggering action:</b><br>Actual RA Onsite Construction at OU # _____                      Actual RA Start at OU# _____<br>Construction Completion <input checked="" type="checkbox"/> Previous Five-Year Review Report<br>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 environment.

### **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.